# 2025

# DIAGNOSTIC REPORT

## BOOK 3

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Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MTN

Read to Lead
A Reading Nation is a Leading Nation

2030 NDP

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# CHAPTER 1

## INTRODUCTION

### MINISTER'S FOREWORD

It is my honour to present the 2025 National Senior Certificate (NSC) Diagnostic Report. The commendable performance of the Class of 2025 stands as a powerful testament to achievement, resilience and collective effort across our education system. This report captures the successful culmination of a rigorous academic journey undertaken by our learners, one made possible through their unwavering commitment and perseverance, as well as the steadfast support of teachers, families and communities throughout the country. Faced with a demanding and evolving educational landscape, the 2025 cohort rose with purpose and determination, reaffirming our belief in the transformative power of education and the promise it holds for shaping a brighter future for all.

In his State of the Nation Address on 6 February 2025, President Cyril Ramaphosa underscored the unwavering commitment of the Government of National Unity: "Central to our efforts to end poverty and to develop our economy is to provide decent, quality education to every young South African." These words come alive in the remarkable achievements of the Class of 2025 in the National Senior Certificate (NSC) examinations, a triumph born from the dedication of teachers, learners, parents, and communities across the nation. Their collective perseverance is a vivid reminder of Malala Yousafzai's words, "One child, one teacher, one book, and one pen can change the world". The accomplishments of this year's learners are not just a reflection of academic excellence, but a testament to our shared resolve to build a future of opportunity, equity, and prosperity.

As an education system we continuously evaluate our progress in terms of the social justice principles of access, redress, equity, quality, efficiency and inclusivity. In the 2025 examinations 87,98% of the candidates obtained the National Senior Certificate and can now access further education opportunities and enter the world of work. In terms of quality, 345 857 learners have obtained admission to Bachelor Studies. All 75 districts obtained a pass rate above 80%.

The Department of Basic Education (DBE) has continued to strengthen its commitment to inclusive education through sustained and targeted support for learners with disabilities and those who encounter barriers to learning. A significant milestone remains the consolidation of South African Sign Language Home Language (SASL HL) as a fully established offering in the National Senior Certificate (NSC), now entering its eighth year in Grade 12.

The National Senior Certificate examinations continue to serve as a steadfast symbol of academic integrity and public confidence, providing assurance that learner achievement is credible, comparable and internationally respected. This standing is reaffirmed by Umalusi, the Quality Assurance Council, through its approval of the 2025 NSC results following a rigorous and comprehensive verification of all examination and assessment processes.

This diagnostic report provides a comprehensive outline of the performance of the Class of 2025 in gateway subjects, home languages, high enrolment first additional languages and the technical subjects. Teachers are encouraged to use it as a teaching tool for the Class of 2026.

As we close the chapter of the Class of 2025 and look to the road ahead, we are reminded that the true legacy of the National Senior Certificate lies not only in certificates awarded, but in minds empowered and futures transformed. *Thuto e matla ho feta tshepe* – education is stronger than iron, stronger than any weapon – because it shapes conscience, unlocks possibility, and builds nations without destroying them. In the achievements of the Class of 2025, we see proof that when education is protected, nurtured and made accessible to all, it becomes South Africa's most enduring force for justice, progress and shared prosperity.

**MS GWARUBE, MP**

**MINISTER OF BASIC EDUCATION**

**12 JANUARY 2026**

## 1.1 INTRODUCTION, SCOPE AND PURPOSE

A diagnostic analysis of learner performance constitutes a systematic and detailed evaluation designed to determine patterns of achievement and areas requiring improvement in learner outcomes. This approach extends beyond the analysis of examination results to include an examination of the contributory factors influencing performance. It enables the identification of areas in which learners demonstrate competence, as well as obstacles that may impede academic progression. The primary purpose of this analysis is to develop an informed understanding of the challenges identified during the marking of the October/November 2025 examinations.

The 2025 Diagnostic Report on Learner Performance draws on insights from earlier reports, notably those published between 2022 and 2024. It presents a comprehensive evaluation of learner achievement in high-enrolment subjects, the 12 official home languages, technology and technical subjects. The analysis contained in this report is intended to support teachers, subject advisors, curriculum developers and other educational stakeholders by offering evidence-based insights into prevailing strengths and areas of concern across these subject areas.

Consistent with previous editions, the report identifies subject-specific and language-specific areas of underperformance and proposes remedial actions to be implemented at school level in order to improve learner outcomes. The findings are informed by both qualitative and quantitative data sources. Qualitative evidence is drawn from reports compiled by chief markers, internal moderators and subject specialists, while quantitative data is obtained through the analysis of a nationally representative sample of 100 scripts per subject, per paper, across all provinces.

This National Diagnostic Report further provides a longitudinal comparison of learner performance over the preceding five years for each subject, alongside detailed analyses of learner responses to individual examination questions. Through the identification of recurring errors, misconceptions and instances of misinterpretation, the report offers targeted recommendations for improvement. Persistent patterns of weak responses in certain subjects point to ongoing challenges related to curriculum coverage, instructional approaches and, in some cases, gaps in educator subject knowledge.

Part One of the report focuses on monitoring progress in areas previously identified as problematic. It evaluates the extent to which corrective measures have yielded improvement and highlights domains where additional support remains necessary. While the report serves as a national reference, it is also intended for practical application at provincial, district and school levels, with the longer-term objective of embedding diagnostic analysis as a core component of teaching and learning practices throughout the education system.

## 1.2 METHODOLOGY

This diagnostic report presents a comprehensive analysis of learner performance in the National Senior Certificate examinations, with the purpose of identifying key trends, strengths and areas requiring improvement across subjects. Drawing on both qualitative and quantitative evidence, the report seeks to deepen understanding of learner achievement and the factors influencing examination outcomes. The findings are intended to support informed decision-making at national, provincial, district and school levels, and to guide the development of targeted interventions aimed at strengthening teaching and learning and improving overall learner attainment.

Each subject-specific diagnostic report opens with a comparative presentation of learner performance trends spanning a five-year period from 2021 to 2025. The analysis contained in the 2025 report is informed primarily by qualitative evaluations prepared by chief markers, internal moderators and subject specialists following the marking of the National Senior Certificate (NSC) examinations. In addition, quantitative evidence for the ten high-enrolment subjects and English First Additional Language was obtained through the systematic analysis of a random sample of 100 scripts from each province (a total of 900 scripts) per subject, per question paper, drawn from all provinces. The integration of qualitative and quantitative data enables the identification of subject-specific areas of underperformance and informs the formulation of targeted remedial actions to be implemented at school level to strengthen learner achievement.

The report provides a comprehensive question-by-question and subquestion analysis, organised into three key sections.

**Section 1: Performance Trends (2021–2025)**

This section presents a longitudinal comparison of learner performance over the five-year period, with specific reference to the number of candidates who sat for the examinations, as well as the numbers and proportions of learners achieving 30 per cent and above, and 40 per cent and above. The data are displayed in tabular and graphical formats to support clear interpretation of performance patterns, including medium-term trends and year-on-year variations.

In addition, performance distribution curves are provided to illustrate the spread of learner results over the most recent three-year period. Shifts in the position of the 2025 curve relative to the preceding two years indicate changes in overall performance: a movement to the right reflects improvement, while a movement to the left signals a decline.

**Section 2: Overview of Learner Performance**

This section offers a consolidated overview of learner performance in each question paper, identifying areas of relative strength and difficulty. It explores potential factors contributing to observed trends and provides a broad perspective on learner engagement with the assessed content, highlighting any systemic challenges that may have affected outcomes.

**Section 3: Diagnostic Analysis of Questions**

This section comprises:

- Graphical illustrations of the average percentage scores achieved per question;
- A detailed examination of learner responses to individual questions, indicating levels of performance and explaining observed response patterns;
- An identification of recurring errors and misconceptions evident in learners' work; and
- Recommendations aimed at improving teaching and learning practices, content coverage and methodology, subject advisory support and the effective use of Learning and Teaching Support Materials (LTSM).

Reports compiled by internal moderators from all nine provinces for each subject and question paper have been synthesised, with the key findings reflected in this diagnostic report. It is advised that this report be used in conjunction with the November 2025 NSC question papers, as specific references are made to individual questions. When used in this manner, the report can assist educators in establishing a baseline for the 2026 Grade 12 cohort, informing differentiated teaching approaches, and guiding the planning and implementation of school-based assessment activities throughout the academic year.

## 1.3 SCOPE AND LIMITATIONS OF THE DIAGNOSTIC ANALYSIS

While the 2025 National Diagnostic Report on Learner Performance offers important insights into learner achievement and examination outcomes, it is necessary to recognise the scope within which the analysis was conducted, as well as certain inherent limitations. These considerations should be taken into account when interpreting the findings and applying them to teaching, learning and support interventions.

### 1.3.1 Intended Use of the Report

This diagnostic report is not intended to function as a prescriptive guide for classroom practice. Rather, it serves as a reflective and analytical resource to support educators, subject advisors and curriculum planners in understanding learner performance patterns. The findings should be used in conjunction with other data sources, professional judgement and contextual knowledge to inform teaching strategies, curriculum implementation and learner support initiatives.

### 1.3.2 Focus on Selected Subjects

The analysis is limited to ten high-enrolment Grade 12 subjects, English First Additional Language, the 12 official home languages, and selected technology and technical subjects. These subjects provide a broad indication of national performance patterns; however, they do not represent the full range of subjects assessed in the NSC examinations. Diagnostic analyses for other subjects are produced separately through reports compiled during the marking process by provincial chief markers and internal moderators. Consequently, the findings presented here should be interpreted as subject-specific rather than comprehensive across the entire curriculum.

### 1.3.3 Predominantly Qualitative Orientation

The report is primarily diagnostic and qualitative in nature. Its central purpose is to provide an informed analysis of learner responses to identify common strengths, weaknesses, misconceptions and instructional challenges across subjects. Quantitative data are included mainly to illustrate performance trends over time and average achievement per question in the NSC examinations. The analysis does not extend to detailed psychometric evaluation, item-level test development or disaggregation by specific learner cohorts. As such, while the quantitative data support the diagnostic findings, they do not constitute an exhaustive statistical analysis, which falls beyond the intended scope of this report.

### 1.3.4 National-level Perspective

The diagnostic findings presented in this report reflect performance trends at a national level. While they highlight recurring areas of difficulty and common errors, these patterns may not be uniformly applicable across all provinces, districts or schools. Learner performance is influenced by contextual factors such as access to resources, educator expertise, teaching approaches and learner backgrounds, which can vary significantly across regions. The report should therefore be regarded as providing a broad national overview rather than a definitive account of challenges at local levels.

### 1.3.5 Need for District-level Analysis

In light of regional variation in learner performance, it is recommended that district subject specialists develop district-specific diagnostic reports. Such analyses would enable a more focused examination of local performance trends and challenges, supporting targeted interventions and professional development initiatives that are responsive to district-level needs.

### 1.3.6 Limited School-level Specificity

The report does not offer detailed diagnostic analyses at individual school level. Given the unique contexts in which schools operate, national trends may not fully reflect the specific strengths and challenges experienced by individual institutions. Schools are therefore encouraged to conduct their own diagnostic analyses based on learner performance data, enabling the design of targeted, context-specific strategies to improve teaching and learning.

### 1.3.7 Constraints Related to Data Representation

The quantitative data used in this report are derived from a random sample of examination scripts. While the sample size is sufficient to identify general trends, it may not fully capture the diversity of learner performance across all provinces and school contexts. Additionally, despite rigorous moderation processes, variations in marking practices and examination conditions may influence the interpretation of certain results.

## 1.4 OBSERVATIONS IN LEARNER PERFORMANCE FOR 2025

The 2025 diagnostic reports for the ten key subjects included in this publication (Part 1) indicate an improvement in pass rate at the 30 per cent level across most subjects, with the exception of Accounting, Agricultural Sciences and Mathematics. In these three subjects, a decline is also evident in the proportion of learners achieving 40 per cent and above.

In English First Additional Language, the pass rate decreased at both the 30 per cent and 40 per cent thresholds.

In the home languages (Part 2), improvements in pass rates were recorded in Afrikaans, English, Setswana and South African Sign Language. By contrast, marginal declines were observed in IsiNdebele, IsiXhosa, Sepedi and Tshivenda. Performance in IsiZulu, Sesotho, SiSwati and Xitsonga remained broadly consistent with that recorded in 2024.

A general trend of gradual improvement continues to be evident across the technology and technical subjects.

## 1.5 AREAS OF CONCERN AND RECOMMENDATIONS TO IMPROVE THE QUALITY OF TEACHING AND LEARNING

The marking of the NSC 2025 examinations revealed several recurring challenges that affected learner performance across various subjects. These challenges highlight areas where learners are struggling and require targeted interventions to improve their overall performance. Below are the major challenges observed, along with proposed solutions for addressing each one, including subject-specific examples.

### 1.1.1 Cryptic and Underdeveloped Candidate Responses

An emerging concern evident in diagnostic assessments is the tendency of candidates to provide responses that are cryptic, fragmented and insufficiently developed in relation to the marking guidelines. Rather than offering coherent, elaborated explanations or well-structured arguments, many candidates present brief statements, bullet-like points, or isolated facts that lack justification, depth and synthesis. This pattern suggests not only gaps in content mastery but also challenges in extended written communication and higher-order cognitive engagement as required by curriculum standards and assessment objectives.

One contributing factor to this phenomenon may be the pervasive influence of social media and the broader digital environment on learners' cognitive and communicative practices. Contemporary learners are increasingly immersed in platforms that privilege brevity, immediacy, and visual or abbreviated forms of communication, such as short-form videos, captions, emojis, and character-limited text (Carr, 2010; Rosen, Lim, Smith, & Smith, 2011). These modes of interaction may inadvertently condition candidates to prioritise speed and minimal expression over sustained reasoning and detailed explanation. Research suggests that frequent exposure to rapid, fragmented digital content can affect attention span, depth of processing, and the ability to engage in prolonged analytical tasks (Ophir, Nass, & Wagner, 2009).

Furthermore, the shift towards surface-level information consumption in the digital age may impact candidates' capacity to organise ideas logically and align responses with assessment criteria. Marking guidelines typically reward clarity, structure, justification and the integration of relevant concepts; however, candidates accustomed to informal digital communication may struggle to translate their understanding into academically rigorous written responses (Baron, 2008). This disconnect highlights the importance of explicitly teaching and reinforcing assessment literacy, extended writing skills and metacognitive awareness, ensuring that candidates understand not only what is being assessed but how to communicate their knowledge in a manner that meets established academic standards.

**How is this addressed in teaching and learning?**

To address the prevalence of cryptic and underdeveloped responses, teachers play a critical role in explicitly scaffolding the skills required for comprehensive, criterion-referenced answers. One effective strategy is the deliberate modelling of high-quality responses. By unpacking exemplar answers and mapping them directly to marking guidelines, teachers can make visible the level of detail, structure and justification expected in each question. This process supports learners in understanding how knowledge must be communicated and not merely recalled.

In addition, embedding structured writing frameworks within teaching practice can assist candidates in organising their responses. Approaches such as paragraph scaffolds, sentence starters and explicit instruction in academic language enable learners to move beyond brief statements towards more elaborated explanations. Research highlights that sustained practice in extended writing, coupled with formative feedback, improves both conceptual understanding and response quality (Graham & Perin, 2007).

Teachers are also encouraged to foster assessment literacy by regularly engaging learners with marking criteria and success descriptors. Activities, such as peer assessment, self-assessment and the annotation of sample responses, help learners internalise assessment expectations and recognise the limitations of overly concise or ambiguous answers. This is particularly important in counteracting habits of minimal expression reinforced by digital communication norms.

Finally, classroom practices that promote focused attention and deeper cognitive engagement, such as longer-form problem-solving tasks, reflective writing and discussion-based learning, may help mitigate the attentional fragmentation associated with digital media use. By intentionally creating spaces for sustained thinking and extended response, teachers can support candidates in developing the endurance and discipline required for comprehensive academic writing.

#### 1.1.2 Reliance on past examination papers

While past papers remain a valuable resource for familiarising learners with examination expectations, they should be used strategically and diagnostically, not as the sole or dominant mode of preparation.

One of the hallmarks of a well-constructed examination is its capacity to challenge learners beyond rote recall and predictable patterns. Examiners intentionally design questions that are innovative, authentic and aligned with real-world contexts, drawing on curriculum frameworks and current affairs to require meaningful engagement and deeper thinking from candidates. Research on assessment design emphasises that high-quality examinations should move beyond repetition of familiar tasks to reflect complex cognitive demands, including analysis, synthesis and problem-solving, which correspond to the highest levels of Bloom's taxonomy and prepare learners for future learning and life challenges (Aldosari, 2025; systematic reviews of authentic assessment design).

In contrast, a reliance on past examination papers, a strategy often adopted by learners and teachers, and sometimes reinforced through narrow examination preparation, can inadvertently cultivate a culture of predictability. When learners focus disproportionately on memorising past questions or formats, they are less likely to develop the critical thinking dispositions and adaptive reasoning skills required by novel questions. Studies in educational research have shown that traditional assessments rooted in repetition and recall fail to foster robust critical thinking, limiting learners' capacity to evaluate, infer and reflect flexibly in unfamiliar contexts.

When teaching and learning environments prioritise preparation for predictable item types, this can narrow learners' understanding of subject matter and diminish opportunities for learners to engage in sustained reasoning, authentic problem solving and originality of thought.

Addressing this challenge requires assessment practices that intentionally disrupt predictability and reward critical thinking, creativity and transfer of knowledge to new situations. By preparing learners for question papers that draw on contemporary issues or real-world scenarios, teachers can better ensure that learners deploy deep understanding rather than rehearsed responses.

#### 1.1.3 Limited Conceptual Understanding and Critical Thinking Skills

One effective approach is the deliberate use of unseen, context-based questions during teaching and assessment. By designing tasks that draw on contemporary issues, real-life scenarios or interdisciplinary contexts aligned with the curriculum, teachers can require learners to apply knowledge in novel ways. Research on authentic assessment demonstrates that such tasks promote deeper learning and improve learners' ability to reason, evaluate and problem-solve in unfamiliar situations (Darling-Hammond & Adamson, 2014; Villarroel et al., 2020).

Teachers can also strengthen critical thinking by explicitly teaching learners how to unpack instructional verbs and analyse question demands. Regular classroom practice that involves discussing why a particular response earns marks—rather than merely what the correct answer is—helps learners move beyond pattern recognition towards analytical engagement. This aligns with research showing that explicit instruction in metacognitive and reasoning strategies enhances learners' adaptability in assessment contexts (Schraw, 2018).

Furthermore, incorporating varied assessment formats—such as open-ended questions, problem-based tasks, short analytical writing and oral justification—can reduce predictability and discourage rote learning. Such variation signals to learners that understanding, reasoning and explanation are consistently valued, regardless of the surface structure of questions.

Ultimately, by modelling flexible thinking, emphasising conceptual connections and reducing dependence on repetitive past-paper drilling, teachers can better prepare learners to engage confidently with innovative examination questions. This approach not only aligns classroom practice with the intentions of high-quality assessment design, but also equips learners with transferable skills essential for lifelong learning.

#### 1.1.4 Lack of Basic Numeracy Skills

During the marking of the October/November 2025 examinations, several candidates' responses revealed a notable lack of basic numeracy skills across a range of questions. Many candidates experienced difficulty with fundamental numerical operations, including addition, subtraction, multiplication and division, particularly when these skills were required within contextualised or multi-step problems. Similar challenges were evident in the manipulation of fractions, percentages and ratios. Research indicates that weaknesses in foundational numeracy significantly impede learners' ability to engage successfully with more complex mathematical reasoning tasks (Siegler et al., 2012).

In numerous cases, candidates appeared to understand the procedural demands of a question but were unable to produce accurate final answers due to computational errors. The absence of estimation skills and limited ability to evaluate the reasonableness of solutions resulted in learners accepting implausible answers without reflection. According to Kilpatrick, Swafford and Findell (2001), numerical fluency is a critical component of mathematical proficiency and underpins successful problem-solving across all content areas.

The excessive reliance on calculators for basic calculations further suggests that numeracy fluency has not been sufficiently consolidated. Studies have shown that over-dependence on calculators at early stages may hinder the development of number sense and mental computation skills (Rittle-Johnson & Schneider, 2015). These deficiencies limited candidates' ability to access higher-order questions, where accuracy in basic numerical processes is essential for progression.

### How can numeracy skills be strengthened in teaching and learning?

In order to address the identified shortcomings in basic numeracy, the following research-informed strategies are recommended:

(a) Explicit and Continuous Teaching of Numeracy Fundamentals: Foundational numeracy skills should be taught explicitly and reinforced continuously across grades. Evidence suggests that sustained exposure and practice are essential for achieving numerical fluency and long-term retention (Siegler et al., 2012).

(b) Embedding Numeracy Across Mathematical Topics: Numeracy should be integrated across all areas of Mathematics rather than treated as a discrete component. This approach supports the transfer of skills and promotes conceptual coherence (National Council of Teachers of Mathematics, 2014).

(c) Balanced Use of Calculators: While calculators have a place in Mathematics instruction, learners should first demonstrate competence in manual and mental calculation strategies. Research highlights the importance of developing mental arithmetic skills to support deeper mathematical understanding (Rittle-Johnson & Schneider, 2015).

(d) Promotion of Estimation and Self-checking Strategies: Teachers should place greater emphasis on estimation and the evaluation of the reasonableness of answers. These practices enhance metacognitive awareness and reduce careless computational errors (Kilpatrick et al., 2001).

(e) Early Diagnostic Assessment and Targeted Intervention: Regular diagnostic assessments should be used to identify gaps in numeracy skills at an early stage. Targeted support programmes have been shown to significantly improve learner outcomes when implemented timeously.

### 1.1.5 Poor Reading Comprehension Skills

An analysis of candidate responses indicates that poor reading comprehension skills remain a significant barrier to achievement. Many candidates struggled to interpret questions accurately, resulting in responses that were incomplete, irrelevant or misaligned with the demands of the task. In several instances, learners overlooked key words, misread instructions or failed to identify critical information embedded in longer or multi-step questions. This suggests that, although some learners may possess the required content knowledge, they are unable to access and apply it effectively due to limited comprehension of the question text.

Difficulties were particularly evident where questions required learners to infer meaning, integrate information from different parts of a text or interpret questions that combined written language with data presentations such as tables, graphs or scenarios. Research confirms that reading comprehension is not only a language skill but a foundational academic competency that influences performance across all subjects (Snow, 2010). Where candidates misinterpreted command words such as *explain*, *justify*, *compare* or *evaluate*, responses were frequently descriptive rather than analytical, indicating inadequate understanding of assessment verbs and their required cognitive demand.

Furthermore, the limited range of academic vocabulary displayed by some candidates negatively impacted their ability to engage with subject-specific terminology. Cain and Oakhill (2014) argue that comprehension is closely linked to vocabulary knowledge, inferencing ability and the capacity to monitor understanding while reading. These weaknesses contributed to candidates responding impulsively, without fully unpacking the question, which ultimately reduced the quality and relevance of their answers.

**What strategies can be implemented to improve reading comprehension skills in teaching and learning?**

To strengthen reading comprehension skills, the following strategies are recommended:

(a) Explicit Teaching of Comprehension Strategies: Learners should be taught how to identify key information, unpack questions and interpret command words. This includes modelling how to underline critical terms and restate questions in their own words.

(b) Development of Academic Vocabulary: Regular exposure to subject-specific terms and academic language should be prioritised to support accurate interpretation of questions and texts.

(c) Structured Reading Practice Across Subjects: Reading should be integrated across the curriculum, with routine opportunities for learners to engage with examination-style texts, instructions and data-based contexts.

(d) Promoting Careful Reading and Self-monitoring: Learners should be encouraged to read slowly, re-read where necessary and check whether their answers align with what the question is asking.

(e) Regular Diagnostic Interventions: Teachers should use short diagnostic tasks to identify comprehension weaknesses and implement focused support, particularly for learners who struggle to extract meaning from written information.

## 1.6 MEDIATING THE 2025 DIAGNOSTIC REPORT

The successful implementation of the recommendations outlined in this diagnostic report depends on effective communication and mediation at various levels of the education system. It is crucial that the report is disseminated and utilised from the provincial level down to individual schools, with a focus on active involvement from subject specialists, district officials and teachers.

### 1.7.1 Provincial Education Departments

This diagnostic report is intended for a broad audience, including teachers, learners and education officials. As such, it is imperative that the report is cascaded systematically from the provincial level to the district and school levels. This process will ensure that the findings and recommendations reach the relevant stakeholders, allowing for the identification of areas of improvement and the implementation of targeted interventions. Provincial education departments should take responsibility for ensuring that the diagnostic report is shared with all schools within their jurisdiction, enabling the entire education system to benefit from the insights provided.

### 1.6.2 Subject Advisors and District Officials

(a) **Subject Advisors' Meetings and Workshops**

Subject advisors play a key role in facilitating professional development and ensuring that the diagnostic report is effectively mediated. They should organise meetings or workshops where teachers can discuss the findings of the report and explore strategies for addressing the challenges identified. These sessions should focus on fostering collaboration among teachers, encouraging the sharing of best practices, and providing guidance on how to incorporate the recommendations into classroom teaching.

(b) **Monitoring Teacher Improvement Plans**

It is essential that subject advisors monitor the improvement plans of teachers, ensuring that the recommendations in the diagnostic report are incorporated. This will help teachers to make the necessary adjustments in their teaching approaches, thereby improving learners' performance. Monitoring should focus on specific actions and strategies that align with the identified areas for improvement.

(c) **Curriculum Coverage Monitoring**

District officials must ensure that the curriculum is being adequately covered in accordance with the Revised Annual Teaching Plan (ATP). This is particularly important to ensure that learners are fully prepared for the demands of the examinations. Incomplete or rushed curriculum coverage can leave critical gaps in learners' knowledge, hindering their ability to respond effectively to exam questions. Ensuring that all topics are adequately covered will provide learners with the necessary preparation to succeed in the NSC exams.

(d) **Monitoring SBA Quality and Standard**

The monitoring process should also focus on the quality of the school-based assessments (SBA). High-quality assessment tasks, aligned with the learning objectives and cognitive levels of the curriculum, are essential in preparing learners for the NSC examinations. District officials should ensure that SBA tasks are of a high standard, providing learners with the opportunity to develop and demonstrate their understanding of the content.

(e) **Enhancing Teaching Resources**

Subject advisors should direct teachers to relevant online resources, educational websites and digital tools that can enhance teaching and learning. These resources can provide teachers with access to updated content, innovative teaching strategies and interactive activities to engage learners, ensuring that learners receive the most up-to-date and effective instruction.

### 1.6.3 Teachers

(a) **Providing Resources for Self-Regulated Learning**

Teachers and schools must ensure that learners have access to adequate resources that enable self-regulated learning. This will empower learners to take ownership of their education, improving their ability to study independently. Teachers should guide learners in using textbooks, online resources, and supplementary materials to reinforce their understanding.

(b) **Creating Opportunities for Reflection, Analysis, and Evaluation**

Teachers should prepare learners for the demands of the NSC examinations by creating opportunities for them to reflect on, analyse and evaluate the content. This will foster deeper understanding and applied competence, helping learners develop critical thinking skills that are necessary for tackling complex exam questions.

(c) **Ensuring Comprehensive Curriculum Coverage**

Teachers must ensure that they cover the entire curriculum and include a full range of cognitive levels in both teaching and assessment strategies. Simple recall-based tasks will not adequately prepare learners for the higher-order thinking required in the NSC exams. Teachers should focus on creating learning opportunities that encourage analysis, evaluation, and application of knowledge to ensure that learners are fully equipped to tackle a range of question types in the examinations.

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# CHAPTER 2

## TECHNICAL MATHEMATICS

**The following report should be read in conjunction with the Technical Mathematics Paper 1 and Paper 2 question papers for the NSC November 2025 examinations.**

### 2.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Technical Mathematics examination in 2025 increased by 3 350, compared to that of 2024.

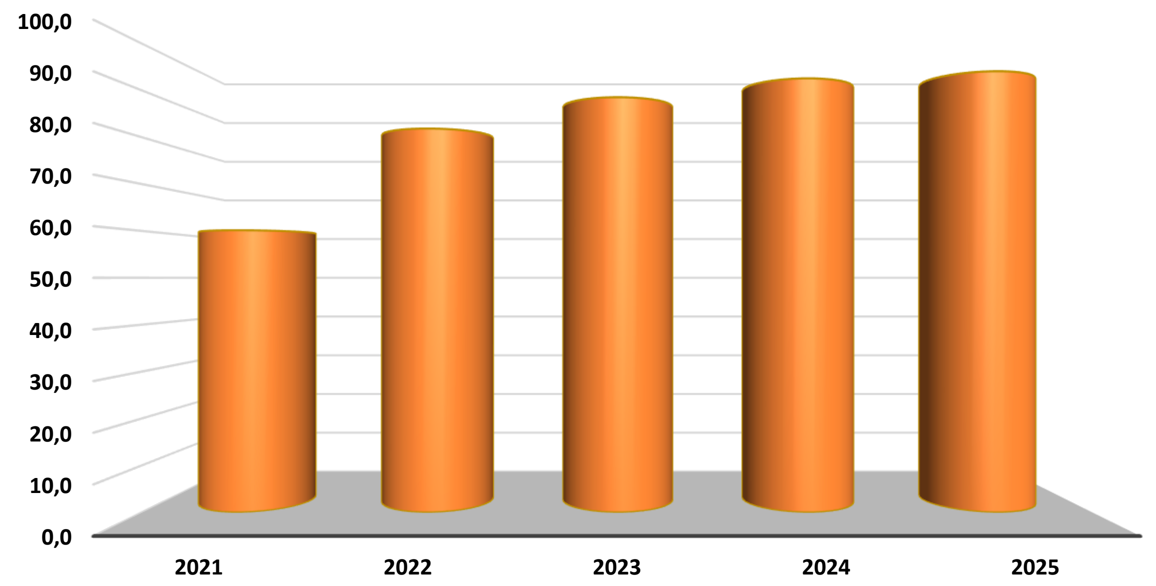
There was a significant improvement in the pass rate this year. The pass rate at the 30% level improved from 92,5% to 94,0%, however, distinctions declined from 4,2% to 2,3% in 2025 compared to 2024.

The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall improvement in the subject.

**Table 2.1.1 Overall achievement rates in Technical Mathematics**

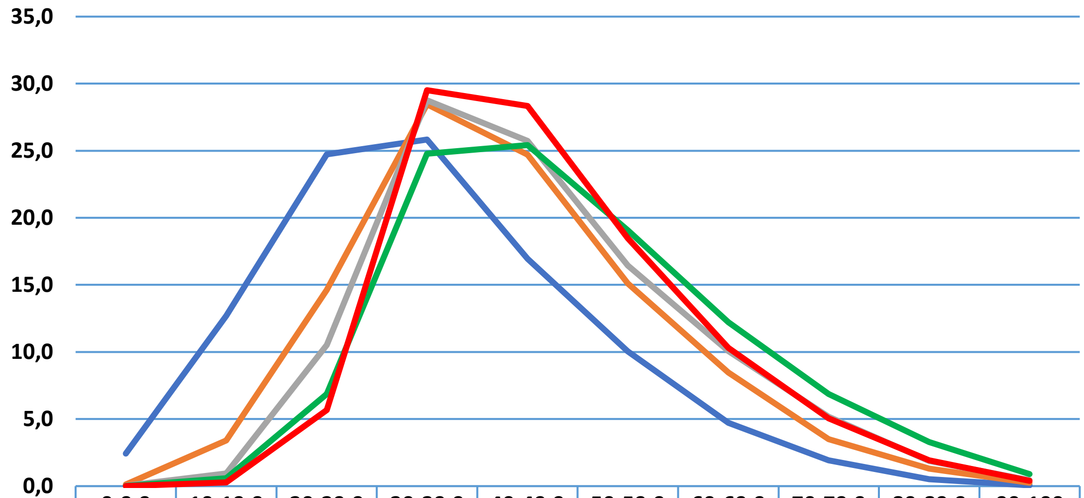
| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| **2021** | 13 403 | 8 060 | 60,1 |
| **2022** | 14 657 | 11 993 | 81,8 |
| **2023** | 15 193 | 13 446 | 88,5 |
| **2024** | 16 579 | 15 340 | 92,5 |
| **2025** | 19 929 | 18 743 | 94,0 |

**Graph 2.1.1 Overall achievement rates in Technical Mathematics (percentage)**




| | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| % achieved at 30% and above | 60,1 | 81,8 | 88,5 | 92,5 | 94,0 |

**Graph 2.1.2 Performance distribution curves in Technical Mathematics (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 2,4 | 12,7 | 24,7 | 25,8 | 17,0 | 10,0 | 4,7 | 1,9 | 0,5 | 0,1 |
| 2022 | 0,1 | 3,4 | 14,6 | 28,5 | 24,7 | 15,1 | 8,5 | 3,5 | 1,3 | 0,2 |
| 2023 | 0,0 | 1,0 | 10,5 | 28,8 | 25,7 | 16,4 | 10,1 | 5,2 | 1,9 | 0,5 |
| 2024 | 0,0 | 0,6 | 6,9 | 24,8 | 25,4 | 19,1 | 12,2 | 6,9 | 3,3 | 0,9 |
| 2025 | 0,0 | 0,3 | 5,7 | 29,5 | 28,3 | 18,5 | 10,3 | 5,1 | 1,9 | 0,4 |

**General comments on Paper 1 and Paper 2**

The structure of the 2025 question papers was similar to previous years' question papers; however, candidates committed errors like those that were highlighted in previous years' diagnostic reports. This is an indication that the diagnostic reports are not considered a valuable resource when preparing lessons.

Although this examination revealed an improvement of candidates' understanding of some basic concepts across topics in the curriculum, over-reliance on previous question papers as teaching tools is evident. While the use of past examination papers is advised as a valuable resource for revision, the teaching and learning of basic mathematical concepts is strongly encouraged.

Teachers should ensure that they incorporate technical applications into all topics where appropriate, as required by the *CAPS*.

## 2.2 OVERVIEW OF CANDIDATES' PERFORMANCE IN PAPER 1

**General comments**

(a) Candidates performed well in Q1, which assessed Quadratic Equations, Inequalities and Binary Numbers. This is an indication that candidates were better prepared to deal with these questions since the topics are covered in the lower grades.

(b) A noticeable improvement was observed in Q2, which focused on the Nature of Roots; however, there are still challenges in questions requiring application in this concept.

(c) Many candidates were able to respond and score marks in questions where topics learned in Grade 12 were assessed, i.e. Differential Calculus and Integration, but they displayed poor algebraic skills when integration of topics and interpretation were required.

(d) While candidates were able to respond to questions requiring knowledge and routine procedures in many of the questions, they were challenged by questions where a deduction or conclusion was required.

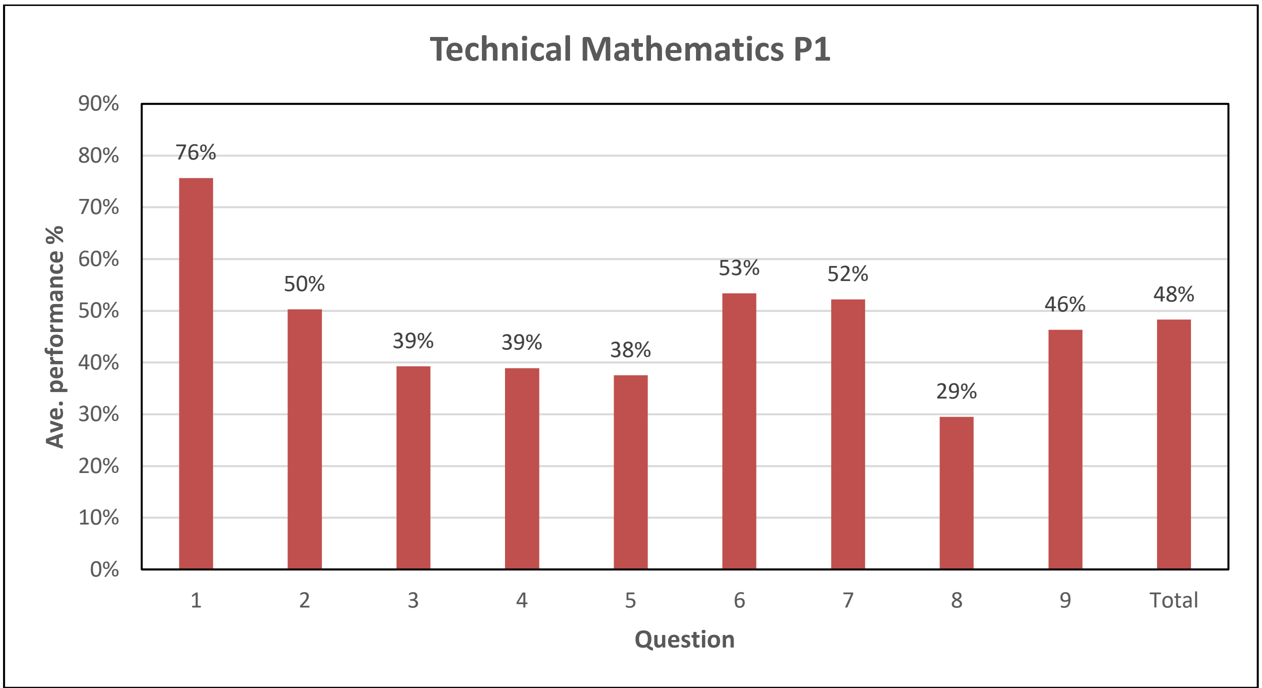
(e) The use of a calculator remains a challenge for some of the candidates, for example, the early rounding in Finance and rounding off values to the number of decimals indicated.

(f) Some candidates did not adhere to the instructions as stipulated in the question paper, such as the correct use of an answer book and the correct numbering of questions. A few candidates altered the numbering in the answer book provided.

## 2.3 DIAGNOSTIC QUESTION ANALYSIS OF PAPER 1

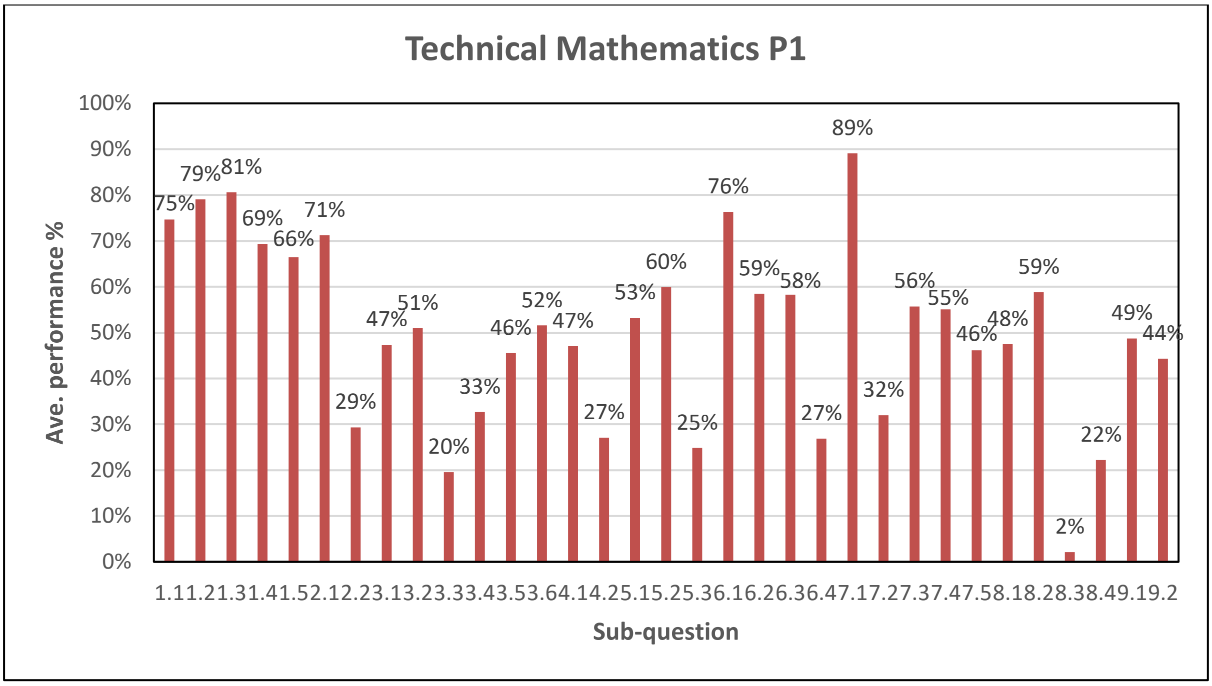
The following graph is based on data from a random sample of candidates. While this graph might not accurately reflect national averages, it is useful in assessing the relative degrees of challenge of each question as experienced by candidates.

**Graph 2.3.1 Average performance per question in Paper 1**




| Question | Topic | Ave. performance % |
|---|---|---|
| 1 | Equations, Inequalities and Binary Numbers | 76% |
| 2 | Nature of Roots of Quadratic Equations | 50% |
| 3 | Exponents, Surds, Logs and Complex Numbers | 39% |
| 4 | Functions and Graphs | 39% |
| 5 | Finance, Growth and Decay | 38% |
| 6 | Differential Calculus (Differentiation) | 53% |
| 7 | Differential Calculus (Cubic Functions) | 52% |
| 8 | Differential Calculus (Optimization) | 29% |
| 9 | Integration | 46% |
| **Total** | | **48%** |

**Graph 2.3.2 Average performance per subquestion in Paper 1**




## 2.4 ANALYSIS OF LEARNER PERFORMANCE IN EACH QUESTION IN PAPER 1

### QUESTION 1: EQUATIONS AND INEQUALITIES (ALGEBRA)

**Common errors and misconceptions**

(a) In Q1.1.1 some candidates incorrectly expanded the given factors and ended up with incorrect *x*-values. Some candidates displayed limited understanding of quadratic theory, since they had one root instead of two solutions. Some candidates gave one of the roots as $x = -\frac{4}{9}$ instead of $x = \frac{4}{9}$.

(b) Some candidates in Q1.1.2 failed to remove brackets correctly and simplify to arrive at standard form. A few candidates still wrote the quadratic formula incorrectly as $x = \frac{b \pm \sqrt{b^2 - 4ac}}{2a}$ or $x = \frac{-b \pm \sqrt{b^2 + 4ac}}{2a}$ or $x = -b \pm \frac{\sqrt{b^2 - 4ac}}{2a}$
Some candidates incorrectly substituted values in the formula, interchanging the values of a and b.
They displayed poor calculator skills and rounding off to the required number of decimal places.

(c) In Q1.1.3 many candidates failed to expand, interpret the inequalities and write the correct notation. Some candidates misinterpreted 'or' and 'and' when writing their solution. They wrote the solution as $x > -2 \text{ or } x < 3$, instead of $x > -2 \text{ and } x < 3$.
Some candidates used graphical representation of the solution but failed to identify the correct region.
Candidates were challenged by the interval notation, and could not differentiate between $x \in (-2;3)$ and $x \in [-2;3]$.

(d) Some candidates in Q1.2.2 correctly substituted $y = x - 1$ to have $x^2 + x(x - 1) = 3$ but when trying to remove the brackets, they ended up having $x^2 + x^2 - 1 = 3$ which resulted in an incorrect standard form of $2x^2 - 4 = 0$ instead of $2x^2 - x - 3 = 0$.
Some candidates decided to make $x$ the subject of the formula and substituted it to finally come up with the quadratic equation in terms of $y$, i.e. $2y^2 + 3y - 2 = 0$ but they erroneously used the quadratic formula as $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ instead of $y = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ and hence confused the values of $x$ and $y$.

(e) Many candidates failed to make N the subject of the formula in Q1.3; the concepts of multiplicative and additive inverses were misunderstood.
Some of the responses candidates wrote included:

$\mathrm{N} = \frac{\mathrm{BP}}{2\pi} \times \mathrm{T}$ or $\mathrm{N} = \frac{\mathrm{BP}\text{-}2\pi}{\mathrm{T}}$ and $\mathrm{N} = 2\pi - \mathrm{BP.T}$

(f) In Q1.4 and Q1.5 some candidates were unable to convert a decimal number to a binary number or vice versa. A few candidates omitted base 2 in binary number.

**Suggestions for improvement**

(a) Revision of topics done in earlier grades, e.g. factorisation, expansion, solution of simultaneous equations, simplification of fractions and binary number operations, is strongly encouraged. When solving simultaneous equations, learners must be encouraged to use brackets when doing substitution.

(b) Teachers are strongly advised to spend enough time on the introduction of the following key principles to make Question 1 more routine and manageable for learners:

**CFS** – Common factor, Factor form and Standard form. This will help learners to identify the stage of the equation and understand that each stage has a different approach.
**BODMAS** – Bracket of Division, Multiplication, Addition and Subtraction. This will assist with understanding the order of operations.
**ERS** – Exponential, Radical and Simultaneous equations. Learners need to be drilled on changing from the radical form to the exponential form.

(c) Learners should be exposed to different forms of literal equations and quadratic equations, where the subject of the formula, simplification and the correct use of calculators are required. The distinction between *linear* and *quadratic equations* should be made clear and explained to learners thoroughly.

(d) Teachers should expose learners to different methods of solving inequalities so that learners may choose the method best suited to solving the problem and representing solutions, i.e. verbally, graphically, interval notations, set builder notations.

(e) Teachers should explain to learners the difference between ***'and'*** and ***'or'*** in the context of inequalities. Learners cannot use these words interchangeably as they have different meanings.

(f) Teachers should integrate algebra with functions so that learners have a visual understanding of inequalities, but teaching must not be limited to that method; teaching for conceptual understanding of inequalities is very important.

**QUESTION 2: NATURE OF ROOTS**

**Common errors and misconceptions**

(a) In Q2.1.1 some candidates did not write the discriminant correctly although this formula is in the information sheet included at the end of the question paper.
They wrote:

$\Delta = -b^2 - 4ac$ or $\Delta = 4ac - b^2$ or $\Delta = -b \pm \sqrt{b^2 - 4ac}$ or $\Delta = b^2 + 4ac$

(b) Some candidates failed to describe the nature roots in relation to $\Delta = b^2 - 4ac = -4$ as non-real in Q2.1.3. They were confused, seeing 4 as a perfect square; they disregarded the negative sign and wrote rational roots.

(c) In Q2.2 some candidates failed to write the correct standard form.
They were unable to identify the correct values of a, b and c, hence they substituted incorrectly and ended up with $(2)^2 - 4(1)(-4) = m \quad \therefore m = 20$.
Many candidates used $b^2 - 4ac > 0$ whilst other candidates used $\Delta = b^2 - 4ac$ without giving its condition, hence they lost one mark for the incorrect condition of the discriminant.

**Suggestions for improvement**

(a) When teaching nature of roots, teachers should show learners that the discriminant, $\Delta = b^2 - 4ac$, originates from the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. In other words, the quadratic formula could be written as $x = \dfrac{-b \pm \sqrt{\Delta}}{2a}$. The value that appears under the radical sign determines the nature of the roots of the equation.

(b) It should be emphasised to the learners that if the discriminant is less than zero $(\Delta < 0)$ it does not necessarily mean that there are **no roots**. The equation does have roots, but they are **non-real**. Graphical representation of this scenario is where the parabola does not have the $x$-intercepts. To conclude that there is no solution here is incorrect, since the roots are **non-real** or **imaginary** but not undefined.

(c) Teachers should expose learners to application questions involving the nature of roots including solving problems where the conditions are given.

