Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjhabela: Lefapha la Thuto

**EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE**
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REPUBLIC OF SOUTH AFRICA, Website: www.ecdoe.gov.za

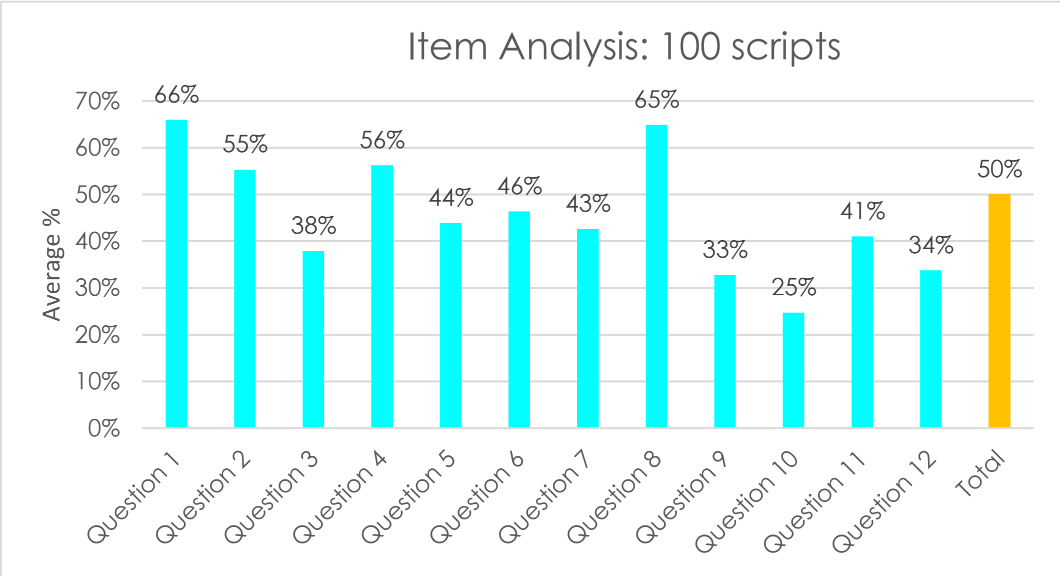
# 2024 NSC CHIEF MARKER'S REPORT

| | | | |
|---|---|---|---|
| **SUBJECT** | **MATHEMATICS PAPER 1** | | |
| **QUESTION PAPER** | **1** | | |
| **DURATION OF QUESTION PAPER** | **3 hr** | | |
| **PROVINCE** | **EASTERN CAPE** | | |
| **NAME OF THE INTERNAL MODERATOR** | **NDUMISO MKANDLA** | | |
| **NAME OF THE CHIEF MARKER** | **NCEBAKAZI LUSANDA NDZABE** | | |
| **DATES OF MARKING** | **29 NOVEMBER – 13 DECEMBER 2024** | | |
| **HEAD OF EXAMINATION:** | **MR E MABONA** | | |

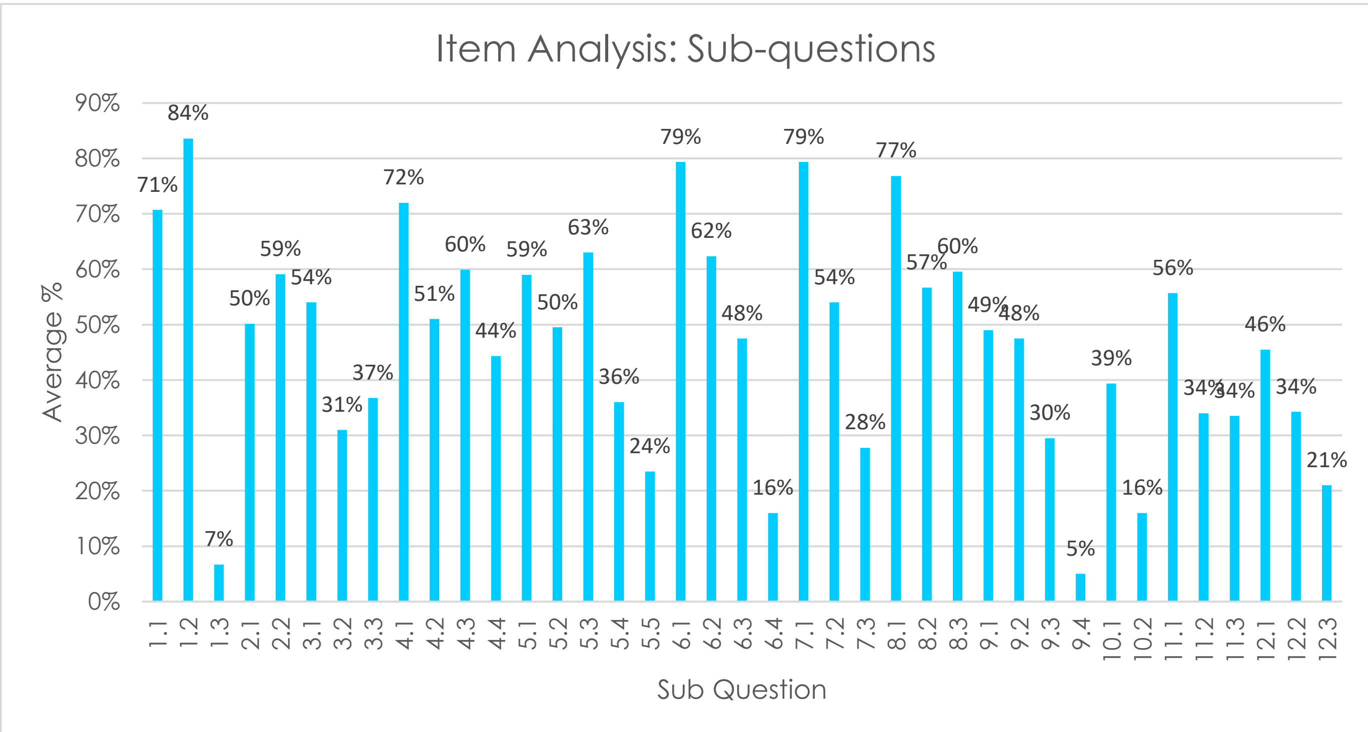
**SECTION 1: (General overview of Learners Performance in the question paper as a whole)**

Based on the item analysis, the pass rate for this year is expected to decline compared to 2023. Of the 100 scripts sampled, the average score was 50% with a standard deviation of 42, indicating a wide spread in marks. The sample was drawn from 2024 matric students in our province. The best-performing questions were Questions 1, 8, and 4, with averages of 66%, 65%, and 56%, respectively. This strong performance can be attributed to the familiarity of sub-questions in the topics covered. For example, Question 1 contained mostly familiar questions except for Question 1.3, a problem-solving question. Question 1.1.4, though uncommon in matric exams, is frequently found in Grade 11 past papers. Similarly, Question 8, despite a format change, was well-answered, and Question 4 benefitted from familiarity with exponential functions, which are often considered more approachable by candidates.

However, the application of differential calculus in Question 10 was the worst-performing section, with an average score of 25%. This poor performance is likely due to a lack of instruction or ineffective teaching, as many candidates did not attempt the question. Questions 9 and 12 followed closely with averages of 33% and 34%, respectively. Notably, Question 12 was relatively easy this year, suggesting that poor teaching rather than question difficulty impacted performance.




Performance in Questions 2 and 3 also declined significantly compared to 2023. Question 2's average dropped from 68% in 2023 to 55% in 2024, while Question 3's average fell from 44% to 38%. These declines may be attributed to the challenging sub-questions in these sections. For instance, Question 3 included variations like radius (3.1), areas of circles (3.2), and diameter (3.3). Questions 3.2 and 3.3 were particularly poorly answered, with averages of 31% and 37%, respectively. Additionally, Questions 1.3 and 9.4 were the least performed sub-questions, with averages of 7% and 5%, respectively.



| SECTION 2: Comment on candidates' performance in individual questions |
|---|
| The bar graphs generated from the Item Analysis are included for each question. Please note that these graphs are drawn from 100 scripts ranging from 0 to almost full marks and do not provide a complete reflection of the overall achievement of all candidates. However, they offer a good indication of how results for the sub-questions vary. The overall achievement of candidates was very poor as too many learners lack the basic knowledge and understanding of Mathematics.<br><br>Brief comments are made on common mistakes and advice is provided to educators to help future candidates achieve optimal results. Comments are also included to assist educators with internal marking and the setting of internal papers. It is strongly advised that educators read this report in conjunction with the official marking guideline. |

**QUESTION 1 (Summary)**

1.1 Solve for $x$:

1.1.1 $x(x-3)=0$ (2)

1.1.2 $2x^2+1=4x$ (correct to TWO decimal places) (4)

1.1.3 $x^2-2x-3>0$ (4)

1.1.4 $2^{2x}-2^{x+2}-32=0$ (5)

1.1.5 $\sqrt{-2x+4}-x=2$ (4)

1.2 Solve for $x$ and $y$ simultaneously:

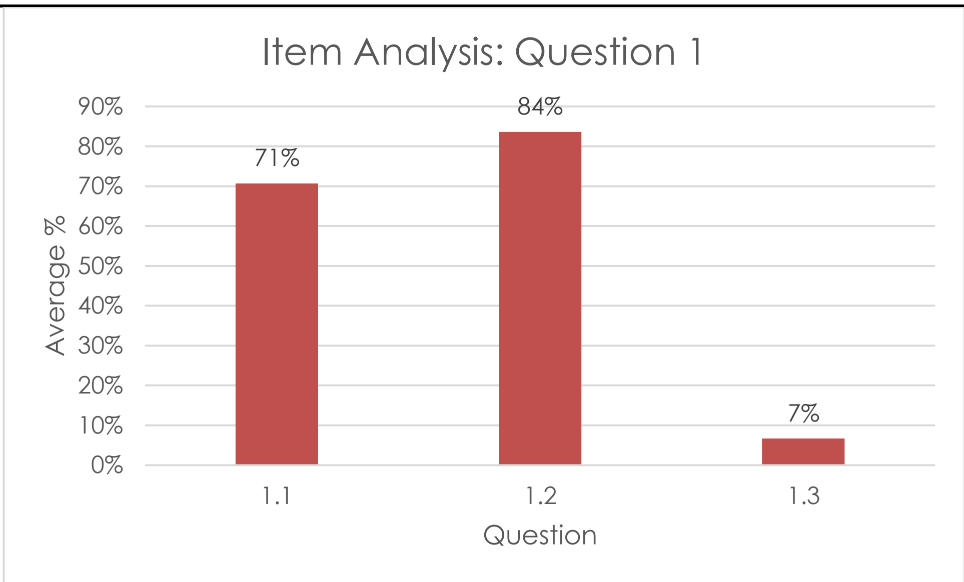
$2x+y=3$
$y^2+xy=2$ (5)

1.3 Consider the product $\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1+\frac{1}{4}\right)...$

Each factor in the product is of the form $\left(1+\frac{1}{n}\right)$ for $n\geq 2$.

Determine ALL the values of $n$ for which the product will be an integer value. (3)

**[27]**




**(a) General comment on the performance of Candidates in the specific question. Was the question well answered or poorly answered?**

**QUESTION 1.1.1**

- Well answered by most candidates, with full marks awarded for correct answers.
- Some candidates did not recognize that the equation was already in factorized form and unnecessarily multiplied through.
- Using the zero product rule or transposing remains a problem among weaker learners.

**QUESTION 1.1.2**

- Well answered by the majority of candidates. No marks were awarded for using an incorrect formula.
- Educators need to stress the importance of showing substitution into the formula. Full marks were awarded for answers only as the usage of calculators was tested.
- Candidates who showed substitution into the quadratic formula could score a mark even if they used the calculator incorrectly. This was the only question where candidates were penalized for rounding errors.

**QUESTION 1.1.3**

- Many candidates struggled with understanding the concept of solving inequalities. Various methods, such as parabola, number line, or tables, could assist learners in comprehending the solutions better.
- Full marks were not awarded for answers written as "or" instead of the correct interval notation.
- The concept of AND/OR remains a significant challenge for most candidates.
- Full marks were not awarded for writing the answer as $x \le -1$ or $x \ge 3$; $x < -1$ and $x > 3$.

**QUESTION 1.1.4**

- Poorly answered by most candidates.
- Common errors included dropping the base early or misapplying exponential laws.

  Many candidates struggled with expressing terms using laws of exponents, e.g. $2^{2x} = 2^2.2^x$
- incorrect handling of bases during addition. e.g.

  $2^{2x} - 2^{x+2} = 2^5$

  $\therefore 2x - (x+2) = 5$

  $x = 7$

**QUESTION 1.1.5**

- Most candidates performed poorly, with the majority scoring only 3 marks.
- The concept of isolating terms before squaring remains a significant challenge.

  $\left(\sqrt{-2x+4}\right)^2 - (x)^2 = (2)^2$.
- Candidates frequently neglected to discard extraneous roots in solutions.
- Testing answers to ensure full marks should be emphasized during preparation.

**QUESTION 1.2**

- A routine question, well answered by most candidates.
- Simple mistakes, such as incorrect subject isolation in linear equations, led to lost marks.
- CA marking was applied, allowing candidates to earn a maximum of 4 out of 5 marks despite errors in intermediate steps.