**QUESTION 3: EXPONENTS, SURDS, LOGARITHMS AND COMPLEX NUMBERS**

**Common errors and misconceptions**

(a) Some candidates failed to apply laws of exponents and surds to give a simplified answer in Q3.1.1 and Q3.1.2 where they:

- Took out the common factor, $\frac{3.2^x}{2^x.2^2-2^x}=\frac{3.2^x}{2^x\left(4-0\right)}=\frac{3}{4}$

- Treated the question as division of powers with the same base $\frac{3.2^x}{2^{x+2}-2^x}=3.2^{x-x-2-x}=3.2^{-2-x}$

- Multiplied in the numerator and did not factorize in the denominator

$$\frac{6^x}{2^x.2^2-2^x}=\frac{6^x}{4}$$

- Wrote the denominator $2^{x+2}$ as $2^x+2^2$

(b) In Q3.2 to Q3.4 many candidates failed to apply the log property. When concluding, they left without providing a final or valid solution. They wrote:

$$\begin{aligned}&2\ \log_a \sqrt{a}\\&=2\ \log_a a^{\frac{1}{2}}\\&=2\times\frac{1}{2}\times\log_a a\\&=2\times\frac{1}{2}\times 0\\&=0\end{aligned}$$

A few candidates confused: $\log_a a$ with $\log 1$

$\log 3^3$ with $\left(\log 3\right)^3$

Many candidates did not realise that: $\log 5$

$$\begin{aligned}\log\left(\frac{10}{2}\right)&=\log 10-\log 2\\&=1-p\end{aligned}$$

Some candidates incorrectly transposed 1 and wrote:

$$\begin{aligned}&\log_3 x+\log_3\left(x+2\right)=1\\&\log_3 x\left(x+2\right)=1\\&\log_3 x^2+2x-1=0\end{aligned}$$

Most candidates did not reject $-3$ and presented it as part of the solution.

(c) Some candidates omitted *i* in Q3.5.2 and ended up with a sum of the values:
$v=2(\cos 120°+i\sin 120°)=-1+\sqrt{3}=0,73$

(d) In Q3.6 some candidates did not substitute $i^2 = -1$. When substituting $i^2$ with $-1$, some candidates changed $-21$ to $21$ and wrote $a+7bi=21(-1)+21i$ instead of $a+7bi=-21(-1)+21i$ ending up with $a$ as $21$ instead of $a=-21$

**Suggestions for improvement**

(a) A thorough and regular revision of all exponential laws, surds and logarithmic laws, which are taught to learners in earlier grades, should be done in Grade 12.

(b) Teachers should emphasise to the learners that they must check if all their solutions satisfy the given equations and reject whichever is not applicable.

(c) Learners should be exposed to different types of problems involving complex numbers and different representations of complex numbers.

(d) Teachers should familiarise learners with the information sheet and encourage adherence to instructions.

**QUESTION 4: FUNCTIONS**

**Common errors and misconceptions**

(a) In Q4.1 certain candidates failed to write the correct equation of the asymptote.
They wrote:

$0$ and $3$

$p=0$ and $q=3$ instead of writing $x=0$ and $y=3$

They only gave $y=3$ as their answer.

horizontal asymptote = 3 and vertical asymptote = 0

(b) Some candidates displayed limited understanding of the domain in Q4.1.2, where they omitted $x \neq 0$ and wrote only $x \in R$.
Some candidates wrote $x \in [-\infty;\infty]$, $x \neq 0$ instead of $x \in (-\infty;\infty)$, $x \neq 0$, an indication of poor understanding of the difference between the curved and square bracket.

(c) Some candidates struggled with x being in the denominator in Q4.1.4 and did not transpose correctly and ended up with $x=1$ instead of $x=-1$

(d) In Q4.1.5 some candidates could not sketch the graphs. They failed to plot the intercepts, asymptotes and the shape of the hyperbola correctly. Some candidates sketched a half graph of the hyperbola and located it in the 3rd quadrant. A few candidates drew the parabola instead of the hyperbola.

(e) Many candidates, having failed to correctly draw the graph in Q4.1.5, were challenged by the given statement which required them to interpret in relation to the given functions in Q4.1.6. They were unable to identify the critical values and correct notation. A few candidates wrote $-1 < x < 0$ or $-1 \leq x \leq 0$ instead of $-1 \leq x < 0$.
Some candidates wrote $x \geq -1$ or $x < 0$ instead of $x \geq -1$ and $x < 0$.

(f) In Q4.2.1 some candidates did not realise that the given $x$-coordinate of the turning point is the axis of symmetry. They tried to use the equation $x=-\frac{b}{2a}$ in vain as the values of $p$ and $q$ are not known.

(g) Some candidates used the equation of $f$, $0=-\left(x+p\right)^2+q$ in Q4.2.2; however, with insufficient information they were unable to get to the coordinates of B.

(h) In Q4.2.3 some candidates assumed the coordinates of B and some candidates substituted the incorrect value of $p$ as $-1$, ending up with $q = 25$.

(i) In Q4.2.4 candidates displayed poor understanding of the range, since some wrote the range in terms of $x$. There were a few candidates wrote the range as:

$y \in [9;-\infty)$
$y < 9$
$y \in [-\infty;9)$

(j) Some candidates incorrectly wrote $g(x) = 6$ or just 6 as the equation of the asymptote in Q4.2.5.

(k) Many candidates did not respond to Q4.2.6 and those who did respond failed to calculate the value of $a$ correctly due to incorrect substitution or simplification.

**Suggestions for improvement**

(a) Teachers should emphasise that an equation of the asymptote, whether vertical or horizontal, should be *y* =…. or *x* =… .

(b) Characteristics and graphical representations of graphs should be thoroughly demonstrated to learners using a variety of graphing software and transformation should be incorporated in the teaching of functions and graphs to illustrate the effects of the parameters.

(c) Learners should be exposed to more questions involving two graphs sketched on the same set of axes, incorporating interpretation and not only focusing on the drawing of graphs.

(d) Teachers should have a glossary list for all terms used in functions to assist in correcting the misconception and clearly unpacking what each term defines, relating it to graphical representation and interpretation.
E.g. **Equation** is a mathematical statement that shows that two expressions are equal. It uses the symbol '=' to indicate equality.

**QUESTION 5: FINANCE, GROWTH AND DECAY**

**Common errors and misconceptions**

(a) In Q5.1.1 many candidates failed to identify the correct formula to calculate simple depreciation despite this formula being included on the information sheet.

(b) Some candidates correctly used the simple depreciation formula but rounded off incorrectly in Q5.1.2 and lost a mark.

(c) In Q5.2 candidates omitted % from the equation when substituting the interest rate, presented as $A = 32000(1+7{,}15)^4$ which led to an incorrect solution. A few candidates used the equation $A = P\left(1+\frac{i}{n}\right)^{n\times m}$ and confused the compounding period with the number of years in the substitution.

Some candidates also rounded off the interest rate $7{,}15\% = 0{,}0715$ to $0{,}07$ which consequently changed the answer from R42 181,18 to R41 945,47.

(d) In Q5.3.1 a few candidates divided 5 000 by 35 and some multiplied 5 000 litres of water by 35 to get 175 000, which is an indication of poor reading and a lack of understanding the necessary skill.

(e) Many candidates experienced a challenge to interpret the information given in Q5.3.2. They assumed that $A > P$ and failed to make *i* the subject of the formula.
Some candidates concluded that $i = 1{,}96\%$ instead of $i = 0{,}0196$ or $r = 1{,}96\%$.
In the equation *i* = etc. candidates were unable to differentiate between
$i$ – which refers to interest per compounding period and is in decimal notation and $i = \frac{r}{100}\times\frac{1}{m}$, in which *m* refers to the compounding period and $r$ refers to the annual interest rate in %.

(f) In Q5.3.3 most candidates incorrectly substituted P =1 500 instead of 5 000, and missed that an hour is equivalent to 60 minutes as the question required amount of water per minute. Many candidates lost a mark for not concluding: 'Yes, more than 1 500 litres will be left in the tank.'

**Suggestions for improvement**

(a) Learners should be encouraged to read thoroughly and correctly identify the formula from the information sheet included in the question paper. Learners should be able to identify key words that hint at the correct formula, such as:

Compound interest – (compound growth, population growth, inflation).

Simple interest – (linear growth, higher purchase).

Compound decay – (reducing balance, compound depreciation).

Simple decay – (straight line depreciation).

(b) Revision of finance concepts done in earlier grades, such as percentages, interest, hire purchase, inflation and other real-life applications, is strongly suggested.

(c) Teachers should demonstrate and explain to learners how to change the subject of the formula using the different variables in the formulae.

(d) Teachers should explain to learners that rounding off the interest rate given will lead to an incorrect solution. Leaners should be coached on correct use of a calculator.

(e) Teachers should emphasise the clear distinction between interest rate per year $(r)$ and interest rate per compounding period $(i)$.

It should be made clear that: $i=\dfrac{r}{100}$ (decimal) and $r=i\times 100$ (%)

Thus, the formula $A=P\left(1\pm i\right)^{n}\approx P\left(1\pm\dfrac{r}{100}\right)^{n}$

(f) Teachers should expose learners to scenarios not only limited to monetary-based problems, but also to the application of real-life problems.

**QUESTION 6: CALCULUS**

**Common errors and misconceptions**

(a) In determining the derivative using first principles in Q6.1, some candidates:

- Incorrectly copied the definition and committed notational error when writing $f(x)=\dfrac{f(x+h)-f(x)}{h}$ or $f(x)=\lim\limits_{x\to 0}\dfrac{f(x+h)-f(x)}{h}$ or $f'(x)=\lim\limits_{x\to 0}=\dfrac{f(x+h)-f(x)}{h}$
- Failed to substitute and use brackets correctly, leading to incorrect simplification, writing

$$f^{/}(x)=\lim_{h\to 0}\frac{4+\frac{1}{3}x+h\ -\ 4+\frac{1}{3}x}{h}$$

instead of writing $f^{/}(x)=\lim\limits_{h\to 0}\dfrac{4+\frac{1}{3}\left(x+h\right)\ -\ \left(4+\frac{1}{3}x\right)}{h}$

(b) Candidates confused differentiation and integration.

(c) Some candidates differentiated the numerator and the denominator and wrote $-\dfrac{18x^{5}}{4x^{3}}=-\dfrac{9}{2}x^{2}$

(d) Some candidates found it difficult to simplify $-\dfrac{4x}{3}+\sqrt[4]{x^{-5}}$. Some of them wrote $-4.3x^{-1}+x^{-20}$

(e) Candidates were unable to find the *x*-value of the point of contact when the *y*-value was provided, and as a result, they struggled to find the value of *a*.

**Suggestions for improvement**

(a) Learners must be exposed to first principles with respect to a fraction.

(b) When teaching Calculus and Integration, emphasis should be placed on ensuring that learners clearly understand which methods and techniques are needed in Questions 6 and 9. It is essential that learners recognise the distinct rules for differentiation and integration to eliminate confusion.

(c) Learners must be taught to look carefully for the integration sign and apply the relevant rules.

(d) Teachers should reinforce this by exposing learners to a wide range of examples that show the different ways in which derivative and integral questions may be presented.

**QUESTION 7: CUBIC FUNCTION**

**Common errors and misconceptions**

(a) Some candidates failed to read the *x*-intercept from the equation. They tried to substitute into the equation and made mistakes along the way, which resulted in an incorrect *y*-intercept.

(b) Some candidates struggled to determine the quadratic factor of the cubic equation.

(c) Some candidates worked out the derivative of $g(x)$ as $g^{/}(x) = 3ax^2 - 4x - 19$ and then equated it to 0 without substituting $a = 1$. They wrote $0 = 3ax^2 - 4x - 19$ and were unable to use the quadratic formula if the co-efficient of $x^2$ was $3a$.

(d) Many candidates calculated the turning points instead of the *x*- intercepts. They swapped the two calculations in 7.3 and 7.4 and therefore lost marks.
Many candidates used the formula $x = -\frac{b}{2a}$ to calculate the turning point instead of finding the *x*-coordinate by differentiation.

**Suggestions for improvement**

(a) In teaching any function, teachers should expose leaners to all aspects of the function. This includes the sketching and interpretation of graphs.

(b) Teachers should emphasise that $x = -\dfrac{b}{2a}$ applies only in quadratic functions and not cubic functions; and that at the turning points, the derivative is equal to zero.

(c) Teachers should emphasise that it is very important for them to follow the instructions and to respond accurately to what the question requires. For example, if learners are required to clearly show all the intercepts with the axes and the coordinates of the turning points, they must show them to score all marks allocated for that question.

**QUESTION 8: APPLICATION OF CALCULUS**

**Common errors and misconceptions**

(a) Some learners failed to interpret the graph correctly. They did not realise that the maximum number of fat cakes that could have been sold was 100.

(b) Some candidates did not understand the question and they substituted $t = 5$ into the derivate, e.g. $F^{/}(5) = 20 - 2(5) = 10$.

(c) Some candidates multiplied 75 by R2,50 in Q8.2 to arrive at R187,50. They did not realise that they had to calculate the difference between 100 and 75 to get 25.

(d) Instead of equating the derivative to 0, some candidates equated $F(x)$ to 0 and solved for *t*:

$$20t - t^2 = 0$$
$$t(20 - t) = 0$$
$$t = 0 \text{ or } \mathrm{t} = 20$$

instead of :

$$F^{/}(t) = 20 - 2t$$
$$20 - 2t = 0$$
$$t = 10$$
$$\therefore p = 10$$

**Suggestions for improvement**

(a) Learners should be exposed to as many contextual application questions as possible, so that they are tested on the concepts of optimisation including aspects such as rate of change and calculus of motion.

(b) Teachers should thoroughly demonstrate when one gets maximum or minimum value using different questioning strategies in test and non-test tasks.

(c) Integration of topics, as well as the use of different formulae involving solids, cones and pyramids in real-life applications, is advised.

(d) Learners should be encouraged to read the problem to understand the different parts that yield the required solution.

**QUESTION 9: INTEGRATION**

**Common errors and misconceptions**

(a) A few candidates omitted *C* when writing the indefinite integral. Instead of integration, some candidates differentiated the function.

(b) Most candidates struggled to simplify $\frac{1}{x^2}(x-2)$. They wrote: $\frac{1}{x^2}(x-2) = \frac{1}{x^3} - \frac{2}{x^2}$

(c) When integrating $2^{3x}$, some candidates wrote $2^{3x} = \frac{2^{3x}}{3\ln x}$ instead of $2^{3x} = \frac{2^{3x}}{3\ln 2}$

(d) In Q9.2 some candidates failed to identify and use correct boundaries. They were also unable to write the correct notation for area when using integrals; they did not set up the area notations for definite integrals; they had negative areas.

**Suggestions for improvement**

(a) Learners should be reminded to consult the information sheet at the back of the question paper and pay attention to 'C'; the constant C must always be added.

(b) Teachers should emphasise that in definite integrals the given function must be integrated before substituting the limits.

(c) The difference between *differentiation* and *integration* should be explained and demonstrated thoroughly. Correct use of *integral notation* should be emphasised.

(d) In the teaching of integration, learners should be taught to include the lower and upper boundaries when setting up the area notation for definite integrals. Teachers should emphasise the use of brackets when substituting negative values.

(e) The calculation of the area bounded by a function and the *x*-axis should be demonstrated so that learners can observe how the value of the constant influences the area.

(f) Teachers should emphasise that it should not be a habit to add two different areas as the question might require comparing one area to another. Learners should be exposed to a variety of applications involving integration to enhance their understanding of the concept. They should always be encouraged to draw up conclusions in response to the questions asked in the given scenarios.

## 2.5 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 2

(a) Candidates performed relatively well in Q1. This question was based on Analytical Geometry. Candidates performed well in questions involving length, gradient and the equation of the straight line, which are concepts covered in Grade 10.

(b) Candidates performed poorly in Q5 (Trig graphs), Q6 (Trig -2D application) and Q8 (Euclidean Geometry – Circle Theorems) with Q5 being the most poorly answered question.

(c) Some candidates displayed poor simplification and calculator skills required to solve mathematical problems. This was evident in several subquestions where basic simplification techniques such as products, substitution, factorisation and changing the subject of a formula was required.

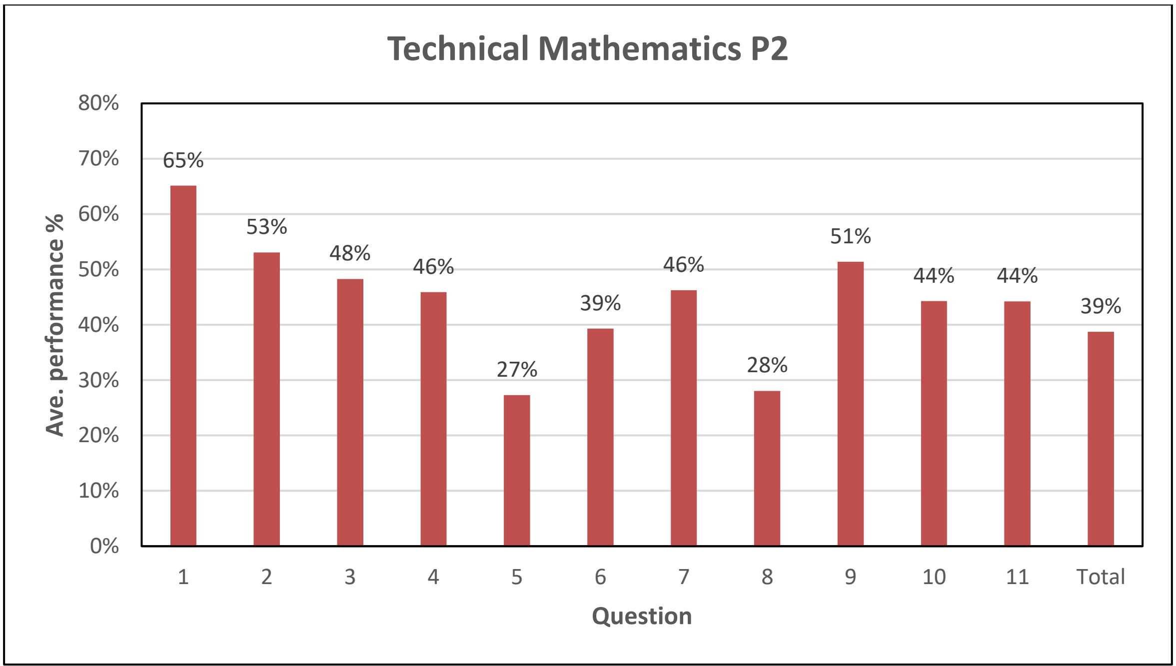
(d) Many candidates were able to respond and score marks in questions requiring knowledge and routine procedures in several of the questions in the paper. This is an indication that candidates were better prepared to deal with these questions. However, theorem statements in Euclidean Geometry posed a serious challenge.

(e) Many candidates did not attempt the higher-order questions where the interpretation and integration of topics was required.

## 2.6 DIAGNOSTIC QUESTION ANALYSIS OF PAPER 2

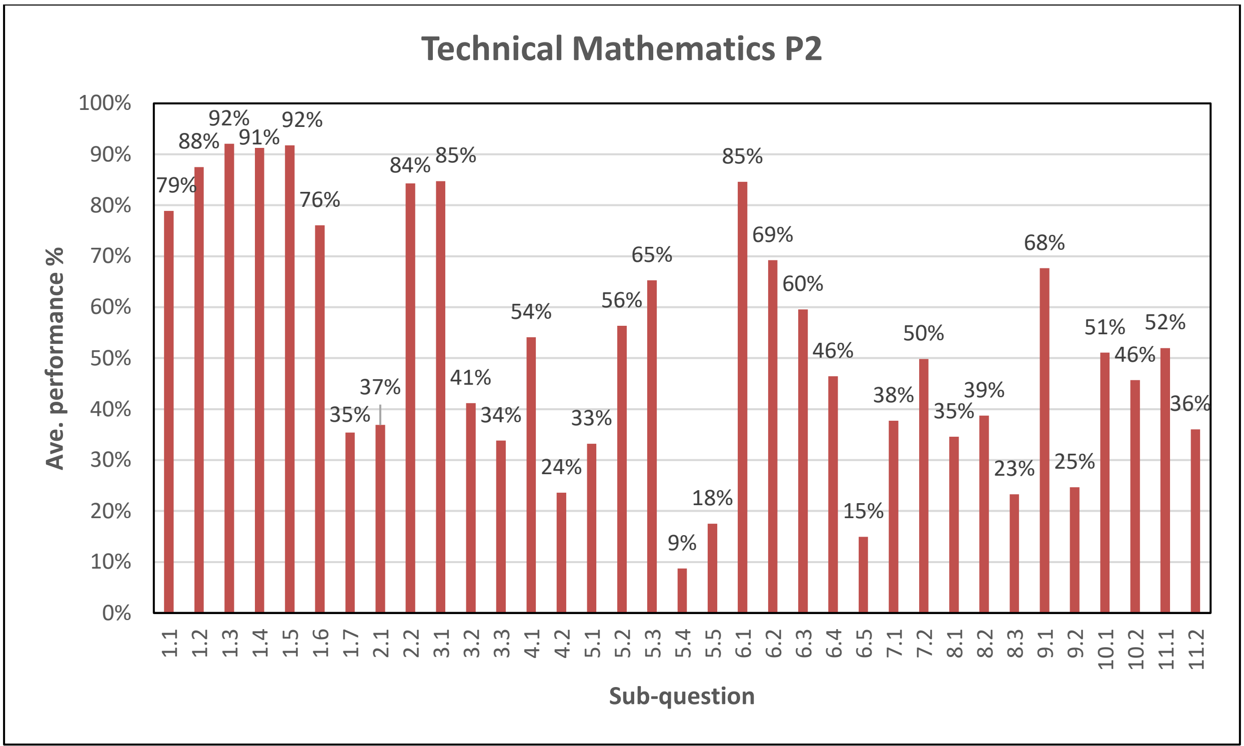
The following graph is based on data from a random sample of candidates. While this graph might not accurately reflect national averages, it is useful in assessing the relative degrees of challenge of each question as experienced by candidates.

**Graph 2.6.1 Average performance per question in Paper 2**




| Q | Topics | Q | Topics |
|---|---|---|---|
| 1 | Analytical Geometry – Lines | 7 | Euclidean Geometry – Circle, Angle in Semi–circle, Cyclic Quads and Angles in Same Segment. |
| 2 | Analytical Geometry – Circle; Tangents; Ellipse | 8 | Euclidean Geometry – Circle – Equal Chords, Angle at Centre and Exterior Angle of Cyclic Quads |
| 3 | Trigonometry – General ratios and Equations | 9 | Euclidean Geometry – Proportionality and Similarity |
| 4 | Trigonometry – Angles, Reductions and Identities | 10 | Mensuration – Angular Velocity, Arc and Sector |
| 5 | Trigonometry – Functions and Graphs | 11 | Mensuration – Area and Volume |
| 6 | Trigonometry – 2D – Sine and Cosine rule | | |

**Graph 2.6.2 Average performance per subquestion in Paper 2**




## 2.7 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 2

### QUESTION 1: ANALYTICAL GEOMETRY

**Common errors and misconceptions**

(a) In Q1.1 many candidates expressed the length of OA as – 4, ignoring the fact that a length cannot be negative.

(b) Some candidates calculated gradient instead of the midpoint in Q1.2. In some instances, candidates swapped the *x*- and *y*-coordinates, writing down: $\mathrm{M}\left(\frac{-2+0}{2};\frac{-3+(-4)}{2}\right)$ and $\mathrm{M}\left(\frac{-3+(-4)}{2};\frac{-2+0}{2}\right)$ instead of $\mathrm{M}\left(\frac{0+(-2)}{2};\frac{-4+(-3)}{2}\right)$

(c) In Q1.3 some candidates wrote the correct formula for the gradient but swapped the *x*- and *y*-coordinates, writing down $m=\frac{3-0}{2-(-4)}$ instead of $m=\frac{2-(-4)}{3-0}$. Furthermore, the omission of brackets when substituting resulted in incorrect simplification, which was evident for many candidates.

(d) Many candidates did not link the gradient calculated in Q1.3 to the size of $\theta$ in Q1.4. They used an unknown gradient that was not given or calculated. Some candidates substituted the gradient value in the position of the angle, that is $\theta=\tan(2)$ instead of $\theta=\tan^{-1}(2)$.

(e) In Q1.6 some candidates substituted incorrect coordinates, by using the coordinates of point A or C instead of B. Furthermore, many candidates struggled with simplification after substituting the coordinate by carrying out incorrect products or transposition. An example of this is shown below:

| | | |
|---|---|---|
| $y-(-3)=2\left(x-(-2)\right)$ | | $y-(-3)=2\left(x-(-2)\right)$ |
| $y+3=2x+2$ | instead of | $y+3=2x+4$ |
| $y=2x+2+3$ | | $y=2x+4-3$ |
| $y=2x+5$ | | $y=2x+1$ |

(f) In Q1.7 most candidates displayed poor conceptual understanding of the 'angle of inclination'. Some candidates correctly calculated the acute (reference) angle but then failed to calculate the angle of inclination which was obtuse. Also, candidates were able to correctly find the angle of inclination $\alpha$, but thereafter could not link it to determining the gradient by simply using the formula $m=\tan\left(\alpha\right)$.

**Suggestions for improvement**

(a) Teachers should continually emphasise that distance is always positive.

(b) The properties of parallel lines need to be emphasised. Learners should know that the gradients of parallel lines are equal.

(c) Learners often confused the gradient formula with the distance formula and the midpoint formula. It is therefore imperative that a solid distinction between the formulae and their respective uses be established by teachers.

(d) Teachers should expose learners to different forms of the equations of straight lines, $y-y_1=m\left(x-x_1\right)$ and $y=mx+c$ as well as how to manipulate these correctly.

(e) Teachers should emphasise the theory and the connection between the gradient and the angle of inclination. Teachers should focus on how to use the formula $\tan\theta=m$ to find the inclination and/or gradient the of a line. Furthermore, the integration of topics is clearly outlined in the *CAPS* document and *Examination Guidelines*, thus teachers should continually endeavour to expose learners to higher order questioning.

**QUESTION 2: ANALYTICAL GEOMETRY**

**Common errors and misconceptions**

(a) In Q2.1.1 many candidates substituted point N which had an unknown *y*-coordinate instead of using point L when attempting to find the equation of the circle. Some candidates also gave the final equation in terms of *r* (i.e. $x^2+y^2=13$) instead of terms of r2 (i.e. $x^2+y^2=169$).

(b) A clear error evident among many candidates in Q2.1.2, was that they did not consider the quadrant containing point N and instead of writing the value of *k* as negative, they wrote it as positive. Also, some candidates omitted the use of brackets during substitution, writing $-5^2+k^2=169$ instead of $\left(-5\right)^2+k^2=169$ resulting in incorrect simplification.

(c) In Q2.1.3 some candidates erroneously attributed the midpoint formula to the finding of point M, which was the intersection of the two tangents. Many candidates displayed difficulty in determining the equation of a tangent to a circle and incorrectly applied the concept of the gradient of perpendicular lines i.e. $m_1 \times m_2 = -1$ when attempting to find the gradient of the tangent line. For instance, if $m_1 = \frac{12}{5}$ many candidates incorrectly respond that $m_2 = -\frac{12}{5}$.

(d) In determining the intercepts of the ellipse in Q2.2, some candidates incorrectly swapped the intercepts (*y*-intercepts = $\pm 5$ and *x*-intercepts = $\pm 2$) instead of the other way around and hence ended up with the vertical ellipse.

**Suggestions for improvement**

(a) Teachers must make learners aware that the equation of a circle is not included in the information sheet. Additionally, educators should highlight that the final equation requires the $r^2$ value and not the r value.

(b) Teachers should provide exercises for learners where they must determine coordinates based on points in different quadrants, paying close attention to the signs of the coordinates.

(c) The tan-radius theorem and its related application to the gradient of perpendicular lines (being negative reciprocals) must be thoroughly taught. Teachers should also demonstrate that the formula $x.x_1 + y.y_1 = r^2$ can be used as an easier alternative for finding the equation of the tangent to a circle.

(d) Teachers should focus on determining of intercepts of an ellipse from its standard form. Learners must also be taught how to correctly plot intercepts and graphs on the Cartesian plane.

**QUESTION 3: TRIGONOMETRY**

**Common errors and misconceptions**

(a) Using the calculator to determine trigonometric ratios in Q3.1 was a challenge for most candidates. Many candidates used the wrong reciprocal of sec and/or substituted incorrectly by interchanging A and B. For example, they wrote:

$= \sqrt{\sin 30{,}5° + \frac{1}{\tan 72°}}$ or $= \sqrt{\sin 72° + \frac{1}{\cos 30{,}5°}}$

In addition, some split the square root and evaluated each ratio separately, despite the expression being under a single radical and wrote:

$= \sqrt{\sin 30{,}5°} + \sqrt{\frac{1}{\cos 72°}}$

(b) In Q3.2.1 candidates often solved for *r* or *y* instead of *x*. Many of them also misidentified the sign of *x* in the fourth quadrant, and then obtained the wrong value for cos *θ*.

(c) In Q3.2.2 it was evident that many candidates did not know the basic definitions of the six trigonometric functions and consequently wrote down incorrect values for cot *θ* and cosec *θ*. Some candidates also included the ratios with the values as follows: $\cot\left(\frac{-12}{5}\right)-\cos ec\left(\frac{-13}{5}\right)$ and this resulted in incorrect answers.

(d) Most of the candidates were unable to get to $\tan x = \frac{1}{-0,587}$ in Q3.3. Many used an incorrect reciprocal for cot *x* or just changed cot *x* to tan *x*. Furthermore, some candidates stopped after finding the reference angle and could not determine the values for *x* in the correct quadrants. This indicated that they did not fully understand the CAST rule.

**Suggestions for improvement**

(a) Teachers must emphasise the three reciprocal trig functions (sec, cosec and cot) and their relationship to the three main trig functions (cos, sin and tan). The importance of accurate substitution must also be emphasised. Learners must be taught to first substitute the given values into the expression before attempting to find the reciprocal. The use of a calculator, with the correct setting in degrees, must also be practised.

(b) Teachers should reinforce the integral relationship between a trigonometric ratio, the CAST rule and the Pythagoras principle. Learners should be instructed to complete the diagram on the Cartesian plane right from the start of the question. They must label the given values on the diagram and use Pythagoras to calculate the unknown side.

(c) Teachers should highlight the difference between a *ratio* and an *angle*; and that a ratio cannot be substituted in the place of an angle.

(d) In terms of trigonometric equations, teachers must expose learners to solving equations involving the three main functions as well as the reciprocal trig functions. Teachers must highlight that the reference angle should always be positive and acute-angled. Furthermore, teachers must emphasise the use of the CAST rule to determine the unknown angles in the respective quadrants.

**QUESTION 4: TRIGONOMETRY**

**Common errors and misconceptions**

(a) In Q4.1.1 most candidates struggled with the basic reduction.

(b) Many candidates could not complete the identity correctly in Q4.1.2. Some candidates mis-read this question and provided the reciprocal identity $\left(\frac{1}{\tan x}\right)$ instead.

(c) In Q4.1.3 most candidates did not know when an expression was undefined. Furthermore, many gave answers as intervals instead of listing the values.

(d) Many candidates struggled to apply the reduction formulae $(180°\pm x)$, $(360° - x)$ in Q4.1.4 as in Q4.1.1; most of them who applied the reduction formulae correctly could not identify the basic identities of $\sin^2 x+\cos^2 x=1$, nor that $\frac{1}{\sin x}+\frac{1}{\tan x}$ leads to

$\operatorname{cosec} x + \cot x$.

(e) It was clear in Q4.2.1 that most candidates did not know how to factorise the given trigonometric expression.

(f) In Q4.2.2 most candidates wrote an incorrect identity for $1 - \sin^2\theta$. Also, many failed to see the link between the common factor removed on the numerator in Q4.2.1. and its relevance in Q4.2.2.

**Suggestions for improvement**

(a) The mastering of the basic reduction rules and identities cannot be overemphasised. Teachers must use the CAST diagram to demonstrate whether a trigonometric ratio is positive or negative in a specific quadrant. Also, learners need to know that radian angles $\pi$ and $2\pi$ stand for 180° and 360° respectively.

(b) Teachers must highlight the importance of using the information sheet to apply key trigonometric identities, such as:
$\sin^2\theta + \cos^2\theta = 1$ and $1 + \tan^2\theta = \sec^2\theta$ and $1 + \cot^2\theta = \operatorname{cosec}^2\theta$

(c) Learners need to practise rearranging these identities to make a specific variable the subject, for example $1 - \sin^2\theta = .....$

(d) The need to apply a systematic approach when simplifying trigonometric expressions or proving trigonometric identities must be emphasised. Teachers must highlight starting with one side, simplifying step-by-step and comparing with the other side. Furthermore, strategies such as finding common denominators, factorising, and substituting equivalent expressions related to the main identities must be emphasised.

**QUESTION 5: TRIGONOMETRY**

**Common errors and misconceptions**

(a) In Q5.1 many candidates could not identify in which direction graph *g* had moved and therefore could not correctly identify the value of *p*. Additionally, many gave an incorrect value for *m*, thus suggesting that they did not understand how it impacted the period of graph *h*.

(b) Many candidates expressed the period of *h* as an interval, such as $(0°;180°)$ in Q5.2. This notation is incorrect and even though the candidates showed an understanding of the concept tested, they could not express the solution in the correct manner.

(c) In Q5.3 some candidates expressed the maximum in coordinate form $(45°;1)$ instead of just giving the maximum value as 1.

(d) Many candidates found Q5.4.1 and Q5.4.2 challenging because of the higher level of complex interpretation involved. Learners were unable to determine where the relevant intervals for $g(x) < h(x)$ and $g(x).h(x) \geq 0$ could be found on the graphs. Many also struggled to write their responses with the correct notation.

(e) In Q5.5 some candidates added 1 to the function instead of subtracting, showing a clear misunderstanding of the concept of vertical translation.

## Suggestions for improvement

(a) Teachers must firstly ensure that learners are grounded in the sketching of trigonometric functions, then gradually expose them to analysis and interpretation of such functions.

(b) Special attention must be given to the effect of the parameters on the sine and cosine functions. Learners should have a strong understanding of how changes to these values modify the graph.

(c) Teachers must focus on basic theory like period, range, amplitude and asymptotes.

(d) Special attention must be given to the technique of interpreting and reading from the graph's intervals where, for instance, $g(x) \geq 0$ or $g(x) \geq h(x)$ etc. Teachers must also focus on how to write these intervals with the correct notation.

### QUESTION 6: TRIGONOMETRY

**Common errors and misconceptions**

(a) Basic geometric concepts such as 'sum angles of a triangle'; 'classification of triangles' and 'properties of parallel lines' tested in Q6.1, Q6.2 and Q6.4 were generally well answered. However, some candidates showed that they did not have an understanding of these basic geometric concepts, which is extremely worrisome since these concepts are covered in Grades 8 and 9. In Q6.1 some candidates wrote $30m$ instead of $30^\circ$, and in Q6.4 many gave the correct value of $M\hat{R}S$ but did not give a reason or gave an incorrect reason.

(b) In Q6.3 most errors occurred when candidates incorrectly used values or sides from different triangles and substituted them into the sine rule or the cosine rule to calculate the length of side MR in $\Delta$ PMR. This approach was invalid, as the rules apply only within the same triangle, and such errors resulted in incorrect calculations and a breakdown in the solution process. Some candidates also used the Pythagoras theorem to find the unknown side even though the triangle was clearly not right-angled.

(c) In Q6.5 candidates were expected to determine whether triangle MRS is right-angled or not; many assumed that it already was and simply verified it being so. Calculations based on assumptions lead to a conceptual breakdown.

**Suggestions for improvement**

(a) A thorough knowledge of basic Euclidean geometry is essential to solve 2D and 3D triangle applications. Teachers must therefore continually revise these Euclidean Geometry concepts from Grades 8–10.

(b) Teachers must ensure that learners know when and how to use the sine, cosine and area rule. They need to understand what is required to use the trigonometric rule and what can then be calculated. In the sine rule for instance, they must know that within the triangle they will need measurements of either two sides and an opposite angle or two angles and one side. For the cosine rule they will need two sides and the included angle or all three sides.

(c) Learners must also be shown how to manipulate each rule and how to make a specific side or angle the subject of the rule.

(d) Teachers must also expose learners to applications requiring higher order reasoning so that they are able to combine knowledge from other topics in Technical Mathematics together with the trigonometry rules to solve such problems.

**QUESTION 7: EUCLIDEAN GEOMETRY**

**Common errors and misconceptions**

(a) A significant number of candidates did not recognise that AC is a diameter of the circle in Q7.1.1. In several instances, candidates provided incomplete or incorrect reasons, such as merely stating 'semi-circle' without linking it to the applicable theorem.

(b) In Q7.1.2 many candidates failed to utilise the given parallel lines and consequently did not identify ACDE as a cyclic quadrilateral.

(c) Evidence from learner responses in Q7.2 indicated that many candidates were unable to complete theorem statements correctly or provide acceptable geometric reasons as prescribed in the *Examination Guidelines*.

(d) Some candidates incorrectly applied congruency properties, instead of the required similarity principles.

**Suggestions for improvement**

(a) Learners are encouraged to revisit Circle Geometry, which is a Grade 11 topic, and to revise all the basic theorems thoroughly.

(b) Learners should be taught systematically to interpret and transfer given information onto the diagrams. Annotating diagrams remains a critical skill in solving Euclidean Geometry problems and teachers should demonstrate this skill when doing Euclidean Geometry riders in class.

(c) Teachers must ensure that learners present solutions strictly in line with the DBE *Examination Guidelines*, particularly those relating to acceptable theorem reasons.

(d) Teachers should spend more time demonstrating to learners how to solve basic problems before moving on to more difficult riders. Teachers should ensure that Grade 12 learners keep engaging with Euclidean Geometry throughout the year and not only whilst teaching proportion and similarity.

**QUESTION 8: EUCLIDEAN GEOMETRY**

**Common errors and misconceptions**

(a) In Q8.1.1–Q8.1.5 most candidates confused sides with angles when giving reasons. They also incorrectly treated the central angle as an angle in the same segment.

(b) Learner responses to Q8.2 highlighted a limited theoretical understanding of Euclidean Geometry, particularly with respect to accurate theorem statements. Most candidates did not follow the theorem correctly and muddled their answers.

(c) In Q8.3 several candidates made incorrect assumptions due to not reading the question correctly.

(d) Some candidates incorrectly assumed that BCF is a tangent, leading to invalid conclusions.

(e) In Q8.3.1 many candidates failed to calculate the sizes of angles correctly. In cases where the correct statement was identified, the reason provided was often unacceptable.

(f) Some candidates frequently omitted the condition AB ∥ CD from their reasoning in Q8.3.1(c), resulting in the loss of the reason mark. Some candidates also incorrectly assumed that AD ∥ BC, leading to flawed deductions.

(g) In Q8.3.2, many candidates were unable to prove that CE = DE. Attempts made were not concluded with the correct reason.

**Suggestions for improvement**

(a) Teachers must emphasise that 'isosceles triangle' is not an acceptable reason. Learners must correctly apply the following theorems:
- If two sides of a triangle are equal, then the angles opposite those sides are equal (∠s opposite = sides).
- If two angles of a triangle are equal, then the sides opposite those angles are equal (side opposite = ∠s or converse ∠s opposite = sides).

(b) Clear distinction between these theorems must be reinforced through targeted practice.

(c) Teachers should consistently emphasise that alternate and corresponding angles are equal; and that co-interior angles are supplementary only when the lines are parallel. Failure to state parallelism results in the loss of the reason mark.

(d) Learners should be exposed to a variety of Euclidean Geometry problems at different cognitive levels to build confidence and procedural fluency in solving geometric riders.

(e) Teachers must ensure that learners practise consistently, as Euclidian Geometry requires the integration of multiple theorems. Insufficient practice remains a major contributor to weak learner performance.

**QUESTION 9: EUCLIDEAN GEOMETRY**

**Common errors and misconceptions**

(a) In Q9.1.1 many candidates demonstrated a lack of understanding of proportionality by selecting incorrect corresponding sides when forming ratios.

(b) Several candidates incorrectly identified more than one pair of parallel lines, despite only one valid pair being present in the diagram.

(c) In Q9.1.2 many learners did not understand the directive 'HENCE', failing to use the established proportion from Q9.1.1 to calculate the length of AD.

(d) In Q9.2 some candidates wrote down proportions without expressing them as ratios or demonstrating the equality of ratios.

(e) Incorrect reasons for similarity were frequently provided, with several candidates stating SSS, which is a condition for congruency and not similarity.

**Suggestions for improvement**

(a) Learners must be exposed to the different ways of applying the proportionality theorem across the parallel sides of the triangle.

(b) Teachers need to emphasise the difference between the ratios for similarity and those for proportionality.

(c) Teachers must ensure that learners understand that triangles are similar when: corresponding angles are equal, or corresponding sides are in the same proportion.
To prove similarity, learners must demonstrate either:
- Two pairs of equal angles, or
- Three pairs of corresponding sides in the same ratio.

(d) Teachers must work through exercises on proving triangles similar using both methods of similarity with learners.

**QUESTION 10: CIRCLES, ANGLES AND ANGULAR MOVEMENT**

**Common errors and misconceptions**

(a) In Q10.1.1 and Q10.1.2 numerous breakdowns were evident. For example, although some candidates correctly calculated the rotational frequency as 60 r/min in Q10.1.1, they incorrectly substituted rotational frequency for angular velocity in Q10.1.2, resulting in a complete breakdown.

(b) Many candidates substituted 310 mm (the lawnmower body) instead of 300 mm (the blade), indicating poor understanding of contextual information.

(c) Several candidates omitted the square on $x^2$ during substitution in Q10.1.3, resulting in the loss of the substitution mark.

(d) In Q10.2.1, a notable number of candidates were unable to convert degrees to radians correctly. Many incorrectly wrote $115° \times \frac{180°}{\pi}$ instead of $115° \times \frac{\pi}{180°}$.

(e) Some candidates failed to substitute angles in radians, leading to the loss of the simplification mark. They incorrectly wrote down:

$$\begin{aligned} A &= \frac{r^2\theta}{2} \\ &= \frac{(4,5)^2 \times 115°}{2} \\ &= 1164,38 \end{aligned}$$

(f) In Q10.2.3 most candidates either did not attempt the question or displayed a limited understanding of ratios, incorrectly assuming that DO = 3 m, based on the given ratio.

**Suggestions for improvement**

(a) Teachers must show explicitly the potential breakdown points when applying the various formulae. They must also train learners to check substitutions carefully.

(b) Learners must be reminded consistently that in angular motion formulae, the angle ($\theta$) must be expressed in radians.

(c) Teachers should emphasise that ratios do not represent actual lengths. For example:
- If (BO) is divided into 2 parts and 3 parts, then 5 parts represent the total length.
- One-part equals $0,9\ m$; therefore $\mathrm{DO} = 3 \times 0,9 = 2,7\ m$.

(d) Teachers should regularly expose learners to real-life problems involving circular and angular motion as this will enhance their understanding of these types of problems and better prepare them for the examinations.

## QUESTION 11: MENSURATION

### Common errors and misconceptions

(a) In Q11.1.3 many candidates lost marks due to incorrect substitution into the mid-ordinate rule. Confusion arose from alternating between the two provided formulae, resulting in a complete breakdown of the solution. Some candidates revealed uncertainty in interpreting $o_{n-1}$. They all subtracted 1 from the ordinates and consequently did not simplify correctly.

(b) In Q11.2.2, many candidates had trouble converting units from metres to centimetres. Candidates did not know whether to multiply or divide by the factor, which was 100. Some incorrectly assumed that the factor was 10 or 1 000.

(c) Some candidates misread the question or formula in Q11.2.3, substituting 20 cm instead of 10 cm (for the radius) and 0,5 m instead of the converted height of 50 cm.

(d) In Q11.2.4 most learners failed to recognise that the question involved volume, resulting in learners not attempting the question or incorrectly comparing areas.

(e) The higher order Q11.2.4 posed a challenge for most candidates. Persistent weaknesses were observed in working with percentages, particularly in calculating and interpreting the 18% loss. Many used incorrect formulae and could not determine the volume of the cylindrical rod or a single steel bearing to answer the question correctly.

### Suggestions for improvement

(a) Teachers should use only one formula for the mid-ordinate rule to avoid confusing learners.

(b) Unit conversion should be reinforced as a foundational skill using a structured approach: Current units × Conversion factor = Required units.

(c) Learners should be given regular opportunities to work with percentage calculations in varied contexts.

(d) Teachers must emphasise key words, contextual interpretation and careful reading of questions as Mensuration questions in most instances require direct application of the provided formulae.

(e) Regular exposure to real-life problems will enhance the understanding of measurement problems. Teachers should also ensure that such questions are designed to elicit higher order reasoning and integration of different concepts and skills.

# CHAPTER 3

## TECHNICAL SCIENCES

**The following report should be read in conjunction with the Technical Sciences question papers of the NSC November 2025 examinations.**

### 3.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Technical Sciences examination in 2025 increased significantly by 3 231 compared to that of 2024.

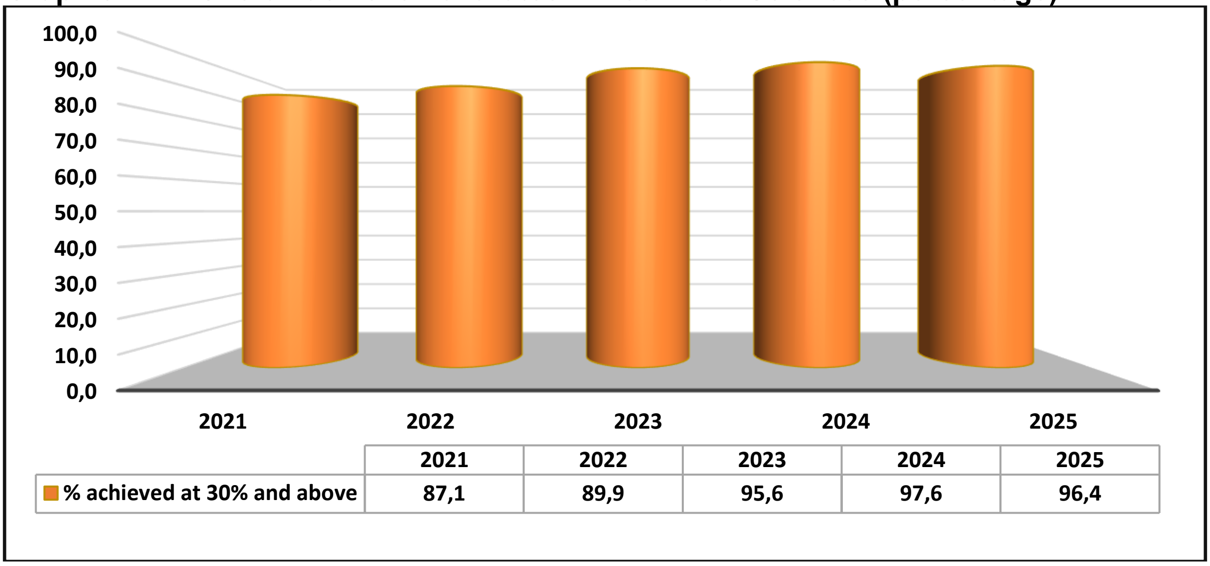
There was a marginal decline in the pass rate this year, but an increase in the number of candidates who passed. The percentage of candidates who passed at the 30% level declined from 97,6 in 2024 to 96,4 in 2025. There was a corresponding decline in the pass rate at the 40% level and above over the past two years from 71,8% to 61,2%. The percentage of distinctions over 80% also declined from 1% in 2024 to 0,4% in 2025. The total number of distinctions has shown a decrease for the past two years from 173 in 2024 to 82 in 2025.

Despite the slight decline in the number of distinctions, the results achieved by this cohort are commendable. Strategic intervention programmes at all levels (National, Provincial, Districts and Schools) ensured that learners were adequately prepared. The diligence and perseverance of the above-average candidates also contributed to the favourable overall performance.