**QUESTION 1.3**

- This was among the worst-answered questions in the entire paper. Most learners struggled to understand the question's requirements.
- Candidates who concluded that must be an odd number without showing complete working were disadvantaged by the marking guideline.
- Adjustments in the marking approach for problem-solving questions like this are recommended to better reflect partial understanding.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- Educators can refer to Mind the Gap study guide compiled by the Department of Basic Education for inequalities. Educators should take more time in grade 10 and put more emphasis in teaching learners on how to represent inequalities
- Difference between **AND, ; , OR** must be explained thoroughly so that learners do not to confuse the two terms.
- Most of the content in Question 1 is completed in grade 11, therefore Grade 11 work should

be revised and whenever learners are to write controlled test try to include Question 1 content.

- As learners struggle with factorisation, educators must encourage those learners to use the quadratic formula as an alternative.
- Learners must be reminded about rounding off, they should know that incorrect rounding off results in loss of marks. Usage of quadratic formula should not only be confined to the unknown $x$ but also use other variables to be used.

**(c) Provide suggestions for improvement in relation to Teaching and Learning.**

- Teachers should be careful not to tell learners to focus on grade 12 work only, but always encourage them to revise grade 10 and 11 work also.
- Exponents should be included in all revision of algebra to give learners more exposure.

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- Teachers should understand that the syllabus for the subject starts in the lower grades.

**QUESTION 2 (Summary)**

2.1 The first term of an arithmetic series is 7. The common difference of this series is 5 and the series contains 20 terms.

2.1.1 Calculate the sum of this series. (2)

2.1.2 The original arithmetic series is extended to 75 terms. The sum of these 75 terms is 14 400. Using sigma notation, write down an equation for the sum of the terms added to the original series. (4)

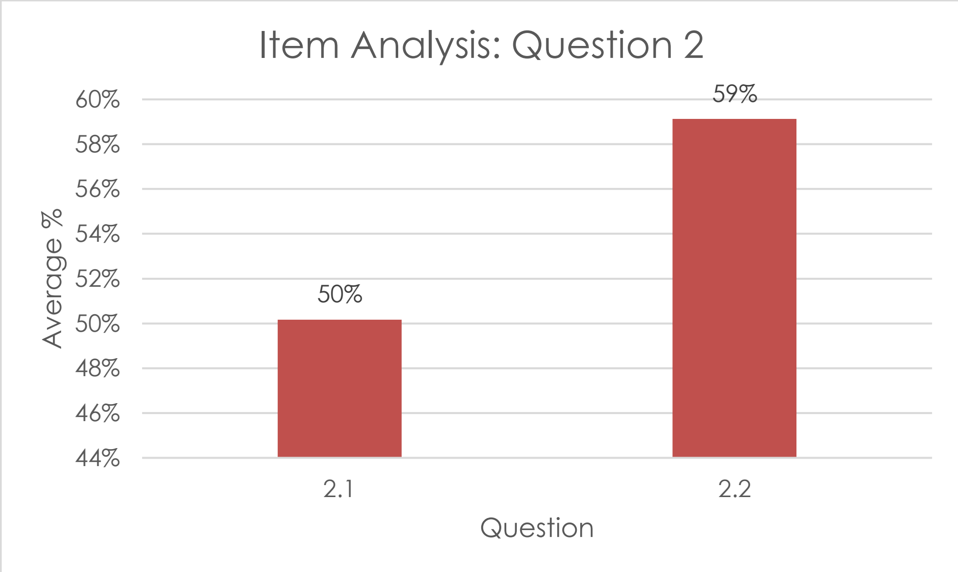
2.2 The sequence of the first differences of a quadratic pattern is: 1 ; 3 ; 5 ; …

2.2.1 If $T_{99}$ of this quadratic pattern is 9 632, calculate the value of $T_{98}$. (3)

2.2.2 If it is further given that the third term of the quadratic pattern is 32, determine the general term, $T_n$, of the quadratic pattern. (5)

**[14]**

**(a) General comment on the performance of Candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 2.1.1**

- Generally well answered as most candidates got full marks.

**QUESTION 2.1.2**

- The question was poorly answered. Candidates scored better marks in this question in previous years. It is unfamiliar to ask candidates to use sigma notation and set up an equation.
- Due to a possible different understanding to the question, most learners ended up adding two sequences and that led them not getting full marks.

  i.e. $\sum_{k=1}^{20}(5k+2)+\sum_{k=21}^{75}(5k+2)=13300$
- Most learners got only 1 mark if $\sum_{k=1}^{75}(5k+2)=14400$ was used as they did not understand that they had to first find the difference between two sums.

**QUESTION 2.2.1**

- The question was not well answered by some candidates.
- Most candidates did not get marks since they swapped Questions 2.2.1 with 2.2.2.
- Marks were not awarded if candidates used 32 from Question 2.2.2. This question could be solved by using the method for general term.

**QUESTION 2.2.2**

- Generally, well done except for candidates who failed due to the fact it was asked in an unfamiliar manner. They could not get the quadratic number pattern.
- There are many candidates who used the linear number pattern as if it was quadratic leading to a breakdown.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- This question tested the understanding of sigma notation. There are a few concepts that need to be remembered when teaching sigma notation. The essence of Questions 2.1.2, 2.2.1 and 2.2.2 was lost by most candidates as it required a good understanding of the language of mathematics.
- The most common mistake that candidates made was to use 32 in 2.2.1 in determining $T_{98}$ which was treated as a breakdown.
- There is a clear misunderstanding of sigma notation equation coupled with the fact at most times candidates are asked to interpret the equation rather than make one.

**(c) Provide suggestions for improvement in relation to Teaching and Learning.**

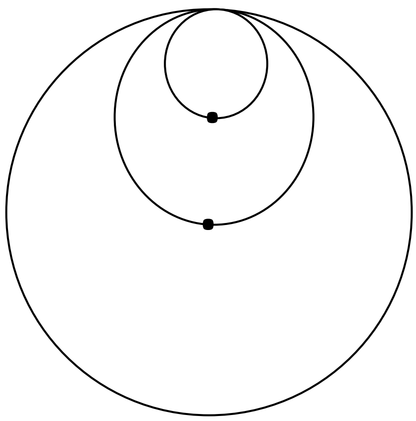
- Educators should teach learners the link between quadratic number patterns and functions and also the "partnership" between quadratic and linear number patterns.
- When teaching Quadratic number patterns, include questions on the linear first differences.
- Do not accept that learners know the difference between all the formulae. TEST THEM!
- Learners must be provided with abstract questions.
- Expose learners to various expressions as well as various combinations of starting and ending values when dealing with sigma notation.

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- Educators are encouraged to teach Maths, not to only coach learners
- Working on previous papers is a good strategy. If all papers were to be set on the same trend, we will not be testing Mathematics, but memory.
- With regards to Number Patterns. It is strongly advised to deal with arithmetic sequences separately. After the learners have mastered that, move on to geometric sequences then provide mixed questions of arithmetic and geometric sequences so that they do not get confused between the two when writing test or examinations

**QUESTION 3**

A circle with radius 6 cm is drawn.
A second, smaller circle is drawn through the centre of the first circle and also touches the first circle internally, as shown in the diagram.
A third, smaller circle is drawn through the centre of the second circle and touches the second circle internally. The process of drawing circles continues and forms a geometric pattern.



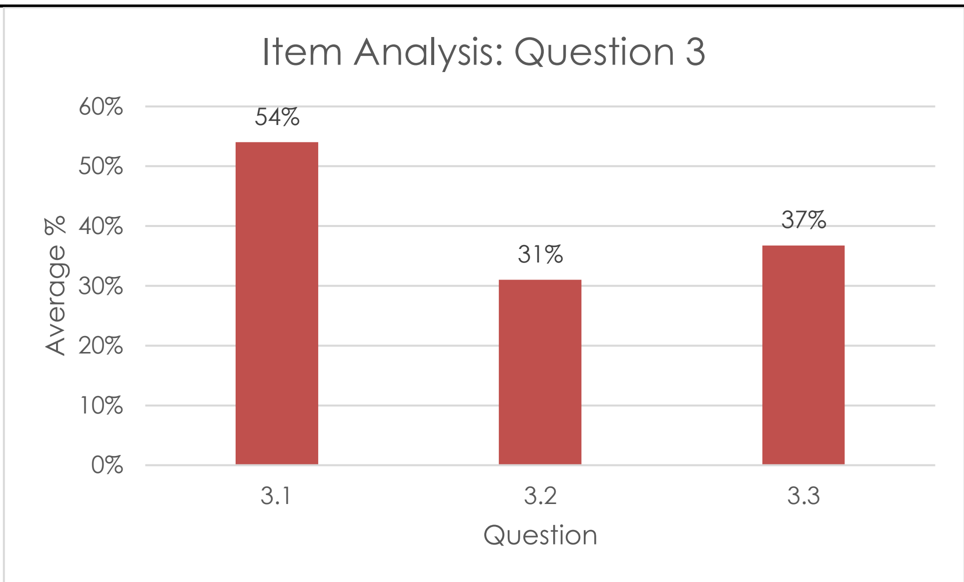
3.1 Write down the radius of the $3^{rd}$ circle. (2)

3.2 Calculate the sum of the areas of the first 10 circles. (4)

3.3 Which circle has a diameter of $\frac{3}{128}$ cm? (4)

**[10]**

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 3.1**

- The question was not as well answered as we thought it would be, a lot of students could not find the required radius.

**QUESTION 3.2**

- The question was poorly answered by most candidates. Most candidates excluded $\pi$ when creating the sequence i.e $a = 6$ and not $a = \pi(6)^2$ and that led to most candidates getting 3 marks.
- Some candidates used radius and that led them to getting only 2 marks only.

**QUESTION 3.3**

- Most candidates performed badly in this question. There was a lot of confusion between radius and diameter. Most candidates mixed the radius and diameter as shown below:

$$6\left(\frac{1}{2}\right)^{n-1} = \frac{3}{128}$$
$$\left(\frac{1}{2}\right)^{n-1} = \frac{1}{256}$$
$$\left(\frac{1}{2}\right)^{n-1} = \left(\frac{1}{2}\right)^{8}$$
$$n-1 = 8$$
$$n = 9$$

or

- Answer only was not awarded marks. Candidates who used method of expansion of diameters to ten terms and concluded that $n = 10$, were awarded full marks.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- Bringing together the concept of a sequence with the radius, diameter and area might have caught the candidates unprepared as they thought those are Grades 8 and 9 concepts.
- Candidates were totally confused between radius, diameter, area and common ratio. The two *r* variables were also confusing even to the stronger learners.
  Area = $2\pi r^2$
  $a = 6$ and not $a = \pi(6)^2$
  $r = \frac{1}{2}$ and not $r = \frac{1}{4}$
- Learners did not apply the area as the number pattern.

**(c) Provide suggestions for improvement in relation to Teaching and Learning**

- Educators must always encourage learners to use sketches to interpret questions.
- Encourage learners to leave answers in terms of $\pi$ particularly when dealing with a geometric sequence that involve radius, diameter, area and even circumference.
- The basic theory of radius, diameter and area is covered Grade 8 and 9 work, then teachers need to encourage their learners to always learn to remember that it is Grade 8 and 9 where the basics of mathematics starts and can be examinable beyond those grades.

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- There should be more exposure to higher order questions relating specifically to sequences and series. Educators must emphasise the importance of reading the question very carefully and identify key words before answering.

**QUESTION 4**

Given: $f(x) = a^x - 1$ for $a > 0$. B$\left(2\,;\frac{-5}{9}\right)$ is a point on *f*.

4.1 Calculate the value of $a$. (2)

4.2 Write down the range of *f*. (1)

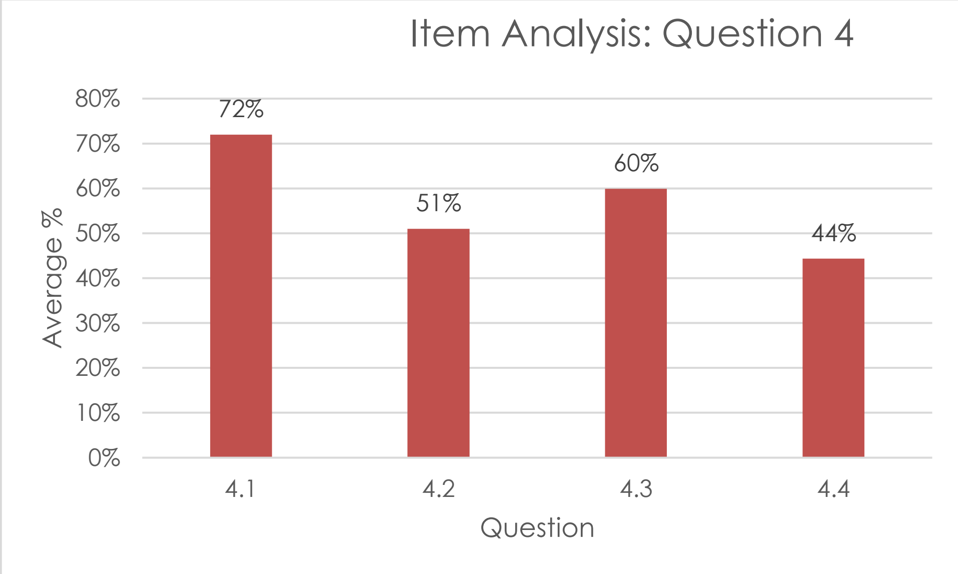
4.3 Sketch the graph of f. Clearly show the intercepts with the axes and asymptotes, if any. (3)

4.4 It is further given that C is a point on $f$ at $y = \frac{19}{8}$.

Determine the coordinates of $C^{/}$, the image of C, when C is reflected about the line $y = x$. (3)

**[9]**

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 4.1**

- The question was well answered by most candidates. They fully understood the concept of an exponential function. This proves that most learners were taught the concept effectively.
- Those that did not get it right, did not correctly substitute the coordinates of B.