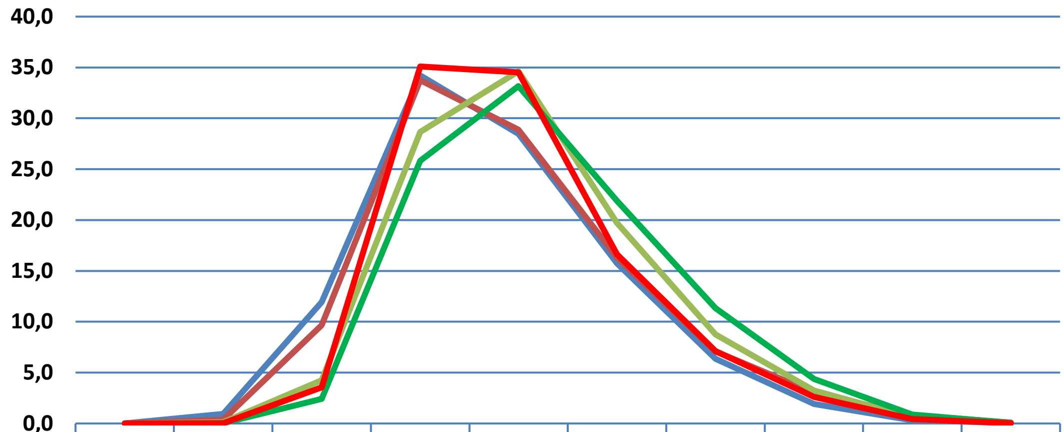
**Table 3.1.1 Overall achievement rates in Technical Sciences**

| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| **2021** | 14 642 | 12 758 | 87,1 |
| **2022** | 15 753 | 14 168 | 89,9 |
| **2023** | 16 322 | 15 609 | 95,6 |
| **2024** | 17 273 | 16 854 | 97,6 |
| **2025** | 20 504 | 19 768 | 96,4 |

**Graph 3.1.1 Overall achievement rates in Technical Sciences (percentage)**



**Graph 3.1.2 Performance distribution curves in Technical Sciences (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,9 | 11,9 | 34,2 | 28,5 | 15,7 | 6,4 | 1,9 | 0,3 | 0,0 |
| 2022 | 0,0 | 0,4 | 9,7 | 33,8 | 28,9 | 16,3 | 7,1 | 3,0 | 0,8 | 0,1 |
| 2023 | 0,0 | 0,1 | 4,2 | 28,6 | 34,6 | 19,7 | 8,7 | 3,2 | 0,6 | 0,1 |
| 2024 | 0,0 | 0,0 | 2,4 | 25,8 | 33,2 | 21,9 | 11,3 | 4,4 | 0,9 | 0,1 |
| 2025 | 0,0 | 0,0 | 3,6 | 35,1 | 34,5 | 16,6 | 7,1 | 2,6 | 0,4 | 0,0 |

There is much room for improvement in the performance of the candidates as the challenges surrounding conceptual understanding, mathematical skills, integration of topics, problem-solving skills and practical work are being addressed.

## 3.2 OVERVIEW OF CANDIDATES' PERFORMANCE IN PAPER 1

**General comments**

(a) The multiple-choice items in Q1 and the questions on Newton's laws (Q2), Momentum (Q3) and Impulse and Electric Circuits (Q9) were generally well answered.

(b) Generally, Q4, Q5, Q7, Q8 and Q10 were poorly answered. Q4 assessed work, energy and power; Q5 was based on elasticity; Q7 examined waves, sound and light; Q7 focused on capacitors; and Q10 tested electric machines (motor, generators and transformers).

(c) Candidates continued to struggle with recall questions although there was a slight improvement in these types of questions. Key words were still being omitted by candidates.

(d) The application of mathematical principles, such as understanding and using formulae, scientific notation as well as interpreting and representing direction in terms of a positive and negative sign, was still a challenge for many candidates.

(e) The concept of SI units must be thoroughly emphasised.

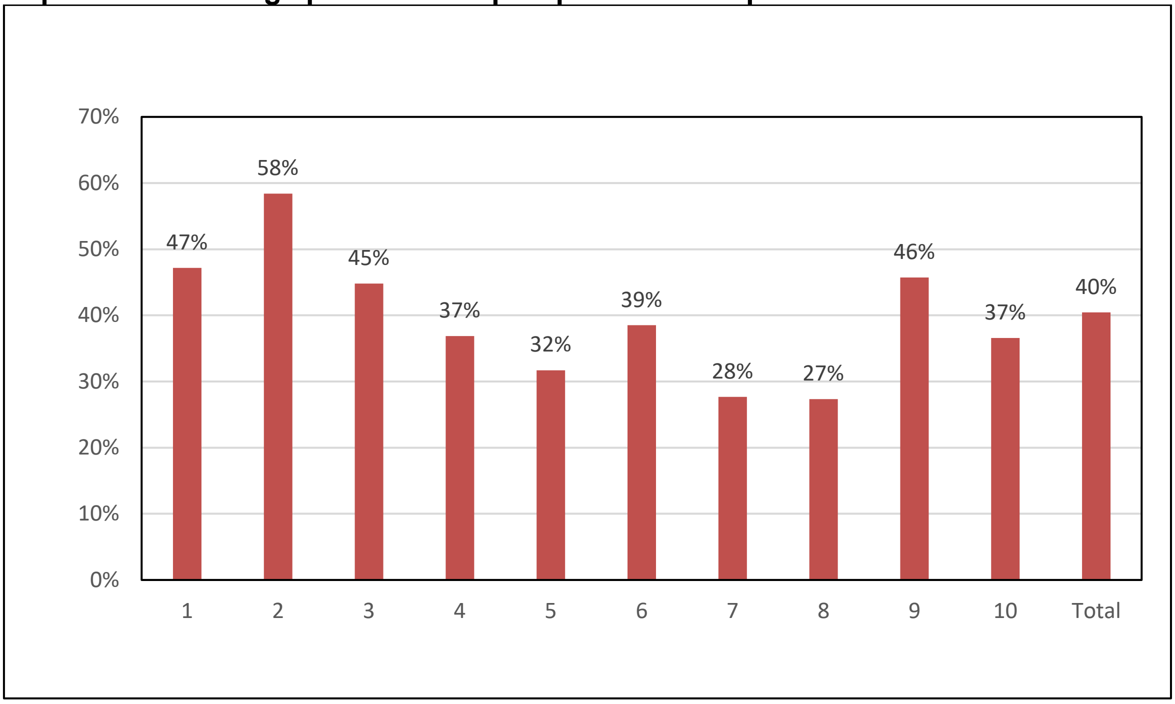
(f) Interpretation of graph-based questions still posed a challenge.

(g) Compared to previous years, candidates improved in drawing and labelling free-body diagrams.

## 3.3 DIAGNOSTIC QUESTION ANALYSIS OF PAPER 1

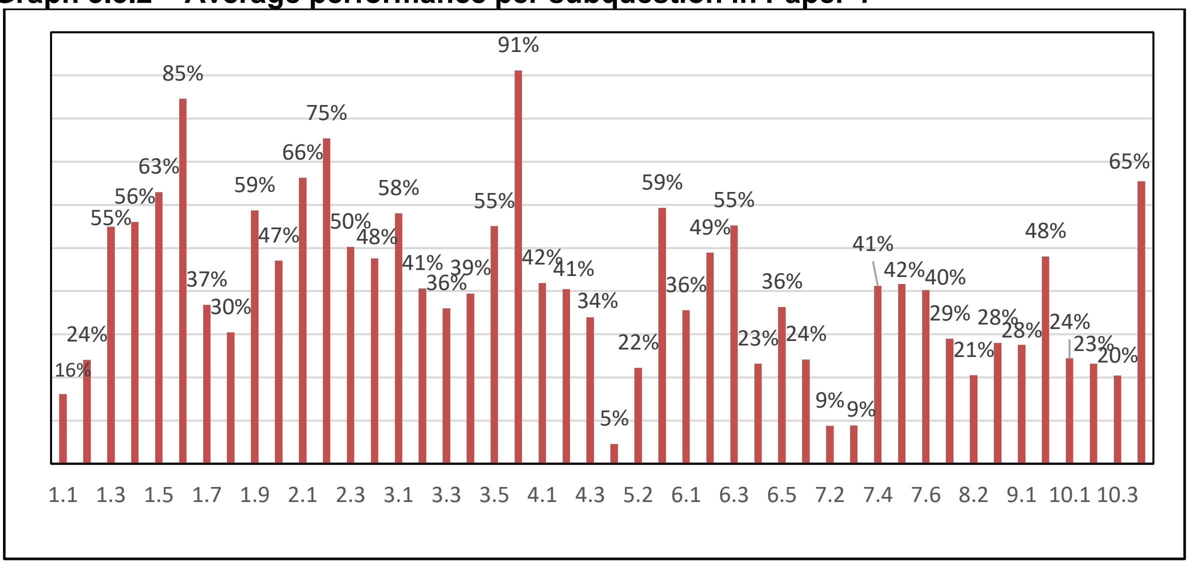
The following graph is based on data from a random sample of candidates. While this graph might not accurately reflect national averages, it is useful in assessing the relative degrees of challenge of each question as experienced by candidates.

**Graph 3.3.1 Average performance per question in Paper 1**




| Q | Topic | Q | Topic |
|---|---|---|---|
| 1 | MCQ | 6 | Hydraulics and Viscosity |
| 2 | Newton's laws | 7 | Light and Electromagnetic radiation |
| 3 | Momentum and impulse | 8 | Electrostatics: Capacitors |
| 4 | Work, energy and power | 9 | Electric Circuits |
| 5 | Elasticity | 10 | Electromagnetism |

**Graph 3.3.2 Average performance per subquestion in Paper 1**



## 3.4 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 1

### QUESTION 1: MULTIPLE-CHOICE QUESTIONS

**Common errors and misconceptions**

(a) The majority of candidates failed to compare the coefficients of static friction and kinetic friction when the same object moves on the same surface in Q1.1. This indicated that there were misconceptions and a lack of understanding of the fundamental difference between the two types of friction.

(b) In Q1.2 most candidates failed to correctly relate the object's mass and acceleration for given objects with different masses and how they influence the object's acceleration if the mass is increased.

(c) In Q1.3 a significant number of candidates struggled to relate the object's mass and velocity for given objects with different masses and how they influence the object's speed if the mass of one object was double the other.

(d) Many candidates displayed a lack of understanding of properties of the image formed by the concave lens when an object was placed between F and the lens in Q1.8.

**Suggestions for improvement**

(a) The coefficient of static friction should be used only when the object is at rest relative to the surface or when determining the minimum force required to initiate motion. The coefficient of kinetic friction should be referred to only when the object is moving across the surface. Teachers must explain that the coefficient of static friction is always greater than the coefficient of kinetic friction, ($\mu_s > \mu_k$).

(b) Teachers must expose learners to questions from different cognitive demands, including simple basic calculations to complex ones and those that require the application of ratios in formal and informal assessments.

(c) Teachers are advised to incorporate multiple-choice questions in their daily informal assessment tasks. Learners should be given the opportunity to explain their choices so that misconceptions can be clarified.

(d) Properties of images for both concave and convex lenses must be explained through practical work and drawing of ray diagrams for different positions of the object.

### QUESTION 2: NEWTON'S LAWS OF MOTION

**Common errors and misconceptions**

(a) When stating Newton's second law in Q2.1, some candidates omitted the word 'net' and wrote 'force' instead of 'net force'. A notable number of candidates stated Newton's First Law while others stated Newton's Second Law in terms of momentum.

(b) In Q2.2 a notable number of candidates committed the following errors when drawing a free body diagram:
- Lines without arrows
- No dot to represent the object

- Leaving gaps between the dot and the lines
- Drawing dotted lines instead of solid lines
- Drawing extra force(s)
- Incorrect direction of the forces
- Unconventional abbreviations like '$f_{fr}$' for friction; 'tt' for tension; '$N_f$ or 'n' for normal force and '$G_f$' as gravitational force

(c) Most candidates left out the vertical component of the applied force in Q2.3.1 when calculating the normal force. Some used the incorrect equation N = mg for calculating the normal force instead of $N = F_g + F_{y.}$ In the final answer, they also omitted the unit and rounded off incorrectly.

(d) When calculating the acceleration of the system in Q2.3.3, some candidates did not isolate the objects when applying Newton's second law. A notable number used system approach and omitted the subscript 'net' in the formula $F_{net}$ = ma. Some candidates calculated tension instead of acceleration. In cases where acceleration was calculated, the incorrect SI unit of $m \cdot s^{-1}$ was used.

(e) In Q2.4 the majority of candidates failed to understand how the normal force would be affected for the same object, when the angle between the surface and applied force was changed from 25° to 0° without changing the surface.

**Suggestions for improvement**

(a) Teachers must train learners to state the laws and principles without omitting the key words.

(b) The concept of net force must be clearly explained through the use of practical examples.

(c) When drawing free-body diagrams, teachers must emphasise the use of labelled arrows and acceptable labels or abbreviations. The use of dotted lines must be discouraged.

(d) Teachers must explain that the normal force expression changes according to the given scenario and is not always equal to the weight. When an external force is applied at an angle, its vertical component must be considered when calculating the normal force.

(e) For a two-body system, the objects must be isolated when calculating the acceleration. Simultaneous equations must be derived from both objects. The formula used must be copied as it is on the formula sheet and appropriate units must be used.

(f) Learners must be exposed to higher-order questions that involve explaining, justifying, evaluating, etc. They must also be encouraged to use formulae to explain the relationship between variables.

**QUESTION 3: MOMENTUM AND IMPULSE**

**Common errors and misconceptions**

(a) In Q3.1 a notable number of candidates omitted key words, such as 'total', 'magnitude', 'isolated system' and 'direction', when stating the principle of conservation of linear momentum.

(b) In Q3.2.1 most candidates could not write the correct formula or expression for the principle of conservation of linear momentum. They left out subscripts to represent car A and car B. They struggled with application of sign convention for direction when substituting in the formula. Others swopped the initial and final velocities and did not include direction in the final answer.

(c) A significant number of candidates could not extract or interpret data from the graph provided to calculate the net force that car A exerts on car B in Q3.2.2. They struggled to write the correct formula and wrote $p = F_{net}\,\Delta t$ omitting the $\Delta$ sign instead of $\Delta p = F_{net}\,\Delta t$. Some swopped the initial and final velocities and masses of car A and B.

(d) Many candidates started the calculation using the expression $\Sigma E_{ki} = \Sigma E_{kf}$ and $\Sigma p_i = \Sigma p_f$ to determine if the collision was elastic or inelastic in Q3.3. The $\Sigma E_{ki}$ and $\Sigma E_{kf}$ should be calculated separately and then a conclusion be made. In other instances, the sigma sign was omitted and the initial and final velocities were swopped.

(e) In Q3.4 a significant number of candidates failed to write the magnitude of the force that car B will exert on car A. They could not relate this question to Newton's third law of motion.

**Suggestions for improvement**

(a) Daily short speed tests should be conducted to train learners to learn definitions, principles and laws.

(b) Teachers should emphasise the importance of writing subscripts in all the formulae that require them. Sign convention and having appropriate units and direction, where necessary in the final answer, must be emphasised.

(c) Guided practice should be used to teach learners how to read and analyse graphs. Interpretation of graphs may be used in daily assessments to prepare learners for formal assessment.

(d) Learners must be encouraged to underline the key words in the statement, e.g. *rest*, *stationary*, *constant velocity*, etc., when analysing the question.

(e) When determining if the collision is elastic or inelastic, learners must calculate the total kinetic energy before and after collision separately before writing a conclusion.

(f) Integration and application of laws must be drilled through informal and formal assessments.

(g) When dealing with calculations, the writing of a correct formula, substitution, answer with appropriate units and direction in case of vectors as well as correct computation skills, should be well-addressed.

(f) Teachers must undertake all informal experiments as they form part of the assessment.

**QUESTION 4: WORK AND ENERGY AND POWER**

**Common errors and misconceptions**

(a) Most candidates left out key words such as 'net' and 'external force' when defining isolated system in Q4.1.

(b) In Q4.2.2 many candidates struggled to calculate the work done by friction. They substituted 40° instead of 180° for θ in the formula W = FΔxcosθ.

(c) A significant number of candidates failed to explain whether mechanical energy is conserved or not when a block slides along a frictionless track in Q4.3.1.

(d) In Q4.3.2 and Q4.3.3 most candidates omitted the subscripts in the formulae,

$EP_{(A)} + EK_{(A)} = EP_{(B)}) + EK_{(B)}$ and $ME_{(C)} = ME_{(B)}$.

**Suggestions for improvement**

(a) Teachers must emphasise the inclusion of key words when stating the laws or principles and when defining the terms.

(b) Teachers must explain that the purpose of cos $\theta$ is to find the component of the force that is acting in the direction of the displacement. Resolution of forces into components must be emphasised.

(c) The correct use of the angles 90°, 270°, 0° and 180° between the displacement and forces acting on the object must be thoroughly explained.

(d) The importance of using correct formulae from the data sheet, including subscripts where necessary, must be emphasised.

**QUESTION 5: ELASTICITY**

**Common errors and misconceptions**

(a) The majority of candidates defined *elasticity* or *strain* instead of *Young's modulus of elasticity* in Q5.1.

(b) In Q5.2.1 many candidates guessed the answer without considering whether the material's stiffness or flexibility aligns with the given scenario. A good number of them could not motivate their choice in Q5.2.2.

(c) In Q5.3 a notable number of candidates used Y in a formula of Young's modulus of elasticity instead of K. Some substituted values with incorrect exponents.

**Suggestions for improvement**

(a) Definitions must be infused into daily teaching and learning to reinforce understanding of concepts. Teachers must explain concepts thoroughly.

(b) Explanation and scientific reasoning types of questions must be infused in daily assessment.

(c) Learners must be encouraged to use the information sheet and data sheet. Teachers should emphasise the identification and copying of the correct formulae into the answer sheet.

**QUESTION 6: HYDRAULICS AND VISCOSITY**

**Common errors and misconceptions**

(a) In Q6.1 the majority of candidates omitted the key words 'continuous liquid', 'pressure applied', 'equilibrium' and 'equally' when stating Pascal's law.

(b) A notable number of candidates in Q6.2 used the inappropriate formula of $\sigma$ = F/A or P = $\sigma$gh instead of P = F/A. Some candidates were unable to calculate the area before substitution into the formula for pressure.

(c) A significant number of candidates could not justify why oil with lower viscosity was suitable to be used in a cold environment in Q6.4.1 and Q6.4.2.

(d) In Q6.5 a significant number of candidates struggled to explain what would happen to the viscosity of the hydraulic oil when the machine is in operation. Their responses centred on cold environment instead of the relationship between temperature and viscosity.

**Suggestions for improvement**

(a) To master the definitions, learners and teachers must use the *Examination Guidelines* and identify key words in the definitions. Laws must be stated as they appear in the *Examination Guidelines*.

(b) Learners must be familiar with the data sheet so that they can identify relevant formulae for each topic.

(c) Viscosity must be taught using examples relating to industry and technology. Teachers must explain the relationship between oil viscosity and the temperature of the environment.

(d) Use experiments to compare flow rates of liquids at different temperatures to visualize viscosity changes.

(e) Learners must be exposed to questions that require reasoning and explanation.

**QUESTION 7: LIGHT AND ELECTROMAGNETIC RADIATION**

**Common errors and misconceptions**

(a) A substantial number of candidates could not define *reflection* in Q7.1.1; instead they provided the definition for *refraction*

(b) In Q7.1.2 a significant number of candidates struggled to write down the letters as they would appear in the mirror. They wrote the letters as **LAP** or **˥∀d** instead of reversing letters correctly as ⅃Aꟼ . Candidates thought 'reflection' means rearranging letters, not reversing orientation.

(c) Some candidates failed to state the characteristics of the image formed in the plane mirror in Q7.1.3. They omitted the words 'laterally inverted' and only wrote 'inverted'.

(d) Most candidates struggled to define the term *critical angle* in Q7.2.1. Phrases like 'angle of incidence 'and 'optically dense medium' were omitted.

(e) In Q7.2.2 a significant number of candidates failed to write the range of angles that will make it possible for the total internal reflection to occur.

(f) The majority of candidates were not familiar with how electromagnetic waves are generated in Q7.3.

(g) In Q7.4.1 many candidates could not define a *photon*. Some omitted the key words 'quantum' or 'packet'.

(h) Some candidates could not calculate the frequency of the photon in Q7.4.3. Those that managed to calculate it did not correctly round off the final answer.

(i) A significant number of candidates failed to identify the electromagnetic wave with the lowest penetrating ability in Q7.5.1 and the shortest wavelength in Q7.5.2.

(j) In Q7.6 the majority of candidates had difficulty in writing the relationship between wavelength and frequency.

**Suggestions for improvement**

(a) The use of the *Examination Guidelines* must be encouraged for learners to master definitions.

(b) Teachers are encouraged to use demonstrations, experiments using the ray box and simulations when teaching the concept of light. Hands-on experience provides a valuable opportunity to consolidate theoretical knowledge and strengthen a conceptual understanding of the topic.

(c) Teachers should provide tables for learners to fill in image properties for plane mirrors versus lenses to notice the difference. For plane mirrors a mnemonic device can be used, e.g. 'VULS' → **V**irtual, **U**pright, **L**aterally inverted, **S**ame size.

(d) The spectrum of light and electromagnetic radiation must be taught using sketches, diagrams, videos, pictures and animations to enhance learners' conceptual development and understanding.

(e) The relationship between the wavelength, speed, energy and frequency must be thoroughly explained.

(f) In calculations, learners must analyse the data and identify the variable to be calculated before deciding which formula to use.

**QUESTION 8: ELECTROSTATICS: CAPACITORS**

**Common errors and misconceptions**

(a) In Q8.1 most candidates defined *capacitor* instead of *capacitance*. Those who managed to define *capacitance* omitted the words 'amount', 'per volt' or 'store'.

(b) The majority of candidates were unable to name the components of a capacitor in Q8.2.

(c) When calculating the value of the potential difference in Q 8.3.1, most candidates did not convert 300 μF to F. Some substituted the 230 V that was supposed to be used as a comparison to decide whether the capacitor would work. Others could not provide a correct conclusion.

(d) In Q8.3.2 a notable number of candidates struggled to state ways to decrease the capacitance of a capacitor. Those candidates that were able to provide the factors that would affect the capacitance, did not explain how these factors decrease capacitance, e.g. 'area of the plates' instead of 'decrease the area of the plates'

**Suggestions for improvement**

(a) The difference between a capacitor and capacitance must be thoroughly explained.

(b) When teaching capacitors, teachers should explain the components of a capacitor by means of diagrams, pictures and physical components.

(c) Teachers should expose learners to the practical applications of capacitors and the process to charge and discharge a capacitor.

(d) Practical activities and PhET simulations must be used to reinforce the understanding of the concepts and factors affecting the capacitance of a capacitor.

(e) Learners must be given multi-step problems where they calculate Q, V, and energy stored. Conversion of units must be infused in daily activities for drilling purpose.

(f) Teachers may use the table below as a guide to assist the learners:

| Aspect | Capacitor | Capacitance |
|---|---|---|
| **Definition** | A physical electrical component that stores electric charge. | The ability of a capacitor (or system) to store electric charge per unit volt. |
| **Type** | A device/material object. | A physical property or quantity. |
| **Unit** | No unit (it is a component). | Measured in farads (F). |
| **Symbol** | Usually represented by this circuit symbol: ┤├ | Represented by the symbol C. |
| **Function** | Stores energy in an electric field between two plates. | Quantifies how much charge can be stored per unit voltage. |
| **Depends On** | Plate area, distance between plates, type of dielectric. | All the physical characteristics of the capacitor. |
| **Example** | Ceramic capacitor, electrolytic capacitor. | A capacitance of 100 μF, 10 pF, etc. |

**QUESTION 9: ELECTRIC CIRCUITS**

**Common errors and misconceptions**

(a) In Q9.1 a significant number of candidates could not state factors affecting the resistance of a conductor. Some candidates used the word 'size' instead of 'length or thickness' when stating factors, and 'heat' was used instead of 'temperature'.

(b) In Q9.2.1 some candidates struggled to calculate *power* in the 4 Ω light bulb while others wrote the wrong unit SI unit.

(c) A notable number of candidates calculated the total resistance of the circuit instead of the total resistance of the parallel branch in Q9.2.2.

**Suggestions for improvement**

(a) Factors affecting the resistance must be thoroughly taught in Grade10 and should be formally and informally assessed in Grade 11 and 12.

(b) Teachers must expose learners to different examples showing the different types of connections and assessment when teaching electric circuits. Learners must be provided with the formula sheet to be used in formal and informal assessment.

(c) Use colour codes to identify series vs parallel branches before calculating.

(d) Practical activities and PhET simulations must be used to reinforce the understanding of the concepts of resistors connected to parallel and series.

(e) Mathematical skills such as the addition and inversion of fractions must be given attention when calculating resistors in series and in parallel.

**QUESTION 10: ELECTROMAGNETISM**

**Common errors and misconceptions**

(a) When stating Lenz's Law in Q10.1, some candidates omitted key terms like 'direction' 'induced emf', 'opposes' and 'effect that produces it'.

(b) Most candidates struggled to give examples of applications of Lenz's Law in Q10.2.

(c) A good number of candidates could not draw the magnetic field pattern around the current-carrying loop/conductor in Q10.3.2. A notable number of candidates drew a magnetic field around a bar magnet.

(d) In Q10.4 some candidates tried to manipulate the formula to calculate the voltage in the primary coil, but were unsuccessful in getting it right.

**Suggestions for improvement**

(a) Teachers must emphasise and drill the skill of stating the laws and principles.

(b) Learners must be provided with a list of examples of Lenz's Law in technology.

(c) Teachers must emphasise the correct representation of induced magnetic fields around straight current carrying conductor, loop and a solenoid.

(d) Learners must be encouraged to copy the formulae directly from the formula sheet and substitute into them without manipulating the formula.

## 3.5 OVERVIEW OF CANDIDATES' PERFORMANCE IN PAPER 2

**General comments**

(a) Candidates performed below 40% in the following questions: chemical reactions of organic compounds (Q4); electronic properties of matter (Q5) and the electrolytic cell (Q6). As in previous years, Q4 continues to challenge candidates.

(b) The best performance was in Q1 (Multiple-choice Questions), Q2 (Naming of organic compounds) and Q7 (Galvanic cell). However, it appeared that some candidates continued to guess the answers to the multiple-choice questions by writing one letter for all questions or following a specific pattern.

(c) In general, there was an improvement in performance in Paper 2. Q1, based on multiple-choice questions, was the question that showed the most improvement, improving from 35% in 2024 to 49% in 2025.

(d) Q6, which focused on electrolytic cells, registered a decline in performance.

(e) A notable number of candidates did not adhere to the instructions in the question paper.

(f) Most candidates improved in recall questions, however, a significant number of them omitted key words in definitions.

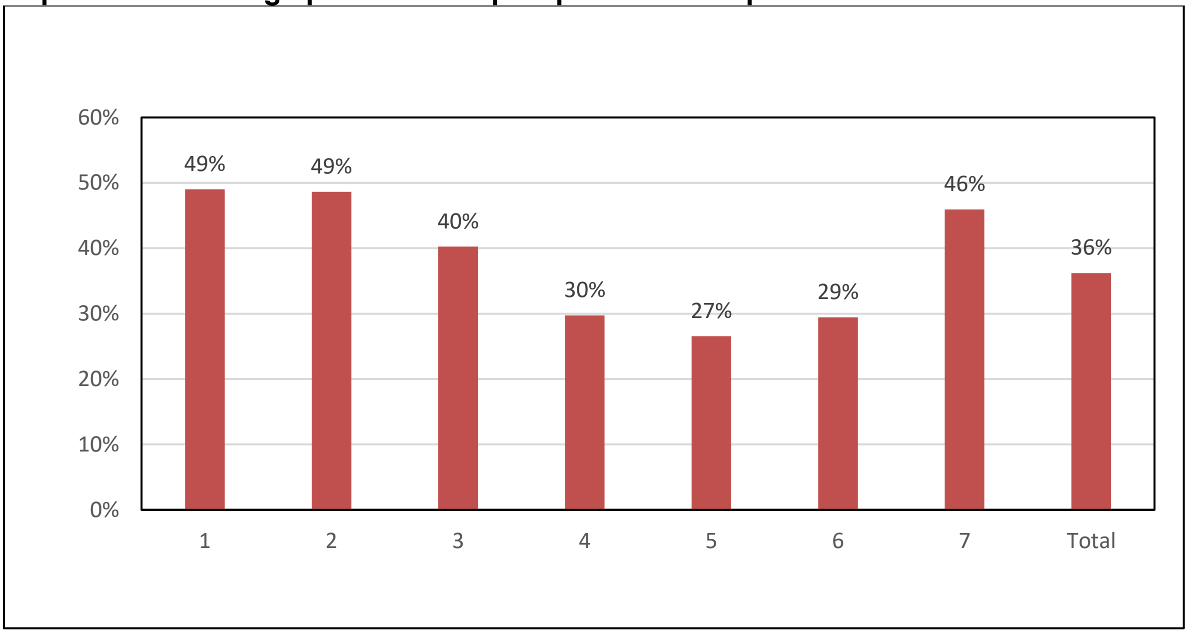
(g) A significant number of candidates had difficulty to answer Q1.4 which was based on the topic of electronic properties of matter.

(h) The majority of candidates were not familiar with the Table of Standard Reduction Potentials.

## 3.6 DIAGNOSTIC QUESTION ANALYSIS OF PAPER 2

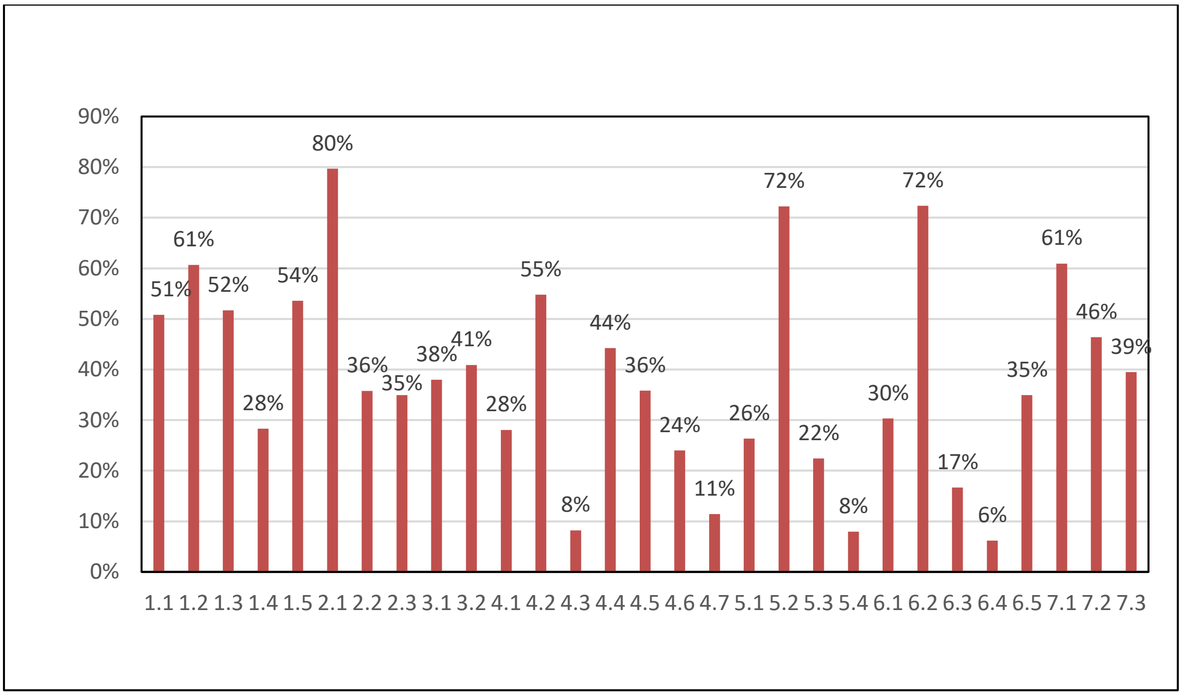
The following graph is based on data from a random sample of candidates. While this graph might not accurately reflect national averages, it is useful in assessing the relative degrees of challenge of each question as experienced by candidates.

**Graph 3.6.1 Average performance per question in Paper 2**




| Q | Topics | Q | Topics |
|---|---|---|---|
| 1 | Multiple-choice Questions | 5 | Electronic Properties of Matter |
| 2 | Naming of Organic Molecules and Structures | 6 | Electrolytic Cell |
| 3 | Physical Properties of Organic Molecules | 7 | Galvanic Cell |
| 4 | Reactions of Organic Compounds | | |

**Graph 3.6.2 Average performance per subquestion in Paper 2**




## 3.7 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 2

**QUESTION 1: MULTIPLE-CHOICE QUESTIONS**

**Common errors and misconceptions**

(a) A notable number of candidates struggled to distinguish between the addition of $H_2$ to an alkene (hydrogenation) and the addition of $X_2$ (halogenation) in Q1.1.

(b) In Q1.3 a significant number of candidates failed to select a saturated hydrocarbon from four different condensed structures.

(c) The concept *doping* in Q1.4 posed a serious challenge to most candidates. A significant number of candidates had difficulty to select elements in the periodic table that can be used for doping. They were not familiar with the terms *trivalent* and *pentavalent*.

(d) In Q1.5 the majority of candidates struggled to identify the correct characteristics of a galvanic and electrolytic cells. A notable number of candidates selected option A.

**Suggestions for improvement**

(a) Multiple-choice questions must be infused into informal activities like classwork, homework, class tests and quizzes.

(b) When answering multiple-choice questions, teachers should encourage learners to use the elimination method and provide a reason for their choice.

(c) Different types/names of organic reactions must be taught using examples and simulations.

(d) Learners should be exposed to different types of formulae, such as molecular; condensed structural and structural formula.

(e) Teachers should teach learners about the periodic table prior to teaching electronic properties and the elements used for doping.

(f) District/PED subject advisors must develop a study manual with multiple-choice questions and share it with teachers and learners.

(g) Examinable Grade 10 and 11 topics should always be integrated into teaching and learning in Grade 12.

(h) Teachers should drill learners on basic concepts such as SI units, symbols, definitions and principles/laws.

(i) Learners must be given constructive feedback timeously.

**QUESTION 2: NAMING OF ORGANIC MOLECULES AND STRUCTURAL FORMULAE**

**Common errors and misconceptions**

(a) In Q2.1.1 most candidates had difficulty identifying a *saturated hydrocarbon* as they confused it with the *unsaturated hydrocarbon*.

(b) Q2.1.2 required candidates to identify an *isomer of but-2-ene*. A substantial number of candidates struggled to answer this question.

(c) A notable number of candidates wrote *ketone* instead of *keto/carbonyl* group when asked to write a functional group of propanone in Q2.2.1. Others also wrote *formyl* or *carboxylic* group instead of *carbonyl* group. Some of them confused a functional group and a homologous series.

(d) In Q2.2.2 the writing of IUPAC names posed a serious challenge for the majority of candidates. Common errors were:
- Failure to write the substituents in IUPAC name in alphabetical order; some wrote substituents in capital letters.
- Inability to give a functional group (halide/bromide) highest priority/lowest possible number.
- Miscalculating the number of carbon atoms of the compound to identify a parent name.
- Omitting a comma and/or a hyphen, or inserting them in the incorrect positions.

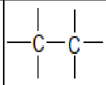
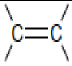
(e) A significant number of candidates wrote 'easter' instead of 'ester' in Q2.3.1. Some candidates confused an ester with a ketone.

(f) The majority of candidates omitted the bonds or hydrogens when writing a structural formula of an ester/ethyl butanoate in Q2.3.2. Some drew carbons with 5 bonds.

(g) In Q2.3.3 a substantial number of candidates struggled to write a general formula of a given ester, ethyl butanoate.

**Suggestions for improvement**

(a) Teachers should encourage learners to use this table with structures of functional groups and names of different homologous series.

| Homologous series | Structure of functional group | |
|---|---|---|
| | Structure | Name |
| Alkanes |  | Only C-H and C-C single bonds |
| Alkenes |  | Carbon-carbon double bond |
| Alkynes |  | Carbon-carbon triple bond |

(b) Use informal activities to drill learners to write general formulae of all the homologous series.

(c) The importance of adhering to IUPAC nomenclature rules, including the correct use of hyphens and commas, must be emphasised. Regular practice exercises should be incorporated into lessons, focusing on both naming compounds from the given structures and drawing structures from names.

(d) When drawing the structural formulae, learners should note the following:
- First identify the homologous series, functional group, and the number of carbons.
- Each carbon must have a maximum of four bonds.
- All hydrogens must be included.
- Show all the bonds.
- Hydrogen can only have one bond.

(e) Functional groups of different homologous series must be thoroughly taught so that learners can identify, name and draw them with ease. Use exercises that involve identifying and naming functional groups of different molecules.

(f) Naming and drawing of structural formulae of the esters must be thoroughly explained and drilled using informal activities.

(g) Learners must be taught the difference between:
- *Homologous series* and a *functional group*
- *General* formula, *molecular* formula and *structural* formula.

**QUESTION 3: PHYSICAL PROPERTIES OF ORGANIC MOLECULES**

**Common errors and misconceptions**

(a) In Q3.1 most candidates omitted the key word 'exerted' and the phrase 'closed system' when defining vapour pressure. Others used 'isolated system' instead of 'closed system'.

(b) A notable number of candidates had difficulty analysing the graph, and they struggled to state a relationship between temperature and the vapour pressure of alkanes in Q3.2.

(c) In Q3.2.1 a significant number of candidates wrote 'decrease' or 'no effect' as their answer.

(d) In Q3.2.2 most candidates wrote A and B; those who answered B correctly seemed to have guessed as they were unable to provide the correct reason in Q3.2.3. Some of them had difficulty to understand the boiling point as a concept. They could not link it to the atmospheric pressure and vapour pressure.

(e) A substantial number of candidates wrote that the vapour pressure of compound B equals atmospheric pressure, omitting the key word 'temperature'.

(f) Candidates compared C with only A or B in Q3.2.4. A notable number of candidates used words such as 'smaller' and 'larger''/bigger' instead of 'weaker' and 'stronger' when comparing the strength of the intermolecular forces of the compounds. Some candidates were still using the phrase 'the breaking of the bonds' instead of 'overcoming the intermolecular forces'.

**Suggestions for improvement**

(a) Teachers and learners should use the *Examination Guidelines* document as a reference for all the definitions and these definitions must be infused into daily assessments.

(b) Learners must be given activities involving graph interpretation exercises. Graphs must be used to show relationships between the different variables.

(c) Teachers should give learners more activities that involve physical properties of different compounds.

(d) Learners must be able to:
- Identify the intermolecular forces in different homologous series.
- Compare the strength of intermolecular forces.
- Explain the reason for the difference in the strength of the intermolecular forces.
- Compare the energy needed to overcome the intermolecular forces and draw a conclusion.

(e) Learners must refrain from using unconventional abbreviations like IMF, Bp, Vp and Mp.

(f) Teachers must teach intermolecular forces thoroughly as learners are introduced to this topic for the first time in Grade 12.

**QUESTION 4: REACTIONS OF ORGANIC COMPOUNDS**

**Common errors and misconceptions**

(a) In Q4.1.1, Q4.2 and Q4.4 a notable number of candidates used unconventional abbreviations like 'Add' instead of 'Addition' and 'Sub' for 'Substitution'. Others wrote 'adding reaction' or 'subtracting reaction' instead of 'addition' or 'substitution reactions'.

(b) Most candidates wrote 'mild heat' as the reaction condition for Q4.1.2. Some just wrote 'water' instead of 'excess water'. Others wrote 'concentrated strong acid' instead of 'sulphuric acid' ($H_2SO_4$) or 'phosphoric acid' ($H_3PO_4$). There were those who wrote standard conditions for a galvanic cell like temperature (25 $^\circ$C); pressure (1 atm) and concentration (1 mol·dm$^{-3}$).

(c) The majority of candidates were unable to identify chlorine as the substance that reacts with propane to form 2-chloropropane. Some wrote 'chlorine' instead of writing the formula in Q4.3. Others wrote $C\ell$ instead of $C\ell_2$.

(d) In Q4.5.1 most candidates wrote only one correct isomer instead of a pair, i.e. they wrote either 'propanal or propanoic acid' instead of 'propanal and propanoic acid'.

(e) A significant number of candidates drew functional groups instead of *structural formula* of the two isomers in Q4.5.2.

(f) In Q4.6 most candidates struggled to define a polymer. A substantial number of candidates omitted key words such as 'large molecules' and 'smaller monomer units'. Others omitted the words 'covalently' and 'repeating pattern'.

(g) Most candidates had difficulty drawing the structural formula of the monomer used in the production of the polymer polyethylene in Q4.7. A notable number of candidates drew the structural formula for ethane instead of chloroethene. Others drew the structural formula for ethene instead of chloroethene.

**Suggestions for improvement**

(a) Teachers should discourage learners from using unconventional abbreviations like 'Add' instead of 'addition' and 'Sub' for 'substitution'.

(b) Learners must be exposed to different types of reactions and their conditions. Flow diagrams must be used to drill learners on reaction types, names and conditions.

(c) The mnemonic device below can be useful when teaching learners reaction types and conditions.

| Mnemonic | Reactant | Product | Type of reaction |
|---|---|---|---|
| USA | Unsaturated | Saturated | Addition |
| SSS | Saturated | Saturated | Substitution |

(d) Molecular, structural and condensed structural formulae must be used to write different reaction equations. Names and structural formulae monomers and their polymers must be taught thoroughly. Learners must also be exposed to flow diagrams of different reactions.

(e) Teachers must drill learners to write correct definitions by referring to the *CAPS* and *Examination Guidelines*.

(f) Learners must be exposed to different isomers as prescribed in the *Examination Guidelines*, including the functional isomers involving aldehyde-ketone isomers and the carboxylic acid-ester isomers.

(g) Simulations, analogies and summary sheets must be used to teach the following reactions:
- Hydrogenation = addition of $H_2$
- Halogenation = addition of $X_2$
- Hydrolysis = addition of water
- Oxidation = increase in oxygen/decrease in hydrogen.

## QUESTION 5: ELECTRONIC PROPERTIES OF MATTER

### Common errors and misconceptions

(a) Most candidates were not familiar with the symbol of p-n junction diode. When asked in Q5.1 to identify the anode, they wrote LED, diode, n-type and/or p-type.

(b) In Q5.2 the majority of candidates struggled to state whether the diode drawn was forward biased or reverse biased. Those who wrote 'forward biased' could not give a reason why this was in Q5.3.

(c) A notable number of candidates wrote the following types of statements in Q5.3:
- Current flows from positive to negative.
- Arrow shows forward and direction is anticlockwise.
- Left side is the anode/negative.
- Right side is the cathode/positive.

(d) A significant number of candidates struggled to state the characteristics of a p-n junction diode in Q5.4.

### Suggestions for improvement

(a) Learners must be taught definitions that are given in the *Examination Guidelines*, with emphasis on the inclusion of key words.

(b) Teachers must teach the topic on electronic properties of matter thoroughly using a periodic table. Learners must know the difference between:
- p-type and n-type materials
- Forward and reverse biased diode
- Pentavalent and trivalent material

(c) Sketch diagrams and simulations must be used to reinforce understanding of the following concepts:
- Zero biased, reversed biased, and forward biased
- The formation of n–type semiconductor, p–type semiconductor
- The construction and working of a p–n junction diode.

## QUESTION 6: ELECTROLYTIC CELL

### Common errors and misconceptions

(a) Most candidates defined the *electrolytic cell* instead of the *electrolyte* in Q6.1. A notable number of them omitted key words such as 'liquid', 'solution', 'dissolved' and 'movement of ions'. Some wrote 'a substance that conducts electricity'.

(b) In Q6.3 the majority of candidates used double arrows in half reactions. Some wrote the reduction half reaction instead of the oxidation half reaction. Others omitted a charge on $C\ell^-$.

(c) Q6.4.1 required the candidates to write a chemical formula of substance forming at electrode N. A significant number of candidates ignored the instructions in the question and wrote the name of the substance (copper) instead of the chemical formula (Cu). Many candidates wrote the chemical formula of an oxidising agent ($Cu^{2+}$) instead of the name (copper (II) ions) in Q6.4.2. Some of those who tried to write $Cu^{2+}$ omitted the charge and just wrote Cu. A significant number of those who attempted to write 'copper (II) ions' omitted '(II)' and wrote 'copper ions' instead.

(d) A significant number of candidates displayed a lack of understanding of the topic, alternate energy, in Q6.5.

(e) In Q6.5.3 the majority of candidates struggled to write down the energy conversion that takes place in solar energy. A notable number of candidates responded that the energy conversion is from heat energy to electrical energy.

(f) Most candidates got the first part of the definition in Q6.5.4 correct, but in the second part of the definition they referred to nature, fossil fuels and oil.

**Suggestions for improvement**

(a) Teachers and learners should use the *Examination Guidelines* document as a reference for all the definitions. These definitions must be infused into daily assessments like classwork, homework and class tests.

(b) Every learner must be given a copy of the standard potential table and be encouraged to use it to solve problems based on electrochemistry (i.e. galvanic and electrolytic cells).

(c) Learners should label the cell by identifying the anode and cathode and writing the half reactions taking place at each electrode before attempting to answer the questions.

(d) The following analogies can be used to summarise electrochemical cells:
- OILRIG: Oxidation Is Loss, Reduction Is Gain
- ANOX: ANOde = OXidation
- REDCAT: REDuction = CAThode
- PANIC: Positive Anode, Negative Is Cathode *(for electrolytic cells).*

(e) Learners must be taught alternate energy thoroughly as they can collect marks easily on this topic.

**QUESTION 7: GALVANIC CELL**

**Common errors and misconceptions**

(a) In Q7.1 most candidates had difficulty defining reduction in terms of electron transfer. They wrote 'loss of electrons' or 'decreasing of electrons' and some defined it in terms of oxidation number.

(b) Q7.2 required the candidates to identify the electrode in half-cell **B**, using a calculation. The majority of candidates wrote $E^0$cell instead of $E^\theta$cell in the formula, despite the fact that this formula was given in a formula sheet. In a substitution step, some candidates swopped the value for $E^\theta$cell with that of $E^\Theta_{\text{oxidising agent}}$. A notable number of them omitted the units in the final answer. Some were unable to identify electrode B as iron.

(c) A significant number of candidates used double arrows when writing a half reaction in Q7.3.1. Some wrote the oxidation half reaction instead of the reduction half reaction. Others omitted the charge on $Ni^{2+}$.

(d) In Q7.3.2 most candidates struggled to write a cell notation. Some of them swopped the oxidation half-cell with the reduction half-cell. Others wrote a (net) cell reaction instead of cell notation. Some used $Fe/Fe^{3+}$ instead of $Fe/Fe^{2+}$ half-cell.

**Suggestions for improvement**

(a) Learners must be given a copy of the *Examination Guidelines* and be encouraged to learn the definitions provided in it.

(b) Teachers must teach learners to identify different components of a galvanic cell and their functions.

(c) Every learner must have a copy of a formula sheet and the standard potential table in their exercise book. Learners must be trained on how to use the standard potential table.

(d) More activities on the calculation of cell potential must be given to learners for practice and emphasis must be on selecting the correct formula and writing the units in the final answer. Formulae should be copied as they are given in the formula sheet. The meaning of a positive and negative value of $E^{\Theta}_{cell}$ must be explained.

(e) Teachers must explain to learners what is meant by *half-reaction* and why a single arrow must be used.

(f) Learners must be taught the difference between *cell notation* and *net cell reaction*. Teachers must provide learners with more activities where they are required to examine both.