**QUESTION 4.2**

- Poorly answered by most candidates. The concept of range requires candidates' understanding of inequalities. Questions relating to the range of a function is regarded in the CAPS document as a Level 1 in terms cognitive levels. Candidates show little understanding of the concept.

**QUESTION 4.3**

- Partially answered by most candidates. 1 mark for asymptote was awarded in cases where candidates failed to represent intercepts and ultimately the shape becomes incorrect.

**QUESTION 4.4**

- Not well answered by some candidate.
- The candidates were unable to interpret the conditions given on the question needed to be able to calculate the value of $x$.
- Working with exponential equations involving fractions is still a challenge to most candidates. Candidates were unable to change

$$\left(\frac{27}{8}\right)=\left(\frac{2}{3}\right)^{x} \text{ to } \left(\frac{3}{2}\right)^{3}=\left(\frac{3}{2}\right)^{-x}$$

This led them to getting a wrong value of $x$.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- Some candidates had an extra asymptote in their sketches of which that led them to getting 2 marks.
- CA marking not applied in the case where the value of $a$ in Question 4.1 being negative.
- Some candidates did not draw the asymptote, they only indicated $-1$ on their sketches without specifying whether it was $x$ or $y$ equation.
- In Question 4.4 Candidates did not understand the concept of reflection especially about the line $y = x$. Most candidates reflected the point about the $x-$axis.
- Also in Question 4.4 most candidates struggled to solve exponential equations involving fractions determining the value of $x$.

**(c) Provide suggestions for improvement in relation to Teaching and Learning.**

- Teach basics of functions like domain and range. More emphasis must be on inequality notations when dealing with domain and range.
- Teachers must explain how to write equations of asymptotes, domain and range.
- Learners to learn to use the given sketches to make sense of what is needed in a question, e.g. one should not expect to get a negative $x-$coordinate when the diagram clearly shows that the coordinate are positive.

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

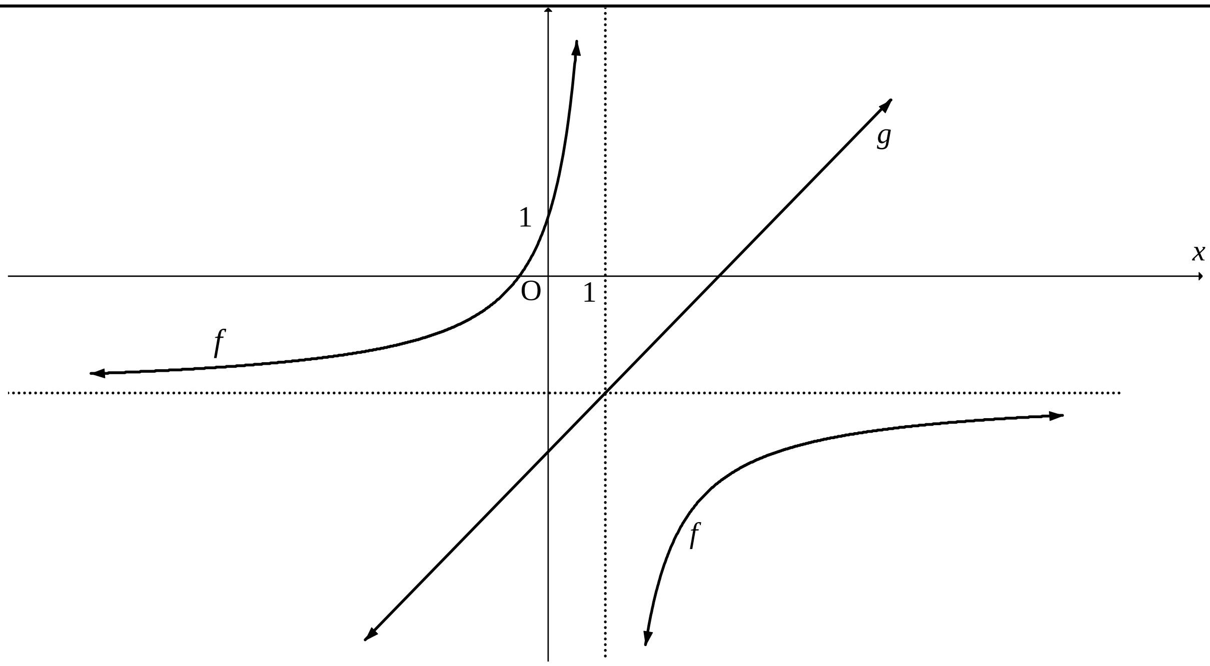
- Thorough teaching of all concepts involving functions in earlier grades.
- More practice and explanation of functional concepts need to be revised in grade 12.
- Revision for Grade 12 exams must be all encompassing so that learners can understand concepts covered in lower grades. Wherever necessary, encourage learners to visit their work from lower grades.

**QUESTION 5**

Sketched below is the graph of $f(x) = \dfrac{a}{x+p} + q$ having the domain $(-\infty\,;1) \cup (1\,;\infty)$.

The graph of $f$ cuts the $y$-axis at $(0\,;1)$. A line of symmetry of $f$ is given by $g(x) = x - 3$.

$y$




5.1 Write down the value of $p$. (1)

5.2 Determine the equation of the horizontal asymptote of $f$. (2)

5.3 Calculate the value of $a$. (2)

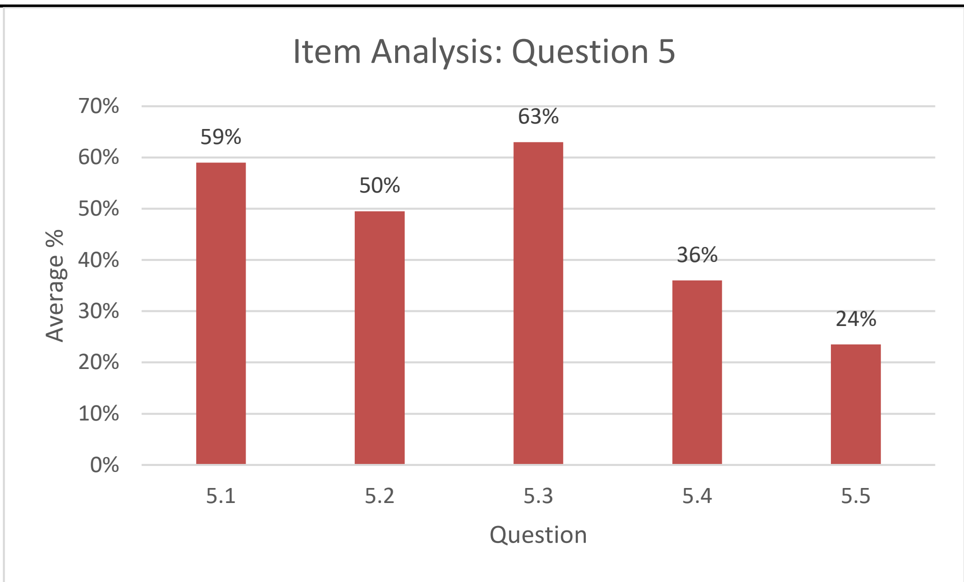
5.4 For which values of $x$ is $f(x) \geq 0$? (3)