# CHAPTER 4

## CIVIL TECHNOLOGY

Civil Technology encompasses three specialisation subjects, namely Civil Services, Construction and Woodworking. This was the eighth examination in which the specialisation subjects were examined. The following report should be read in conjunction with the respective question papers of the November 2025 NSC examinations.

A detailed analysis of performance trends is provided for each specialisation subject. It must be noted that the following general comments are observations noted across all three subjects and are therefore stated at the outset.

**General comments on Civil Services, Construction and Woodworking**

Certain trends were identified in the 2021, 2022, 2023, 2024 and 2025 NSC examinations; however, many of the challenges stated in the *2024 Diagnostic Report* were still evident in the 2025 November NSC examinations.

(a) Even with a modest improvement, it was evident that a significant number of candidates did not follow the instruction of starting each question on a new page.

(b) It was observed that a significant number of candidates had difficulty interpreting and employing academic and subject-related terminology correctly.

(c) A significant number of candidates encountered difficulties with interpreting and responding to action verbs (e.g. *describe, explain, deduce, differentiate*), resulting in an inability to distinguish between the various question types.

(d) Many candidates demonstrated limited drawing and interpretation skills, showing confusion among line diagrams, sketches, pictorial views, and scale drawings. Many scale drawings were inaccurately executed due to the absence of proper drawing equipment.

(e) Many candidates showed limited knowledge, relying heavily on memorised sketches from previous question papers without understanding their structural elements. Consequently, many were unable to produce accurate sketches of new or unseen tasks.

(f) It was evident from the responses that most candidates had insufficient practical exposure and experience.

(g) A considerable number of candidates neglected to label their drawings, which resulted in a loss of marks.

(h) A significant number of candidates demonstrated difficulty in expressing themselves effectively in descriptive and explanatory responses.

(i) It was observed that some candidates did not attempt the matching items or multiple-choice questions.

(j) Many candidates were unable to cope with questions presented in new formats, and their responses reflected serious deficiencies in reading and comprehension skills.

(k) It was evident that many candidates, due to limited practical exposure, were unable to explain practical applications theoretically.

(l) Candidates should note that answers to calculation questions will not be credited if the appropriate unit of measurement is omitted.

(m) It is essential that candidates follow the instructions provided in each question, such as drawing either a line diagram or a detailed representation of the object. Failure to comply with these instructions may result in the loss of marks.

(n) Some candidates wrote the answers to calculations in pencil instead of using a pen. Candidates should be made aware that if they respond to questions using pencil they may not be credited for those answers.

(o) Teachers and learners should note that the assessment criteria provided in the answer sheets do not capture all aspects or mark allocations required for the drawings. The table on the left illustrates details presented in the question paper, while the table on the right reflects the marking guidelines. Learners are therefore expected to know all parts and dimensions of the required drawings.

| ASSESSMENT CRITERIA | | |
|---|---|---|
| **NO.** | **MARK** | **CANDIDATE'S MARK** |
| 1 | 2 | |
| 2 | 2 | |
| 3 | 1 | |
| 4 | 1 | |
| 5 | 2 | |
| **TOTAL:** | **8** | |

| NO. | ASSESSMENT CRITERIA | MARK |
|---|---|---|
| 1 | Queen post | 2 |
| 2 | Strut | 2 |
| 3 | Connection of parts | 1 |
| 4 | Any ONE label | 1 |
| 5 | Application of scale:<br>All correct = 2<br>ONE incorrect = 1<br>TWO and more incorrect = 0 | 2 |
| | **TOTAL:** | **8** |

# 4.1 CIVIL SERVICES

**The following report should be read in conjunction with the Civil Services question paper of the November 2025 examinations.**

## 4.1.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Civil Services examination in 2025 increased (significantly) by 193 compared to that of 2024.

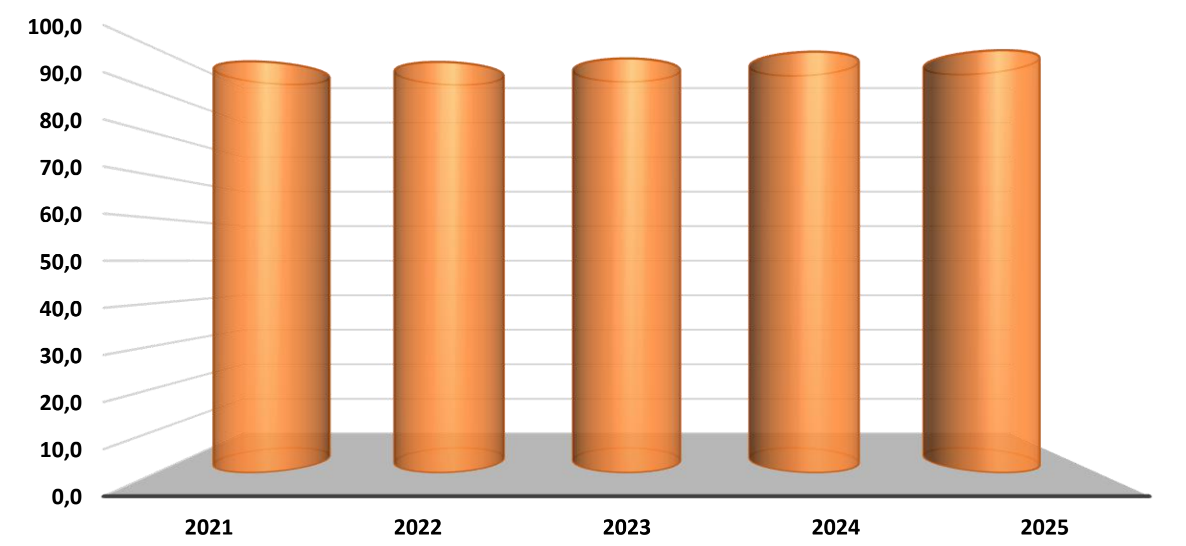
There was also a marginal improvement in the pass rate this year. Candidates who passed at the 30% level improved from 99,2 % in 2024 to 99,6 % in 2025. There was a corresponding improvement in the pass rate at the 40% level over the past two years from 88,2% to 88,7%.

The percentage of distinctions over 80% declined from 1,5 % in 2024 to 1,1 % in 2025. Given the increase in the size of the 2025 cohort, this converts into a decrease in the total number of distinctions from 12 to 11.
The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall improvement in the subject.

**Table 4.1.1 Overall achievement rates in Civil Services**

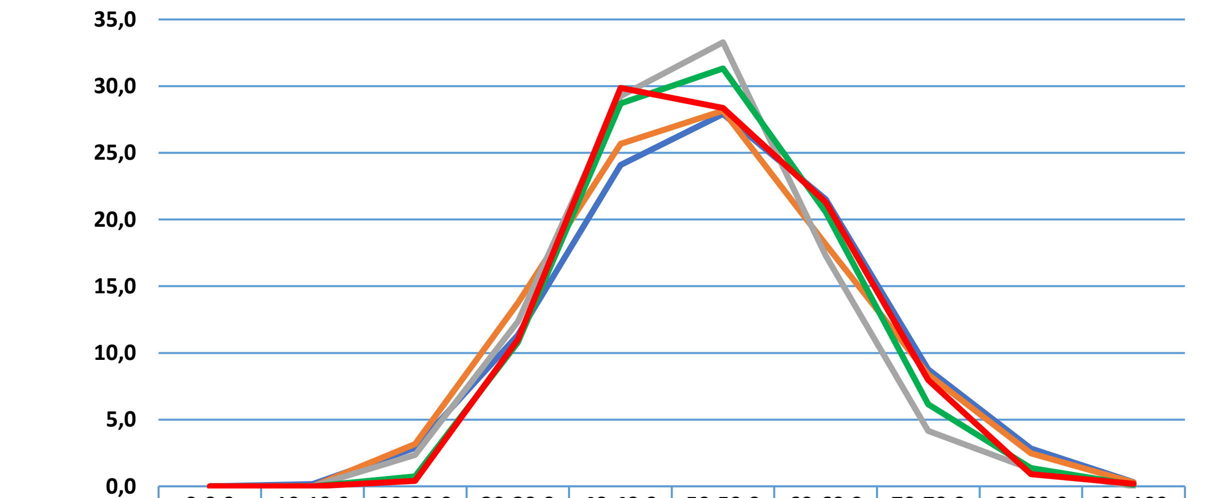
| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| 2021 | 627 | 608 | 97,0 |
| 2022 | 728 | 705 | 96,8 |
| 2023 | 769 | 751 | 97,7 |
| 2024 | 798 | 792 | 99,2 |
| 2025 | 991 | 987 | 99,6 |

**Graph 4.1.1(a) Overall achievement rates in Civil Services (percentage)**




| | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| % achieved at 30% and above | 97,0 | 96,8 | 97,7 | 99,2 | 99,6 |

**Graph 4.1.1(b) Performance distribution curves in Civil Services (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,2 | 2,9 | 11,3 | 24,1 | 27,9 | 21,5 | 8,8 | 2,8 | 0,3 |
| 2022 | 0,0 | 0,0 | 3,2 | 13,7 | 25,7 | 28,2 | 18,1 | 8,4 | 2,5 | 0,3 |
| 2023 | 0,0 | 0,0 | 2,3 | 12,4 | 29,3 | 33,3 | 17,3 | 4,2 | 1,3 | 0,0 |
| 2024 | 0,0 | 0,0 | 0,8 | 10,8 | 28,7 | 31,3 | 20,6 | 6,1 | 1,4 | 0,1 |
| 2025 | 0,0 | 0,0 | 0,4 | 11,0 | 29,9 | 28,4 | 21,3 | 8,0 | 0,9 | 0,2 |

## 4.1.2 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN CIVIL SERVICES

### QUESTION 1: OHSA, MATERIALS, TOOLS, EQUIPMENT AND JOINING

**Common errors and misconceptions**

(a) In Q1.1 (10 marks) candidates generally performed above average in selecting the correct word(s) from the options provided in brackets. However, some candidates displayed limited knowledge of the more technical aspects of scaffolding, particularly in Q1.1.1–Q1.1.4.

(b) In Q1.3 (2 marks) many candidates were not able to explain the different specifications according to which bolts are purchased.

(c) In Q1.4.1 (2 marks) most candidates were unable to explain the powder-coating process, particularly in terms of the material used and the method of application.

(d) Q1.5 and 1.6 (3 marks) were generally well answered by the majority of the candidates.

(e) Q1.7 was poorly answered by the majority of the candidates. Candidates' responses suggested a total lack of knowledge and practical exposure to the setting up of a dumpy level and the accessories used to accurately position the instrument on a reference point.

**Suggestions for improvement**

(a) Teachers should emphasise the technical aspects of scaffolding (e.g. safety features, structural components and usage scenarios) during lessons. Incorporate site visits, videos, or classroom models to show scaffolding in real-world contexts. Learners should practise technical vocabulary through glossaries, flashcards and short quizzes.

(b) Teachers should cover bolt specifications in detail, including diameter, length, thread type, grade, and material and show learners actual bolts with different specifications to illustrate how they are purchased and used.

(c) It should be emphasised that powder coating is a finishing process in which a dry powder, usually a thermoplastic or thermoset polymer, is applied to a surface. The powder is electrostatically charged and sprayed onto the workpiece, after which it is cured under heat to form a smooth and durable coating. To reinforce understanding, videos or animations can be used to demonstrate how the powder is sprayed and cured, making the process more accessible and engaging. Where possible, a practical demonstration or factory visit should be arranged to give learners direct exposure to the technique.

(d) Regular practical assessments should be included where learners can set up and use the dumpy level under supervision. Teachers should provide examination-style questions that require learners to explain or demonstrate the setup process and give detailed feedback on errors in both theoretical and practical responses.

### QUESTION 2: GRAPHICS AS A METHOD OF COMMUNICATION

**Common errors and misconceptions**

(a) In Q2.1 (1 mark) some candidates were not able to deduce the correct elevation from the building plan using the north direction given on the plan as the reference point.

(b) Q2.2 to Q2.5 (4 marks) were well-answered by most candidates.

(c) In Q2.6 many candidates experienced difficulties in deducing the material that was recommended to manufacture the guard rails on the patio. Instead of deducing the answer from the notes on the building plan where the material was specified, many candidates wrote any suitable material and lost marks as a result.

(d) In Q2.8 (1 mark) some candidates did not use capital letters when writing down the abbreviation of the finished floor level (FFL) as required according to the *SANS Code of Practice* and were not credited with the mark as a result.

(e) In Q2.9 (1 mark) some candidates had difficulty to identify the end shape of the downpipe.

(f) Q2.11 (1 mark) was poorly answered by many candidates. Instead of providing a specific electrical fitting that was omitted, e.g. socket outlet, many candidates responded with *electrical fittings* which is a generic answer and was not credited with a mark as a result.

(g) In Q2.14 some candidates responded with *metal* instead of providing the specific material, e.g. *stainless steel* or *cast iron* as required by the question. Teachers and learners need to note that vague and general responses may not be credited with marks.

(h) Many candidates had difficulty in drawing the symbols for a grease trap and undisturbed earth correctly in Q2.23 and Q2.24 (6 marks).

(i) A surprising number of candidates could not calculate the area of the scullery in Q2.26 (3 marks). Many candidates made principal errors in this calculation and added instead of multiplying. Some candidates calculated the area using millimetres instead of metres and were not able to convert the answer to square metres correctly.

(j) Q2.27 (7 marks) was well-answered by most candidates. There was a significant improvement in the ability of candidates to answer this type of question, but many candidates still find this type of question challenging.

**Suggestions for improvement**

(a) Teachers should encourage learners to revise the relationship between building plans (top view) and elevations (front/side views), ensuring that they can visualise how one relates to the other. Remind learners that the north direction is a crucial reference point. They should always begin by identifying the orientation of the plan relative to north, before attempting to determine any elevation.

(b) Learners should be taught to read all notes and annotations on building plans. Teachers must emphasise that important information such as materials, finishes, dimensions and specifications is often given in the general notes or on specific callouts. Learners should be taught to scan the entire plan, including legends and notes, before answering questions on the plans.

(c) Teachers can compile a list of common Civil Technology abbreviations (e.g. FFL, DPC, DPM) required by the *SANS Code* and provide learners with a reference sheet that can be integrated into lessons. Teachers should also reinforce that abbreviations must always be written in capital letters. They can include short, low-stakes quizzes, where learners practise writing abbreviations correctly.

(d) It should be emphasised that examiners expect exact names of fittings (socket outlet, light switch, distribution board, etc.), not broad categories. Teachers can provide learners with a list of common electrical fittings and conduct regular drills of their names. Classroom exercises where learners must identify fittings from drawings or site photographs can also be used effectively to reinforce these concepts.

(e) Where learners cannot recall and reproduce the correct technical symbols, teachers can create a symbol reference chart (aligned with the *SANS Code*) for Civil Technology learners and display these charts in classrooms and workshops for constant reinforcement. Teachers can also integrate symbol drawing drills into lessons (e.g. quick 5-minute exercises).

(f) To improve learner performance in calculations of areas, it is important to reinforce the principle that area is calculated by multiplying length and width, not by adding dimensions, and to ensure learners develop strong unit awareness by consistently working in metres and converting correctly from millimetres to square metres. Teachers should encourage step-by-step problem solving where learners explicitly identify dimensions, convert units, multiply and present the answer in the correct unit, while also providing varied practice exercises that include mixed units to sharpen accuracy. Linking these skills to real-world applications, such as calculating flooring or tiling requirements, will help learners appreciate the practical importance of accuracy and reduce principle errors in future assessments.

## QUESTION 3: CONSTRUCTION ASSOCIATED WITH CIVIL SERVICES, OHSA AND QUANTITIES

### Common errors and misconceptions

(a) In Q3.1 (3 marks) many candidates had difficulty to identify the faults in the manhole installation. Many candidates managed to point out the item involved but they failed to describe the specific fault, which resulted in the loss of marks.

(b) Q3.1.4 (1 mark) was poorly answered by most candidates. Many candidates were not able to explain why a dust mask does not provide sufficient protection against harmful gases.

(c) In Q3.2 (7 marks) the majority of the candidates were not properly equipped to draw the formwork to support the sides of a trench in firm soil and many candidates did not attempt this question.

(d) Q3.3 was poorly answered by many candidates. There was a slight improvement in the ability of candidates to answer this type of question, but many candidates had difficulty with the conversion from millimetres to metres and used the incorrect formulae.

(e) In Q3.4 candidates' responses suggested that they did not possess the required skill and knowledge to interpret the drawing and were not fully equipped to project and draw the second course of the double-return angle of a one-brick wall in stretcher bond.

**Suggestions for improvement**

(a) It is recommended that in questions of this nature learners should be taught to move beyond simply identifying the item in the manhole installation but to also clearly describe the specific fault associated with it. Teachers can strengthen this skill by incorporating fault-finding exercises using diagrams, site photographs or construction drawings where learners must both name the component and explain what is wrong with it. Classroom activities should emphasise that marks are awarded for accuracy and detail, not partial identification, and learners should practise phrasing answers in full, such as 'the cover is placed below ground level' rather than just 'cover'.

(b) To improve performance in this type of question, learners need to understand the limitations of a dust mask and why it cannot protect against harmful gases. A dust mask is designed to filter out solid particles such as dust but does not contain the chemical filters or cartridges required to absorb or neutralise gases and vapours. Teachers should emphasise this distinction during lessons on personal protective equipment (PPE), making clear that different hazards require different types of protection.

(c) It will be beneficial to learners if they are exposed to stronger preparation in both the conceptual understanding and practical drawing skills required to illustrate formwork for supporting trench sides in different types of soil. Teachers should ensure that learners are explicitly taught the purpose of trench support, the different types of formworks used and the correct way to represent these in technical drawings. Regular practice with step-by-step drawing exercises starting from simple sketches and progressing to more detailed, scaled representations should build confidence and accuracy.

(d) Performance in calculations can be improved by providing learners with targeted support in both unit conversion and the correct application of formulae. Teachers should emphasise the importance of converting dimensions from millimetres to metres before performing calculations, reinforcing the rule that incorrect units will lead to wrong answers. Regular practice exercises should be provided where learners convert measurements step-by-step and then apply the correct formula, with clear guidance on when to use multiplication versus other operations.

(e) To improve performance in drawings of brick bonds, learners need stronger skills in drawing interpretation and knowledge of brickwork bonds. Many learners struggled to project and draw the second course of the double-return angle in stretcher bond, which requires understanding of how courses overlap. Teachers should provide step-by-step demonstrations using physical models and annotated drawings, while learners practise projecting from simple sections to complex angles. Regular drawing drills focusing on accuracy and proportion, along with error-analysis activities, will build confidence. Linking these exercises to real-world construction examples will reinforce precision and practical relevance.

**QUESTION 4: COLD AND HOT-WATER SUPPLY, TOOLS, EQUIPMENT AND MATERIALS**

**Common errors and misconceptions**

(a) Most candidates responded well to Q4.1 (8 marks) but many candidates could not select the correct responses for the expansion control valve and the red-water diverter in Q 4.1.2.and Q4.1.6 respectively.

(b) In Q4.2.1 to Q4.2.5 (8 marks) a significant number of candidates were unable to identify the different components of a high-pressure geyser and they experienced difficulties to respond to the more technical questions of a high-pressure geyser installation.

(c) A number of candidates could not differentiate between the use of a pressure control valve and a drain cock in Q4.2.6 (2 marks).

(d) Q4.2.7 was poorly answered by most candidates and they were not well equipped to draw the symbol for a hot-water storage tank.

(e) In Q4.3 (2 marks) the majority of the candidates experienced challenges to explain the difference between *a water-pressure testing pump* and a *centrifugal pump* in terms of its use.

(f) In Q4.5.2 (2 marks) most candidates found it challenging to explain how a shortage of hot water from a geyser can be prevented.

(g) Q4.7 was very poorly answered by most candidates. The electrolytic reaction between dissimilar metals is a higher cognitive level question, related to the chemical reactions that take place and most candidates were unable to respond correctly to this question.

(h) In Q4.8.1 many candidates found it challenging to explain how a mixer tap and a demand pillar tap can save water. Instead, many candidates explained the working principles of each tap without referring to the way in which water can be saved while using these taps.

**Suggestions for improvement**

(a) It is recommended that more emphasis be placed on the use of labelled diagrams and workshop demonstrations of plumbing systems showing where the different valves are located. Learners often confuse these because they do not visualise the system holistically. If possible, teachers should show learners actual valves and diverters in a geyser installation. If learners are given the opportunity to handle the components, they will become familiar with and remember the names of these components.

(b) A dual-teaching approach where the actual hot-water storage tank (or a photograph) alongside its symbol is shown to learners may be beneficial to learners. Learners often fail to connect the abstract symbol to the physical object. Sketch-and-label activities can be used effectively where learners are required to sketch a geyser installation and insert the correct symbols for each component.

(c) Practical demonstrations can greatly enhance learners' understanding of the differences between pumps. A hands-on activity should be conducted where learners are shown a pressure-testing pump connected to a pipe section, allowing them to observe how it is used to check for leaks and system integrity. This can then be contrasted with a centrifugal pump moving water from a tank, highlighting its role in continuous water transfer. In cases where equipment is not available, short videos or animations can be used to illustrate the operation of both pumps, ensuring that learners grasp the functional differences clearly and effectively.

(d) Learners need to understand that a shortage of hot water is usually linked to incorrect usage, poor maintenance or undersized geysers. By linking technical knowledge to practical household scenarios, learners will be better equipped to explain how shortages can be prevented. Emphasise that prevention is about ensuring adequate heating capacity and efficient use.

(e) Learners would benefit if teachers strengthened conceptual foundations. Introduce the principle of galvanic/electrolytic reaction and explain that when dissimilar metals (e.g. copper and steel) are in contact with water, an electrolytic reaction occurs, leading to corrosion. Simplify the science by using everyday analogies (like rust forming on iron) to make the concept less abstract.

(f) In water-saving devices, teachers should differentiate between the mechanical operation and the functional benefit of water conservation. Effective teaching strategies to help learners understand how mixer taps and demand pillar taps save water should emphasise the distinction between how these taps work and why they conserve water. Where possible, practical demonstrations should be conducted to show a mixer tap and demand pillar tap in action, measuring the amount of water used compared to traditional taps, thereby providing learners with concrete evidence of their efficiency.

## QUESTION 5: GRAPHICS AS MEANS OF COMMUNICATION, ROOF WORK AND STORM WATER

### Common errors and misconceptions

(a) Q5.1 (5 marks) was generally well answered by most candidates.

(b) In Q5.2 (4 marks) most candidates found it challenging to correctly identify the gutter components and to describe the location of the gutter corner and union clip. Instead of naming the specific component, many candidates incorrectly described it as a *90-degree gutter*. This indicates that candidates experienced challenges recognising standard gutter fittings and providing the correct name for each component.

(c) In Q5.3 (2 marks) many candidates were unable to explain the possible consequences of a poorly designed storm-water drainage system around a building. Most responses lacked understanding of how inadequate drainage can affect structural integrity, the surrounding environment, and the safety of occupants.

(d) In Q5.4 poor performance was displayed in the drawing of the development of a shoe offset of a cylindrical downpipe (19 marks). The majority of the candidates could not project at the angle that was required for the development. The divisions for the points of the development were incorrectly plotted and many of the candidates projected for the development from the vertical pipe instead of pipe A as required. The seams for the development were omitted by many candidates.

### Suggestions for improvement

(a) It will benefit learners if teachers reinforced standard terminology. Learners should be provided with a glossary of gutter components, such as the *gutter corner, union clip, stop end* and *bracket*. It is important to emphasise that examiners expect the correct technical names rather than descriptive substitutes. This will ensure that learners will develop accuracy in their responses. These terms should also be consistently included in baseline tests and revision packs to normalise their use and strengthen learners' familiarity with the proper terminology.

(b) It is recommended that teachers connect storm-water management with its practical consequences for buildings and people, focusing on:

- Structural integrity: water pooling around foundations can cause cracks, weaken walls and lead to subsidence.
- Environmental impact: poor drainage may cause soil erosion, flooding and contamination of nearby water sources.
- Safety of occupants: standing water increases slip hazards, encourages mosquito breeding and can lead to dampness and mould inside buildings.

(c) To strengthen projection skills, learners should be guided through step-by-step scaffolding that teaches them how to project from the correct pipe. Angle practice drills can be introduced to allow learners to repeatedly project at different angles, building confidence and accuracy. In addition, reinforcing geometric division is essential. Learners should engage in plotting exercises that train them to divide circles and cylindrical surfaces correctly before attempting full developments. Finally, incremental practice should be applied, beginning with simple cylindrical developments and gradually progressing to more complex tasks such as shoe offsets.

**QUESTION 6: SEWERAGE, SANITARY FITTINGS AND JOINING**

**Common errors and misconceptions**

(a) In Q6.1 (5 marks) many candidates could not select the correct option from those provided to complete the sentences that explained the sewerage treatment process.

(b) Q6.2 (7 marks) was generally well answered by most candidates.

(c) In Q6.3 (2 marks) poor performance was recorded. Many candidates had difficulty to respond to the questions related to general drainage principles and regulations.

(d) Very poor performance was recorded in Q6.5 and Q6.6. Most candidates were not fully equipped to respond correctly to the properties of solder and the tinning process of a soldering iron.

(e) In Q 6.7 many candidates confused the *conservancy tank* with a *septic tank* and as a result provided incorrect responses for which they were not credited.

(f) In Q6.8 (16 marks) the design and drawing of the drainage plan was challenging for many candidates. Candidates had difficulty to apply basic drainage principles in the design of the drainage plan. Many candidates used the incorrect line type for the sewerage pipes, could not position the branch pipes and other components correctly and were not able to draw the connection of the two main sewer pipes at an angle of 45° with the correct direction of flow.

**Suggestions for improvement**

(a) To strengthen conceptual understanding, the sewerage treatment process should be broken down into clear stages. Simple flow diagrams can be used to illustrate how water moves through each stage, making the process easier to visualise and understand. In addition, terminology must be reinforced by providing learners with a glossary of key terms, such as sedimentation, aeration and chlorination. It is important to emphasise that examiners expect precise technical terms rather than vague descriptions, and these terms should be consistently included in baseline tests and revision packs in order to familiarise the learners with their use. This will ensure that learners will become confident in applying them.

(b) Teachers should put more emphasis on the basic principles of drainage in a clear and structured way. This includes understanding the importance of correct pipe gradients to ensure effective flow; maintaining proper separation between stormwater and sewerage systems to prevent contamination; providing adequate venting to avoid the build-up of foul gases; and ensuring accessibility of inspection chambers for maintenance. Simplified notes and flow diagrams can be used to illustrate how water moves through a system when these principles are applied correctly, helping learners visualise the practical impact of proper drainage design.

(c) It will be beneficial to learners if, in addition to the theory, practical demonstrations are used to develop the knowledge and skills pertaining to soldering. Learners should be shown how solder melts and flows between two metals to form a joint, and how tinning is carried out by heating the soldering iron and applying solder to the tip to enhance efficiency. To consolidate this knowledge, learners should be given the opportunity to practise tinning under supervision, ensuring that they gain hands-on experience and confidence in applying the process correctly.

(d) To clarify the distinction between the two systems, learners should understand that a conservancy tank is a sealed container designed solely to store sewage until it is removed by suction tankers, while a septic tank is a partially sealed unit that allows sedimentation and anaerobic digestion to occur, with the effluent discharged into a soakaway or French drain. It is important to emphasise that the conservancy tank functions purely as a storage facility, whereas the septic tank involves a treatment process. In reinforcing terminology, learners should be provided with a glossary of sanitation systems, including conservancy tank, septic tank, soakaway and French drain.

(e) It is recommended that in addition to the strengthening of the basic principles of drainage, technical drawing conventions must be strengthened by providing clear instructions on the correct line types for sewerage pipes, branch pipes and inspection chambers. Symbol sheets and revision packs can be used to standardise the learners' understanding of these conventions, while targeted exercises should be included where learners identify and correct incorrect line types in sample drawings. This combined approach will help learners develop both theoretical knowledge and practical drawing accuracy.

## 4.2 CONSTRUCTION

**The following report should be read in conjunction with the Construction question paper of the November 2025 examinations.**

### 4.2.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Construction examination in 2025 increased (significantly) by 856 compared to that of 2024.

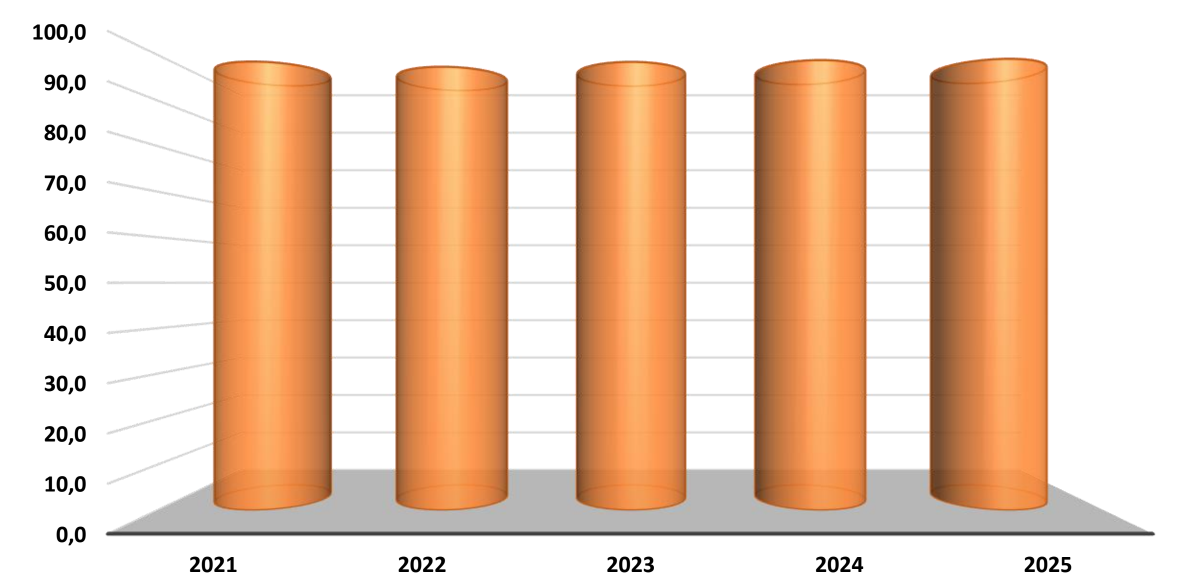
There was also a marginal improvement in the pass rate this year. Candidates who passed at the 30% level and above improved from 98,8% in 2024 to 99,1% in 2025. There was a significant increase in the pass rate at the 40% level and above over the past two years from 88,8% to 90,1%. The percentage of distinctions over 80% increased from 2,1 % in 2024 to 2,5% in 2025. Given the increase in the size of the 2025 cohort, this converts into an increase in the total number of distinctions from 96 to 136.

The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall improvement in the subject.

**Table 4.2.1 Overall achievement rates in Construction**

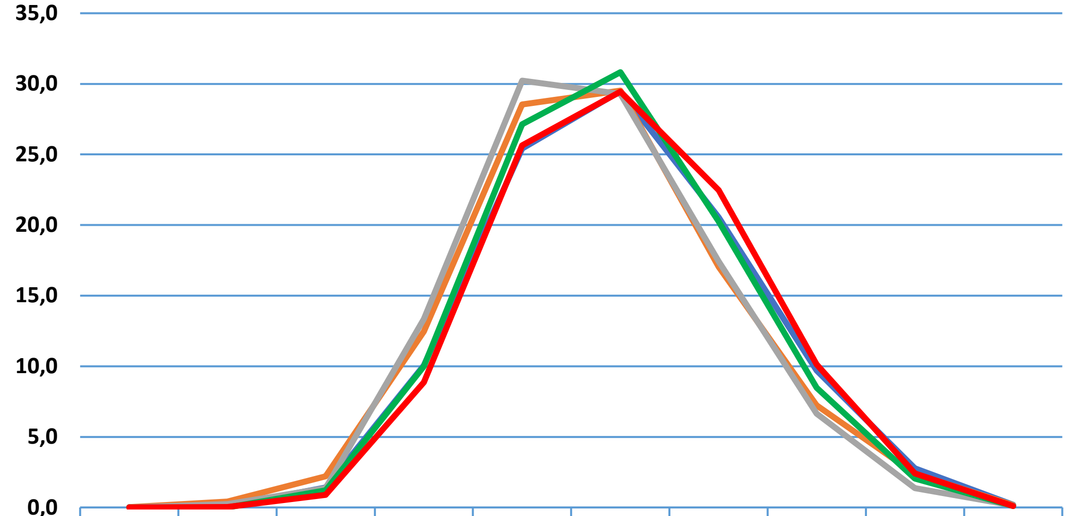
| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| 2021 | 4 474 | 4 406 | 98,5 |
| 2022 | 4 773 | 4 646 | 97,3 |
| 2023 | 4 387 | 4 317 | 98,4 |
| 2024 | 4 571 | 4 516 | 98,8 |
| 2025 | 5 427 | 5 377 | 99,1 |

**Graph 4.2.1(a) Overall achievement rates in Construction (percentage)**




| | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| % achieved at 30% and above | 98,5 | 97,3 | 98,4 | 98,8 | 99,1 |

**Graph 4.2.1(b) Performance distribution curves in Construction (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,1 | 1,4 | 10,1 | 25,4 | 29,5 | 20,5 | 9,7 | 2,8 | 0,2 |
| 2022 | 0,0 | 0,4 | 2,2 | 12,5 | 28,5 | 29,5 | 17,0 | 7,2 | 2,4 | 0,2 |
| 2023 | 0,0 | 0,2 | 1,4 | 13,3 | 30,2 | 29,3 | 17,4 | 6,6 | 1,4 | 0,1 |
| 2024 | 0,0 | 0,0 | 1,2 | 10,0 | 27,1 | 30,8 | 20,3 | 8,5 | 2,0 | 0,1 |
| 2025 | 0,0 | 0,0 | 0,9 | 8,9 | 25,6 | 29,4 | 22,5 | 10,1 | 2,4 | 0,1 |

## 4.2.2 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN CONSTRUCTION

**QUESTION 1: OHSA, MATERIALS, TOOLS, EQUIPMENT AND JOINING**

(a) In Q1.1 (10 marks) candidates generally performed above average in selecting the correct word(s) from the options provided in brackets. However, some candidates displayed limited knowledge of the more technical aspects of scaffolding, particularly in Q1.1.1–Q1.1.4.

(b) In Q1.3 (2 marks) many candidates were not able to explain the different specifications according to which bolts are purchased.

(c) In Q1.4.1 (2 marks) most candidates were unable to explain the powder-coating process, particularly in terms of the material used and the method of application.

(d) Q1.5 and 1.6 (3 marks) were generally well answered by the majority of the candidates.

(e) Q1.7 was poorly answered by the majority of the candidates. Candidates' responses suggested a total lack of knowledge and practical exposure to the setting up of a dumpy level and the accessories used to accurately position the instrument on a reference point.

**Suggestions for improvement**

(a) Teachers should emphasise the technical aspects of scaffolding (e.g. safety features, structural components and usage scenarios) during lessons. Incorporate site visits, videos, or classroom models to show scaffolding in real-world contexts. Learners should practise technical vocabulary through glossaries, flashcards and short quizzes.

(b) Teachers should cover bolt specifications in detail, including diameter, length, thread type, grade, and material and show learners actual bolts with different specifications to illustrate how they are purchased and used.

(c) It should be emphasised that powder coating is a finishing process in which a dry powder, usually a thermoplastic or thermoset polymer, is applied to a surface. The powder is electrostatically charged and sprayed onto the workpiece, after which it is cured under heat to form a smooth and durable coating. To reinforce understanding, videos or animations can be used to demonstrate how the powder is sprayed and cured, making the process more accessible and engaging. Where possible, a practical demonstration or factory visit should be arranged to give learners direct exposure to the technique.

(d) Regular practical assessments should be included where learners can set up and use the dumpy level under supervision. Teachers should provide examination-style questions that require learners to explain or demonstrate the setup process and give detailed feedback on errors in both theoretical and practical responses.

**QUESTION 2: GRAPHICS AS A METHOD OF COMMUNICATION**

**Common errors and misconceptions**

(a) In Q2.1 (1 mark) some candidates were not able to deduce the correct elevation from the building plan using the north direction given on the plan as the reference point.

(b) Q2.2 to Q2.5 (4 marks) were well-answered by most candidates.

(c) In Q2.6 many candidates experienced difficulties in deducing the material that was recommended to manufacture the guard rails on the patio. Instead of deducing the answer from the notes on the building plan where the material was specified, many candidates wrote any suitable material and lost marks as a result.

(d) In Q2.8 (1 mark) some candidates did not use capital letters when writing down the abbreviation of the finished floor level (FFL) as required according to the *SANS Code of Practice* and were not credited with the mark as a result.

(e) In Q2.9 (1 mark) some candidates had difficulty to identify the end shape of the downpipe.

(f) Q2.11 (1 mark) was poorly answered by many candidates. Instead of providing a specific electrical fitting that was omitted, e.g. socket outlet, many candidates responded with *electrical fittings* which is a generic answer and was not credited with a mark as a result.

(g) In Q2.14 some candidates responded with *metal* instead of providing the specific material, e.g. *stainless steel* or *cast iron* as required by the question. Teachers and learners need to note that vague and general responses may not be credited with marks.

(h) Many candidates had difficulty in drawing the symbols for a grease trap and undisturbed earth correctly in Q2.23 and Q2.24 (6 marks).

(i) A surprising number of candidates could not calculate the area of the scullery in Q2.26 (3 marks). Many candidates made principal errors in this calculation and added instead of multiplying. Some candidates calculated the area using millimetres instead of metres and were not able to convert the answer to square metres correctly.

(j) Q2.27 (7 marks) was well-answered by most candidates. There was a significant improvement in the ability of candidates to answer this type of question, but many candidates still find this type of question challenging.

**Suggestions for improvement**

(a) Teachers should encourage learners to revise the relationship between building plans (top view) and elevations (front/side views), ensuring that they can visualise how one relates to the other. Remind learners that the north direction is a crucial reference point. They should always begin by identifying the orientation of the plan relative to north, before attempting to determine any elevation.

(b) Learners should be taught to read all notes and annotations on building plans. Teachers must emphasise that important information such as materials, finishes, dimensions and specifications is often given in the general notes or on specific callouts. Learners should be taught to scan the entire plan, including legends and notes, before answering questions on the plans.

(c) Teachers can compile a list of common Civil Technology abbreviations (e.g. FFL, DPC, DPM) required by the *SANS Code* and provide learners with a reference sheet that can be integrated into lessons. Teachers should also reinforce that abbreviations must always be written in capital letters. They can include short, low-stakes quizzes, where learners practise writing abbreviations correctly.

(d) It should be emphasised that examiners expect exact names of fittings (socket outlet, light switch, distribution board, etc.), not broad categories. Teachers can provide learners with a list of common electrical fittings and conduct regular drills of their names. Classroom exercises where learners must identify fittings from drawings or site photographs can also be used effectively to reinforce these concepts.

(e) Where learners cannot recall and reproduce the correct technical symbols, teachers can create a symbol reference chart (aligned with the *SANS Code*) for Civil Technology learners and display these charts in classrooms and workshops for constant reinforcement. Teachers can also integrate symbol drawing drills into lessons (e.g. quick 5-minute exercises).

(f) To improve learner performance in calculations of areas, it is important to reinforce the principle that area is calculated by multiplying length and width, not by adding dimensions, and to ensure learners develop strong unit awareness by consistently working in metres and converting correctly from millimetres to square metres. Teachers should encourage step-by-step problem solving where learners explicitly identify dimensions, convert units, multiply and present the answer in the correct unit, while also providing varied practice exercises that include mixed units to sharpen accuracy. Linking these skills to real-world applications, such as calculating flooring or tiling requirements, will help learners appreciate the practical importance of accuracy and reduce principle errors in future assessments.

**QUESTION 3: ROOFS, STAIRCASES AND JOINING**

**Common errors and misconceptions**

(a) Q3.1.1–3.1.2 (2 marks) reflected a poor performance by the candidates. Candidates had difficulty to recall the spacing between roof trusses for different types of roof coverings.

(b) Q3.2 (6 marks) proved to be challenging for most candidates. Many candidates were not well equipped to draw the two-dimensional drawings of the different purlins in the correct proportion and to correctly indicate the dimensions on the drawings.

(c) In Q3.3 (4 marks) many candidates were not familiar with the technical criteria required when designing concrete staircases and were not able to respond correctly to these questions.

(d) Most candidates responded well to Q3.4 (1 mark) and Q 3.5 (5 marks).

(e) The performance in Q3.6 (12 marks) was below average. Many candidates could not draw the close-couple roof truss correctly and were not able to apply the prescribed scale correctly. Most candidates placed the wall plates and ridge beams incorrectly and were not credited as a result.

**Suggestions for improvement**

(a) It is recommended that teachers reinforce core knowledge, by focusing on the standard spacing requirements for roof trusses under different coverings such as tiles, sheeting, and thatch. Emphasis should be placed on the fact that spacing is determined by the weight and type of covering as well as the need for structural stability. In addition, visual aids should be used to strengthen understanding by incorporating diagrams and roof layouts that show truss spacing under different coverings. These visuals should be displayed in classrooms for continuous exposure.

(b) It will be beneficial to learners if they are exposed to actual purlins in workshops or site visits to strengthen their visual memory. By combining conceptual clarity, structured drawing practice, and dimensioning reinforcement, learners will be better equipped to produce accurate two-dimensional drawings of purlins in future assessments.

(c) Learners' understanding of staircase design can be greatly improved through practical exposure and structured activities. Workshop demonstrations or site visits should be conducted to allow learners to observe staircase construction in real settings and measure dimensions directly, reinforcing theoretical knowledge with hands-on experience. Furthermore, integrating staircase design tasks into practical assessment tasks (PATs) will strengthen recall and ensure that learners develop both, the confidence and the accuracy in applying the required design principles.

(d) It is recommended that more exercises on the scale drawings of roof trusses are given to learners, focusing on the application of different scales and the correct use of drawing equipment. Teachers should encourage learners to check their drawings' alignment and symmetry before finalising their drawings.

**QUESTION 4: EXCAVATIONS, FORMWORK, TOOLS AND EQUIPMENT AND MATERIALS**

**Common errors and misconceptions**

(a) In Q4.1 (5 marks) many candidates could not match the word from the provided list with its description demonstrating a lack of basic knowledge of the properties of different materials.

(b) Above average performance was recorded in Q4.2 (6 marks).

(c) In Q4.3 (2 marks) a significant number of candidates experienced challenges to state the specifications that must be verified on the working drawings, before excavations can commence.

(d) In Q4.5 (1 mark) many candidates could not identify the type of soil required, when the poling boards for the shuttering, is spaced further apart.

(e) Q4.7 (5 marks) was well answered by most candidates.

(f) In Q4.8 many candidates responded by stating that the reason for conducting the slump test is to test the quality of the concrete instead of listing the actual properties of the concrete that is tested while conducting the slump test.

(g) Poor performance was recorded in Q4.10 where the majority of the candidates were not fully equipped to draw the supporting members of the formwork for a concrete beam correctly.

**Suggestions for Improvement**

(a) To help learners recall material properties more effectively, teachers can introduce mnemonics, such as 'Concrete is strong in compression, weak in tension,' which makes technical information easier to remember. Learners should also be encouraged to create flashcards with the material name on one side and its properties on the other, allowing for quick revision and self-testing. Short quizzes or matching games can be used in class to reinforce recall and make learning interactive. In addition to these strategies, visual and practical reinforcement is essential. Real-life samples of materials can be incorporated to make properties more tangible and relatable. Workshop demonstrations, such as bending steel or breaking concrete samples, provide learners with direct exposure to how materials behave under stress.

(b) Teachers should emphasise that before excavation begins, working drawings must be carefully checked for key specifications. These include the dimensions and positions of foundations, the levels and depths of excavation required and the location of services such as water, sewerage and electrical lines to prevent damage. Emphasis should be placed on the fact that verifying these details ensures accuracy, safety and compliance with building regulations. In addition, visual aids can be used to strengthen understanding by providing learners with annotated working drawings that highlight the specifications to be verified.

(c) Visual aids can be highly effective in helping learners understand the concept of *poling board spacing* in different soil conditions. Diagrams or sectional sketches should be provided to clearly show how poling boards are spaced further apart in firm soil compared to the closer spacing required in loose soil.

(d) Testing the quality of concrete is a very broad term used as introduction to both the slump and the cube test. The purpose of the slump test should be clearly explained to learners as it specifically measures the workability and consistency of fresh concrete. It is important to emphasise that the slump test does not assess the overall *quality* of concrete but rather focuses on how easily the concrete can be placed, compacted and finished during construction. This distinction helps learners understand that while the slump test evaluates the handling properties of concrete, the cube test is used to measure its compressive strength, thereby ensuring they can differentiate between the two methods and their respective purposes.

(e) Learners should be guided through step-by-step drawing exercises where they sketch each supporting member of the formwork in sequence, ensuring that they build a clear understanding of the structure piece by piece. Emphasis must be placed on proportion and alignment, with props, bearers, and other members drawn accurately to scale to reflect real construction practice. Correct line types and conventions in technical drawings should be consistently reinforced to instil precision and accuracy.

## QUESTION 5: PLASTER AND SCREED, BRICKWORK AND GRAPHICS AS MEANS OF COMMUNICATION

### Common errors and misconceptions

(a) In Q5.1 (3 marks) many candidates were able to respond accurately to most of the questions based on the plastering of a wall, but many candidates could not name the tool that was used in the figure.

(b) Responses from most candidates indicated that they found it difficult to name the different types of screeds and were not able to explain how to test the absorptiveness of concrete in Q5.2 (5 marks).

(c) Q5.3 (5 marks) was well answered by the majority of candidates.

(d) In Q5.4 (7 marks) a significant number of candidates found it challenging to draw the horizontal sectional view of the installation of a steel door frame. Many candidates drew a timber door frame.

(e) In Q5.5 (4 marks) many candidates could draw the basic members of the closed eave but very few of the candidates could add all the omitted members, like the hanger and quarter round.

### Suggestions for improvement

(a) It is recommended that teaching should include hands-on examples of various plaster and screed techniques, allowing learners to practise these methods to better grasp their principles and uses.

(b) Learners should gain hands-on experience installing door frames so they can clearly explain and accurately illustrate the process, and teachers should create these opportunities during practical periods.

(c) Installing a closed eave involves many intricate steps, therefore teachers should dedicate sufficient time to ensure learners grasp the finer details, not just the basic structure.

## QUESTION 6: REINFORCEMENT IN CONCRETE, FOUNDATIONS, CONCRETE FLOOR AND QUANTITIES

### Common errors and misconceptions

(a) In Q6.1 (5 marks) many candidates displayed an inability to select the correct description in column B to match the items listed in column A.

(b) It was evident that most candidates found it difficult to respond accurately to Q6.2 and Q6.3 (3 marks) which involved questions based on foundations and beams. Many candidates confused the pile foundations with the step or strip foundations.

(c) Many candidates were able to respond accurately to Q6.4 (6 marks) by drawing the difference between a square column and a round column. There were, however, some candidates that could not add the stirrups and main bars in the correct place.

(d) In Q6.5 (5 marks) the majority of the candidates were unable to identify the parts of the rib and block floor, labelled A to E.

(e) In Q6.6 (8 marks) many candidates performed well in completing the drawing of the reinforced concrete beam.

(f) In Q6.7 (15 marks) it was evident that the calculation of the length of a wall plate, number of roof trusses and number of purlins of the building was very challenging for many candidates. The candidates demonstrated that they could not use the dimension paper correctly.

**Suggestions for improvement**

(a) Learners may struggle to select correct descriptions due to limited exposure to the different topics. Teachers should provide more exercises and similar questions to improve performance.

(b) Teaching about concrete reinforcement should be broken into smaller topics, covering beam types and reinforcement methods. This will enable the learner to understand each part's function and placement, rather than relying on memorisation.