5.5 Graph $f$ undergoes a transformation to $h$ where:

- The domain and range of $h$ are the same as that of $f$
- $h^{\prime}(x)$, the derivative of $h$, is negative on its domain

Describe a possible transformation that $f$ could have undergone to result in $h$. (2)
**[10]**

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QESTION 5.1**

- Generally, well answered although there are candidates who have a problem with asymptotes.

**QUESTION 5.2**

- The question was poorly answered by most candidates.
- Most candidates expressed the answer in terms of $q$, consequently, they got 1 mark provided calculations were shown.
- Candidates who wrote the answer as $q = -2$ only were not awarded any marks.

**QUESTION 5.3**

- Well answered by the majority of candidates.
- CA Marking applied from Questions 5.1 and 5.2

**QUESTION 5.4**

- Most candidates were unable to answer this question.
- The question tested the pupil's knowledge of Inequalities with reference to the given diagram.
- Most candidates managed to obtain 1 mark for the $x$-intercept but were unable to conclude. This is due to them failing to answer inequalities in Question 1. Some included the asymptote in the answer i.e. $-\frac{1}{2} \leq x \leq 1$.
- Learners who make use of interval notation must clearly show if they are using squared brackets or round brackets.

**QUESTION 5.5**

- Poorly answered question by most candidates.
- This question is based on the grade 10 syllabus where translation and reflection of functions is introduced.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- Some candidates wrote the equation of asymptote in terms of $q$.
- In Question 5.1, $x=-p$, a lot of candidates wrote that $p=1$instead of $p=-1$. Others candidates used $y=-1$.
- In Question 5.3, candidates lost 1 mark when the answers were:
  - $-\frac{1}{2}\leq x\leq 1$ or
  - $-\frac{1}{2}< x< 1$
- Swapping of values led to candidates getting only 1 mark.

**(c) Provide suggestions for improvement in relation to Teaching and Learning**

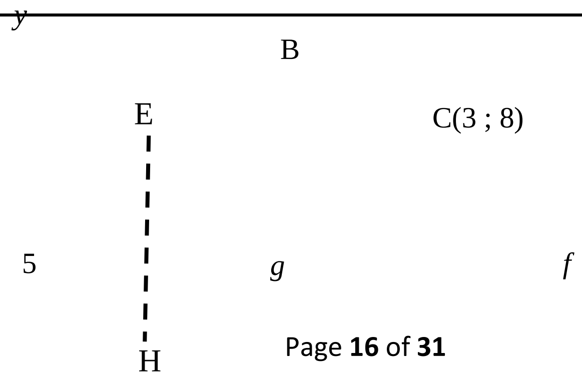
- Teachers need to teach hyperbolas with more examples. There is evidence that learners know how to attempt the hyperbola but when it comes to the intercepts, they need more practice.
- There is need to explain the difference between the equation of asymptote and the values of p and q.
- This question included routine questions (5.1-5.5) on functions but was poorly answered. The majority of functions are completed in grade 11 and learners must be motivated and assisted in revisiting this topic at the beginning of grade 12. Functions form a critical part of the syllabus and can be integrated in many other topics.

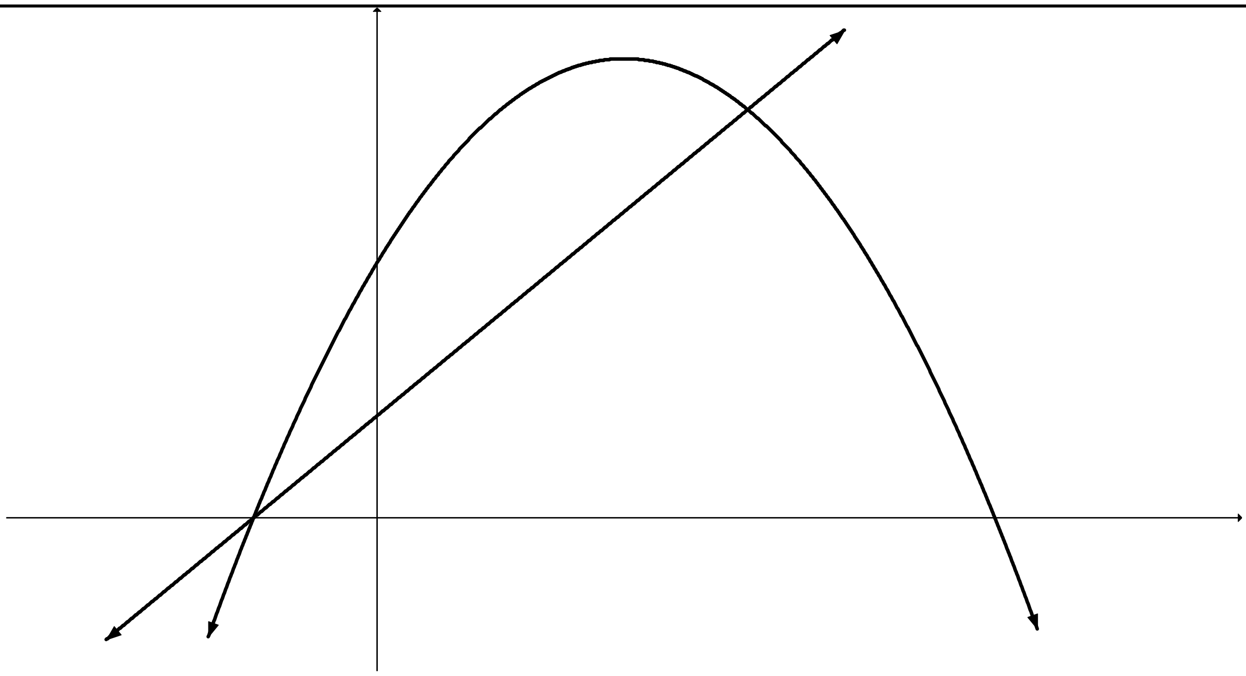
**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- This question is based on the grade 10 syllabus where translation of functions is introduced. More practice and explanation need to be revised in grade 12.
- Revisit transformations from grade 8 and 9 when teaching functions.
- Teach the interpretation of graphs from grade 10.
- Integrate topics from grade 10.
- Interpretation of functions and the correct notations (inequalities) should be stressed when revising. Putting more emphasis on grade 10 and 12 functions.
- Revision of basics algebra when teaching functions because functions need algebraic skills like factorisation, solving of equations etc.

**QUESTION 6**

In the diagram below, the graphs of $f(x)=-x^2+4x+5$ and $g$, a straight line, are drawn. $C(3;8)$ is a point of intersection of $f$ and $g$. EH is drawn parallel to the y-axis, with E a point on $f$ and H a point on $g$.





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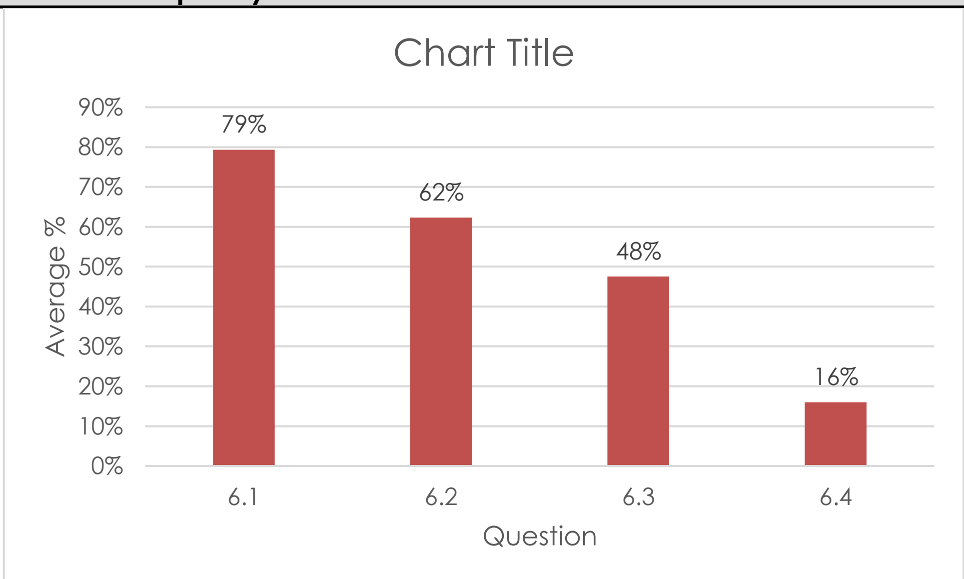
| 6.1 | Calculate the coordinates of B, the turning point of $f$. | (3) |
| 6.2 | Show that the equation of the line through A and C is given by $g(x)=2x+2$. | (3) |
| 6.3 | Calculate the maximum length of EH for $f>g$. | (4) |
| 6.4 | Given: $k(x)=f(x+m)=-x^2-2mx-m^2+4x+4m+5$ | |
| | Determine the value of $m$ such that $g$ is a tangent to $k$. | (5) |
| | | **[15]** |

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 6.1**

- Well answered by most candidates, although some candidates made substitution errors that resulted in a negative axis of symmetry.

- Although the diagram is not necessarily drawn to scale, candidates should have realised that they have made a mistake and worked through their response to correct the error.

**QUESTION 6.2**

- Answered by most candidates.
- Most candidates managed to get full marks, as the first part of the question required them to apply factorisation (Question 1).
- The concept of determining the gradient was applied correctly.
- Candidates who used negative $x$ value rather than $A(-1;0)$ were awarded 2 marks.

**QUESTION 6.3**

- Not well answered by most candidates as they mostly assumed that point E is the reflection of point B about axis of symmetry of $f$.
- Finding the length of EH in terms of $x$ was a key to getting full marks.
- If a candidate uses the midpoint method , $\mathrm{E}(1;8)$ have to be calculated not assumed.
- Equating EH to zero led to breakdown.
- Candidates using trial and error method were expected to show length of EH to get full marks.
- CA marking applied only WHEN the $x$-value used to determine the maximum length is $-1 < x < 3$.

**QUESTION 6.4**

- Poorly answered question by many candidates.
- Candidates do not have any understanding of nature of roots integrated in functions.
- A number of candidates were unable to derive $k(x)$.
- Lack of understanding of the meaning of $f(x+m)$.
- Answer only led to 0 marks.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- In 6.3 candidates did not understand the concept of maximum length, that is, it is always at the midpoint of the distance between intersection of the two functions.
- Common errors made by candidates in 6.3 include:
  - Equating the difference i.e. $f(x)-g(x)=0$, led to no marks
  - $g(x)-f(x)$ led to candidates getting negative value of $x$ as a result of 3 marks if the candidate recognises that the length will never be negative. Then in that case a candidate needs to conclude so as to get the 3 marks.

- Not showing any calculations for the coordinates of E.
- Many candidates derived correctly, some used method of axis of symmetry in finding the value of $x$ but no understanding of what to do after that.

- In 6.4 lack of understanding of tangent integrated with nature of roots

**(c) Provide suggestions for improvement in relation to Teaching and Learning**

- It is not always advisable to draw an accurate graph of the function, but basic graphical concepts of quadratic functions can be helpful in understanding and answering functions.
- Educators should practise a variety of questions of this nature, especially with the stronger learners. It will always be a popular way to test interpretation of functions.
- Assuming values to answer a question does not yield any further marks.

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- Learners should be told that diagrams are not necessarily drawn to scale, therefore they should not assumptions when answering questions.
- Assuming that the diagram is drawn to scale will result in loss of marks.

**QUESTION 7**

7.1 Mary's grandparents deposited R5 000 into a savings account on the day that she was born. The account pays interest at a rate of 6,8% p.a., compounded quarterly. Calculate the accumulated amount in this account on Mary's 16th birthday. (3)

7.2 After 4 years, the value of a printer was half of its original value. Determine the rate at which the value of the printer depreciated over this period, if depreciation was calculated according to a straight-line method. (2)