(c) Teachers should spend more time on formwork and reinforcement topics to help learners understand the finer details and be able to illustrate all the components involved in the installation. Incorporating more drawings of this type during lessons will improve learners' ability to respond accurately.

(d) The poor performance in Q6.5 may be because this question is often asked in the form of a drawing, and learners are not used to identifying the parts. To prepare learners for different question formats, teachers should test topics by using various question types.

(e) Learners should be exposed to more exercises on the calculation of quantities of materials for a building to develop a better understanding of the topic. These calculations should always be done on dimension paper so that learners become familiar with this process of the correct use of the dimension paper in preparation for examinations.

## 4.3 WOODWORKING

**The following report should be read in conjunction with the Woodworking question paper of the November 2025 examinations.**

### 4.3.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Woodworking examination in 2025 increased (significantly) by 494 compared to that of 2024.

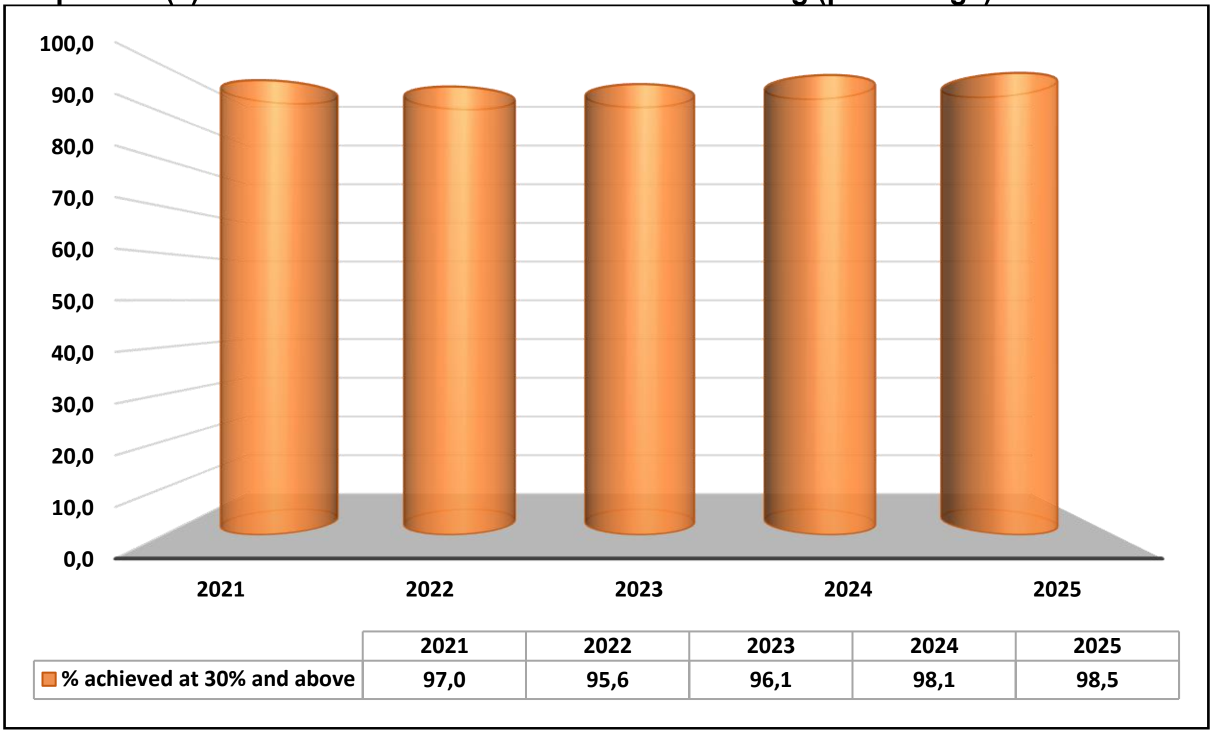
There was also a marginal improvement in the pass rate this year. Candidates who passed at the 30% level and above improved from 98,1% in 2024 to 98,5% in 2025. There was an increase in the pass rate at the 40% level and above over the past two years from 84,3% to 86%. The percentage of distinctions over 80% increased from 1,5% in 2024 to 1,9% in 2025. Given the increase in the size of the 2025 cohort, this converts into an increase in the total number of distinctions from 35 to 53.

The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall improvement in the subject

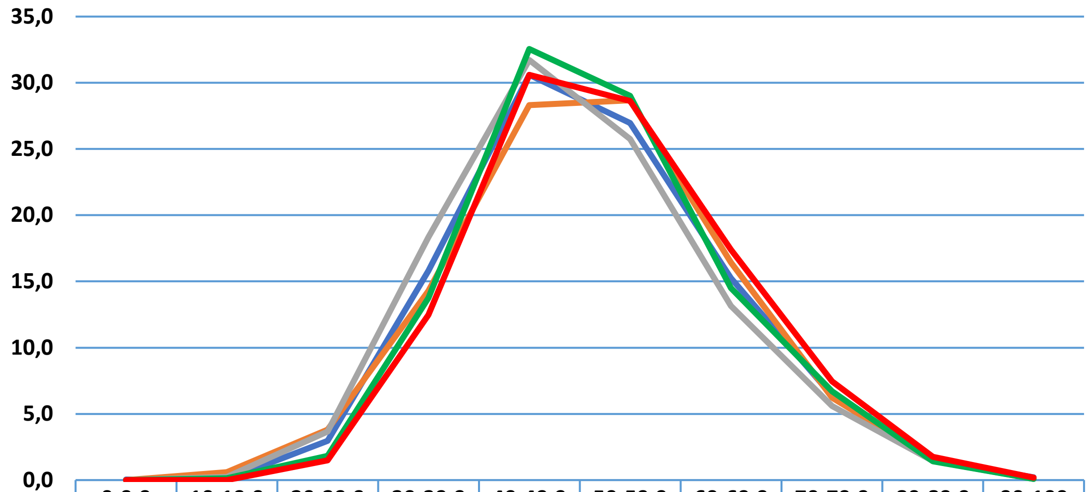
**Table 4.3.1 Overall Achievement Rates in Woodworking**

| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| **2021** | 2 366 | 2 294 | 97,0 |
| **2022** | 2 542 | 2 430 | 95,6 |
| **2023** | 2 213 | 2 127 | 96,1 |
| **2024** | 2 310 | 2 265 | 98,1 |
| **2025** | 2 804 | 2762 | 98,5 |

**Graph 4.3.1(a) Overall achievement rates in Woodworking (percentage)**



**Graph 4.3.1 (b) Performance distribution curves in Woodworking (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,0 | 3,0 | 15,8 | 30,6 | 27,0 | 15,3 | 6,4 | 1,5 | 0,2 |
| 2022 | 0,0 | 0,6 | 3,8 | 14,3 | 28,3 | 28,7 | 16,4 | 6,2 | 1,6 | 0,1 |
| 2023 | 0,0 | 0,2 | 3,7 | 18,3 | 31,7 | 25,8 | 13,1 | 5,6 | 1,4 | 0,1 |
| 2024 | 0,0 | 0,1 | 1,8 | 13,8 | 32,6 | 29,0 | 14,5 | 6,7 | 1,4 | 0,1 |
| 2025 | 0,0 | 0,0 | 1,5 | 12,5 | 30,6 | 28,6 | 17,4 | 7,5 | 1,7 | 0,2 |

## 4.3.2 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN WOODWORKING

**QUESTION 1: OHSA, MATERIALS, TOOLS, EQUIPMENT AND JOINING**

(a) In Q1.1 (10 marks) candidates generally performed above average in selecting the correct word(s) from the options provided in brackets. However, some candidates displayed limited knowledge of the more technical aspects of scaffolding, particularly in Q1.1.1–Q1.1.4.

(b) In Q1.3 (2 marks) many candidates were not able to explain the different specifications according to which bolts are purchased.

(c) In Q1.4.1 (2 marks) most candidates were unable to explain the powder-coating process, particularly in terms of the material used and the method of application.

(d) Q1.5 and 1.6 (3 marks) were generally well answered by the majority of the candidates.

(e) Q1.7 was poorly answered by the majority of the candidates. Candidates' responses suggested a total lack of knowledge and practical exposure to the setting up of a dumpy level and the accessories used to accurately position the instrument on a reference point.

**Suggestions for improvement**

(a) Teachers should emphasise the technical aspects of scaffolding (e.g. safety features, structural components and usage scenarios) during lessons. Incorporate site visits, videos, or classroom models to show scaffolding in real-world contexts. Learners should practise technical vocabulary through glossaries, flashcards and short quizzes.

(b) Teachers should cover bolt specifications in detail, including diameter, length, thread type, grade, and material and show learners actual bolts with different specifications to illustrate how they are purchased and used.

(c) It should be emphasised that powder coating is a finishing process in which a dry powder, usually a thermoplastic or thermoset polymer, is applied to a surface. The powder is electrostatically charged and sprayed onto the workpiece, after which it is cured under heat to form a smooth and durable coating. To reinforce understanding, videos or animations can be used to demonstrate how the powder is sprayed and cured, making the process more accessible and engaging. Where possible, a practical demonstration or factory visit should be arranged to give learners direct exposure to the technique.

(d) Regular practical assessments should be included where learners can set up and use the dumpy level under supervision. Teachers should provide examination-style questions that require learners to explain or demonstrate the setup process and give detailed feedback on errors in both theoretical and practical responses.

**QUESTION 2: GRAPHICS AS A METHOD OF COMMUNICATION**

**Common errors and misconceptions**

(a) In Q2.1 (1 mark) some candidates were not able to deduce the correct elevation from the building plan using the north direction given on the plan as the reference point.

(b) Q2.2 to Q2.5 (4 marks) were well-answered by most candidates.

(c) In Q2.6 many candidates experienced difficulties in deducing the material that was recommended to manufacture the guard rails on the patio. Instead of deducing the answer from the notes on the building plan where the material was specified, many candidates wrote any suitable material and lost marks as a result.

(d) In Q2.8 (1 mark) some candidates did not use capital letters when writing down the abbreviation of the finished floor level (FFL) as required according to the *SANS Code of Practice* and were not credited with the mark as a result.

(e) In Q2.9 (1 mark) some candidates had difficulty to identify the end shape of the downpipe.

(f) Q2.11 (1 mark) was poorly answered by many candidates. Instead of providing a specific electrical fitting that was omitted, e.g. socket outlet, many candidates responded with *electrical fittings* which is a generic answer and was not credited with a mark as a result.

(g) In Q2.14 some candidates responded with *metal* instead of providing the specific material, e.g. *stainless steel* or *cast iron* as required by the question. Teachers and learners need to note that vague and general responses may not be credited with marks.

(h) Many candidates had difficulty in drawing the symbols for a grease trap and undisturbed earth correctly in Q2.23 and Q2.24 (6 marks).

(i) A surprising number of candidates could not calculate the area of the scullery in Q2.26 (3 marks). Many candidates made principal errors in this calculation and added instead of multiplying. Some candidates calculated the area using millimetres instead of metres and were not able to convert the answer to square metres correctly.

(j) Q2.27 (7 marks) was well-answered by most candidates. There was a significant improvement in the ability of candidates to answer this type of question, but many candidates still find this type of question challenging.

**Suggestions for improvement**

(a) Teachers should encourage learners to revise the relationship between building plans (top view) and elevations (front/side views), ensuring that they can visualise how one relates to the other. Remind learners that the north direction is a crucial reference point. They should always begin by identifying the orientation of the plan relative to north, before attempting to determine any elevation.

(b) Learners should be taught to read all notes and annotations on building plans. Teachers must emphasise that important information such as materials, finishes, dimensions and specifications is often given in the general notes or on specific callouts. Learners should be taught to scan the entire plan, including legends and notes, before answering questions on the plans.

(c) Teachers can compile a list of common Civil Technology abbreviations (e.g. FFL, DPC, DPM) required by the *SANS Code* and provide learners with a reference sheet that can be integrated into lessons. Teachers should also reinforce that abbreviations must always be written in capital letters. They can include short, low-stakes quizzes, where learners practise writing abbreviations correctly.

(d) It should be emphasised that examiners expect exact names of fittings (socket outlet, light switch, distribution board, etc.), not broad categories. Teachers can provide learners with a list of common electrical fittings and conduct regular drills of their names. Classroom exercises where learners must identify fittings from drawings or site photographs can also be used effectively to reinforce these concepts.

(e) Where learners cannot recall and reproduce the correct technical symbols, teachers can create a symbol reference chart (aligned with the *SANS Code*) for Civil Technology learners and display these charts in classrooms and workshops for constant reinforcement. Teachers can also integrate symbol drawing drills into lessons (e.g. quick 5-minute exercises).

(f) To improve learner performance in calculations of areas, it is important to reinforce the principle that area is calculated by multiplying length and width, not by adding dimensions, and to ensure learners develop strong unit awareness by consistently working in metres and converting correctly from millimetres to square metres. Teachers should encourage step-by-step problem solving where learners explicitly identify dimensions, convert units, multiply and present the answer in the correct unit, while also providing varied practice exercises that include mixed units to sharpen accuracy. Linking these skills to real-world applications, such as calculating flooring or tiling requirements, will help learners appreciate the practical importance of accuracy and reduce principle errors in future assessments.

## QUESTION 3: CASEMENTS, CUPBOARDS, WALL-PANELLING AND QUANTITIES

**Common errors and misconceptions**

(a) Q3.1 (4 marks) reflected an average performance by the candidates. Many candidates had difficulty to identify all the members of the casement and a number of candidates could not spell the members correctly which made it difficult to understand or interpret their responses.

(b) Q3.2 (5 marks) the performance of the candidates varied, and some candidates could respond well to identifying errors in the installation of the wall panel but many could not identify any of the errors. The majority of the candidates could draw the bottom part of the wall panel.

(c) In Q3.3 (7 marks) the majority of the candidates could respond well to the drawing of the cupboard but the majority were not able to respond accurately to the completion of the cutting list for the cupboard.

**Suggestions for improvement**

(a) It is recommended that teachers should take time to explain these topics in detail and that learners have enough opportunities to practise drawing and adding labels to drawings and improving on the memorisation and spelling of different parts of the casement.

(b) It will be beneficial to learners if they are exposed to the installation of wall panels in the workshop to strengthen their visual memory.

(c) It is recommended that learners should practice completing cutting lists and drawing the different objects (models) often. The different parts of the drawing and how they are combined or joined should be discussed in detail so that learners can understand why different parts are subtracted or added to final answers.

**QUESTION 4: ROOFS, CEILINGS, TOOLS AND EQUIPMENT AND MATERIALS**

**Common errors and misconceptions**

(a) In Q4.1 (5 marks) many candidates lacked the content knowledge to identify the correct machine that should be used to perform the task as listed in column B.

(b) In Q4.2 (7 marks), many candidates were able to respond well to the questions regarding woodworking machines.

(c) In Q4.3 (5 marks) most candidates were not able to give the correct name for a description that was given.

(d) In Q4.4 and 4.5 (4 marks) many candidates were not able to respond accurately to the joining methods of roof trusses.

(e) In Q4.7 (14 marks) most of the candidates were able to draw all the members of the king post roof truss, but many candidates found it difficult to use a scale to draw the roof truss accurately resulting in no marks for the scale of the drawing.

**Suggestions for improvement**

(a) It is advised that learners should be offered the opportunity to use all kinds of materials and finishes during practical sessions to obtain the necessary exposure and experience, which will enable them to respond to these types of questions accurately.

(b) Different terminologies should be studied and memorised. Conducting informal tests that include the descriptions and terminologies of different topics will enable the learner to respond better to these types of questions.

(c) It will benefit the learners if they are exposed more often to the joining of truss members during practical periods. Visiting building sites will also give learners a visual background to generate knowledge on this topic when they are expected to respond to these questions.

(d) Teachers should encourage learners to create drawings of this nature on a regular basis; drawings should be given as homework and the ability to draw trusses can be tested often during formal and informal tasks. Visual aids in the classroom based on this topic will also assist in the memorisation of these members.

**QUESTION 5: CENTERING, FORMWORK, SHORING AND GRAPHICS AS MEANS OF COMMUNICATION**

**Common errors and misconceptions**

(a) In Q5.2 (2 marks) most candidates were not able to explain why columns should be braced by inclined props.

(b) In Q5.3 (5 marks) very few candidates were able to identify the different parts of the double-flying shore.

(c) In Q5.4 (2 marks) the majority of the candidates were not able to name the materials that could be used to cover the openings of laggings of centering.

(d) Candidates responded well to the drawing in Q5.6; however, many candidates did not add the horizontal and diagonal bracing to the drawing.

**Suggestions for improvement**

(a) When teaching, the correct terminologies should be used and the use of layman's terms should be avoided. This will ensure that learners will be able to respond to questions that include terminologies so that they will be able to respond accurately to a question of this nature.

(b) Although 2D drawings of the different types of shoring are available in the resource material, visual aids such as videos or site visits will enable the learner to understand this topic better because visual exposure to real shoring gives more depth to the image and will enable the learner to respond better to these types of questions.

(c) It will benefit learners if a practical application of this content (building a scale model of an arch) can be created in class. This will assist learners with understanding how the members are constructed and connected.

(d) Teaching learners how to respond to questions and to read a question carefully before responding is of utmost importance and will prevent learners from losing valuable marks due to certain parts not being drawn.

**QUESTION 6: SUSPENDED FLOORS, STAIRCASES, IRONMONGERY, DOORS AND JOINING**

**Common errors and misconceptions**

(a) In Q6.1 (6 marks) many candidates had difficulty matching the items in column A with the descriptions in column B.

(b) In Q6.2 and 6.3 (4 marks) most candidates' responses reflected that they were not equipped to explain the different joining methods.

(c) In Q6.4 (8 marks) most candidates were not familiar with the different parts on the horizontal sectional view of a three-panel door and could not draw the required sectional view correctly.

(d) The performance of the candidates in Q6.6 was below average and candidates found it difficult to create the drawing because there was not a comparative view from which to project.

(e) Q6.7 was well answered by many candidates because it is a familiar topic. However, many candidates drew the outer-foundation wall instead of the pier.

**Suggestions for improvement**

(a) Teachers should ensure that the last topics in the curriculum receive the same attention as the first topics and that none of the topics are rushed. This will enable learners to have enough opportunity to gain the necessary knowledge to respond accurately to these questions.

(b) The performance of candidates in this topic can be enhanced by setting up regular practical examples of the different joining methods and by showing videos or other visual aids to the learner to increase their understanding of joining methods.

(c) It will be beneficial to learners if they are exposed to more exercises where they are required to produce drawings from given specifications and sectional views to develop their drawing skills and enable them to respond more accurately to these types of questions.

(d) The preparation for the examinations should not only be limited to the resource material and previous question papers. Learners should be conditioned and prepared to be able to answer any type of question on any of the topics. Teachers should expose learners to drawing questions in various formats, not limited to those in resource materials.

(e) Learners should be taught to analyse questions carefully before attempting to answer them. In many cases learners only study one drawing and are not adaptable when questions are structured differently. Teachers should structure questions in varied ways to help learners practice drawing different parts and adapt to unfamiliar formats.

# CHAPTER 5

## ELECTRICAL TECHNOLOGY

There are three specialisation subjects in Electrical Technology, namely Digital Electronics, Electronics and Power Systems.

A detailed analysis of performance trends is provided for each specialisation subject. It must be noted that the following general comments are observations noted across all three subjects and are therefore stated at the outset.

**General comments: Digital Electronics, Electronics and Power Systems:**

(a) Questions based on recall of content were poorly answered by the majority of the candidates. Weekly informal assessment tasks should be used to reinforce basic concepts and principles. This can be used effectively for content relating to definitions, functions, labelling and operations as listed in the *CAPS* and the *Examination Guidelines*.

(b) Several candidates encountered challenges in manipulating formulae accurately. The following steps are suggested:
- This skill, as well in calculation-related topics, must be introduced in Grade 10 and revised in Grade 11;
- More informal calculations involving the manipulation of formulae must be given to learners as a repetition of doing these types of calculations will improve their skill to master them;
- Identify and use the relevant formulae provided on the formula sheet; and
- Apply the correct substitution and provide the answer with the correct unit and direction in terms of what is required by the question.

(c) Most candidates still experience challenges with questions that require the application of mathematical operations.

(d) Candidates' handwriting must be legible and their calculations should not be cramped onto a section of the page. They must also be taught to follow the general instructions provided on the cover and to read questions carefully so that they are able to answer certain subquestions appropriately.

(f) Some candidates still show a lack of fundamental knowledge and understanding, which should have been gained in Grades 10 and 11. This might be as a result of the practice by the majority of teachers who rely on using previous years' question papers only, instead of using the variety of teaching and learning resources at their disposal, such as the internet and the DBE learner study guides.

(g) A lack of content and skills knowledge was demonstrated by the candidates in the 2025 examinations. It showed poor or inadequate preparation for learning and assessment.

# 5.1 DIGITAL ELECTRONICS

**The following report should be read in conjunction with the Digital Electronics question paper of the November 2025 examinations.**

## 5.1.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Digital Electronics examination in 2025 slightly increased by one candidate, compared to that of 2024.

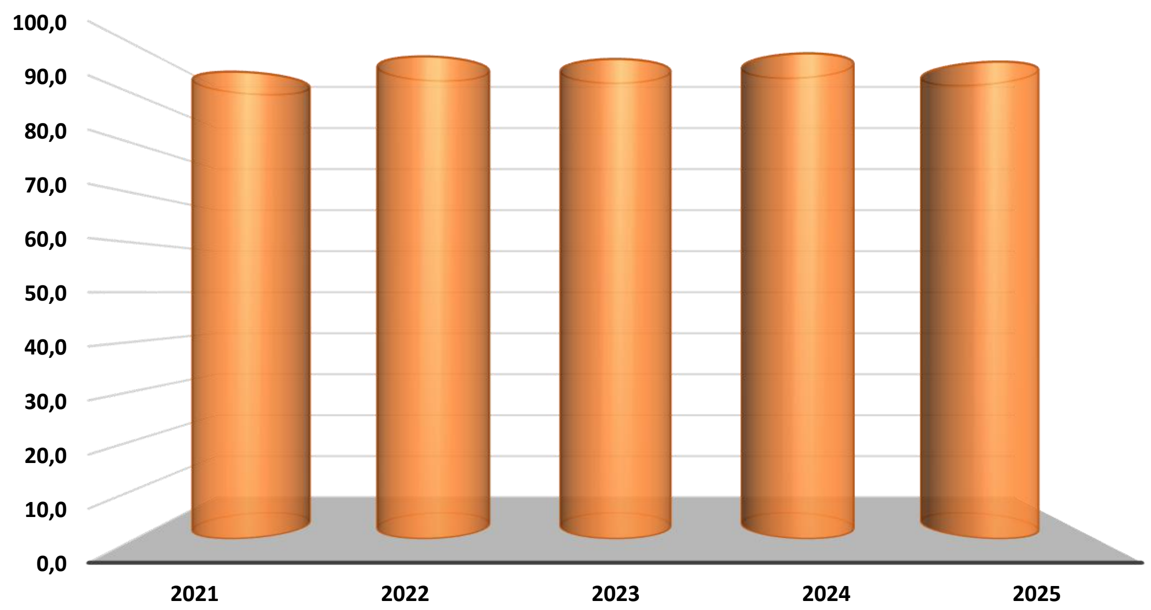
There was a slight decline in the pass rate this year. Candidates who passed at the 30% level and above decreased from 98,3% in 2024 to 96,6% in 2025. There was a corresponding decline in the pass rate at the 40% level and above over the past two years from 77% in 2024 to 71,7% in 2025. The percentage of distinctions over 80% increased from 1,4% in 2024 to 1,9% in 2025. The total number of distinctions has increased for the past two years from six in 2024 to nine in 2025.

The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall performance of the subject.

**Table 5.1.1 Overall achievement rates in Digital Electronics**

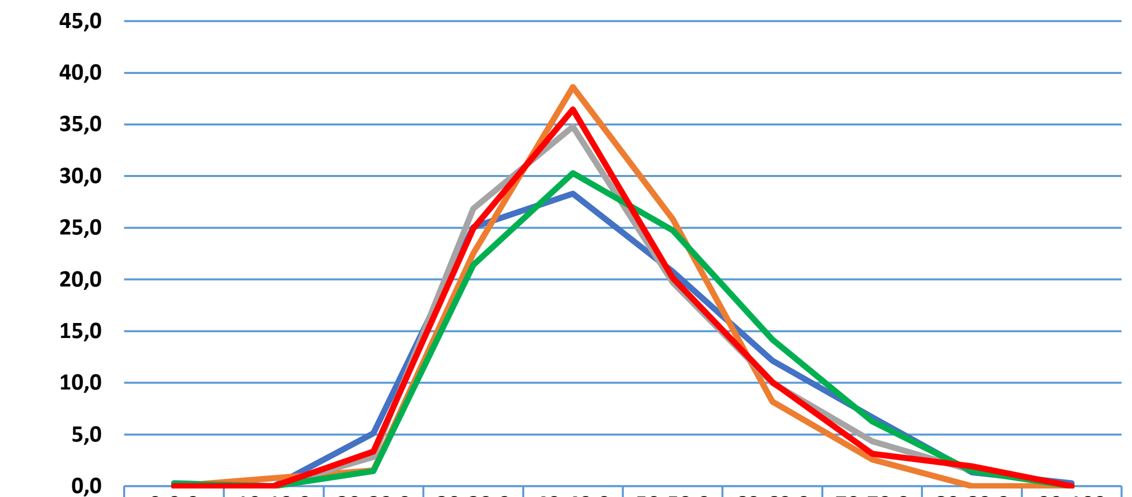
| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| **2021** | 371 | 351 | 94,6 |
| **2022** | 391 | 382 | 97,7 |
| **2023** | 391 | 380 | 97,2 |
| **2024** | 416 | 409 | 98,3 |
| **2025** | 417 | 403 | 96,6 |

**Graph 5.1.1(a) Overall achievement rates in Digital Electronics (percentage)**




| | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| % achieved at 30% and above | 94,6 | 97,7 | 97,2 | 98,3 | 96,6 |

**Graph 5.1.1(b) Performance distribution curves in Digital Electronics (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,3 | 0,0 | 5,1 | 25,1 | 28,3 | 20,8 | 12,1 | 6,6 | 1,3 | 0,3 |
| 2022 | 0,0 | 0,8 | 1,5 | 22,5 | 38,6 | 25,8 | 8,2 | 2,6 | 0,0 | 0,0 |
| 2023 | 0,0 | 0,0 | 2,8 | 26,9 | 34,8 | 19,7 | 10,0 | 4,3 | 1,5 | 0,0 |
| 2024 | 0,2 | 0,0 | 1,4 | 21,4 | 30,3 | 24,8 | 14,2 | 6,3 | 1,4 | 0,0 |
| 2025 | 0,0 | 0,0 | 3,4 | 24,9 | 36,5 | 20,1 | 10,1 | 3,1 | 1,9 | 0,0 |

**General comments**

To improve learner performance and to be more productive and efficient, the following areas need to be revised: *switching circuits, digital* and *sequential devices and microcontrollers*. It was evident in previous examinations, including the 2025 NSC examination, that most candidates experience challenges in these areas. Curriculum specialists and teachers are urged to attend to these areas of concern as a matter of urgency.

Furthermore, candidates should:

- Complete well-planned practical activities for these areas;
- Be assessed on complex questions that use instructional verbs such as *explain*, *describe*, *discuss*, *state*, *determine* and *motivate,* which can be sampled from previous examination papers; and
- Be exposed to problem-solving activities in all topics in the curriculum in lower grades, particularly in Grade 10.

## 5.1.2 OVERVIEW OF CANDIDATES' PERFORMANCE IN DIGITAL ELECTONICS

**General comments**

Most provinces mentioned that the issues identified in the 2021–2024 diagnostic reports are still relevant to this report.

(a) An overall poor performance was recorded, even in questions that were set at the lower cognitive levels.

(b) It was evident from candidates' responses that they lacked relevant content knowledge and the necessary skills to answer questions.

Many candidates experienced difficulty in answering questions of a narrative nature on the application of theory, and mathematical operations learned from Grade 10, for example:

- Principle operations of circuits;
- Manipulation of formulae; and
- Analysis of circuit diagrams.

**General suggestions for improvement**

These suggestions, as mentioned in the 2021–2024 diagnostic reports*,* are still relevant with certain amendments.

(a) Past NSC question papers can be valuable as teaching and learning resources when used effectively. They may be utilised for learner assessment, revision and, to some extent, for teachers' self-evaluation. It is essential that all learners have access to past examination papers from November 2018 to November 2025, as these papers are aligned with the current *CAPS* content.

(b) Although the NSC examinations assess only Grade 12 content, knowledge acquired in Grades 10 and 11 forms a critical foundation that prepares candidates to engage effectively with Grade 12 material. It is therefore essential that this prior learning be integrated into lesson preparation and planning.

(c) PED internal moderators' reports indicate that although candidates generally completed the examination within the allocated time, some questions were partially answered, e.g. Questions 5 and 6. Teachers are encouraged to engage in self-diagnostic practices and consult additional resources where necessary. By working through previous examination papers, educators can identify their areas of strength and weakness. This self-evaluation will highlight specific questions or sections that require improvement, enabling teachers to pursue professional development.

(d) Each *CAPS* topic concludes with prescribed practical experiments designed to deepen learners' understanding of the subject content. Teachers are encouraged to implement these practical activities, as they play a vital role in preparing candidates for the practical assessment tasks (PATs).

### 5.1.3 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN DIGITAL ELECTRONICS

**QUESTION 1: MULTIPLE-CHOICE QUESTION**

**Common errors and misconceptions**

(a) Many candidates had trouble identifying the multivibrator circuit in Q1.2.

(b) Some candidates were not familiar with the applications of a Schmitt trigger in Q1.4.

(c) The concept of 'open-loop gain' in op amps was not understood by candidates in Q1.6, with some attributing it to the power supply or internal structure.

(d) In Q1.10, many candidates incorrectly chose 'none of the above-mentioned'.

(e) Candidates often incorrectly identified the answer as 'data bus' in Q1.12.

(f) Many candidates could not distinguish between an 'algorithm' and 'program' in Q1.15.

**Suggestions for improvement**

(a) To enhance learner performance in multiple-choice questions, teachers should emphasise the following strategies:
- Analyse, interpret and re-word questions before answering.
- Provide a possible answer before considering the options.
- Read the entire question stem before looking at the options.
- Highlight keywords such as 'trigger', 'threshold' and 'reference'.
- Use elimination techniques to cross out options that contradict Digital Electronics principles.
- Compare remaining options to definitions used in class and reflected in the memo.
- Use consistent circuit formats, symbols, and definitions.

(b) Teachers are advised to:
- Provide past Q1 items for revision to familiarise learners with distractor patterns;
- Show learners how definitions in Q1 relate to content in Q3, Q4, and Q5; and
- Encourage conceptual learning over memorisation.

(c) To build conceptual clarity, learners should:
- Justify their multiple-choice question answers with short verbal or written explanations;
- Read questions carefully and choose an answer before looking at the options; and
- Practise multiple-choice questions regularly in class.

(d) Teachers should also:
- Introduce the full operation of all circuits and truth tables;
- Emphasise thorough textbook reading to build a strong foundation in the subject matter; and
- Encourage learners to develop a strong grasp of the subject matter, practise effective time management and improve their ability to eliminate incorrect options.

**QUESTION 2: OCCUPATIONAL HEALTH AND SAFETY**

**Common errors and misconceptions**

(a) Many candidates had trouble with defining 'machinery' in Q2.1. They frequently defined it as a tool used to perform tasks rather than a device that converts energy to perform work. Key aspects that were often overlooked included:
- Energy conversion: Machinery converts energy from one form to another.
- Performing work: The primary purpose of machinery is to perform work, such as moving objects or processing materials.

(b) In Q2.2 many candidates' responses were often vague and lacked specificity, as they provided one-word answers that did not describe precautionary measures to help an electrocuted person safely.

(c) In Q2.3 many candidates described unsafe acts/conditions instead of dangerous practices. Candidates often did not recognise that working with live circuits during fault finding and etching PC boards are inherently dangerous practices.

(d) In Q2.4 most candidates could not differentiate between an 'accident' and a 'critical incident'. Many did not acknowledge that a critical incident requires that external emergency services be called.

(e) In Q2.5 many candidates did not fully address the question, with some not mentioning that the removal of safety guards creates an unsafe condition that can compromise the safety of others.

**Suggestions for improvement**

(a) To enhance learner understanding and performance, teachers are advised to:
- Encourage learners to master the structure of a definition that will receive full marks and the importance of precise vocabulary;
- Emphasise that questions worth multiple marks require answers with corresponding components and provide practice tasks to help learners identify these components;
- Use marking-guideline-aligned wording and provide practice tasks to help learners understand how correct wording affects marks; and
- Reinforce the differences between terms with similar marks, such as 'dangerous practice', 'critical incident' and 'unsafe condition'.

(b) To achieve better performance, learners should do the following:
- Develop a deeper understanding of Electrical Technology concepts and their practical applications.
- Improve comprehension of complex concepts and relationships.
- Enhance description and explanation skills to articulate ideas clearly.
- Refine language proficiency to convey meaning and understanding accurately.
- Gain practical experience by observing real-world applications of Electrical Technology concepts.

**QUESTION 3: SWITCHING CIRCUITS**

**Common errors and misconceptions**

(a) In Q3.1 many candidates had difficulty in explaining the concept of reference voltage in relation to operational amplifiers, often providing answers related to the 555 IC instead.

(b) In Q3.2.1 most candidates only referred to the purpose of R1 and R2, but could not elaborate on keeping pin 2 and pin 4 high.

(c) In Q3.2.2 the majority of candidates found it challenging to grasp the concept of a floating/fluctuating output at pins 2 and 4 when R1 and R2 are bypassed.

(d) In Q3.2.3 a significant number of candidates experienced difficulty with the following:
- Drawing the output of a bistable multivibrator and understanding the actual working principle of the circuit.
- Differentiating between the output voltage of a stable multivibrator circuit using a 741 op-amp and 555 IC.
- Understanding the concept of 'dual power supply'.

(e) In Q3.3.2 most candidates were challenged by the timing concept, often drawing the output waveform incorrectly.

(f) In Q3.3.4 the majority of candidates did not label and number the components in the circuit diagram.

(g) In Q3.4 most candidates struggled to:
- Draw the output signal of the Schmitt trigger circuit; and
- Explain the term 'trigger voltage' in the context of the Schmitt trigger circuit.

(h) The majority of candidates had difficulty in determining the approximate values of trigger voltage in Q3.4.3.

(i) In Q3.4.4 a significant number of candidates could not draw the correct output waveform for a given input waveform.

(j) In Q3.5.1 most candidates could not explain one characteristic that makes a summing amplifier suitable for use in audio mixing.

(k) In Q3.5.2 and Q3.5.3 many candidates made errors in unit conversion and calculation.

(l) In Q3.5.4 many candidates did not explain how the output signal would react to being driven above the supply voltage.

(m) In Q3.6.1 the majority of candidates struggled to identify the voltage at the inverting input terminal.

(n) In Q3.6.2 most candidates could not:
- Explain the relationship between the input and output voltages of the differentiator; and
- Describe the circuit operation and underlying principles.

**Suggestions for improvement**

To enhance learner understanding, teachers are advised to do the following:
- Explain the working principle of circuits, including input and output waveforms and mathematical principles.
- Demonstrate how changing component values affects circuit characteristics and output waveforms.
- Use simulations, visual tools and hands-on learning to reinforce theoretical concepts.
- Reinforce fundamental switching concepts, such as threshold levels and stable vs unstable states.

**QUESTION 4: SEMICONDUCTOR DEVICES**

**Common errors and misconceptions**

(a) In Q4.1.1 many candidates could not explain the purpose of the index mark on the 741 IC.

(b) In Q4.1.2 several candidates recognised that the output will be inverted but could not explain that it will be amplified.

(c) In Q4.3 most candidates could not explain the stages of the internal circuit of the op amp, particularly the intermediate stage.

(d) In Q4.4 many candidates could not label the components of the circuit diagram.

(e) In Q4.5.2 several candidates had trouble explaining the RS flip-flop and its stable states.

(f) In Q4.5.3 a significant number of candidates could not explain the purpose of pin 4 in the 555 timer and why it is connected to the positive voltage rail.

(g) In Q4.5.4 most candidates recognised the use of capacitors, but did not specify small value capacitance.

**Suggestions for improvement**

(a) Teachers should emphasise the:
- Pin configuration and functions of ICs, such as the 741 op amp and 555 timer;
- The purpose and use of the index mark for identifying pin 1;
- Practical experimentation with ICs and circuit diagrams, which can reinforce theoretical knowledge;
- Need for the dual rail power supply during operation of the op amp including amplification and inversion of the input waveforms; and
- Correct labelling of the components on circuit diagrams.

(b) It is important to understand fully all the internal stages of the 741 op amp during its operation.

(c) Teachers are advised to emphasise the:
- Functions of the 555 timer IC pin 4/reset pin and its connection to the positive voltage rail which is essential to design and troubleshoot 555 timer circuits; and
- Use of capacitors for noise filtering and decoupling in electronic circuits; understanding the importance of selecting appropriate capacitance values for effective noise filtering is crucial.

**QUESTION 5: DIGITAL AND SEQUENTIAL DEVICES**

**Common errors and misconceptions**

(a) In Q5.1.3 most candidates could not complete the diagram on sourcing digital output, with errors in circuit symbols and labelling.

(b) In Q5.3.3 a significant number of candidates had difficulty describing the difference between 'full adder' and 'half-adder logic circuits', often providing incomplete or inaccurate responses.

(c) In Q5.4.1 many candidates used incorrect gate combinations and struggled to complete the J-K flip-flop diagram.

(d) Most candidates were unable to draw the output waveform of a JK-latch correctly by using the inputs provided in Q5.4.2.

(e) In Q5.5 the majority of candidates provided incomplete responses, omitting crucial details about the circuit's operation.

(f) In Q5.6 candidates could not explain 'propagation delay' and how to eliminate it.

(g) In Q5.8.2 several candidates could not explain the function of the AND-gate and complete the truth table of the counter in Q5.8.3 due to errors in the numbering of clock pulses, or the conversion of decimal numbers to binary.

(h) A significant number of candidates could not define a 'register' in Q5.9.2.

(i) In Q5.9.4 most candidates could not describe how data flows through a register, often providing incomplete or inaccurate responses.

**Suggestions for improvement**

(a) Teachers should emphasise the:
- Practice of completing digital output circuit diagrams, i.e. sourcing and sinking, to ensure accuracy and attention to detail and further familiarise learners with the components and connections involved in digital output circuits;
- Logic circuits and truth tables of both full adders and half-adders and the key differences between them, including the number of inputs and outputs;
- Practice of correct gate combinations in the JK flip-flop diagram and the drawing of the output waveform of a JK-latch from given inputs; and
- Operation of the synchronous and asynchronous counters including the function of their components.

(b) Teachers must emphasise the importance of precision and accuracy in defining technical terms and provide examples of different types of registers, such as:
- Serial-in parallel-out (SIPO) shift registers
- Parallel-in serial-out (PISO) shift registers
- Serial-in serial-out (SISO) shift registers
- Parallel-in parallel-out (PIPO) registers

(c) Teachers should use visual aids to illustrate the flow of data through a register and implement the following:
- Provide a step-by-step explanation of the process of data entry, storage and retrieval in a register.
- Emphasise the differences between 'serial' and 'parallel' data transfer.
- Provide examples of how data flows through different types of registers, such as SIPO, PISO, SISO, and PIPO.

**QUESTION 6: MICROCONTROLLERS**

**Common errors and misconceptions**

(a) In Q6.1 many candidates described a microcontroller as 'a single chip computer' without mentioning its dedicated task or required components (CPU, memory, I/O).

(b) The majority of candidates demonstrated a limited understanding of TRIS, specifically setting the direction of I/O pins in Q6.2.2.

(c) In Q6.3.2 some candidates could not explain how data is transferred from A to B.

(d) In Q6.3.3 a significant number of candidates could not describe 'synchronous communication', including clock-based synchronisation and data sampling.

(e) Most candidates correctly identified the higher data transfer rate of synchronous communication but did not mention the importance of shared clock pulses in Q6.3.4.

(f) A significant number of candidates could not explain the function of UART, often describing it as 'parallel communication' instead of 'serial communication' with buffering and start/stop bits in Q6.4.

(g) In Q6.5 some candidates misunderstood the difference between 'half-duplex' and 'full duplex', thinking it related to data quantity rather than transmission direction and timing.

(h) In Q6.6.3 and Q6.6.4 most candidates could not state the advantages and explain the function of SPI, often confusing it with data processing or confusing 'MOSI' and 'MISO'.

(i) Most candidates could not define programming terms/commands in Q6.7.

(j) In Q6.8 many candidates had difficulty drawing and completing the flowchart correctly, inserting incorrect symbols and commands without proper labelling.

**Suggestions for improvement**

(a) Teachers are advised to encourage learners to:
- Practise 'TRIS', 'PORT', and bit-direction control, explicitly using table exercises and microcontroller simulators;
- Reinforce synchronous vs asynchronous communication with diagrams and timing examples;
- Practise interpreting and completing flowcharts, especially with counters and conditions; and
- Introduce communication peripherals (UART, SPI, $I^2C$) using block diagrams and real examples.

(b) Teachers should use:
- Practical approaches like PICAXE and CAT (Computer Application Technology) to generate interest;
- Visual aids like poster-type notes and actual microprocessor-based devices to enhance teaching;
- Symbols and their description of action and how to incorporate them into a flowchart;
- Previous examination papers and real-life scenarios as part of their assignments to expose learners to different types of questions; and
- Software like PICAXE legislator 6 to help learners compile flow diagrams and understand simulations.

## 5.2 ELECTRONICS

**The following report should be read in conjunction with the Electronics question paper of the November 2025 examinations.**

### 5.2.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Electronics examinations in 2025 increased by 45 compared to that of 2024.

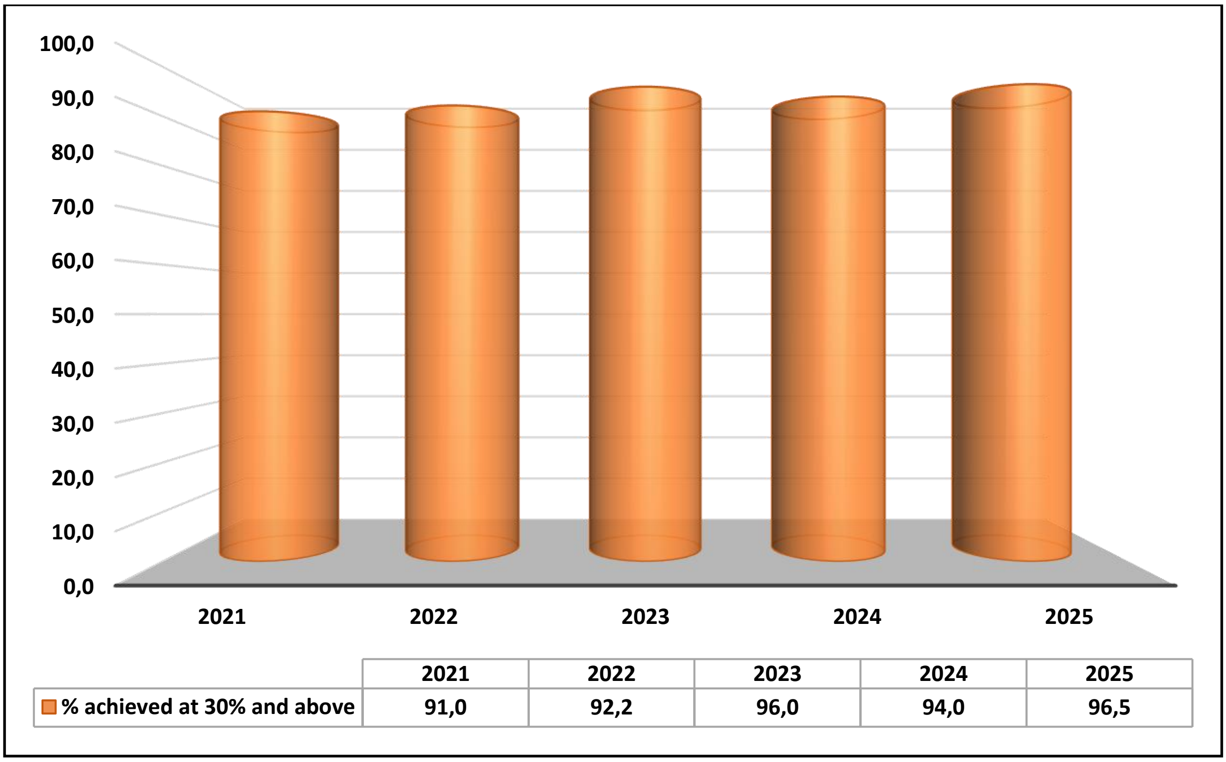
There was a slight improvement in the pass rate this year. Candidates who passed at the 30% level and above increased from 94,0% in 2024 to 96,5% in 2025. There was a corresponding decline in the pass rate at the 40% level and above over the past two years from 66,3% in 2024 to 65,6% in 2025. However, the percentage of distinctions over 80% decreased from 0,8% in 2024 to 0,2% in 2025. The total number of distinctions decreased from eight distinctions in 2024 to two distinctions in 2025.

The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall improvement in the subject.

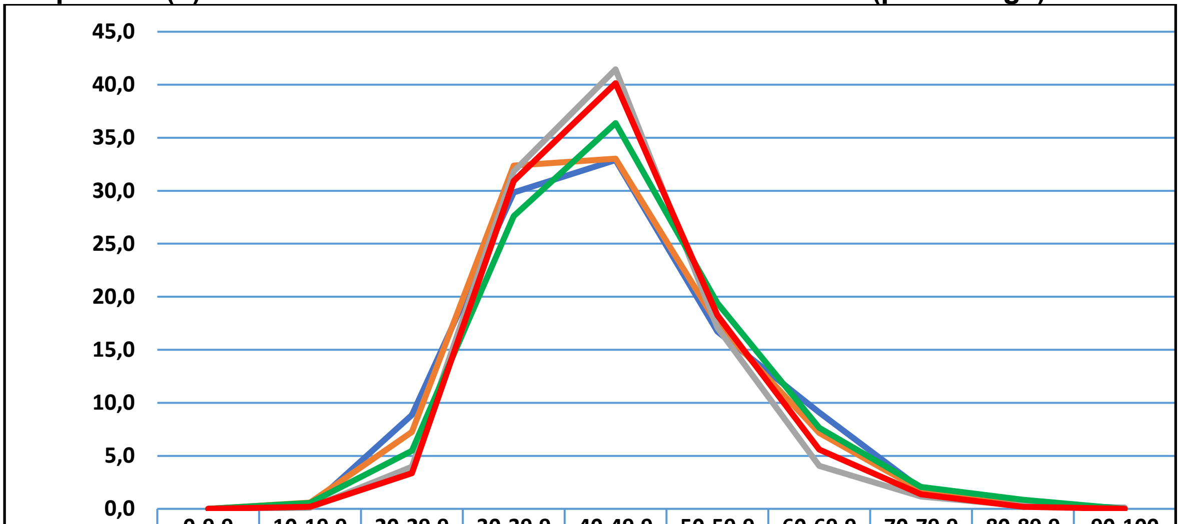
**Table 5.2.1 Overall achievement rates in Electronics**

| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| **2021** | 1 143 | 1 040 | 91,0 |
| **2022** | 1 199 | 1 105 | 92,2 |
| **2023** | 1 112 | 1 067 | 96,0 |
| **2024** | 1 061 | 997 | 94,0 |
| **2025** | 1 106 | 1 067 | 96,5 |

**Graph 5.2.1(a) Overall achievement rate in Electronics (percentage)**



**Graph 5.2.1(b) Performance distribution curves in Electronics (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,2 | 8,8 | 29,8 | 32,9 | 16,7 | 9,1 | 1,9 | 0,4 | 0,1 |
| 2022 | 0,0 | 0,6 | 7,3 | 32,4 | 33,0 | 17,4 | 7,2 | 1,8 | 0,4 | 0,0 |
| 2023 | 0,0 | 0,1 | 4,0 | 31,8 | 41,5 | 17,1 | 4,0 | 1,2 | 0,3 | 0,1 |
| 2024 | 0,0 | 0,6 | 5,5 | 27,6 | 36,4 | 19,4 | 7,6 | 2,1 | 0,8 | 0,0 |
| 2025 | 0,0 | 0,2 | 3,3 | 30,9 | 40,1 | 18,3 | 5,6 | 1,4 | 0,2 | 0,0 |

## 5.2.2 OVERVIEW OF CANDIDATES' PERFORMANCE IN ELECTRONICS

**General comments**

Some comments mentioned in the *2024 Diagnostic Report* are still relevant to this report and therefore they have been retained.

(a) To improve performance, the following areas: *switching circuits*, *semiconductors* and *amplifiers* need to be revised as it was evident that most candidates still found them challenging in the 2025 examination, Curriculum specialists and teachers are urged to attend to these areas of concern as large numbers of candidates obtained zero marks in this question.

(b) A random sample of scripts reflected that Q1 (multiple-choice questions) and Q2 were well-answered; averages of 40% and 50% were observed respectively. These questions comprised only 12,5% of the entire paper. Q3 was also well-answered with an average of 47%. This question made up 17,5% of the question paper.

(c) Q4, Q5 and Q6 were poorly answered. These questions comprised 70% of the question paper. This has impacted negatively on the overall performance of the candidates

(d) In general, candidates made basic mistakes, such as not selecting the correct formulae, not substituting correct values in formulae, omitting the correct units and using the incorrect prefixes of values when doing substitutions.

(e) It was evident from some candidates' responses that they lacked relevant content knowledge and the necessary skills to answer the questions.

(f) Many candidates experienced difficulty in answering questions on:
- Application of theory and the application of mathematical principles;

- Principle operations of circuits;
- Manipulation of formulae; and
- Analysis of circuit diagrams

(g) Marks were lost due to the omission of the units in the calculations and/or incorrect substitutions and the omission of labels in the drawings.

(h) Candidates could not use the answer sheets provided correctly.

**General suggestions for improvement**

Most of the suggestions mentioned in the 2021–2024 diagnostic reports are still relevant and have therefore been retained.

(a) Past NSC question papers can be valuable teaching and learning resources when used effectively. They may be utilised for learner assessment, revision and, to some extent, for teachers' self-evaluation. All learners must have access to past examination papers from November 2018 to November 2025, as these papers are aligned with the current CAPS content.

(b) Although the NSC examinations assess only Grade 12 content, knowledge acquired in Grades 10 and 11 forms a critical foundation that prepares candidates to engage effectively with Grade 12 material. It is therefore essential that this prior learning be integrated into lesson preparation and planning.

(c) PED internal moderators' reports indicate that although candidates generally completed the examination within the allocated time, some questions were partially answered, e.g. Questions 5 and 6. Teachers are encouraged to engage in self-evaluation practices and consult additional resources where necessary. By working through previous examination papers, educators can identify their areas of strength and weakness. This self-evaluation will highlight specific questions or sections that require improvement, enabling teachers to pursue professional development.

(d) Each *CAPS* topic concludes with prescribed practical experiments designed to deepen learners' understanding of the subject content. Teachers are encouraged to implement these practical activities, as they play a vital role in preparing candidates for the practical assessment tasks (PATs).

## 5.2.3 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN ELECTRONICS

### QUESTION 1: MULTIPLE-CHOICE QUESTION

**Common errors and misconceptions**

(a) In Q1.3 and Q1.4 many candidates experienced difficulty with the fundamentals of RLC circuits, particularly in understanding the relationship between current and voltage, as well as how circuit frequency relates to resonance.

(b) Many candidates appeared to be confused when answering Q1.5 and Q1.15, as they were hesitant to choose option D, which was either 'none of the above-mentioned' or 'all of the above'.

(c) Most candidates struggled to identify the correct options in Q1.6.

**Suggestions for improvement**

(a) Teachers should make use of simulations and practical assessment tasks (PATs) to empower learners to apply theoretical concepts in practical, real-life contexts.

(b) Subject advisors and teachers are encouraged to integrate multiple-choice questions into both formal and informal assessments. This practice will assist learners in developing strong analytical and interpretative skills, leading to more accurate responses and reducing the likelihood of learners being misled by distractors or selecting incorrect options.

(c) Teachers should incorporate NSC-aligned multiple-choice activities, including:
- Using past examination papers for practice; and
- Analysis of distractors to develop learners' reasoning skills.

**QUESTION 2: OCCUPATIONAL HEALTH AND SAFETY**

**Common errors and misconceptions**

(a) In Q2.1 most candidates were unable to state the correct definition for 'machinery' and instead provided a broad description, which did not satisfy the requirements of a formal definition.

(b) In Q2.3 most candidates were able to give examples of 'unsafe acts', but they could not distinguish them from 'dangerous practices', resulting in incorrect responses.

(c) In Q2.4 a significant number of candidates could not differentiate between a 'critical incident' and an 'accident'. Their responses did not address key distinguishing aspects, such as the involvement of external emergency services in a critical incident as opposed to an accident.

**Suggestions for improvement:**

(a) Teachers should highlight the core principle that machinery is designed to convert energy from one form to another, to ensure that this concept is clearly understood by learners.

(b) Teachers should clearly explain the difference between 'dangerous practices' and 'unsafe acts'. Using practical examples and scenarios could help learners identify and differentiate between these concepts accurately during assessments.

(c) Teachers can adopt scenario-based teaching by presenting situations in the classroom, such as:
- Unsafe use of tools;
- Improper use of personal protective equipment (PPE);
- Malfunctioning or faulty equipment;
- Operation of machinery without authorisation; and
- Learners should be guided to identify the hazard, assess the risk and determine the correct OHSA control measure.

(d) To reinforce vocabulary and short written explanations, teachers should emphasise the following:
- Definitions as stipulated by the OHS Act of 1993

- Brief, well-structured answers
- Expanding of explanations to respond to two-mark questions adequately

**QUESTION 3: RLC CIRCUITS**

**Common errors and misconceptions**

(a) In Q3.3 most candidates could not score 4 out of 4 for the phasor diagram due to incorrect labelling; they either omitted the values or did not differentiate between the length of $V_L$ and $V_C$. Certain candidates labelled the diagram incorrectly with reactance values, ignoring the fact that the question specifically asked for a voltage phasor diagram. Another common error was candidates' not ending the resultant phasor $V_T$ directly above the $V_R$ phasor but in line with $I_T$.

(b) In Q3.4.1 most candidates incorrectly placed the smaller capacitive current (IC) before the larger inductive current ($I_L$) when applying the current formula $I_T = \sqrt{{I_R}^2 + (I_L - I_C)^2}$ . When the inductive current IL is greater than the capacitive current IC, the circuit is inductive. If the inductive current IL is less than the capacitive current IC, the circuit is capacitive and $I_T = \sqrt{{I_R}^2 + (I_C - I_L)^2}$ .

(c) In Q3.6 candidates could not indicate how an increase in frequency causes the circuit to resonate. Most candidates only mentioned one of the two variables (either inductive or capacitive reactance) instead of mentioning both.

(d) In Q3.7.2 many candidates lost a mark during substitution because they did not take note of the characteristic curve where the frequency was given in kHz rather than Hz.

**Suggestions for improvement:**

(a) Key factors should be remembered when drawing RLC series circuit phasor diagrams:
- Series circuits have voltage phasors ($V_L$, $V_C$, $V_R$ and $V_T$).
- Each phasor must:
  - Be labelled and the label correctly placed;
  - Be distinguished by length or a value to indicate its magnitude; and
  - End with an arrowhead to indicate its direction.
- The phase angle will always be between $V_T$ and $I_T$ where:
  - IT is on the horizontal axes in a series circuit with $V_T$ as resultant
  - The resultant phasor is always $V_T$ in a series circuit; and
  - The resultant phasor $V_T$ must end directly above or below VR in a series circuit.
- Do not use reactance and impedance values unless specifically asked to do so.

(b) Teachers are encouraged to place greater emphasis on the following aspects:
- The correct use of unit prefixes when making substitutions in calculations
- Accurate and appropriate labelling of diagrams
- Careful reading, interpretation, and analysis of information presented in graphs

**QUESTION 4: SEMICONDUCTOR DEVICES**

**Common errors and misconceptions**

(a) Most candidates were unable to answer Q4.1.3 and Q4.1.4.

(b) In Q4.2, the majority of candidates could not complete the JFET output characteristic curves correctly; in some instances they omitted the VGS values when drawing the curves.

(c) In Q4.4 most candidates were unable to distinguish between the construction of a MOSFET and a JFET.

(d) In Q4.5 several candidates could not complete and label the sawtooth generator circuit diagram correctly.

(e) In Q4.11 a significant number of candidates were unable to complete and label the inverting operational amplifier circuit diagram correctly.

**Suggestions for improvement:**

(a) The application of transistor operation concepts learned in Grade 11 would enhance learners' understanding of JFET operation. For example, learners should understand how the narrowing of the depletion region leads to a wider channel and consequently an increase in drain current.

(b) Teachers should place emphasis on the following aspects:
- The basic construction and symbols of each semiconductor
- The operation and characteristic curves of semiconductors
- The applications of each semiconductor
- The use of practical activities to reinforce content knowledge and to demonstrate input–output waveforms.

(c) Learners should be reminded that all sketches and diagrams must be drawn large enough, neatly and completely and correctly labelled.

## QUESTION 5: SWITCHING CIRCUITS

### Common errors and misconceptions

(a) In Q5.2.3, Q5.3.2, Q5.3.4 and Q5.4.4 most candidates were unable to draw the correct waveforms, while some candidates omitted the required labels.

(b) In Q5.5.2 some candidates did not include the appropriate unit prefixes during substitution.

(c) In Q5.4.3 most candidates were unable to distinguish between the 'trigger voltage' and the 'supply voltage' of the operational amplifier.

### Suggestions for improvement

(a) Teachers are encouraged to construct all the prescribed circuits and to demonstrate, as well as sketch, the input and output waveforms using an oscilloscope.

(b) To enhance learner understanding, teachers are advised to do the following:

- Explain the working principles of circuits, including input and output waveforms and mathematical principles.
- Demonstrate how changing component values affect circuit characteristics and output waveforms.
- Use simulations, visual tools and hands-on learning to reinforce theoretical concepts.
- Reinforce fundamental switching concepts, such as 'threshold levels' and 'stable' vs 'unstable' states.

**QUESTION 6: AMPLIFIERS**

**Common errors and misconceptions**

(a) In Q6.1 most candidates were only able to describe one fact related to the purpose of the amplifier, and this resulted in their earning one mark instead of two marks.

(b) In Q6.2.1 most candidates could not identify the class of an amplifier from load-lines.

(c) In Q6.3.3 most candidates could not calculate the circuit power gain, and some calculated it correctly but left out the unit *dB*.

(d) In Q6.9 candidates could not differentiate between the 'type of feedback used in amplifiers' and the 'type of feedback used in oscillators'.

**Suggestions for improvement:**

(a) Teachers should focus on the following during lesson presentation:
- Amplification
- Distortion
- The ability to drive the load

(b) Teachers should emphasise the identification and understanding of classes of amplifiers A, B, AB, C from load lines and circuit diagrams.

(c) Teachers are advised to emphasise the instruction on how to deal with questions requiring calculations i.e.:
- Identification of formula
- Correct substitution
- Inclusion of unit which in this case is '*dB*'

(d) Teachers should clearly distinguish between 'feedback in amplifiers (negative feedback)' and 'feedback in oscillators (positive feedback)'.

## 5.3 POWER SYSTEMS

**This report should be read in conjunction with the Power Systems question paper and marking guidelines of the November 2025 examinations.**

### 5.3.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Power System examinations in 2025 increased by 593 compared to that of 2024.

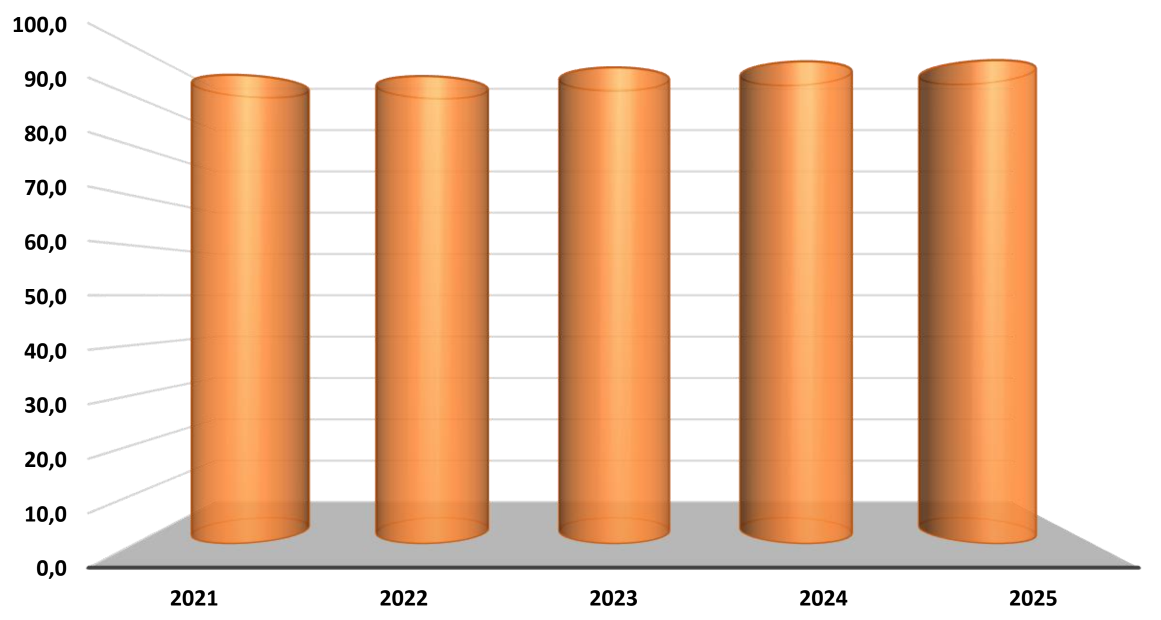
There was a slight improvement in the pass rate this year. Candidates who passed at the 30% level and above increased from 97,1% in 2024 to 97,3% in 2025. However, candidates who achieved at the 40% level and above decreased over the past two years from 80,9% in 2024 to 82,3% in 2025. The percentage of distinctions over 80% declined from 1,8% in 2024 to 1,3% in 2025. Despite the increase in the size of 2025 cohort, the total number of distinctions decreased from 102 in 2024, to 81 in 2025.

The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall improvement in the subject.

**Table 5.3.1 Overall achievement rates in Power Systems**

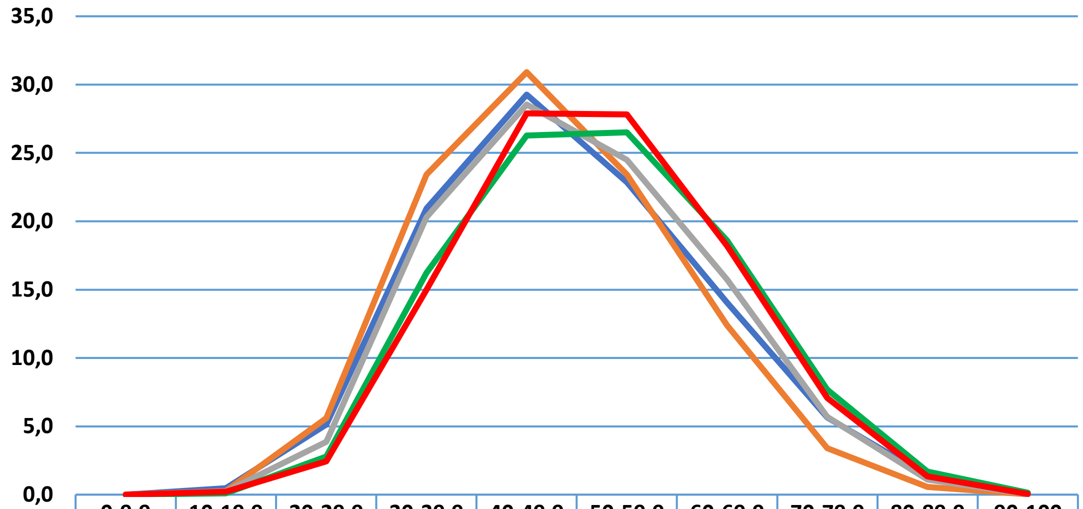
| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| **2021** | 5,675 | 5,357 | 94,4 |
| **2022** | 5,907 | 5,561 | 94,1 |
| **2023** | 5,938 | 5,694 | 95,9 |
| **2024** | 5,670 | 5,506 | 97,1 |
| **2025** | 6,263 | 6,097 | 97,3 |

**Graph 5.3.1(a) Overall achievement rates in Power Systems (percentage)**




| | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| % achieved at 30% and above | 94,4 | 94,1 | 95,9 | 97,1 | 97,3 |

**Graph 5.3.1(b) Performance distribution curves in Power Systems (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,5 | 5,1 | 20,9 | 29,3 | 22,9 | 14,0 | 5,6 | 1,4 | 0,1 |
| 2022 | 0,0 | 0,3 | 5,6 | 23,4 | 30,9 | 23,4 | 12,4 | 3,4 | 0,6 | 0,0 |
| 2023 | 0,0 | 0,2 | 3,9 | 20,3 | 28,5 | 24,5 | 15,7 | 5,7 | 1,1 | 0,0 |
| 2024 | 0,0 | 0,1 | 2,8 | 16,2 | 26,3 | 26,5 | 18,6 | 7,7 | 1,7 | 0,1 |
| 2025 | 0,0 | 0,2 | 2,4 | 15,0 | 27,9 | 27,8 | 18,2 | 7,1 | 1,3 | 0,0 |

## 5.3.2 OVERVIEW OF CANDIDATES' PERFORMANCE IN POWER SYSTEMS

### General comments

Some of the comments mentioned in the *2024 Diagnostic Report* must be revisited as they are still applicable in 2025.

(a) A significant number of candidates found the construction of answers to narrative-type questions difficult. This indicates persistent challenges in both understanding the purpose of questions, and providing detailed, well-organised explanations as required by the assessment.

(b) Many candidates struggled to demonstrate their understanding of circuit behaviour principles, causing incorrect responses. Difficulties in applying theoretical concepts to practical situations further exacerbated these challenges, revealing ongoing gaps in both fundamental knowledge and the analytical skills necessary for formal assessment.

(c) Despite the endeavours during the mediation of the diagnostic report at the provincial and national subject meetings, candidates still struggled with the following:
- Identification and manipulation of formulae
- Correct labelling of drawings
- Responding to questions Q5 and Q7

### General suggestions for improvement

The suggestions, as mentioned in the *2024 Diagnostic Report,* are still relevant with certain amendments.

(a) When answering narrative questions that use verbs like 'describe' or 'explain', learners should consider the mark allocation and ensure their responses include the required number of factual points. The use of bullet points is recommended, as this allows for one fact to be given per bullet, improving clarity and ensuring alignment with the marking criteria.

(b) Even though the NSC examinations assess only Grade 12 content, reviewing and integrating relevant concepts covered in Grades 10 and 11 is essential. The fundamental knowledge gained in earlier grades supports learners' understanding of Grade 12 topics. Therefore, teachers should ensure that this prior knowledge is incorporated in their lesson planning and preparation.

(c) Internal moderators of PEDs noted that although most candidates were able to complete their exams within the given time, some questions were left unanswered or learners underperformed, e.g. in Q1, Q2, Q6 and Q7. To address this challenge, teachers are encouraged to review their teaching practices or strategies and consult additional resources. Working through past examination papers can help educators identify both strengths and areas for improvement, allowing them to focus on targeted professional development where necessary.

(d) Educators are encouraged to conduct the practical experiments listed at the end of each topic in the CAPS. These experiments help learners to understand the subject content more thoroughly and prepare them for the practical assessment tasks (PATs).

## 5.3.3 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN POWER SYSTEMS

### QUESTION 1: MULTIPLE-CHOICE QUESTION

**Common errors and misconceptions**

(a) In Q1.3 and Q1.4 many candidates experienced difficulty with the-fundamentals of RLC circuits, particularly in understanding the relationship between 'current' and 'voltage', and how circuit frequency relates to resonance.

(b) Many candidates appeared confused when answering Q1.5 and Q1.15, as they were hesitant to choose option D, which was either 'none of the above-mentioned' or 'all of the above'.

(c) Most candidates struggled to identify the correct options in Q1.6, and Q1.10 to Q1.12. These were operational questions which required a thorough understanding of three-phase systems and motors.

(d) In Q1.7 many candidates confused the functions of 'wattmeters' and 'kilowatt-hour meters' when referring to billing. Wattmeters measure power, whereas kilowatt-hour meters measure energy consumption, which is used for billing purposes.

(e) Many candidates were not familiar with the concept of harmonics in three-phase transformers in Q1.8, particularly in configurations such as star–star connections, which can result in increased losses, overheating and waveform distortion in the system.

(f) In Q1.11 many candidates concentrated on the polarity of the contactor rather than the phase sequence of the supply voltage applied to the stator coils.

(g) When attempting multiple-choice questions, candidates experienced difficulties due to several factors, such as:
- Ineffective time management: Many candidates did not allocate sufficient time to read and analyse each question carefully.
- Rushed answering: Some candidates responded hastily without thoroughly considering all the options provided.
- Lack of elimination strategies: If learners had eliminated incorrect options systematically, they would have improved their chances of selecting the correct answer.
- Similar distractors: Similarly worded choices caused confusion, making it difficult for candidates to differentiate between correct and incorrect responses.

**Suggestions for improvement**

(a) Teachers should make use of simulations and practical assessment tasks (PATs) to enable learners to apply theoretical concepts in practical, real-life contexts.

(b) Subject advisors and teachers are encouraged to integrate multiple-choice questions into both formal and informal assessments. This practice will assist learners in developing strong analytical and interpretative skills, leading to more accurate responses and reducing the likelihood of learners being misled by distractors or selecting incorrect options.

(c) Teachers should incorporate NSC-aligned multiple-choice activities, including:
- Practice using past examination papers; and
- Analysis of distractors to develop learners' reasoning skills.

**QUESTION 2: OCCUPATIONAL HEALTH AND SAFETY**

**Common errors and misconceptions**

(a) In Q2.1 the majority of candidates were unable to indicate that machinery converts energy from one form to another.

(b) In Q2.2 many candidates provided vague, single-word responses without explaining the necessary precautionary measures to be taken while assisting a person who is being electrocuted.

(c) In Q2.3 most candidates confused 'dangerous practices' with 'unsafe acts'.

(d) In Q2.4 many candidates did not distinguish between a 'critical incident' and an 'accident'. Their responses either defined both concepts or highlighted similarities, rather than clearly outlining the differences.

**Suggestions for improvement**

(a) Educators should highlight the core principle that machinery is designed to convert energy from one form to another, to ensure that this concept is clearly understood by learners.

(b) The difference between 'defining' concepts and 'differentiating' between them must be emphasised. When a question instructs learners to 'differentiate', responses should emphasise the differences rather than the similarities.

(c) Learners must provide two separate facts for questions that count two marks, as a single fact cannot earn multiple marks.

(d) Teachers should clearly explain the difference between 'dangerous practices' and 'unsafe acts'. The use of practical examples and scenarios will help learners identify and accurately differentiate between these concepts during assessments.

(e) Educators should clarify the differences between a 'critical incident' and an 'accident'. Incorporating visual aids, case studies and group discussions can enhance learners' understanding of these key terms related to safety.

(f) Teachers should emphasise the importance of safety guards on machinery, explaining that removing them creates an unsafe condition rather than just a potential risk for others. Providing examples and scenarios to demonstrate how the absence of guards leads to unsafe work environments will reinforce this concept.

(g) Teachers can adopt scenario-based teaching by presenting the following in the classroom:
- Unsafe use of tools
- Improper use of personal protective equipment (PPE)
- Malfunctioning or faulty equipment
- Operation of machinery without authorisation
- Learners should be guided to identify the hazard, assess the risk, and determine the correct OHSA control measure.

(h) To reinforce vocabulary and short written explanations, teachers can emphasise:
- Definitions
- Brief, well-structured answers
- Expanding explanations to respond adequately to two-mark questions

**QUESTION 3: RLC CIRCUITS**

**Common errors and misconceptions**

(a) Most candidates could not identify the given definition as a quality factor in Q3.1.2.

(b) In Q3.2.4 most candidates could not calculate the capacitor value that will cause resonance in the given circuit; they incorrectly substituted the given capacitance value to calculate capacitive reactance instead of equating $X_L$ to $X_C$ because of resonance and replacing the value of $X_L$ in the place of $X_C$ in the equation to calculate the new capacitance value.

(c) In Q3.3 most candidates could not score 4 out of 4 for the phasor diagram due to incorrect labelling; they either omitted the values or did not differentiate between the length of $V_L$ and $V_C$. Certain candidates labelled the diagram incorrectly with reactance values, ignoring the fact that the question specifically asked for a voltage phasor diagram. Another common error was that candidates did not end the resultant phasor $V_T$ directly above the $V_R$ phasor but in line with $I_T$.

(d) In Q3.5 some candidates overlooked the fact that the circuit is parallel and incorrectly classified it as capacitive. They focused on the reactance values in the parallel branches instead of comparing the reactive currents to determine whether the circuit is capacitive or inductive.

(e) In Q3.6 candidates could not indicate how an increase in frequency causes the circuit to resonate. Most candidates only mentioned one of the two variables (either inductive or capacitive reactance) instead of describing both.

**Suggestions for improvement**

(a) The concepts of 'inductive' and 'capacitive' reactance originate in the Gr 10 topics of Electronic Components and Principles of Magnetism. Teachers must ensure that learners understand the fundamentals of *capacitance* and *inductance* and emphasise their importance in future topics, and their applications in the subject in Gr 11 and Gr 12.

(b) 'Q-factor', 'bandwidth' and 'selectivity' are vague concepts for power systems and unfamiliar to learners, and should be clarified to them.

(c) Manipulation of formula is a skill that learners need to master in all topics. During resonance capacitive and inductive reactance are equal, allowing their values to be interchangeable when calculating the component values of L and C during resonance.

(d) Key factors to remember when drawing RLC series circuit phasor diagrams:
- Series circuits have voltage phasors ($V_L$, $V_C$, $V_R$ and $V_T$)
- Each phasor must:
  - Be labelled and the label must be correctly placed;
  - Be distinguished by length or a value to indicate its magnitude; and
  - End with an arrowhead to indicate its direction.
- The phase angle will always be between VT and IT where:
  - IT is on the horizontal axis in a series circuit with VT as resultant;
  - The resultant phasor is always VT in a series circuit; and
  - The resultant phasor VT must end directly above or below VR in a series circuit.
- Do not use reactance and impedance values unless specifically asked to do so.

(e) Substitution of values in all calculations must reflect the accurate/actual values, therefore when the frequency is given as 9,2 kHz, it must be written as (9 200) or ($9,2 \times 10^3$) in the substitution step of the calculation.

(f) During step-by-step teaching of phasor diagrams teachers should:
- Demonstrate phasor diagram drawing;
- Reinforce orientation and magnitude;
- Use colour coding for R, L and C components;
- Demonstrate phase angle calculation and interpretation; and
- Correlate waveforms and phasor representations gradually.

(g) As per the *2024 Diagnostic Report* the following approach may assist learners to master calculations:
- Introduce straightforward, (lower-order) examples to establish fundamental knowledge.
- Gradually incorporate formula manipulation (middle-order) exercises to enhance problem-solving skills.
- After mastering both lower- and middle-order calculations, practise questions that require learners to extract information from characteristic curves and phasor diagrams, deduce values (higher-order) from circuits, e.g. XL or XC, VL or VC and IL or IC during resonance to use in calculations, promoting application and analytical thinking in the process.

## QUESTION 4: THREE-PHASE AC GENERATION

### Common errors and misconceptions

(a) In Q4.2 most candidates were unable to explain adequately what a power factor less than 1 means to earn the allocated 2 marks; they often mentioned only a single fact in their answers.

(b) In Q4.3.3 some candidates drew an incorrect RLC phasor diagram, while others drew the diagram correctly but labelled the phases in the wrong order, swapping phase 2 (yellow) and phase 3 (blue). Additionally, some candidates left out the direction of rotation and the phase angles.

(c) In Q4.4.1 to Q4.4.4 a few candidates confused star and delta configurations, sometimes providing correctly calculated values but using incorrect SI units. Other candidates incorrectly used 16 VA for the apparent power instead of the correct 16 000 VA ($16 \times 10^3$ VA).

(d) A large number of candidates made incorrect substitutions by swopping the input power with output power in Q4.5. Other candidates incorrectly substituted 3,2 and 3,45 instead of $3,2 \times 10^3$ and $3,45 \times 10^3$.

(e) In Q4.6.1 most candidates could not identify coil A in the diagram as the current coil and in Q4.6.3 most candidates could not describe the function of coil B in the given diagram.

(f) Most candidates were unable to explain the purpose of a power factor meter in Q4.7.1. Similarly, in Q4.7.2 many candidates could not describe how a low power factor affects current, omitting the motivation requested by the question.

### Suggestions for improvement

(a) The concept of 'power factor' and 'power factor correction' is key in understanding three-phase systems. Its causes, effects and how to correct it must be clearly understood to master the topic. Teachers must also focus on the interpretation of various readings/measurements when teaching the topics and use practical lessons and demonstrations when teaching three-phase topics.

(b) Key factors for learners to remember when drawing three-phase-phasor diagrams:
- Phase voltage phasors are labelled as ($V_{\mathbf{RN}}$, $V_{\mathbf{YN}}$ and $V_{\mathbf{BN}}$)
- Line voltage phasors are labelled as ($V_{RY}$, $V_{YB}$ and $V_{BR}$).
- Alternative labels are ($V_{L1}$, $V_{L2}$ and $V_{L3}$ or $L_1$, $L_2$ and $L_3$ or R, Y and B).
- Each phasor diagram must indicate the direction of rotation as anticlockwise.
- The phase angle between each phasor of a balanced system is 120º.
- Labelling must be in the correct sequence. As the phasors rotate in an anticlockwise direction, labelling must be done in a clockwise direction to keep the correct sequence for balanced systems.
- Each phasor has magnitude and direction; therefore, each phasor must end with an arrowhead.

(c) Teachers should emphasise the interpretation of various measurements or readings displayed on three-phase measuring instruments. Power factor meter readings must be emphasised for learners to distinguish between 'inductive/lagging' systems and 'capacitive/leading' systems.

(d) Teachers can incorporate practical activities through the use of:
- Two-wattmeter method demonstrations;
- Clamp meters for current measurement;
- Simulation software to illustrate three-phase power flow; and
- Practical reinforcement, which improves conceptual understanding of abstract concepts.

(e) Develop fluency in working with power triangles by guiding learners to systematically:
- Draw power triangles accurately;
- Identify active (P), reactive (Q), and apparent (S) power;
- Apply trigonometric relationships to solve related problems;
- Explain the concept of power factor and how it changes; and
- This method promotes a deeper understanding of real-world three-phase circuit behaviour.

**QUESTION 5: THREE-PHASE TRANSFORMERS**

**Common errors and misconceptions**

(a) In Q5.1 many candidates were unable to provide a detailed explanation of 'mutual inductance in transformers'. They often left out the fact that an electromotive force (emf) is induced in the secondary winding, while some incorrectly described self-inductance instead.

(b) Most candidates were unable to explain why a transformer uses an iron core, and did not provide three supporting facts in Q5.2.2; instead, they incorrectly discussed the laminations of the core, which was not asked.

(c) In Q5.3.2 many candidates confused the term 'application' with 'function' and responded by mentioning it is a step-down transformer, instead of referring to its application, e.g. distribution systems in substations, schools and industry.

(d) Most candidates did not recognise that three single-phase transformers are three separate units that can be replaced individually in case one of them is damaged, in Q5.3.3. Most responded incorrectly by stating that power will still be provided by the other two.

(e) In Q5.4.1 to Q5.4.4 most candidates could not distinguish between 'star' and 'delta' or when to use line vs phase values. They incorrectly used line voltage when substituting the secondary phase voltage in the transformer ratio equation. Other candidates correctly substituted and calculated in Q5.4.3 but they did not write their answer as a ratio; instead, they left it as a numerical answer without converting it to a ratio. Certain candidates used the incorrect formula $\boldsymbol{I_L = \sqrt{3} I_{PH}}$ and subsequently combined primary and secondary values within the same equation.

(f) Most candidates could not correctly describe the function of the conservator during the operation of a transformer in Q5.6. They referred to it as 'storage for the cooling oil'. They did not state that it is there to allow for the expansion and contraction of the oil during temperature changes with different operating loads.

**Suggestions for improvement**

(a) Understanding concepts such as 'inductance' and 'mutual inductance' is essential for mastering all three-phase topics. Their definitions and explanations should be reinforced consistently from Grade 10 to Grade 12.

(b) The fundamental construction of a transformer, along with the core principles of its operation, is taught in Grade 11 and should be thoroughly reviewed/revised before introducing three-phase transformers in Grade 12.

(c) Transformer calculations are complex; therefore, it is crucial for learners to understand and differentiate between 'star' vs 'delta', 'line' vs 'phase values' and 'primary vs secondary values'. Transformer calculations should be practised repeatedly during informal activities with various scenarios and the given information. Learners must have sufficient opportunities to manipulate the different formulae related to transformer calculations.

(d) Teachers can provide scaffolding for multi-step transformer calculations such as the following:

- Identify known values.
- Determine whether it is a step-up or step-down transformer.
- Select the correct formula.
- Substitute exact values and calculate.
- Apply losses.
- Calculate efficiency.
- This will help learners to produce structured, logical responses.

(e) It must be emphasised that *only phase values* are used in the transformer ratio equation.

(f) Primary and secondary values cannot be used interchangeably in power calculations involving transformers. The only value applicable to both primary and secondary sides in a transformer is the *apparent power*.

(g) The differences between 'apparent power', 'reactive power' and 'real/active power' and their SI units must be emphasised.

(h) Reinforce the fundamentals of transformers with hands-on demonstrations which will benefit learners as they will see:

- Primary and secondary coils;
- Open vs short circuit tests;
- Effects of changing loads; and
- Visualisation of flux paths.

(i) Teachers can consider the use of a posters or interactive slides that show the construction of a three-phase transformer and demonstrate how all its parts are labelled. Thereafter an explanation of the function of each part can be provided to the learners.

**QUESTION 6: THREE-PHASE MOTORS AND STARTERS**

**Common errors and misconceptions**

(a) In Q6.1 many candidates incorrectly responded with 'mechanical inspections' rather than 'electrical tests'.

(b) Some candidates were unable to explain 'reactive power' in the context of induction motors in Q6.2. They provided only a single fact and could not explain how the concept specifically applies to induction motors.

(c) In Q6.3.1 some candidates could not identify the points on the speed vs torque curve. Only a few candidates were able to conclude that slip is minimum at no-load speed in Q6.3.2. It was evident that candidates struggled to interpret the provided character curve in Q6.3.

(d) Some candidates made basic calculation errors in Q6.4.1 and Q6.4.2, while others incorrectly wrote the SI unit for synchronous speed as 'rmp' instead of 'r/min'.

(e) In Q6.5.1 most candidates did not deduce that Cosθ = pf is a formula in the first step of the calculation. Most candidates wrote Cosθ = 0,85 in the first step and then gave the answer in the second step as θ = 31,79°.

(f) A large number of candidates struggled to identify the correct formula when calculating $V_L$ in Q6.5.2, while other candidates incorrectly substituted the given 4 kW as '4' instead of '4 000' or '4 x $10^3$' as per the given information in the question paper.

(g) In Q6.6.2 to Q6.6.4 most candidates were unable to analyse the given control circuit correctly. They had difficulty explaining the conditions that would cause the overload (O/L) contact to open in Q6.6.2. Furthermore, many candidates did not understand how to control the forward and reverse rotation of a motor using two contactors, instead mistakenly referring to two separate motors in Q6.6.3.

(h) Some candidates were unable to complete the control circuit diagram in Q6.6.5. They could not draw the correct symbols for the main contactor, and among those who did attempt the circuit, some either omitted the required interlocking contacts or labelled them incorrectly.

(i) In Q6.6.6 several candidates were unable to explain how a faulty stop button would impact the circuit's operation, highlighting a gap in their understanding of the stop button's fundamental role in controlling a circuit.

**Suggestions for improvement**

(a) The concepts of 'apparent power', 'true power' and 'reactive power' are taught in Grade 11 and should be thoroughly revised before introducing this topic in Grade 12.

(b) To clarify some confusion the speed vs torque curve can be explained and interpreted from both directions, from start-up to load, and from no-load conditions back to breakdown torque when a load is applied on a motor.

(c) Calculations involving motors must be practised through activities repeatedly to ensure that learners master them. Various values can be given in different scenarios so that learners practise the identification and manipulation of formulae when calculating different currents, voltages and powers.

(d) Learners must be able to draw all motor control circuits and explain the function of each component during the operation of each circuit. This will only make sense and become clear if these control circuits are demonstrated and built practically.

(e) During practical demonstrations educators can insert and demonstrate the effect of certain faults to learners which will assist them in developing fault finding and analysing skills.

(f) Strengthen understanding of motor starter circuits by including:
- Practical exposure to DOL and star–delta panels;
- Explaining the role of contactors, timers, overloads, interlocks, latching, etc.;
- Sequence diagrams for starting and running conditions; and
- Videos or simulations where physical panels are unavailable.

## QUESTION 7: PROGRAMMABLE LOGIC CONTROLLERS

### Common errors and misconceptions

(a) Many candidates could not explain the output scan in Q7.1.2 for two marks.

(b) In Q7.2 most candidates responded with general advantages of PLC and not with specific advantages with reference to cost, as was required in the question.

(c) Most candidates responded with only one fact in their explanation of why PLC wiring must be checked in Q7.3.

(d) Many candidates could not explain why a PLC system is safer than a hardwired system when a fault condition occurs in Q7.4.

(e) In Q7.5.1 and Q7.5.2 most candidates could not name two facts when stating the purpose of markers and contactors; they responded with one fact even if both were two-mark questions.

(f) Some candidates could not draw the correct logic symbol for the given ladder diagram in Q7.6.1 and some drew the correct symbol, but they did not label it.

(g) In Q7.7 many candidates used incorrect closed symbols for the two overload contacts and incorrect symbols for the outputs. Other candidates drew the correct symbols, but did not label or labelled incorrectly. In some cases, candidates drew vertical rungs and symbols or completely incorrect diagrams. Some candidates did not even attempt the question.

(h) Many candidates struggled to interpret and analyse the speed vs torque and speed vs current curves in Q7.8.1 and Q7.8.2 correctly. Most candidates clearly did not understand the questions as their answers were out of context.

(i) In Q7.11 and Q7.12, most candidates could not respond to the questions by explaining two facts concerning rectification and pulse width modulation. This indicates that they did not fully understand the basic operating principles of the different stages within a VSD.

### Suggestions for improvement

(a) Practising the programs and converting them on the software will deepen the understanding and knowledge of all programmed inputs and instructions when running and simulating control circuits in the program.

(b) All activities, formal and informal, must be marked according to NSC standards, especially drawings of ladder diagrams with their correct symbols and labelling.

(c) Teachers are advised to consider increasing practical PLC demonstration of the following:
- Real PLCs where available;
- Simulation software (e.g. *Easy Soft*, *Logo Soft*);
- Trainer boards for input/output demonstration; and
- Step-by-step programming exercises.

**NOTE:** Practical engagement builds confidence and conceptual accuracy.

(d) Teachers should consider using a scaffolded approach when teaching ladder logic. The following sequence is suggested:
Start off with:
- Basic logic gates
- Simple start/stop circuits
- Basic latching circuits (hardwired latching vs ladder logic latching)
- Interlocking (hardwired interlocking vs ladder logic interlocking)
- Timers and counters
- Full system sequences
- This progressive method ensures learners understand each component before integrating them.

(j) Teachers can consider providing templates and structured examples during informal activities, for example:
- Blank ladder templates
- Logic symbol banks with equivalent ladder logic
- Example sequences with comments
- Multi-step rung-building exercises
- This approach improves layout, symbol use, and logical structuring.

(k) During the teaching of VSDs and their internal operation, teachers can consider using animated videos where simulated operations show the inner workings of a VSD with reference to the three main stages indicated in the block diagrams in the textbook. Reinforce the relationship between frequency, duty cycle, and speed by explicitly explaining how:
- VSD controls speed by varying frequency;
- PWM duty cycle influences output frequency;
- Longer ON time reduces output frequency; and
- Motor speed is proportional to frequency.

**NOTE:** Demonstrations by using an oscilloscope or simulation tools will significantly improve understanding.

# CHAPTER 6

## MECHANICAL TECHNOLOGY

There are three specialisations in Mechanical Technology: Automotive, Fitting and Machining, and Welding and Metalwork.

A detailed analysis of performance trends is provided for each specialisation subject. It must be noted that the following general comments are observations noted across all three subjects and are therefore stated at the outset.

**General comments on Automotive, Fitting and Machining, Welding and Metalwork:**

(a) Questions based on recall of content were poorly answered by the majority of candidates. Weekly informal assessment tasks should be used to reinforce basic concepts and principles. This can be used effectively for content relating to definitions, functions, labelling and operations as listed in the *CAPS* and the *Examination Guidelines*.

(b) Several candidates encountered challenges in accurately manipulating formulae. The following steps are suggested:
- Identify and use the relevant formulae provided on the formula sheet.
- Apply the correct substitution and provide the answer with the correct unit and direction in terms of what is required by the question.

(c) The majority of candidates still experienced challenges with questions that require application of mathematical principles.

(d) Schools need to adhere to the notional time when setting timetables to balance both theory and practicals as per the *CAPS*. Double periods should be allocated for practical tasks.

(e) A lack of knowledge of, or exposure to, the use of various tools and equipment, was evident in the candidates' responses.

(f) Some candidates still displayed a lack of fundamental knowledge and understanding, which they should have gained in Grades 10 and 11. This could be due to the fact that the majority of teachers relied on using previous years' question papers and not using a variety of teaching and learning resources available to their disposal, such as the internet.

(g) The lack of content and skills knowledge demonstrated by the candidates in the 2025 examination, showed inadequate preparation for learning and assessment. This might be caused by the absence of subject advisors, which leaves teachers without the necessary development and oversight to prepare learners effectively for assessment.

(h) Non-compliance with PAT process plans and prescripts as a result of schools' budgetary constraints negatively impacted teaching and learning. Candidates were not exposed to sufficient practical work to complement theoretical knowledge.

# 6.1 AUTOMOTIVE

**The following report should be read in conjunction with the Automotive question paper of the November 2025 examinations.**

## 6.1.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Automotive examination in 2025 increased by 709 compared to that of 2024.

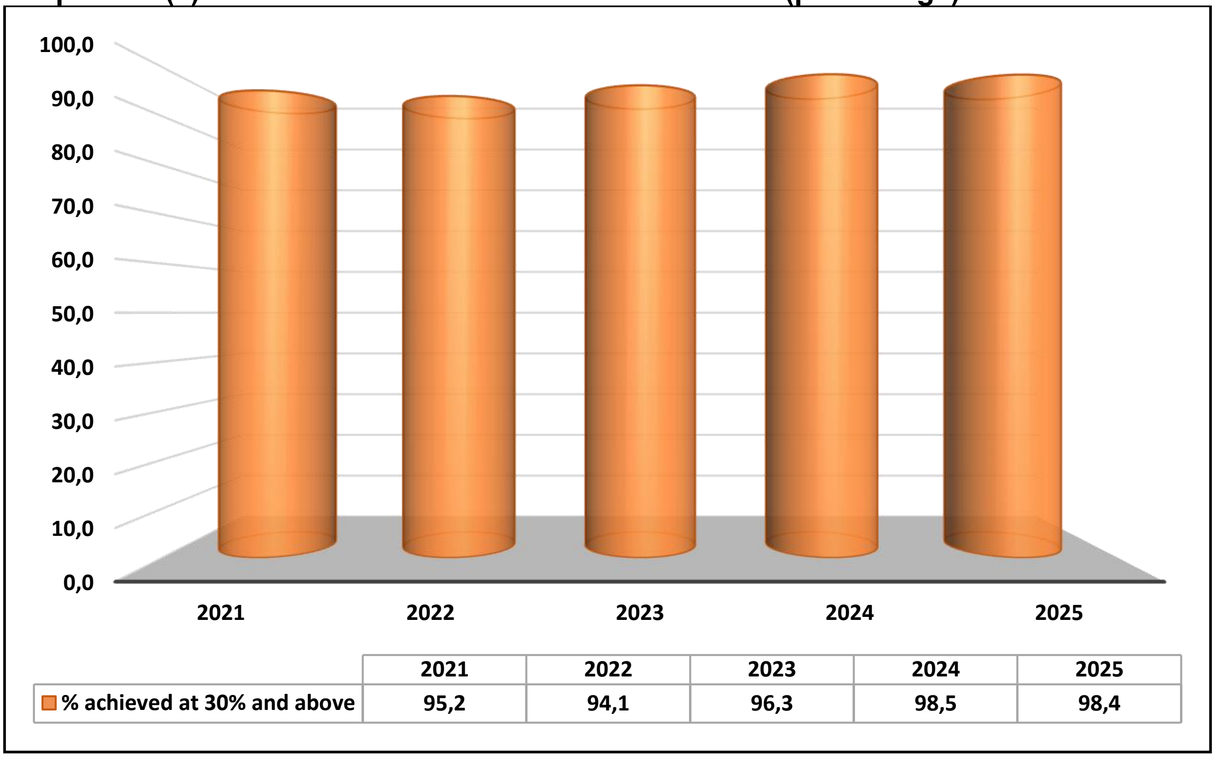
There was a slight decline in the pass rate this year. Candidates who passed at the 30% level and above decreased (marginally) from 98,5% in 2024 to 98,4% in 2025. There was an improvement in the pass rate at the 40% level and above from 80,3% to 84,3% over the past two years. The percentage of distinctions over 80% improved from 1,1% in 2024 to 1,6% in 2025. Given the increase in the size of the 2025 cohort, this converts into an increase in the total number of distinctions from 44 to 75.

Strategic intervention programmes at all levels (national, provincial, districts and schools) ensured that learners were adequately prepared. The diligence and perseverance of the above-average candidates also contributed to the favourable overall performance.

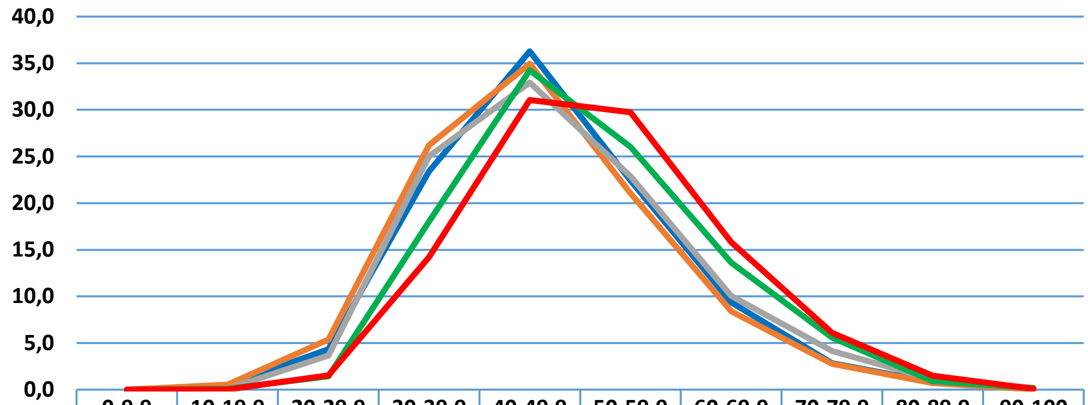
**Table 6.1.1 Overall achievement rates in Automotive**

| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| 2021 | 3 330 | 3 171 | 95,2 |
| 2022 | 3 601 | 3 388 | 94,1 |
| 2023 | 3 711 | 3 572 | 96,3 |
| 2024 | 3 963 | 3 904 | 98,5 |
| 2025 | 4 672 | 4 599 | 98,4 |

**Graph 6.1.1(a) Overall achievement rates in Automotive (percentage)**



**Graph 6.1.1(b) Performance distribution curves in Automotive (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,4 | 4,4 | 23,4 | 36,3 | 22,4 | 9,4 | 2,8 | 0,8 | 0,1 |
| 2022 | 0,0 | 0,5 | 5,4 | 26,2 | 34,9 | 21,0 | 8,4 | 2,8 | 0,7 | 0,0 |
| 2023 | 0,0 | 0,1 | 3,7 | 25,0 | 32,9 | 22,9 | 10,0 | 4,1 | 1,1 | 0,2 |
| 2024 | 0,0 | 0,1 | 1,4 | 18,0 | 34,2 | 26,0 | 13,6 | 5,6 | 0,9 | 0,2 |
| 2025 | 0,0 | 0,0 | 1,5 | 14,2 | 31,1 | 29,7 | 15,8 | 6,1 | 1,5 | 0,1 |

## 6.1.2 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN AUTOMOTIVE

### QUESTION 1: MULTIPLE-CHOICE QUESTIONS

**Common errors and misconceptions**

(a) Candidates demonstrated a lack of basic knowledge and insight needed to answer these questions.

(b) A number of candidates did not attempt to answer the questions, instead they left blank spaces.

**Suggestions for improvement**

(a) Teachers must revise and remediate the Safety and Materials topics in depth. In order to prepare learners to respond with reasons to multiple-choice questions, the use of past question papers and weekly informal assessments is encouraged. Learners must then apply their practical knowledge to the theory questions.

(b) Learners must be taught how to use the elimination technique to arrive at the correct answer in instances where they are unable to identify the correct alternative.

### QUESTION 2: SAFETY

**Common errors and misconceptions**

(a) In Q2.1 most candidates did not read the question properly. The question was about visible signs on an injured person before treatment. Candidates gave non-visible signs during the treatment of the person.
(b) In Q2.5 most candidates were unable to distinguish between the process and product workshop layouts.

**Suggestions for improvement**

(a) Learners must be constantly exposed to workshop practice relating to the safety of tools, equipment in the workshop and the workshop environment.

(b) Teachers must expose learners to good examples of different workshop layouts to ensure understanding of the layouts.

(c) Learners must be encouraged to use previous examination question papers to understand the nature of these questions, and the importance of key words to get the correct response.

**QUESTION 3: MATERIALS**

**Common errors and misconceptions**

(a) In Q3.3 candidates did not use correct terminology in their answers, e.g. soil instead of *sand*.

(b) In Q3.4 many candidates demonstrated a lack of theoretical knowledge and practical application regarding tests to identify different metals.

(c) In Q3.6 many responses were related to the hardening process and not to the case-hardening process.

**Suggestions for improvement**

(a) The knowledge with regard to the tests conducted to identify metals should be enhanced by means of practical activities.

(b) Teachers must ensure that learners are exposed to the different heat-treatment processes to enhance the properties of steel.

(c) The revision programme must include exercises requiring explanation, definition and application of heat-treatment processes. The use of pictures and videos will strengthen the teaching and learning process. Schools need to organise educational excursions to the metallurgy industries to improve the learners' understanding of the processes involved.

**QUESTION 4: MULTIPLE-CHOICE QUESTIONS**

**Common errors and misconceptions**

(a) Most of the multiple-choice questions were incorrectly answered by a number of candidates. This was due to candidates' poor content knowledge.

**Suggestions for improvement**

(a) Teach learners how to arrive at the correct answer by using the elimination technique.

**QUESTION 5: TOOLS AND EQUIPMENT**

**Common errors and misconceptions**

(a) In Q5.2 most of the candidates were unable to give reason why precautions should be taken before performing a compression test in the cylinder.

(b) In Q5.4 the majority of candidates found it difficult to explain the set-up procedure that must be followed when performing exhaust gas analysis.

**Suggestions for improvement**

(a) Teachers must ensure that practical simulations are fully explained and emphasised in their lessons and during their weekly informal assessments to enhance better understanding of theory.

(b) Teachers are strongly advised to expose learners to all tools and equipment as prescribed in the *CAPS* for Automotive. They must also incorporate the correct training on how to use this equipment.

(c) Practical skills to use the exhaust gas analyser must be incorporated into the teaching of this content. Novice teachers need training in the use of specialised equipment before imparting this knowledge to learners. Subject advisors must take the initiative to identify such teachers at an early stage, and design programmes to assist them.

**QUESTION 6: ENGINES**

**Common errors and misconceptions**

(a) In Q6.5 most candidates demonstrated a lack of content knowledge to identify the type of cylinder layout in the engine.

(b) In Q6.7.1 the majority of candidates were unable to differentiate between the advantages of turbo-charged engines and naturally-aspired engines.

**Suggestions for improvement**

(a) Teachers are encouraged to relate theory and practical demonstration while teaching engines using visual examples.

(b) It is important that learners are able to distinguish between the turbocharger's and supercharger's operation when dealing with engines in the workshop. Teachers must also develop worksheets to enhance this aspect in their teaching and learning processes.

**QUESTION 7: FORCES**

**Common errors and misconceptions**

(a) Most candidates struggled to define the engine terminology (clearance volume and compression ratio) of an engine in Q7.1.1 and Q7.1.2 respectively.

(b) In both Q7.2.3 and Q7.2.4 most candidates had trouble with calculating both the swept volume and clearance volume related to the internal combustion engine. They could not interpret the question correctly when they applied basic calculation and converting standard units to the required units. Many candidates found the mathematical concepts, which are essential for such calculations, very challenging.

**Suggestions for improvement**

(a) Teachers are advised to design a worksheet to cater for definitions of terminology involving forces, such as *swept volume, clearance volume, compression ratio*, *indicated power*, *brake power* and *mechanical efficiency*.

(b) The manipulation of formulae forms the basis of calculations in the subject. Learners must be assisted to acquire this skill. Teachers should provide more calculation activities using examples from previous question papers and various textbooks.

(c) Teachers must discuss each step in the calculation using the indicated power and cylinder volume formulae. Teachers should illustrate the steps involved to do each subcalculation indicating the conversion of the unit separately and then applying these results in the main formula.

(d) Mathematical skills can only improve with practice. The following steps are suggested:
- Identify the formula
- Formula manipulation (if necessary)
- Substitution (correct values or units)
- Answer with unit of measure indicated

**QUESTION 8: MAINTENANCE**

**Common errors and misconceptions**

(a) In Q8.2 most candidates were unable to tabulate the faults, causes and possible corrective measures regarding the cylinder leakage test.

(b) In Q8.3.2 most candidates struggled to explain how the wet compression test is conducted on an internal combustion engine.

**Suggestions for improvement**

(a) When conducting the fuel pressure test, teachers are advised to design a worksheet requiring learners to indicate faults and possible causes. This can be done in a table format for differentiating the causes related to corrective measures.

(b) Teachers should conduct a practical demonstration on how to do a compression test on an internal combustion engine.

(c) Teachers are also encouraged to use video clips relating to safety measures when conducting all types of tests in the engine.

**QUESTION 9: SYSTEMS AND CONTROL (AUTOMATIC GEARBOX)**

**Common errors and misconceptions**

(a) In Q9.1.2 most candidates demonstrated limited knowledge of the functions of the torque converter in an automatic gearbox.

(b) In Q9.2.2 the majority of candidates struggled to explain how reverse gear of a single epicyclic gear train is obtained.

**Suggestions for improvement**

(a) Learners should be given more informal class activities and revision exercises to improve understanding and eliminate content gaps.

(b) Teachers should give more drawing exercises to allow learners to master all epicyclic gear systems, definitions and labels. Alternatively, videos can be used to achieve this objective.

(c) Teachers should use charts to show the labels of the automatic gearbox, its advantages, functions, and its operation. If possible, sectioned automatic gearbox or an actual vehicle and videos should be used to show learners the differences in the operation of the power transmission between automatic and manual vehicles.

**QUESTION 10: SYSTEMS AND CONTROL (AXLES, STEERING GEOMETRY AND ELECTRONICS)**

**Common errors and misconceptions**

(a) The majority of candidates struggled to state the purpose of wheel alignment angles in Q10.3.1 and Q10.3.2.

(b) In Q10.5.1 and Q10.5.2 the majority of candidates demonstrated little knowledge of systems that are controlled by ECU devices used in the ignition system.

**Suggestions for improvement**

(a) Teachers should assign more drawing exercises to allow learners to master all wheel alignment angles, definitions and labels. Alternatively, videos can be used to achieve this objective.

(b) Teachers must do the practical application of a steering mechanism so that learners can have a better understanding of the topic.

(c) The use of videos is advised to show the basic operation of an engine ignition system on the vehicle.

(d) Frequent weekly short informal assessment tasks to enhance learners' knowledge and drill revision work, must be an on-going feature of the assessment programme.

## 6.2 FITTING AND MACHINING

**The following report should be read in conjunction with the Fitting and Machining question paper of the November 2025 examinations.**

### 6.2.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Fitting and Machining examination in 2025 increased by 140 compared to that of 2024.

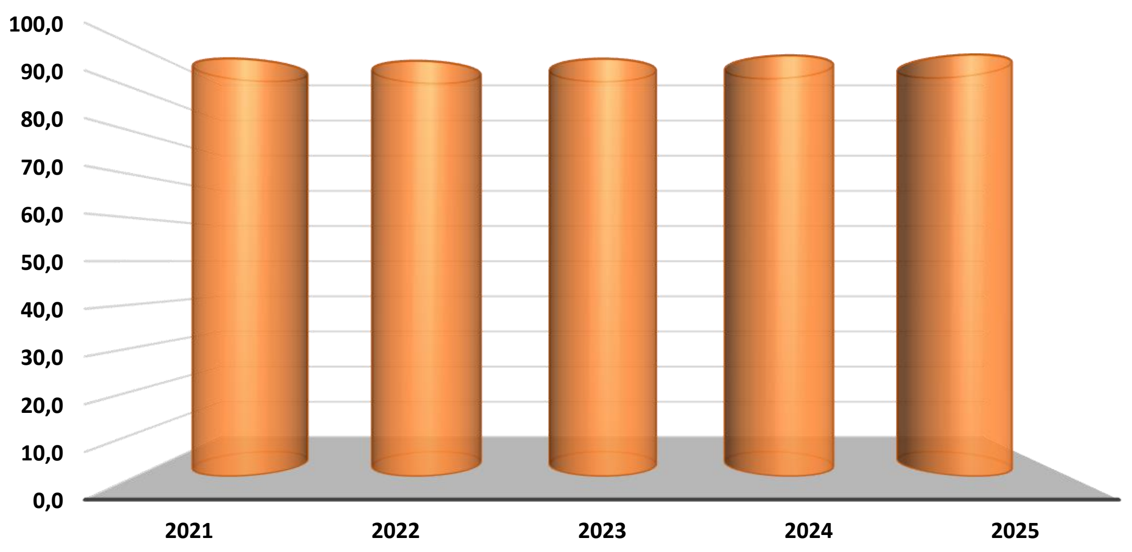
There was a marginal increase in the pass rate this year. Candidates who passed at the 30% level and above increased from 97,8 % in 2024 to 98,0% in 2025. There was a corresponding change in the pass rate at the 40% level and above from 81,9% to 86,5% over the past two years. The percentage of distinctions over 80% improved from 4,3% in 2024 to 7,9% in 2025. Given the increase in the size of the 2025 cohort, this converts into an increase in the total number of distinctions from 84 to 166.

Strategic intervention programmes at all levels (national, provincial, districts and schools) ensured that learners were adequately prepared. The diligence and perseverance of the above-average candidates also contributed to the favourable overall performance.

**Table 6.2.1 Overall achievement rates in Fitting and Machining**

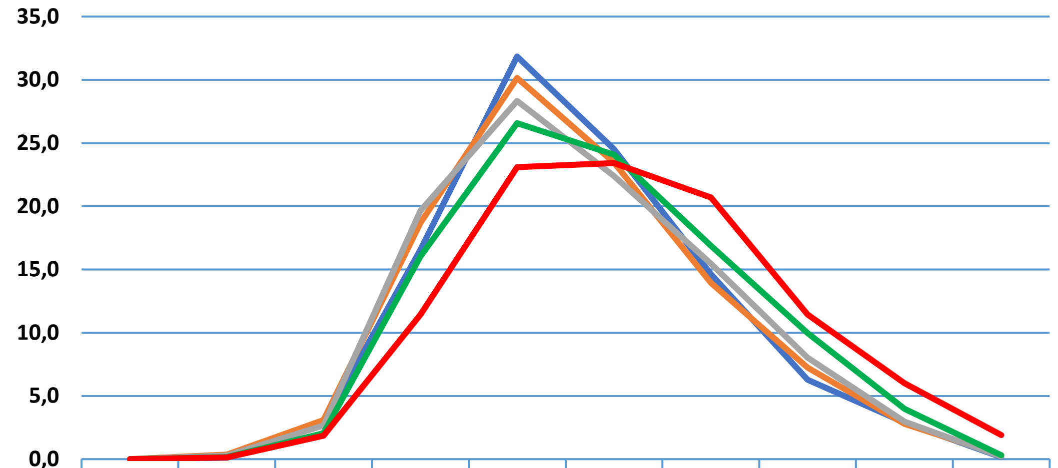
| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| **2021** | 1 991 | 1 933 | 97,1 |
| **2022** | 1 937 | 1 870 | 96,5 |
| **2023** | 2 019 | 1 959 | 97,0 |
| **2024** | 1 957 | 1 914 | 97,8 |
| **2025** | 2 097 | 2 055 | 98,0 |

**Graph 6.2.1(a) Overall achievement rates in Fitting and Machining (percentage)**




| | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| % achieved at 30% and above | 97,1 | 96,5 | 97,0 | 97,8 | 98,0 |

**Graph 6.2.1(b) Performance distribution curves in Fitting and Machining (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,1 | 2,8 | 16,6 | 31,8 | 24,5 | 14,6 | 6,3 | 2,9 | 0,2 |
| 2022 | 0,0 | 0,4 | 3,1 | 18,7 | 30,1 | 23,4 | 13,9 | 7,2 | 2,8 | 0,3 |
| 2023 | 0,0 | 0,3 | 2,7 | 19,7 | 28,3 | 22,4 | 15,5 | 8,0 | 3,0 | 0,2 |
| 2024 | 0,0 | 0,2 | 2,0 | 16,0 | 26,6 | 24,1 | 16,9 | 10,0 | 4,0 | 0,3 |
| 2025 | 0,0 | 0,1 | 1,9 | 11,4 | 23,1 | 23,4 | 20,7 | 11,4 | 6,0 | 1,9 |

## 6.2.2 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN FITTING AND MACHINING

**QUESTION 1: MULTIPLE-CHOICE QUESTIONS**

**Common errors and misconceptions**

(a) Candidates demonstrated a lack of basic knowledge and insight needed to answer these questions.

(b) A number of candidates did not attempt to answer the questions, instead they left blank spaces.

**Suggestions for improvement**

(a) Teachers must revise and remediate the Safety and Materials topics in depth. In order to prepare learners to respond with reasons to multiple-choice questions, the use of past question papers and weekly informal assessments is encouraged. Learners must then apply their practical knowledge to the theory questions.

(b) Learners must be taught how to use the elimination technique to arrive at the correct answer in instances where they are unable to identify the correct alternative.

**QUESTION 2: SAFETY**

**Common errors and misconceptions**

(a) In Q2.1 most candidates did not read the question properly. The question was about visible signs on an injured person before treatment. Candidates gave non-visible signs during the treatment of the person.

(b) In Q2.5 most candidates were unable to distinguish between the process and product workshop layouts.

**Suggestions for improvement**

(a) Learners must be constantly exposed to workshop practice relating to the safety of tools, equipment in the workshop and the workshop environment.

(b) Teachers must expose learners to good examples of different workshop layouts to ensure understanding of the layouts.

(c) Learners must be encouraged to use previous examination question papers to understand the nature of these questions, and the importance of key words to get the correct response.

**QUESTION 3: MATERIALS**

**Common errors and misconceptions**

(a) In Q3.3 candidates did not use correct terminology in their answers, e.g. *soil* instead of *sandl*.

(b) In Q3.4 many candidates demonstrated a lack of theoretical knowledge and practical application regarding tests to identify different metals.

(c) In Q3.6 many responses were related to the hardening process and not to the case-hardening process.

**Suggestions for improvement**

(a) The knowledge with regard to the tests conducted to identify metals should be enhanced by means of practical activities.

(b) Teachers must ensure that learners are exposed to the different heat-treatment processes to enhance the properties of steel.

(c) The revision programme must include exercises requiring explanation, definition and application of heat-treatment processes. The use of pictures and videos will strengthen the teaching and learning process. Schools need to organise educational excursions to the metallurgy industries to improve the learners' understanding of the processes involved.

**QUESTION 4: MULTIPLE-CHOICE QUESTIONS**

**Common errors and misconceptions**

(a) It was disappointing to note that a significant number of multiple-choice questions were answered incorrectly by many candidates due to inadequate content knowledge. In some instances, candidates left blank spaces where responses were required.

**Suggestions for improvement**

(a) Learners should be given guidance on the technique of arriving at the correct answer through the process of elimination in instances where they are unable to identify the correct alternative immediately.

(b) Teachers should give learners multiple-choice questions in all informal assessments on a weekly basis, as this will equip them with the required skills.

**QUESTION 5: TERMINOLOGY – LATHE AND MILLING MACHINE**

**Common errors and misconceptions**

(a) Many candidates confused the *compound slide* with the *tailstock* in Q5.1 and struggled to distinguish between advantages and disadvantages.

(b) In Q5.2 candidates frequently confused the *taper length* with the *length of the workpiece* and had difficulty substituting correct values into formulae. Weaknesses in basic fraction manipulation affected performance in the higher-order calculation questions, particularly in calculating the taper dimensions and tailstock set-over.

(c) Further misconceptions were noted in Q5.4 where candidates explained balancing a workpiece instead of the effects of an unbalanced workpiece.

(d) In Q5.5 the advantages and disadvantages of *up-cut*, *down-cut*, *gang* and *straddle milling* were often confused. Overall, conceptual misunderstandings and calculation errors resulted in an unnecessary loss of marks.

**Suggestions for improvement**

(a) The subject teacher should strengthen integration with Mathematics and Technical Mathematics, while increasing candidates' exposure to application-based questions and practical examples to address misconceptions in taper calculations, workpiece balance and milling operations.

(b) Teachers should administer weekly activities using varied questioning techniques, with regular practice in calculations, formula manipulation, substitution and fraction skills to improve performance, particularly in higher-order questions.

(c) Learners must be encouraged to practise using the diagrams in the question papers to assist them in formulating the calculations.

(d) Participating in hands-on activities helps learners understand concepts and processes, as well as their advantages and disadvantages, thereby improving the quality of their responses to questions. The conceptual understanding of lathe components, machining processes and the correct differentiation between advantages and disadvantages can be strengthened through clear explanations, diagrams, and comparisons.

(e) Mathematical skills can only improve with practice. The following steps are suggested:
- Identify the formula
- Formula manipulation (if necessary)
- Substitution (correct values or units)
- Answer with unit of measure indicated

**QUESTION 6: TERMINOLOGY – INDEXING AND DOVETAILS**

**Common errors and misconceptions**

(a) In Q6.2 candidates were unable to calculate the required dovetail lengths accurately and they had persistent difficulties with basic fraction calculations and formula manipulation in dovetails.

(b) In Q6.3 most candidates used incorrect formulas and demonstrated poor understanding of indexing principles, including the correct use of hole circles and change gears. Many relied on calculators, produced decimal answers instead of fractional indexing results, or failed to present final answers correctly.

(c) Many candidates struggled with basic fraction calculations in Q6.3.3.

**Suggestions for improvement**

(a) It is advisable to integrate relevant subject content with Mathematics and Technical Mathematics. Teachers should provide learners with supplementary activities that incorporate various questioning techniques, such as substitution, formula manipulation, and calculations to enhance these skills.

(b) Learners must be offered practical exposure to the machines and equipment. Teachers are requested to use such opportunities to explain the calculations relevant to the tasks.

(c) Teachers should systematically integrate frequent and progressive calculation activities into lesson planning when teaching this content. These activities should range from guided examples to independent practice and should be reinforced across multiple lessons. This sustained approach will strengthen learners' mathematical competence, improve their ability to manipulate formulas correctly, and enhance overall performance in tests and examinations.

**QUESTION 7: TOOLS AND EQUIPMENT**

**Common errors and misconceptions**

(a) In Q7.1 many candidates confused the principles of hardness testing with the types of hardness tests, showing a lack of theoretical understanding.

(b) In Q7.2, although candidates answered fairly well, several could not correctly label all components of the Brinell hardness tester, indicating incomplete knowledge of instrument parts.

(c) In Q7.5 candidates struggled to distinguish between the methods for reading inside, outside and depth micrometers. Many misread the depth micrometer by interpreting the reverse scale as an outside micrometer, resulting in incorrect readings and loss of marks.

**Suggestions for improvement**

(a) Teachers should reinforce both the theoretical and practical aspects of material hardness measurement. This can be done by providing clear explanations and demonstrations that differentiate the principles of hardness testing from the types of tests, and by using diagrams and hands-on exercises to ensure learners can correctly identify and label all components of instruments such as the Brinell hardness tester and screw thread micrometer.

(b) Additionally, learners should receive guided practice in reading inside, outside and depth micrometers, with particular focus on correctly interpreting reverse scales and distinguishing between different types of micrometer readings. Frequent structured exercises of this nature will help improve accuracy, build confidence and strengthen learners' ability to apply theoretical knowledge to practical measurement tasks.

## QUESTION 8: FORCES

### Common errors and misconceptions

(a) In Q8.1 many candidates failed to use the hint provided in the question. Many did not convert the pushing force to a pulling force, which led to incorrect answers. Additionally, several candidates confused the HC (X) and VC (Y) components, further contributing to errors.

(b) In Q8.2 most candidates struggled with the beam as the question required reactions at support A and B, instead they calculated reaction B at A and reaction A at B.

(c) In Q8.4.1 many candidates struggled with converting measurements to the correct basic SI units, such as converting millimetres to metres and megapascals to pascals. This fundamental error prevented them from accurately calculating the area and, consequently, the magnitude of the applied load or force.

(d) The majority of candidates were unable to correctly rearrange and apply the formula, indicating weaknesses in both unit conversion and formula manipulation, which were essential for solving technical calculation problems accurately in Q8.4.

### Suggestions for improvement

(a) It is recommended that the drawing of diagrams is an effective way that will assist learners in determining the direction of the resultant. Teachers must make more extensive use of this technique.

(b) Learners must be directed to a common understanding of the principle used to calculate reactions. 'Calculate A, take moments about B' and 'Calculate B, take moments about A' is a recommended example to achieve this outcome.

(c) Learners should be encouraged to perform calculations systematically. The following steps are considered to be effective:
- Identify/Use the correct formula (this may be on the formula sheet).
- Manipulate the formula, if necessary, depending on the information available.
- Substitution of correct values or units, as per the question.
- Express the final answer with the relevant unit of measure.

(d) Learners must ensure that they use exponents and the correct derived unit in the answer.

(e) A variety of calculation methods should be explored and explained to learners. It is crucial to practise manipulating formulas, with a thorough explanation of the importance of each element within the formula.

(f) Different scenarios must be practised. These can easily be incorporated in homework and weekly assessment activities.

## QUESTION 9: MAINTENANCE

### Common errors and misconceptions

(a) In Q9.2 candidates focused on preventative maintenance procedures rather than explaining the purpose of conducting preventative maintenance.

(b) In Q9.3 and Q9.4 most candidates demonstrated limited knowledge of the different types of thermoplastics and thermosetting plastics, often confusing the two categories or leaving the questions unanswered.

(c) In Q9.6 most candidates were unable to correctly identify the composite materials used for specific applications, such as bushes (Q9.6.1), frying pan coatings (Q9.6.2), and distributor rotors (Q9.6.3). Overall, the responses indicated significant gaps in understanding of plastic and composite materials, their classifications, and their practical applications.

**Suggestions for improvement**

(a) Resources on this content are readily available on the internet. It is recommended that teachers make use of videos and other visual resources during the lessons.

(b) It should be acknowledged that a complete understanding of maintenance procedures cannot be attained solely through textbooks or notes. Observation or practical application is essential.

(c) Teachers should create additional practical tasks that focus on maintenance procedures, ideally presented in bullet points. It is also important to emphasise the correct use of maintenance-related terminology. Integrating theory and practice in the workshop is essential.

**QUESTION 10: JOINING METHODS**

**Common errors and misconceptions**

(a) In Q10.2 many candidates lacked the relevant knowledge with regard to screw thread terminology. Candidates often failed to calculate the pitch and pitch diameter, which involved substitution and manipulation. Candidates lost marks when they either substituted incorrectly or failed to manipulate the values properly.

(b) Candidates portrayed poor knowledge of V-screw threads in Q10.3.

**Suggestions for improvement**

(a) Teachers need to make sure that lesson plans include clear direction on ensuring that learners know and understand screw-thread terminology.

(b) Learners should engage in extra practice sessions focused on calculations to gain confidence in answering this type of question. Regular activities should be scheduled at key intervals throughout the academic year.

(c) Learners must be encouraged to work systematically through the calculations according to the following steps:
- Identify the relevant formula
- Manipulation of the formula (if necessary)
- Substitution (correct values or units)
- Answer with unit of measure

## QUESTION 11: SYSTEMS AND CONTROL

### Common errors and misconceptions

(a) The majority of candidates answered Q11.1.1 and Q11.1.2 poorly; this is likely due to a lack of mathematical skills and knowledge of hydraulics. Candidates lost marks when the first calculation was incorrect, leading to further errors in subsequent calculations. The candidates also calculated the other ram which was not necessary as the area was provided in the question. It was clear that candidates struggled with converting mass to kilogram.

(b) Q11.3 asked about the basic designs of pumps and candidates provided the wrong answers for the designs. They described the different pumps and not the designs.

(c) In Q11.5.1 many candidates did not calculate the *rotation frequency* of the output shaft.

(d) Q11.5.2 was answered very poorly as candidates did not portray the necessary skill to calculate speed ratio.

### Suggestions for improvement

(a) Teachers should provide targeted practice of the mathematical concepts required in hydraulics. This should include step-by-step problem-solving exercises that guide learners in correctly using given data, avoiding unnecessary calculations and reducing cascading errors in multi-step questions.

(b) Learners must work systematically through the calculations according to the following steps:
- Formula
- Formula manipulation (if necessary)
- Substitution (correct values or units)
- Answer with unit (Pay attention to requirements in the question)

(c) Teachers should focus on reinforcing learners' understanding of hydraulic systems, pump designs, and speed/rotation calculations. This can be achieved through visual aids, diagrams and hands-on demonstrations, as well as frequent formative assessments that require learners to identify pump designs, calculate speed ratios, and determine output shaft rotation. This approach will improve both conceptual understanding and practical application skills.

(d) Teachers must ensure that they also teach the theoretical knowledge with regard to the systems covered in this chapter.

# 6.3 WELDING AND METALWORK

**The following report should be read in conjunction with the Welding and Metalwork question paper of the November 2025 examinations.**

## 6.3.1 PERFORMANCE TRENDS (2021–2025)

The number of candidates who sat for the Welding and Metalwork examination in 2025 increased by 273 compared to that of 2024.

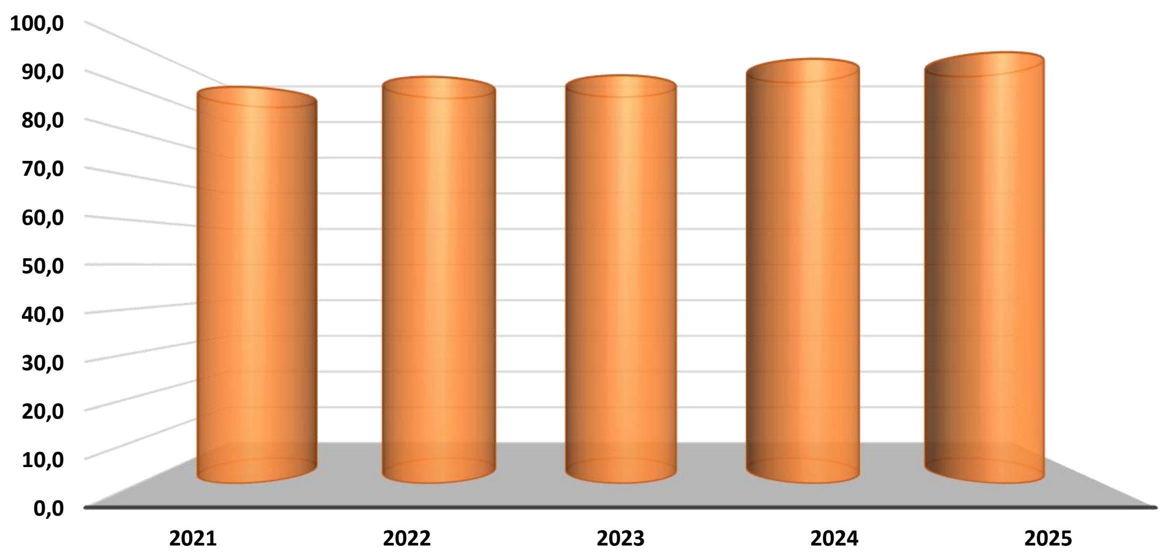
There was also a marginal improvement in the pass rate this year. Candidates who passed at the 30% level and above increased from 97,0% in 2024 to 98,8% in 2025. There was an improvement in the pass rate at the 40% level and above from 78,7% to 83,8% over the past two years. The percentage of distinctions over 80% improved from 1,2% in 2024 to 1,6% in 2025. Given the size of the 2025 cohort, this converts to an increase in the total number of distinctions from 29 to 43.

The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall improvement in the subject.

**Table 6.3.1 Overall achievement rates in Welding and Metalwork**

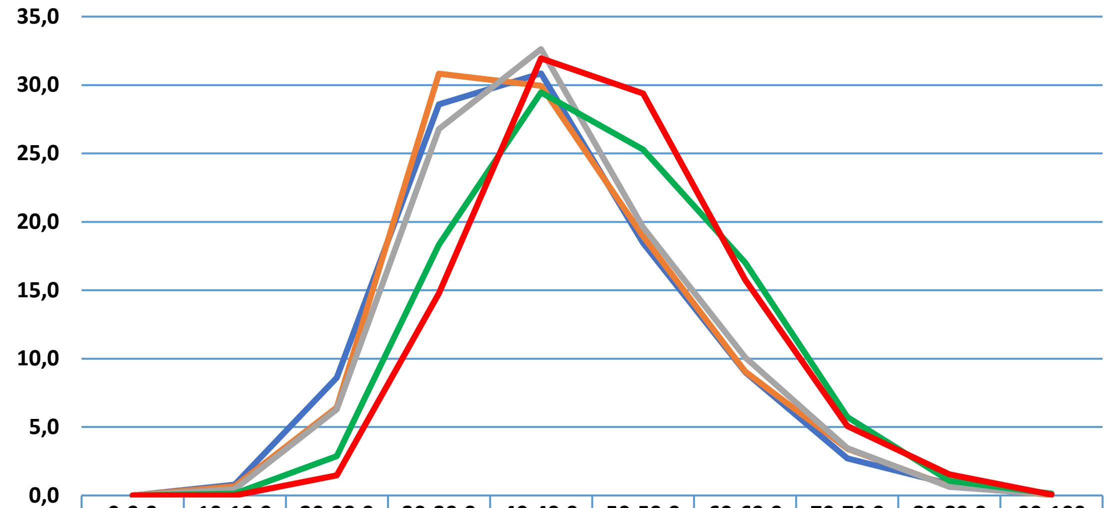
| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| **2021** | 2 308 | 2 091 | 90,6 |
| **2022** | 2 397 | 2 227 | 92,9 |
| **2023** | 2 400 | 2 238 | 93,3 |
| **2024** | 2 444 | 2 371 | 97,0 |
| **2025** | 2 717 | 2 677 | 98,5 |

**Graph 6.3.1(a) Overall achievement rates in Welding and Metalwork (percentage)**




| | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| % achieved at 30% and above | 90,6 | 92,9 | 93,3 | 97,0 | 98,5 |

**Graph 6.3.1(b) Performance distribution curves in Welding and Metalwork (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,8 | 8,6 | 28,6 | 30,8 | 18,5 | 9,0 | 2,7 | 0,8 | 0,0 |
| 2022 | 0,0 | 0,7 | 6,4 | 30,8 | 30,0 | 18,9 | 9,1 | 3,4 | 0,7 | 0,0 |
| 2023 | 0,0 | 0,5 | 6,3 | 26,8 | 32,6 | 19,6 | 10,1 | 3,5 | 0,6 | 0,1 |
| 2024 | 0,0 | 0,1 | 2,9 | 18,3 | 29,5 | 25,3 | 17,0 | 5,7 | 1,1 | 0,1 |
| 2025 | 0,0 | 0,0 | 1,5 | 14,8 | 31,9 | 29,4 | 15,8 | 5,1 | 1,5 | 0,1 |

## 6.3.2 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN WELDING AND METALWORK

**QUESTION 1: MULTIPLE-CHOICE QUESTIONS**

**Common errors and misconceptions**

(a) Candidates demonstrated a lack of basic knowledge and insight needed to answer these questions.

(b) A number of candidates did not attempt to answer the questions, instead they left blank spaces.

**Suggestions for improvement**

(a) Teachers must revise and remediate the Safety and Materials topics in depth. In order to prepare learners to respond with reasons to multiple-choice questions, the use of past question papers and weekly informal assessments is encouraged. Learners must then apply their practical knowledge to the theory questions.

(b) Learners must be taught how to use the elimination technique to arrive at the correct answer in instances where they are unable to identify the correct alternative.

**QUESTION 2: SAFETY**

**Common errors and misconceptions**

(a) In Q2.1 most candidates did not read the question properly. The question was about visible signs on an injured person before treatment. Candidates gave non-visible signs during the treatment of the person.

(b) In Q2.5 most candidates were unable to distinguish between the process and product workshop layouts.

**Suggestions for improvement**

(a) Learners must be constantly exposed to workshop practice relating to the safety of tools, equipment in the workshop and the workshop environment.

(b) Teachers must expose learners to good examples of different workshop layouts to ensure understanding of the layouts.

(c) Learners must be encouraged to use previous examination question papers to understand the nature of these questions, and the importance of key words to get the correct response.

**QUESTION 3: MATERIALS**

**Common errors and misconceptions**

(a) In Q3.3 candidates did not use correct terminology in their answers, e.g. *soil* instead of *sand*.

(b) In Q3.4 many candidates demonstrated a lack of theoretical knowledge and practical application regarding tests to identify different metals.

(c) In Q3.6 many responses were related to the hardening process and not to the case-hardening process.

**Suggestions for improvement**

(a) The knowledge with regard to the tests conducted to identify metals should be enhanced by means of practical activities.

(b) Teachers must ensure that learners are exposed to the different heat-treatment processes to enhance the properties of steel.

(c) The revision programme must include exercises requiring explanation, definition and application of heat-treatment processes. The use of pictures and videos will strengthen the teaching and learning process. Schools need to organise educational excursions to the metallurgy industries to improve the learners' understanding of the processes involved.

**QUESTION 4: MULTIPLE-CHOICE QUESTIONS**

**Common error and misconception**

(a) Some candidates did not attempt to respond to some of the questions, If they had, it might have resulted in some marks being earned. Instead, they left blank spaces.

(b) A number of candidates responded with more than one answer; this indicated uncertainty and they received no credit.

**Suggestion for improvement**

(a) Learners should be taught how to use the elimination technique to arrive at the correct answer in instances where they are unable to identify the correct alternative immediately.

(b) Teachers should expose learners to multiple-choice questions in all informal assessments on a weekly basis. This will contribute to providing them with the necessary skills to approach these questions.

**QUESTION 5: TERMINOLOGY**

**Common errors and misconceptions**

(a) In Q5.2 many candidates lacked the necessary knowledge to draw or interpret the welding symbols correctly.

**Suggestions for improvement**

(a) Learners need to be exposed to more practical application of theory/welding symbols as this will improve the understanding and interpretation of the symbols.

**QUESTION 6: TOOLS AND EQUIPMENT**

**Common errors and misconceptions**

(a) In Q6.1 and 6.3.1 candidates used incorrect terminology when labelling equipment.

(b) In Q6.4 many candidates were unable to explain the operating principles of the manual guillotine.

(c) Candidates had difficulty stating the uses of the press machine in Q6.5.

**Suggestions for improvement**

(a) Teachers must focus on the correct terminology with regard to the different equipment used in the Welding and Metalwork workshop.

(b) Teachers are advised to utilise electronic media to introduce the working principles, functions and procedures of equipment that is not available in the workshop.

(c) Teachers should show learners the practical components of the workshop equipment and ensure that learners use machines frequently in the workshop. In addition, field trips should be organised to visit manufacturing sites/industries where this equipment is being fully used.

**QUESTION 7: FORCES**

**Common errors and misconceptions**

(a) In Q7.1 some candidates had difficulty in calculating stress and strain correctly because of their lack of simple mathematical skills. It was evident that these candidates could not use the correct value or unit.

(b) In Q7.2.1 some candidates calculated the uniformly distributed load (UDL) on the beam incorrectly. Utilising this incorrect value in the following subquestions resulted in more mistakes. However, marks were awarded for the correct substitution.

(c) In Q7.2.4 many candidates were unable to draw the bending moment diagram according to the given scale and some candidates also did not use a curved line to indicate the UDL on the diagram.

(d) In Q7.3 many candidates were not familiar with the procedure to determine the magnitudes and nature of the members in a framework. They did not indicate the arrows on the space diagram, although it is part of the method, and converting mm to Newton was also a challenge to some candidates.

**Suggestions for improvement**

(a) Learners must be provided with opportunities to enhance their mathematical skills at regular intervals. Supporting subjects like Mathematics or Technical Mathematics and Physical Sciences or Technical Sciences, should emphasise relevant sections related to forces.

(b) Diverse calculation methods should be explored. Practice in manipulating formulae is essential, and the significance of each element in the formula should be expounded upon comprehensively.

(c) Learners must be directed to a common understanding of the principle used to calculate reactions. 'Calculate RL, take moments about RR' and 'Calculate RR, take moments about RL' is a recommended example to achieve this outcome.

(d) Teachers must emphasise the procedure to determine the magnitudes and nature of the members in a framework (space diagram, planning diagram, vector diagram/scale and then tabulating the final answers). Transferring the directions determined in the vector diagram to the space diagram to determine the nature of each member is part of the method and should be taught as such.

**QUESTION 8: JOINING METHODS – WELD INSPECTION**

**Common errors and misconceptions**

(a) In Q8.1 and Q8.3 many candidates could not state the causes of and preventative measures for welding defects.

(b) In Q8.4 some candidates were unable to identify the factors to be considered during the machinability test on a welded joint.

(c) Many candidates had difficulty answering questions with regard to tests on welded joints. Candidates could not give reasons, disadvantages or procedures of the tests.

**Suggestions for improvement**

(a) Teachers should expose learners to practical work to bring the theoretical subject matter closer to the learners' understanding.

(b) Teachers are encouraged to use previous examination papers for revision, especially when preparing learners for tests and examinations.

(c) Teachers should use videos and other electronic media during class lessons. Field trips should be arranged to sites where welding inspections are conducted.

(d) Teachers should focus on using the correct terminology during the teaching process. Learners must also be encouraged to use the correct terminology in answering questions.

## QUESTION 9: JOINING METHODS – STRESSES AND DISTORTION

### Common errors and misconceptions

(a) In Q9.1 some candidates were unable to state the visual requirements during the visual inspection process of welded joints.

(b) Many candidates had difficulty in stating the factors that affect the cooling rate after welding in Q9.2.

(c) In Q9.4 a number of candidates did not know the function of strong backs.

(d) In Q9.6 many candidates were not familiar with the definition of elastic deformation.

(e) In Q9.7 candidates could not identify the different types of shrinkages.

### Suggestions for improvement

(a) Learners should practise the requirements during the visual inspection process of welded joints.

(b) Learners should be exposed to videos and simulations on the effects of cooling rate on a welded joint.

(c) This section consists of factual information and teachers should conduct thorough revision to ensure that learners become familiar with the content. Practical exposure will also improve the understanding of the content.

## QUESTION 10: MAINTENANCE

### Common errors and misconceptions

(a) In Q10.1 and Q10.2 many candidates were unable to answer questions with regard to lock-out and tagging of machines during maintenance procedures.

(b) In Q10.3 most candidates were unfamiliar with the negative impact of the lack of maintenance on machines and equipment in the workshop.

(c) In Q10.4 many candidates were unable to state the maintenance guidelines for specific machines.

### Suggestions for improvement

(a) Learners should be exposed to the different kinds of equipment and their working principles to enhance understanding of the required maintenance. Informal practical assessment tasks will support the teaching and learning process.

(b) Teachers must involve learners in the maintenance of the equipment and make learners responsible for specific maintenance tasks in the workshop. Applying lock-out and tagging equipment will enhance the understanding of the theoretical content.

(c) Schools must be sufficiently equipped with the relevant equipment and tools to ensure that practical lessons can take place to develop skills and reinforce the theory.

## QUESTION 11: DEVELOPMENT BY CALCULATIONS

### Common errors and misconceptions

(a) In Q11.1 a number of candidates could not identify a rectangle correctly, instead they identified it as a square by just looking at the drawing and not considering the dimensions given in the drawing.

(b) Q11.2 required specific mathematical knowledge and skills from the candidates who should be proficient in performing calculations. Candidates struggled with this question because they demonstrated a lack of specific mathematical knowledge and skills.

### Suggestions for improvement

(a) Different methods to derive an answer should be explored as learners might not understand one method, but might be able to understand an alternative method.

(b) Teachers must make use of previous examination papers for revision and remedial work in preparation for the assessment tasks planned. Furthermore, integration with Mathematics could assist in improving long-term performance.

(c) Teachers should incorporate a greater number of calculation activities into their lesson planning and assessment when teaching this content. This practice will augment learners' mathematical skills and refine their proficiency in manipulating formulae.

# CHAPTER 7

## ENGINEERING GRAPHICS AND DESIGN

**The following report should be read in conjunction with the Engineering Graphics and Design question papers for the NSC November 2025 examinations.**

### 7.1 PERFORMANCE TRENDS (2020–2025)

The number of candidates who sat for the Engineering Graphics and Design examinations in 2025 increased by 4 174, compared to that of 2024.

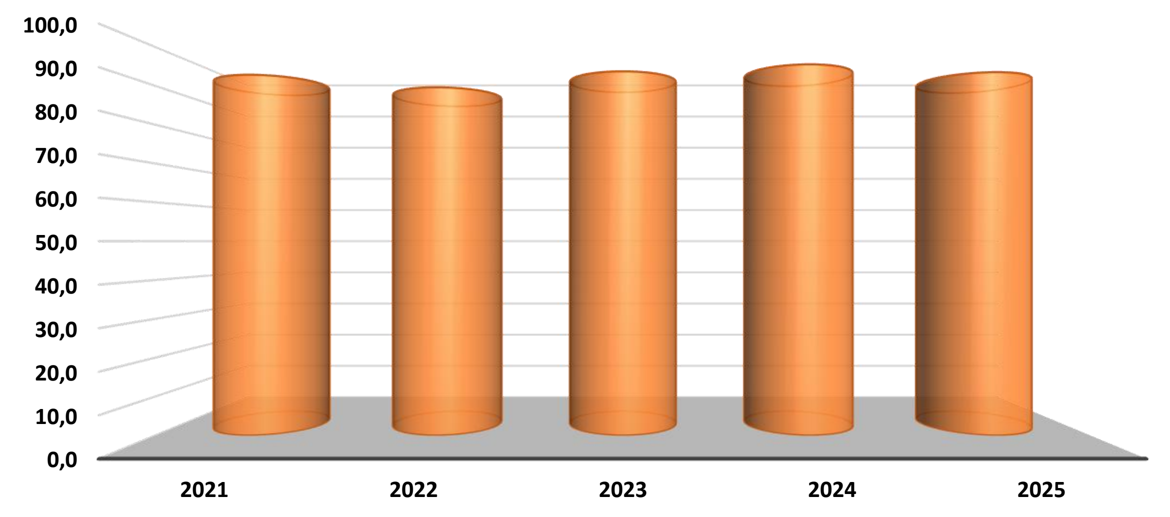
There was a slight decline in the pass rate this year. Candidates who passed at the 30% level and above declined from 95,5% in 2024 to 93,5% in 2025. There was a corresponding decline in the pass rate at the 40% (Level 3) and above over the past two years from 77,0% in 2024 to 70,9%. The percentage of distinctions over 80% also declined from 5,9% in 2024 to 4,4% in 2025. Given the increase in the size of the 2025 cohort, this converts into a decrease in the total number of distinctions from 2 272 to 1 878.

The various commendable intervention strategies employed by teachers, subject advisors and provincial education departments were continued in 2025. The resourcefulness and diligence of the above-average candidates also contributed to the overall improvement in the subject.

**Table 7.1.1 Overall achievement rates in Engineering Graphic Design**

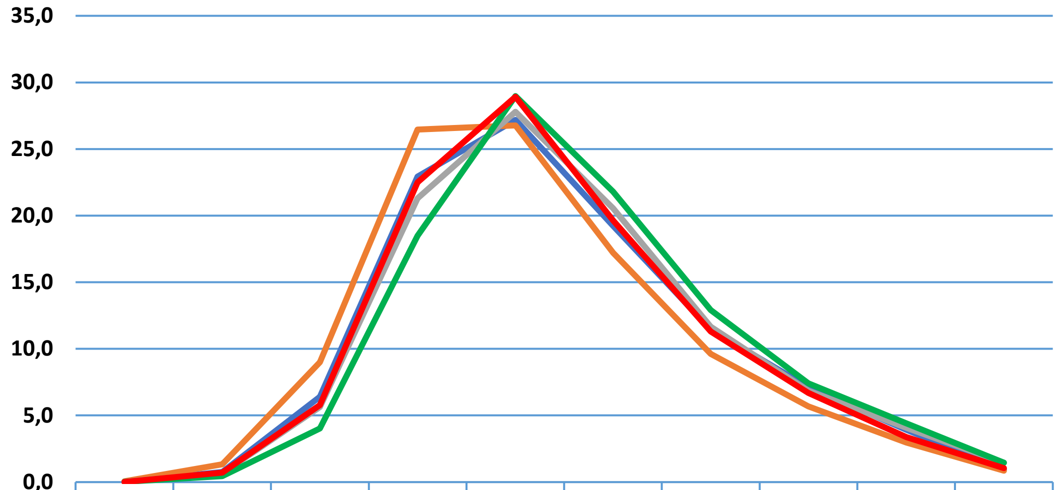
| Year | No. wrote | No. achieved at 30% and above | % achieved at 30% and above |
|---|---|---|---|
| 2021 | 37 131 | 34 463 | 92,8 |
| 2022 | 38 879 | 34 830 | 89,6 |
| 2023 | 38 006 | 35 603 | 93,7 |
| 2024 | 38 506 | 36 771 | 95,5 |
| 2025 | 42 680 | 39 900 | 93,5 |

**Graph 7.1.1 Overall achievement rates in Engineering Graphic Design (percentage)**




| | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|
| % achieved at 30% and above | 92,8 | 89,6 | 93,7 | 95,5 | 93,5 |

**Graph 7.1.2 Performance distribution curves in Engineering Graphic Design (percentage)**




| | 0-9.9 | 10-19.9 | 20-29.9 | 30-39.9 | 40-49.9 | 50-59.9 | 60-69.9 | 70-79.9 | 80-89.9 | 90-100 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 0,0 | 0,7 | 6,4 | 22,9 | 27,2 | 19,2 | 11,4 | 7,1 | 3,9 | 1,0 |
| 2022 | 0,1 | 1,3 | 9,0 | 26,5 | 26,8 | 17,2 | 9,6 | 5,7 | 3,0 | 0,9 |
| 2023 | 0,0 | 0,7 | 5,6 | 21,3 | 27,8 | 20,5 | 11,7 | 6,9 | 4,1 | 1,5 |
| 2024 | 0,0 | 0,5 | 4,0 | 18,5 | 29,0 | 21,8 | 12,9 | 7,4 | 4,4 | 1,5 |
| 2025 | 0,0 | 0,7 | 5,8 | 22,5 | 28,9 | 19,6 | 11,3 | 6,7 | 3,4 | 1,0 |

## 7.2 OVERVIEW OF CANDIDATES' PERFORMANCE IN PAPER 1 AND PAPER 2

(a) **Quality of candidates' performance**

The November National Senior Certificate (NSC) examination results for the 2025 Grade 12 cohort of Engineering Graphics and Design candidates were lower than those of the 2024 cohort in both Paper 1 and Paper 2. However, there was provincial consensus that both papers were compliant and consistent with previous papers in terms of presentation, language and levels of difficulty. They were also both fair and of a high standard.

This report seeks to highlight the general areas of concern as identified during the marking of the candidates' responses for the 2025 NSC examination. However, the report is unable to identify specific schools experiencing challenges or the teachers who may require urgent support.

To arrest the current downward trend in candidates' performance, the problem areas identified in this report must be addressed without delay and decisive interventions should be implemented at all levels of the subject, from national leadership to classroom practice.

It must be reiterated that each of the questions in both the NSC examination papers were designed to assess both drawing skills and fundamental knowledge, while also incorporating elements intended to challenge high-performing candidates.

Although questions pitched at lower-order cognitive levels were generally answered satisfactorily, candidate performance in middle- and higher-order cognitive questions – particularly those relating to Grade 12 content – remained weak.

It should be noted that all questions in both Engineering Graphics and Design papers were designed to be accessible to all candidates. Evidence from examination centres across the provinces shows that many candidates were adequately prepared and able to cope with the complexity and content of the papers. However, the inability of many weaker candidates to effectively respond to less demanding aspects of the questions points to deficiencies within the teaching and learning environment.

Of particular concern is the continued existence of schools (centres) where the majority of candidates performed poorly. This underscores the critical need for knowledgeable and competent teachers, as effective teaching has a direct and undeniable impact on learner performance.

Furthermore, it is evident that topics prescribed in the Grade 10 *Curriculum and Assessment Policy Statement* (*CAPS*) were not afforded sufficient attention. Many candidates demonstrated a lack of understanding of basic concepts, methods and techniques fundamental to Engineering Graphics and Design, which has invariably had a negative impact on their performance in the NSC examination.

(b) **Pertinent factors that cause poor results**:

Poor performance across many centres indicates that challenges in teaching and learning remain prevalent. The following factors continue to be identified as key contributors to underachievement:

**Use of prepared drawing sheets:** Many teachers continue to rely on prepared drawing sheets for daily activities, coursework, tests and even examinations. While this practice may be convenient for marking purposes, it limits learners' opportunities to practise the fundamental skills essential to Engineering Graphics and Design. Prepared drawings often restrict candidates' ability to respond effectively to examination questions. Weaker learners are particularly disadvantaged, as evidenced by difficulties in constructing simple polygons, determining vanishing points or correctly positioning views on a drawing sheet.

**Lack of meaningful revision of Grades 10 and 11 content:** Examination questions are based on concepts taught in previous grades. It is therefore crucial that foundational concepts across all topics are continuously reinforced. Teachers must incorporate revision of these fundamentals into teaching, assessment and intervention programmes, ensuring that learners practise even the most basic drawing skills regularly.

**Poor reading of examination questions:** A critical requirement in Engineering Graphics and Design is the ability to read and understand instructions related to graphic content. Although examination instructions are designed to be clear, concise and consistent from year to year, many of the weaker candidates focus solely on the graphics and make assumptions about the required response. This often results in their producing incorrect answers or running out of sufficient drawing space to prepare the required answer. In addition, poor comprehension leads to incomplete responses or answers that fail to address the question requirements.

**Failure to plan responses:** When candidates do not fully understand a question, they are unable to plan their responses effectively. Many candidates rush into answering questions and later realise that insufficient space has been allocated on the drawing sheet for the required views.

**Language barriers and weak comprehension skills:** If teachers consistently use past examination papers as teaching tools and apply the same terminology used in national assessments when setting internal and provincial tasks, language-related challenges should be reduced. However, some candidates still experience difficulty understanding questions due to language barriers or unfamiliarity with subject-specific terminology. To address this, learners must be explicitly taught reading comprehension skills, and teachers must consistently use correct subject terminology in classroom instruction.

**Lack of formative assessment:** Teachers are expected to implement informal assessment strategies to support formal assessment tasks. Short, formative tests help to build learner confidence across all topics. Self-marking and peer-marking are effective strategies for providing immediate feedback and reinforcing learning.

**Insufficient drawing skills:** Although Engineering Graphics and Design is primarily a knowledge-based subject, it requires a high level of practical drawing skill. Learners must be able to draw accurately, neatly, and efficiently. Regular drawing practice is essential to enable candidates to complete the examination within the allocated time.

(c) **General suggestions to improve results**

Continued poor performance across many centres highlights the need for improved teaching and learning strategies. Given the limited instructional time available each term, teachers are encouraged to incorporate the following practices into their Annual Teaching Plans (ATPs):

**Prior knowledge:** Each topic should begin with a revision of basic concepts and terminology covered in previous grades. This enables learners to establish meaningful connections between prior knowledge and new content.

**Understanding and planning:** Incorrect responses often result from learners failing to read and interpret instructions accurately. Teachers must explicitly teach learners how to analyse and interpret examination questions using past papers. Learners should be trained to:
(i) Read every word of the instruction carefully;
(ii) Underline or highlight key terms;
(iii) Identify relevant source information;
(iv) Plan the layout of the drawing; and
(iv) Decide on the most appropriate starting point for the answer.

**Use of textbooks:** All Engineering Graphics and Design learners must use a *CAPS-compliant* textbook which has been approved by the DBE. Teachers should select from DBE-approved textbooks and **refrain from using prepared drawing sheets**.

**Use of past NSC examination papers:** Past NSC examination papers are among the most valuable teaching and learning resources and should be integrated into lesson planning and instruction. Recent papers provide clear insight into examination trends and questioning techniques. These papers, together with their marking guidelines, are readily available on the Department of Basic Education website and should be accessible to all learners.

**Time management:** Learners must be systematically trained in time management skills. These skills should be reinforced during the preparation of course drawings, tests, and examinations. Mark allocations serve as a good guide for time management, and learners must practise working within specified time limits.

**Drawing fitness and using the correct drawing instruments:** Continuous and regular practice is essential for developing and maintaining the ability to draw quickly, accurately and neatly using the correct instruments that are fit for purpose. Drawing requires sustained manipulation of instruments, which is physically demanding and time-consuming. To complete examination papers within the allocated time, learners must be *drawing fit* – a skill that can only be developed through consistent drawing practice under timed conditions and more specifically, during that neglected period from the trial examinations in September to the Engineering Graphic and Design examinations in November.

**Identifying high-risk learners and monitoring of SBA:** In order to improve the current pass rate it is crucial to identify high-risk learners as early as possible and implement specific intervention programmes. There should be more intervention in the underperforming schools, by subject advisors, through monitoring of the school-based assessment (SBA) tasks and teacher performance.

## 7.3 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 1

### QUESTION 1: CIVIL ANALYTICAL

Question 1 assessed a range of civil concepts related to a *site plan*, the *civil title panel* and the *SANS 10143 Code of Practice for Building Drawing.*

Weaker candidates continued to experience difficulty with several subquestions, while many well-prepared, stronger candidates demonstrated sound insight and understanding, enabling them to achieve good marks.

It should be noted that the initial subquestions were generally well answered by the majority of candidates. These questions were set at a lower-order cognitive level and were of an easy to moderate difficulty.

The subsequent set of subquestions, which targeted a middle-order cognitive level, proved more challenging. These questions were less predictable and required candidates to recall and apply knowledge of the *SANS 10143*. Successful responses depended on whether candidates had been explicitly taught and had studied the examinable content in detail.

The final few subquestions were set at a higher-order cognitive level and were designed to be the most demanding. They assessed the application of the *SANS 10143* requirements and mathematical principles within a civil context. Although these questions should have been reasonably predictable, the results indicated that many candidates were unable to solve these more complex problems. It is disappointing to note that many teachers appeared **not** to have made effective use of previous examination papers to adequately prepare candidates for this question in the final examinations.

**Common errors and misconceptions**

(a) In Q1.7 many candidates did not answer the question with sufficient depth. An arrow, by implication, shows direction; therefore, stating *direction* alone was inadequate. The direction needed to be qualified by specifying the *gate* or *opening*.

(b) With reference to Q1.9, many candidates could not distinguish between *new* and *existing* elements on the site plan. The ability to correctly identify and count elements on a drawing tests a candidate's attention to detail and is regarded as an essential skill. It therefore has to be learned and practised.

(c) The abbreviation for concrete, *CONC*, appears in the *SANS 10143*. A significant number of candidates were unable to answer Q1.13, indicating insufficient study and preparation prior to the examination.

(d) In Q1.15 the majority of candidates were unable to answer the question, '*On what type of drawing is brown used for drains and soil pipes?'* Although this question has appeared previously in a slightly different form, the poor performance suggests that past NSC examination papers are not being effectively used by teachers as teaching resources.

(e) Very few candidates demonstrated the ability to apply basic mathematical skills in Q1.18 and Q1.19 – the same basic mathematical skills that have been assessed in most previous examination papers. It was unclear whether the poor performance was due to weak mathematical foundations, lack of attention to detail, or inadequate reading and comprehension skills.

ANSWER 18
Show ALL calculations.

APPLYING CORRECT FORMULA✓
LENGTH OF FENCE
= (AB + BC + DE + EA) - GATE
= (46,07 + 38,84 + 30 + 64,78) - 6
= 173,69✓ ANSWER IN METRES ✓

ANSWER 19
Show ALL calculations.
APPLYING CORRECT FORMULA✓
5,5 x 8 = 44
3,5 x 5 = 17,5
8 x 12 = 96
7 x 5 = 35
= 192,5✓ $m^2$✓ ANSWER IN SQUARE METRES, WITH m² INCL.

(f) The presentation of answers in many scripts was unacceptable. Responses were often written in pen and were frequently illegible. The *SANS 10143* specifies the required printing standards for drawings, and these standards must be adhered to in all aspects of drawing work.

(g) In Q1.20 neatness and proportion were fundamental requirements for freehand drawing. Many candidates failed to observe these criteria during preparation. All Engineering Graphics and Design work must be presented neatly. In many cases, freehand line work was of a poor quality, and greater care is required when drawing graphic symbols or conventions.

**Suggestions for improvement**

(a) Every learner must have a DBE-approved textbook. Teachers must have access to the *SANS 10143 Code of Practice for Building Drawings* and should refer to it regularly. Civil content must be taught consistently and reinforced through short, periodic formative assessments, which will also serve as effective revision tools.

(b) Learners acquire knowledge in line with the manner in which they are taught. Unfortunately, many teachers are not sufficiently familiar with correct technical terminology. Learners can only master appropriate technical terms if teachers themselves are knowledgeable and use the correct terminology consistently and accurately in the classroom.

(c) When learners are taught to *read with understanding*, only then will they be better able to interpret the requirements of questions and respond appropriately. Learners must be guided on how to provide relevant and accurate answers. Teachers can support this process by exposing learners to a wide range of civil-related questions, particularly past NSC examination papers, together with their marking guidelines.

(d) Learners must regularly practise applying fundamental mathematical formulae to calculate perimeter and area. These calculations should be incorporated into short formative assessments to reinforce learning. Learners should also be taught how to convert measurements between millimetres and metres.

(e) The quality of a learner's line work is assessed in the practical assessment task (PAT). However, this does not justify poor freehand work in examinations. Too many candidates present untidy and unclear freehand drawings. All freehand work must be neat, meaningful, graphically accurate and proportionally correct. Printing must also be clear and neat. This requires ongoing practice and close monitoring by teachers.

(f) Subject advisors should organise regular content workshops to capacitate those drawing teachers who are experiencing challenges and to provide assistance where necessary.

(g) Candidates must answer all questions in pencil.

**QUESTION 2: INTERPENETRATION AND DEVELOPMENT**

In both the May–June 2024 and November 2021 NSC examination papers, Question 2 involved the interpenetration of one solid *passing through* another. This concept should, therefore, not have been unfamiliar to candidates, provided that past NSC examination papers were effectively used as teaching and revision resources.

Overall, Question 2 was poorly answered. It is unclear whether the topic was adequately taught or whether educators advised learners to avoid attempting the question. A more plausible explanation is that some teachers relied on prepared drawing sheets in which the polygon was already positioned and drawn for the learner. This practice denies candidates the opportunity to practise constructing a polygon independently and, as a result, limits their ability to attempt such questions confidently in the examination.

It should be noted that the question was designed to accommodate learners across different ability levels. Weaker candidates could obtain a pass mark by correctly drawing the given views of the two solids, while stronger candidates were expected to recognise the necessity of drawing the right view in order to determine the curve of interpenetration.

**Common errors and misconceptions**

(a) Orthographic projection is a fundamental concept introduced in Grade 10; however, many candidates were unable to distinguish between first-angle and third-angle orthographic projection. As a result, the right view was often incorrectly placed relative to the front view.

(b) Most candidates who attempted this question did not project or draw the right view of the two solids, despite it being a requirement of the question. This raised concerns around whether the topic was adequately taught at school level. The most straightforward method of determining the curve of interpenetration for this type of combination of solids is through the right view, as it clearly indicates the termination points of the edges of the pentagonal prism on the surfaces of the horizontal hexagonal prism. Consequently, many candidates also failed to determine the curve of interpenetration in the front view.

(c) Many candidates, often from the same centres, experienced difficulties constructing regular polygons. Although more candidates were able to correctly construct, position, and draw the pentagon in the top view, fewer managed to correctly construct and position the rotated hexagonal prism, despite being provided with an auxiliary view.

(d) Correct planning and placement of views on the drawing page are critical. Many candidates failed to plan their work effectively, resulting in incomplete, misaligned drawings and an overall poor layout.

(e) Reading for meaning posed a challenge for some candidates, as the required hidden detail was omitted in most responses. The question clearly required candidates to show all hidden detail.

**Suggestions for improvement**

(a) First-angle and third-angle orthographic projection are core topics in the Grade 10 *CAPS* (page 8). It is essential not only that these concepts are taught, but that their differences are regularly emphasised and reinforced throughout the teaching process.

(b) The use of prepared answer sheets should be actively discouraged. The understanding of abstract drawing concepts begins in Grade 10, where the construction and projection of right regular solids form the foundation of all technical drawing. These skills require continuous practice, conceptual understanding, visual perception and graphic problem-solving ability. Learners who rely on prepared answer sheets become dependent on them, which negatively affects their ability to respond to examination questions that require drawings to be constructed from scratch. The inability of many candidates to correctly construct a polygon supports this observation. When teachers use prepared answer sheets with the basic construction already completed – often for the convenience of the teacher – the learner is deprived of valuable opportunities to practise essential construction skills.

(c) Planning is a critical drawing skill that takes time and repeated practice to master. This point warrants reiteration. As long as learners are provided with prepared answer sheets, where they merely complete or add to an existing drawing, they will continue to experience difficulties with planning during examinations. The sequence in which a drawing is prepared is an essential skill that must be taught and regularly reinforced. This is best achieved by requiring learners to complete full drawings, rather than working on partially prepared drawings where only the curve of interpenetration needs to be determined.

(d) Visualising three-dimensional objects represented on a two-dimensional surface is a challenging concept for many learners. This skill can only be developed through sustained and regular practice involving drawings of appropriate and increasing complexity. One effective strategy that teachers can use, particularly for learners who struggle, is introducing numbering or lettering of the base corners of a polygon. This technique can assist learners in working systematically, improving speed and accuracy, and reaching a solution even when they have challenges with spatial visualisation.

(e) Teachers should consistently encourage learners to *read for meaning*. This involves not only reading the given instructions, but also fully understanding what is required of them before attempting the question.

(f) Subject Advisors should identify underperforming schools, based on the analysis of the 2025 NSC results, and provide ongoing, sustained support to teachers at these schools.

This approach is far more effective than short-term intervention or damage control prior to the NSC examination.

## QUESTION 3: PERSPECTIVE DRAWING

Question 3 was generally poorly answered with the stronger candidates showing insight and ability to complete the drawing correctly, accurately and neatly.

What is rather disappointing and somewhat concerning is that **all** the issues that were raised in the diagnostic reports of the past few years, are the very same issues that were identified during the marking of the 2025 NSC examination.

### Common errors and misconceptions

(a) Many candidates were unable to accurately determine the positions of the two vanishing points. As a result, any subsequent construction and drawing was incorrect and had to be penalised accordingly. This section of the drawing represented the lower-order cognitive demand (Grade 11 level) and should have been accessible to all the candidates.

(b) A significant number of candidates continued to move the position of the *Horizon Line* (HL), *Picture Plane* (PP), and/or the *Ground Line* (GL). This indicated little or no understanding of the function of these reference lines or why their positions are fixed. Altering the position of any of these lines fundamentally changes the answer as well as both the cognitive level demand and the level of difficulty of the question.

(c) Many candidates were unable to correctly determine the required height lines or demonstrated little to no understanding of their purpose. Without a correctly constructed height line, the heights of the receding roof sections and other elements of the *pool house and splash pool* could not be accurately determined.

(d) The construction and drawing of the arch (semi-circle) were poorly executed by most of the candidates. Although some candidates attempted the arch, many of those who attempted to draw it, projected the coordinates inaccurately, resulting in perspective curves of very poor quality.

(e) Many candidates experienced difficulty converting the given orthographic views of the *pool house and splash pool* into a pictorial drawing. This was evident where candidates either introduced features not shown in the given views or omitted essential details.

(f) A large number of candidates produced line work of very poor quality that was inaccurate and untidy. This made it difficult to determine whether the candidate understood what was required. All line work must comply with the prescripts of *South African National Standards* (SANS), where **outlines** are drawn as **dark lines** and **construction lines** as **light lines**.

(g) It was evident that the correct teaching of perspective drawing methods had been neglected in some centres. Correct perspective drawings were consistently produced by candidates from those schools where most of the candidates performed satisfactorily in the other questions.

### Suggestions for improvement

(a) The correct determination of vanishing points is fundamental to perspective drawing and is regarded as a lower-order cognitive level skill. Teachers must ensure that all learners master these basic skills by explicitly teaching the terminology, methodology, and fundamental concepts of perspective drawing. Ongoing and regular practice is essential to develop and maintain accuracy, neatness, and confidence.

(b) Learners must understand that the positions of the *Horizon Line* (HL), *Picture Plane* (PP), and *Ground Line* (GL) may not be moved as they are fixed in order to produce a particular answer. This is the only topic where the use of prepared answer sheets is encouraged.

(c) The height of an object can only be determined in the picture plane. Teachers should therefore reinforce the correct method of first establishing the height of an object on a height line that is in the picture plane, and then transferring that height to its correct position in perspective. When there is no height line, one has to be projected.

(d) At Grade 12 level, candidates are expected to understand that construction or projection lines are **B-type** lines and must remain visible, as they demonstrate method. Outlines are **A-type** lines and must be drawn darker. Learners should also be instructed not to erase construction lines, as these are essential for assessment purposes.

(e) Constructing a perspective semicircle is a complex process that requires a sound understanding of accurate projection techniques. Even weaker candidates are expected to demonstrate basic conceptual understanding by correctly dividing the semicircle into 30° segments in the given views.

(f) The complexity of a perspective drawing increases as additional construction lines are introduced to locate points in perspective. Learners must be taught to work methodically and systematically to avoid repeatedly determining the same points, thereby improving efficiency and time management.

(g) Converting orthographic views into a pictorial drawing is a demanding skill and is particularly challenging for learners who struggle to visualise the relationship between views. Teachers should develop a clear, learner-friendly technique when presenting this topic or present a consistent set of rules that can be applied to all perspective drawing tasks.

(h) Poor drawing practices – such as inaccuracy, untidiness, incorrect line work, and weak presentation – must be addressed early before they become entrenched. This corrective process should begin in Grade 10 and continue through to Grade 12.

(i) Teachers must provide learners with relevant course drawings that reflect the level of complexity expected at Grade 12. Learners should engage meaningfully with these drawings. Past NSC examination papers are an excellent resource for perspective drawing practice and should be used extensively.

## QUESTION 4: CIVIL ASSEMBLY AND ELECTRICAL LAYOUT

It was encouraging to note that all provinces reported that the majority of candidates attempted this question, which was significant as it accounted for almost 50% of the total marks for the paper. However, the 2025 results showed a slight decline when compared with previous years.

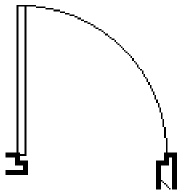
Many weaker candidates still appeared to be either overwhelmed by the demands of the question or insufficiently prepared for the examination. Of ongoing concern is that candidates continue to repeat the same errors identified in past years.

**Common errors and misconceptions**

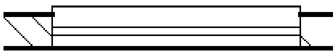
(a) THE FLOOR PLAN

**Common errors in drawing windows and doors:**

- In several instances, doors were not drawn to the correct size or were incorrectly positioned within the doorframe. The arc indicating the door swing was often drawn freehand. It must be emphasised that any work presented in freehand, unless candidates are explicitly instructed otherwise, was not awarded marks.

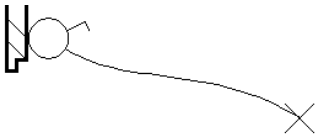


- Windows were frequently not drawn according to the dimensions specified in the window schedule and were instead drawn to fill oversized wall openings on Answer Sheet page 6. Many candidates omitted the window sill or drew it more than 1 mm beyond the wall. In addition, window frames (double lines) were often not centred within the wall thickness.
- Many candidates did not include the arrow indicating which side opened on the sliding door.



**Common errors in drawing the electrical layout:**

- When the electrical layout was added to the floor plan, it was often poorly executed, reflecting a lack of understanding. Electrical symbols were frequently placed haphazardly and drawn inaccurately.
- Labelling of the fluorescent light was generally inadequate.
- A recurring error remains the incorrect attachment of the irregular curve connecting the light fitting to the light switch, with many candidates connecting it to the 'flag' instead of the switch circle.



- Some candidates were unable to correctly identify the appropriate electrical fitting from the given table.

**Common errors in drawing fixtures:**

- Many candidates continued to draw fixtures exactly as shown in the fixture table, rather than converting them to the required SANS 10143 symbols. The fixture table is intended to provide information on sizes and measurements. The candidate was expected to learn, remember and apply the correct SANS 10143 symbols
- Fixtures were often inaccurately drawn, with incorrect application of the required scale ratio.
- Candidates must be reminded that instruments must be used to accurately draw the fixtures.

**Common hatching errors:**

- There was a general improvement in both the quality and correct application of hatching compared to previous years. However, a significant number of candidates still applied mechanical hatching to walls and failed to clearly indicate the required 45° double parallel lines when applying hatching to the walls.

**Common errors with labels:**

- Many candidates failed to add the floor finish to the existing room designation labels. This was a result of instructions not being followed, despite clear guidance provided in the question. Labels must always be neatly printed, correctly sized, and the prescribed font must be used.

(b) SOUTH-EAST ELEVATION

**Common projecting errors:**

- The ability to project accurately from one view to another is a fundamental drawing skill taught and reinforced from Grade 10 onwards. It is therefore concerning that many candidates were unable to correctly project windows and doors from the floor plan.
- A significant number of candidates were also unable to apply the scale correctly.

**Common errors in drawing windows and doors:**

- The heights of windows and doors were frequently determined incorrectly, despite the relevant measurements being clearly indicated on the drawing.
- Window opening lines and window sills were often omitted or poorly executed.
- The finished floor level (FFL) height was not always calculated or indicated correctly.

**Common errors in drawing the roof:**

- Many candidates incorrectly determined the roof height due to an inability to construct angles accurately using a protractor. There was a general lack of precision in setting out the required 20° roof angle. As accuracy is a fundamental and essential drawing skill, it should be noted that a deviation of only 1° is permissible for angular measurements.
- The ridge cap and roof cap (parallel line) were frequently omitted along the roof edges where it was required.
- A large number of candidates drew the fascia board and gutter at incorrect heights, despite the height being clearly specified. In addition, many candidates appeared not to understand the purpose of break lines and merely copied them as they were shown in the question. This indicated that the question was either not read carefully or that candidates were not adequately prepared for the examination. It is essential that learners have access to past NSC examination papers together with the marking guidelines to prevent the recurrence of such basic errors.

**Common errors with the labels:**

- The printing of the labels applied to the drawing was of a very poor quality.

(c) DETAILED SECTION

- Fewer candidates attempted the detailed sectional view drawn to a scale of 1 **:** 20 compared to the other two views. However, many of those who attempted this drawing applied the scale correctly.

- The roof detail, which forms part of the Grade 12 curriculum, was once again poorly answered. Many candidates demonstrated limited knowledge of the ten required roof components. Among those who attempted to draw these components in the detailed section, several failed to draw all components accurately or correctly. The most common errors included the omission of components and the incorrect application of the scale to the parts and angles. This suggests that learners may not have received sufficient practice in drawing the roof detail or were not adequately taught these skills.

| 1. MARK ALLOCATION FOR ROOF | |
|---|---|
| A: ROOF ANGLE | 1 |
| B: ROOF SHEET | 1 |
| C: PURLIN + SPACING | 1,5 |
| D: TRUSS + OVERHANG | 3 |
| E: WALL PLATE | 1 |
| F: FACIA | 1 |
| G: GUTTER | 1 |
| H: BARGE BOARDS | 1,5 |
| J: BRANDERING + SPACING | 1 |
| K: CEILING BOARD | 0,5 |
| TOTAL | 12,5 |

- A frequent error was the failure to draw to the given break line, with many candidates stopping their drawing short of the line. Any alteration to given information may result in a penalty.
- While many candidates drew the lintel correctly, the height of the lintel was often measured incorrectly.
- The wall, barge board and gabled wall to the right (north-east) of the cutting plane was the higher-order cognitive level portion of the question and included for the high performing candidates.
- Many candidates omitted to add the DPC and GL labels.
- Hatching of the various components in the sectional view was generally poorly executed and often did not comply with the requirements of *SANS 10143*.

**Suggestions for improvement**

The basic format of this question has remained relatively constant for a number of years. One of the underlying problems is that this topic is covered very early in the first term. Learners must be given revision drawings, preferably using past NSC examination papers, throughout the year. There are many past NSC examination papers that can be used for revision.

(a) FLOOR PLAN

- Weaker candidates should be advised to begin Q4 by completing the floor plan and to follow all instructions carefully. Learners must be taught how to print the required labels correctly, bearing in mind that these requirements may change from year to year. The focus should also be on adding the electrical layout accurately, using the correct fittings and ensuring that connections are drawn to the circular part of the light switch and not to the 'flag'. In addition, learners must be taught how to draw doors and windows correctly, to the correct size, and to apply hatching details in accordance with *SANS 10143*. It should be emphasised that the window frame must be drawn as a set of parallel lines positioned centrally within the wall, with the window sill shown as a single line projecting beyond the wall.
- Tables provided on the question sheet that contain essential information must be used correctly. The window and door schedules specify the required sizes of these components and must be applied accurately. The correct electrical symbols must be selected from the table and transferred onto the drawing. Learners should have access to, and be taught how to use, the *SANS 10143* graphical symbols for fixtures, applying the dimensions given in the table. The orientation of the text on

the incomplete floor plan indicates the correct positioning and placement of fixtures.
- Hatching must be applied using drawing instruments and must not be done freehand.

(b) NORTH-WEST ELEVATION

- When teaching the learner to prepare an elevation, educators should focus on three key areas: (1) the correct method of projecting windows, doors, and the roof; (2) accuracy when drawing the roof; and (3) overall precision in execution.
- Projecting the roof from the floor plan is a Grade 12 requirement and can be challenging for learners who have not been taught how to draw the roof – complete with all rainwater items. Once the correct methods and details have been taught, learners must be given ample opportunity to practise drawing the roof.

(c) DETAILED SECTION

- Roof detailing is a Grade 12 requirement. Learners must be taught the correct sequence in which roof components fit together and given sufficient practice to draw these components accurately and correctly.
- The same approach applies to the *SANS 10143* hatching patterns used to distinguish the various elements in a sectional elevation.
- Learners must also be taught how to extract measurements from the floor plan or elevation and convert them appropriately for use in detailed drawings. (This is a higher-order cognitive level exercise normally intended for the top candidates)

(d) Teachers should have access to a sufficient range of resource materials to support learner preparation for this topic. At a minimum, these resources should include a copy of the *SANS 10143 Code of Practice for Building Drawings*, a DBE-approved textbook, and past NSC examination papers.

(e) It is essential that course drawings are set at an appropriate level to allow learners to engage meaningfully with content that meets the required standard.

(f) All drawings must be prepared using drawing instruments, and learners are expected to be proficient in their correct use. It must be emphasised that any work presented in freehand, unless explicitly permitted in the question, is not awarded marks, even if it is otherwise correct.

(g) Learners should not be expected to sit an examination without having been taught effective time-management skills. Teachers should therefore set course drawings that must be completed within clearly defined time limits.

(h) Concepts taught in previous grades, as well as relevant terminology, should be briefly revised before introducing new topics. This enables learners to make connections between prior knowledge and new learning. A strong foundation in basic concepts allows learners to engage more confidently with advanced material.

(i) The addition of labels to drawings is considered a lower-order cognitive level task. When candidates omit labels, it strongly suggests that instructions were not read carefully. Many candidates also added labels to features that did not require them

(j) Subject advisors should address issues related to language across the curriculum by providing ongoing opportunities for teacher development.

## 7.4 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH QUESTION IN PAPER 2

The Engineering Graphics and Design Paper 2 NSC examination results for the 2025 Grade 12 cohort of candidates were lower than those of the candidates in the 2024 NSC examination.

Most provinces noted that Paper 2 was scheduled for an afternoon session and as late as week five of the final NSC examination timetable, following a three-hour Geography paper. While the sequencing of two lengthy and cognitively demanding papers on the same day may be regarded as academically undesirable, this does not constitute a valid justification for learner underperformance and should not be used as a mitigating factor. The final timetable was released months prior to the commencement of the examinations, providing both teachers and learners with sufficient opportunity for effective planning and preparation. It remains the responsibility of teachers to adequately prepare learners for all eventualities, however, challenging these may be. As a matter of interest, the timetabling of a skills-based examination so late in the examination timetable and particularly after a lengthy, academically challenging examination in the morning session, has been raised on a number of occasions with the department.

A significant number of candidates displayed limited understanding of the fundamental concepts, methods and techniques essential to Engineering Graphics and Design, which adversely affected their performance in the NSC examination. Of particular concern is the continued presence of schools (centres) where the majority of candidates performed poorly. This highlights the urgent need for knowledgeable and competent teachers, as the quality of teaching has a direct and measurable impact on learner achievement.

Provincial consensus confirmed that Paper 2 was of a high standard and fair. It was consistent with previous years in terms of presentation, language, and level of difficulty. Candidates who were well prepared and *drawing-fit* generally completed the paper within the allocated time, with many achieving very good results.

**QUESTION 1: MECHANICAL ANALYTICAL**

Question 1 assessed a broad range of mechanical concepts relating to: *mechanical parts*, an *assembly*, a *mechanical title block* and the *SANS 10111 Code of Practice for Engineering Drawing*. While weaker candidates continued to experience difficulty with several subquestions, many well-prepared candidates demonstrated sound insight and understanding, enabling them to achieve good marks.

The initial subquestions were pitched at an easy to moderate level and targeted lower-order cognitive skills. These were answered successfully by the majority of candidates.

The middle group of subquestions were less predictable and consequently more demanding, as they required recall of knowledge related to the *SANS 10111*. Set at a middle-order cognitive level, these questions posed noticeable challenges for many candidates.
The final subquestions were the most demanding, as they assessed the application of the *SANS 10111* together with mathematical concepts in a mechanical context. These higher-order questions, although reasonably predictable, were poorly answered overall, which was disappointing.

Overall performance in Question 1 showed a slight decline compared to 2024. A significant number of candidates displayed gaps in fundamental knowledge, suggesting inadequate preparation for the examination or insufficient subject guidance. As in previous years, weaker candidates struggled with the range of the mechanical concepts assessed, while stronger candidates were able to demonstrate insight and competence, resulting in higher achievement.

**Common errors and misconceptions**

(a) A significant concern was the large number of candidates who demonstrated weak reading and comprehension skills when responding to many of the subquestions in Question 1. Numerous responses were irrelevant or showed little connection to what was being asked.

(b) Q1.1 to Q1.6, the majority of candidates performed reasonably well. However, performance declined noticeably in the subsequent questions. The following aspects emerged as areas of concern across many schools and among many candidates.

(c) In Q1.9 and Q1.10 many candidates were unable to correctly name the different types of sections. This information is clearly set out in the *SANS 10111* as well as in any DBE-approved textbook.

(d) Many candidates failed to *determine* (calculate) the angle at E in Q1.13. Some of them were unsuccessful in their attempts to measure the angle using a protractor. This indicated that many candidates could not distinguish between the verbs: *measure* and *determine*.

(e) In Q1.15 most candidates did not calculate the required *maximum* or *minimum* tolerances as instructed. Instead, they merely copied the ± tolerances from the title block. Candidates were expected to *determine* (calculate) the exact *maximum* and *minimum* values which included the decimal point.

(f) Q1.17 and Q1.18, which related to the machining symbol, were poorly answered by most candidates. This suggests that this topic is overlooked in many schools.

(g) Q1.19 (*spot face*) and Q1.20 (*splined shaft*) were based on content from the *SANS 10111*. Although many candidates attempted these questions, both were answered poorly, further indicating that this content was overlooked in many schools.

**Suggestions for improvement**

(a) Teachers should address *language across the curriculum* by explicitly teaching learners to *read for meaning*. This will support accurate understanding and correct application of technical terminology. Past NSC examination papers should be used as a teaching resource, as they expose learners to drawing terminology and the way questions are structured and phrased.

(b) It is essential that every Engineering Graphics and Design teacher has a copy of the *SANS 10111 Code of Practice for Engineering Drawings* in the classroom, as its content is fundamental to the teaching of mechanical drawing. In addition, every learner must have access to a DBE-approved textbook.

(c) Calculating a tolerance is a straightforward mathematical process that has been assessed previously. Learners must be taught how to identify a tolerance, apply it correctly to a given dimension, and carry out the required calculations to determine *maximum* and *minimum* limits. Sufficient practice should then be provided using a variety of dimensions.

(d) Engineering Graphics and Design is both a knowledge-based and skills-based subject. Regular analytical exercises should therefore be incorporated into teaching to help learners develop reading comprehension, become familiar with technical terminology, and learn how to interpret and respond to analytical questions.

(e) Although some aspects of this question may be predictable, examiners will continue to introduce reasonable variations when setting subquestions. Teachers can support learners by exposing them to a wide range of questions based mechanical analysis, particularly by using past NSC examination papers together with their marking guidelines.

(f) Subject Advisors or subject coordinators need to organise regular content workshops to support teachers who experience difficulties with specific content areas, and to provide guidance and assistance where needed.

**QUESTION 2: LOCI**

There was a slight variation in the way this question was asked. Candidates performed well, achieving the highest average mark, in most provinces, based on the past four years' results.

A concerning trend that persists in all the provinces is that there are still far too many centres, where most, if not all the candidates experienced challenges.

**Common errors and misconceptions**

THE CAM

(a) This question was generally well answered by many of the candidates who attempted it. However, it remains a concern that a significant number of candidates confused *simple harmonic motion* with *uniform acceleration and retardation*.

(b) Many candidates were unable to correctly divide the *simple harmonic motion* section of the horizontal axis into 15° divisions.

(c) A common error with many candidates was that they did not align the baseline of the displacement graph with the bottom of the wedge follower, which subsequently caused difficulties when transferring the information from the displacement graph to the cam profile.

(d) Most candidates either did not read the instructions carefully or did not understand the instructions. This was evident in the frequent omission of labels on the displacement graph, despite this being an easy, lower-order cognitive level requirement of the question.

(e) In many cases, the quality of line work was exceptionally poor. Candidates showed little or no differentiation between line types, and curves that were often inaccurately or poorly drawn.

THE MECHANISM

(a) Many candidates were unable to copy the given schematic diagram accurately, despite the task requiring neither interpretation nor understanding, but simply the accurate reproduction of the given schematic information.

(b) An unacceptably large number of candidates failed to reproduce the correct line types from the schematic diagram, resulting in work of very poor quality.

(c) Even among candidates who drew the schematic diagram correctly, many appeared not to understand how to determine the locus of point B as connecting rod AB moved through swivel-guide C. It is unclear whether this difficulty stemmed from poor reading skills, limited conceptual understanding, or ineffective teaching methods. The exact cause can only be established once all contributing factors have been examined.

(d) Although there were centres in each province where candidates performed well, there were also many centres in every province where candidates experienced significant challenges and demonstrated a lack of understanding of the necessary content.

**Suggestions for improvement**

THE CAM

(a) There are three follower motions that must be taught at school level, namely *uniform motion, simple harmonic motion*, and *uniform acceleration and retardation*. The difference between the three motions must be clearly explained to the learners and then reinforced through sufficient practice. Increased practice reduces the likelihood of avoidable errors under examination conditions.

(b) Learners acquire knowledge in line with how they are taught. It is therefore concerning that some teachers appear not to be fully conversant with, or use, the correct technical terminology. Learners will only master appropriate terminology when it is used accurately and repeatedly by the teacher. Teaching learners to read for meaning will further assist them in correctly interpreting examination questions.

(c) Construction lines should be drawn lighter than outlines and must not be erased. These lines indicate the method used by the candidate to arrive at an answer, and marks are often awarded for demonstrating the correct method.

(d) Subject Advisors or subject coordinators need to organise regular content workshops to support teachers who experience difficulties in specific content areas, and to provide guidance and assistance where needed.

THE MECHANISM

(a) Only learners who are familiar with a topic are able to respond effectively when it is presented in an unfamiliar format. This challenge can be addressed by teachers using past NSC examination papers as a foundation for teaching and revision.

(b) All topics prescribed in the *Curriculum and Assessment Policy Statement* (*CAPS*) must be taught. If the *Annual Teaching Plan* (ATP) is followed, sufficient time should be available to cover all content. Continuous and regular practice of basic concepts is essential for developing and maintaining a high level of drawing skill and competence.

(c) A sound understanding of how a mechanism moves is essential for determining the locus of a point on that mechanism. Many mechanisms share common principles, and when these similarities are explained, learners are less likely to feel overwhelmed when confronted with unfamiliar mechanisms.

(d) Teachers must explicitly teach the terminology used to describe the movement and parts of mechanisms so that learners understand what occurs at each stage of motion. Past examination papers should be used extensively to support both teaching and learning.

(e) Candidates must be instructed not to erase construction lines, as these indicate the method used to determine the answer. Learners should also be taught the correct application of line types, as drawing is a universal language and each line type communicates a specific intention to the reader.

(f) Teachers should refrain from using prepared answer sheets. This practice limits learners' ability to respond to the demands of examination questions, as they are not given sufficient opportunity to practise drawing the basic elements independently.

## QUESTION 3: ISOMETRIC DRAWING

Most of the candidates attempted the isometric drawing with a large number of them obtaining satisfactory results. Many learners still experience challenges converting an orthographic drawing into an isometric drawing. There are a few areas of concern.

### Common errors and misconceptions

(a) Many candidates displayed limited skill when required to convert a two-dimensional, (*third-angle orthographic*) drawing into a pictorial (*isometric*) drawing.

(b) A large number of candidates did not draw the required auxiliary view of the angled line which was essential for determining non-isometric lines. Even among those who recognised the need for an auxiliary view, many experienced difficulties in transferring the dimensions accurately from the auxiliary view to the isometric drawing.

(c) The construction of an isometric circle remained a challenge for many candidates. A number of learners attempted to draw the circle freehand without proper construction. In addition, several candidates who constructed the isometric circle correctly failed to include the centre lines.

(d) Many candidates demonstrated weak drawing skills, resulting in inaccurate work. Line quality was often untidy and inconsistent, and in some cases the isometric drawing was completed using construction lines only.

### Suggestions for improvement

(a) The inability of candidates to produce fundamental Grade 10 work, which should have been revised and applied in Grades 11 and 12, is a serious concern that requires urgent attention.

(b) Developing the skill to produce an isometric drawing requires extensive and regular practice. In particular, learners must practise converting a two-dimensional, third-angle orthographic drawing into an isometric drawing by correctly linking features across the views and positioning them accurately. As challenging as this process may be, increased practice improves a learner's ability to visualise features in different views and place them correctly in the isometric drawing.

(c) Learners must be taught that *angled* or *non-isometric* lines cannot be added directly to an isometric drawing. Such lines should first be constructed using a flat *auxiliary view*. Once a 'box' has been drawn around the angled feature in the auxiliary view, the information can be transferred to the isometric drawing and the angled line inserted. This method requires consistent practice to master.

(d) The construction of an isometric circle or arc is a Grade 11 concept. Any accepted method that uses a compass to construct the ellipse may be applied. Freehand curves are unacceptable and are not awarded marks. Learners must also remember to include centre lines when drawing circular features.

(e) Accuracy is a fundamental and essential drawing skill, particularly in isometric drawing where correct alignment of features is critical. Drawing instruments that are used regularly should be replaced once their markings become faded or unclear, as this compromises accuracy.

(f) It is essential that teachers provide learners with an adequate number of appropriate isometric course drawings from Grade 10 through to Grade 12, progressing to the required level of complexity. Grade 12 learners must engage meaningfully with this work to ensure full examination readiness. Teachers can further support learners by exposing them to a wide range of isometric tasks, particularly through the use of past NSC examination papers together with their marking guidelines.

## QUESTION 4: MECHANICAL ASSEMBLY

Question 4 was attempted by almost all candidates, however, the candidates' performance in 2025 was poorer than in previous years. A significant number of weaker candidates appeared to be overwhelmed by the amount of graphic and numerical information that had to be processed, which resulted in the question being perceived as particularly challenging.

The mechanical assembly drawing required candidates to demonstrate an understanding of the relationship between graphic information and numerical data, as well as the correct application of mechanical drawing principles as set out in the *SANS 10111 Code of Practice for Engineering Drawings*. In addition, candidates were expected to follow instructions accurately.

The question was structured in such a way that candidates who had prepared themselves adequately through sufficient practice, and who had made effective use of past NSC examination papers, should have been able to achieve very good results.

### Common errors and misconceptions

(a) The overall performance of candidates who attempted this question was below average. While some candidates completed both the required views, the majority managed to produce only one view. The reasons for this were unclear and may be attributed to factors such as poor time management, inadequate reading and interpretation of the question, insufficient practice, or a lack of *drawing fitness*.

(b) Many candidates prepared only one view. Among those who completed both the required views, a limited understanding of third-angle orthographic projection was evident, as views were often incorrectly positioned or drawn because they were viewed from the wrong direction.

(c) Poor planning was common and contributed to misaligned or incorrectly positioned views.

(d) A large number of candidates demonstrated difficulty in measuring and working consistently with dimensions, despite this being a fundamental drawing skill. This raise concerns as to why some Engineering Graphics and Design learners had not adequately developed this competency. In addition, some candidates appeared not to have the necessary or appropriate drawing instruments or, if they did, were in a bad condition.

(e) Many candidates showed little or no understanding of the rules of sectioning or the convention of symmetry. Both concepts are comprehensively addressed in the *SANS 10111 Code of Practice for Engineering Drawings* and in all DBE-approved textbooks.

(f) The construction of the M16 hexagonal nut and the drawing of threads was particularly weak. A significant number of candidates demonstrated limited or no knowledge of how to construct the required three faces of a hexagonal nut.

(g) A significant number of candidates simply redrew the individual parts of the assembly, unassembled, instead of assembling them as the topic requested. This resulted in substantial penalties, as failure to apply the concept of assembly significantly lowers the cognitive demand of the question and undermines its intent.

(h) Many candidates made avoidable errors, including the omission of centre lines that should have been transferred from the drawing of the given parts, as well as poor overall planning. In addition, several candidates did not read or understand the concept of a half-section and therefore drew the right view as a full view.

(i) The overall presentation and quality of line work were well below the expected standard of skill and competency expected of a Grade 12 candidate. Inaccurate measurements were common and further compounded the difficulties experienced by many candidates.

**Suggestions for improvement**

(a) Teachers must have access to sufficient and appropriate resource material when preparing this topic. As a minimum, this should include a copy of the *SANS 10111 Code of Practice for Engineering Drawings*, a DBE-approved textbook, and past NSC examination papers. Course drawings should be set at an appropriate level of complexity to allow learners to engage meaningfully with the work. As mechanical assemblies are covered early in the academic year, it is essential that learners are given regular revision drawings throughout the year to ensure adequate preparation for the final examinations.

(b) Orthographic projection is a fundamental concept introduced in Grade 10. However, many candidates were unable to distinguish between first-angle and third-angle orthographic projection, often placing views incorrectly or viewing them from the wrong direction. It remains unclear whether these errors were due to poor reading, inadequate planning, or a lack of conceptual understanding.

(c) The rules of hatching used to distinguish between different components in a sectional view are clearly set out in the *SANS 10111* and in all DBE-approved textbooks. These rules, together with the different types of sectioning, must be thoroughly taught and reinforced.

(d) The construction of the hexagonal part of a fastener is a Grade 11 topic, as specified in the *Curriculum and Assessment Policy Statement* (*CAPS*). It is unacceptable that many candidates reach the end of Grade 12 without being able to construct hexagonal fasteners. These components appear in all mechanical assembly drawings, in every DBE-approved textbook, and in all past NSC examination papers.

(e) Teachers who advise weaker learners to simply *redraw the individual parts* of Question 4 must be made aware that heavy penalties are imposed on candidates who fail to assemble the components correctly. Such responses reflect only lower-order cognitive level engagement. Learners must be taught how to interpret the information provided in an exploded isometric drawing. The exploder isometric drawing illustrates the position of each component relative to the others. The purpose of the exploded isometric drawing is to assist candidates in visualising both the overall shape of the parts and the correct assembly sequence.

(f) Accuracy remains a fundamental requirement in the preparation of drawings. A tolerance of only 1 mm is permitted during marking so learners must therefore be made aware of the importance of precise work. All drawings must be completed using appropriate drawing instruments that are fit for purpose, and learners are expected to be proficient in their correct use. Any freehand work, unless specified by the question, is not awarded marks, even if it is otherwise correct.

(g) Learners should not be expected to manage examination time effectively without explicit instruction and practice. Time management skills can only be developed by setting course drawings that must be completed within clearly defined time limits.

(h) Subject advisors or subject coordinators need to organise regular content-focused workshops to support teachers who experience difficulties with specific areas of the curriculum, and to provide guidance and assistance where required.