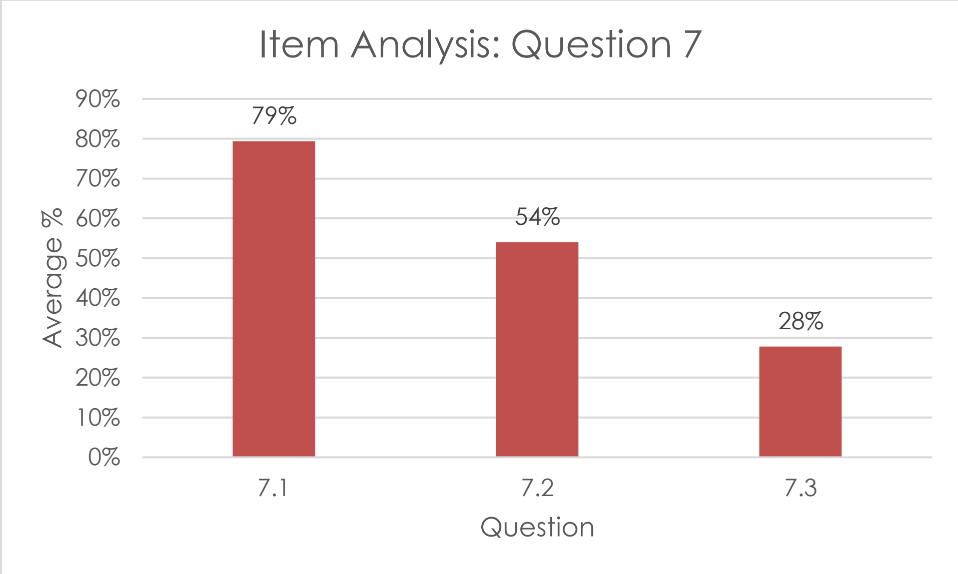
7.3 Tshepo was granted a loan of R100 000 on 1 March 2022 at an interest rate of 13,5% p.a., compounded monthly. Tshepo agreed to repay the loan over 5 years in monthly instalments of R2 300,98, starting on 1 April 2022.

7.3.1 Calculate the total interest that he will pay over the 5 years. (2)

7.3.2 Tshepo paid R22 300,98 (his monthly instalment and an additional R20 000) on 1 March 2024 into the loan account. He continues to pay the original monthly instalment thereafter. How many months earlier will Tshepo repay the loan? (7)

**[14]**

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 7.1**

- This was one of the most accesible questions to the candidates in comparison with the rest of the paper.
- The mistake committed by most of those who did not get full marks was that of failing to get $n = 64$. Many worked with 16 rather.

**QUESTION 7.2**

- It was not done as well as expected mainly due to candidates failing to write a correct formula for straight line depreciation.
- Some candidates did not write their answers as percentage, hence they lost a mark.

**QUESTION 7.3.1**

- Fairly answered although some candidates used the future value formula.

**QUESTION 7.3.2**

- This was one question that was not done well at all. Many candidates struggeld with just doing the first part.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- Questions 7.1 and 7.2 were supposed to be well done but because of not knowing their formulas, candidates lost marks.
- Question 7.3.2 was done badly because most of the candidates could not understand the R22 300,98, they thought that it was a new instalment'
- They did not know which formulas to use when.
- Some candidates probably thought that it was impossible to use the present value formula twice in the same problem. So they got confused after finding the present value formula after 24 months.

**(c) Provide suggestions for improvement in relation to Teaching and Learning.**

- Educators should teach all formulas and desist from calling formulas according to the grades in which they were done. Candidates should understand that questions in the exam can be based on any concept regardless of when they were done.

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- Examiners should consider not assigning less marks to higher order questions because that would mean that if a candidate does not answer that question, he/she could have lost too many marks probably in a topic that he/she is strong in.

**QUESTION 8**

8.1 Determine:

8.1.1 $\frac{d}{dx}\left[3x-5x^2\right]$ (2)

8.1.2 $g^{/}(x)$ if $g(x)=\frac{2}{x^2}-\sqrt[3]{x^7}$ (4)

8.2 Determine the equation of the tangent to $f(x)=x^3-4x^2+2x+3$ at $x=2$. (3)

8.3 Given: $f(x)=-6x^2$

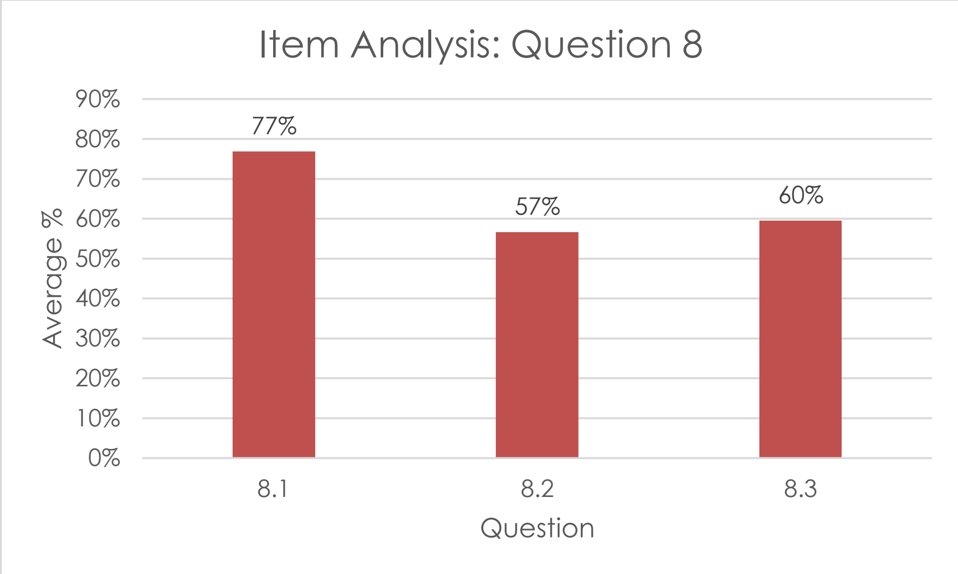
8.3.1 Determine $f^{/}(x)$ from first principles. (5)

8.3.2 Write down how you will restrict the domain of $f$ such that $f^{-1}$, the inverse of $f$, is a function. (1)

8.3.3 Determine the equation of $f^{-1}$ for $f^{-1}(x)\leq 0$. Write your answer in the form $y=\ldots$ (3)

**[18]**

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 8.1.1**

- This question was done very well.
- Most candidates got the full marks.

**QUESTION 8.1.2**

- Not badly done although most of those who failed could not rewrite the two terms in a factorisable form.
- Some candidates wrote $-\sqrt[3]{x^7}$ as $-x^{\frac{3}{7}}$ thereby losing a mark unnecessarily.

**QUESTION 8.2**

- The questions was not badly done. The most common mistake was that finding $f'(x)$, many candidates calculated the value of $y$ by finding $f'(2)$ instead of $f(2)$.

**QUESTION 8.3.1**

- Fairly well done. Most candidates were able to get at least 4 marks in this question.
- There is a common tendency by candidates to skip the stage of substitution, $f(x+h)-f(x)$ is written as $-12xh-6h^2$ leaving out the $-6x^2$ at the start and the $-(-6x^2)$ at the end.

**QUESTION 8.3.2**

- Fairly well done as well, however most of the candidates who did not get it right did not include $x=0$ in their answers.

**QUESTION 8.3.3**

- This question was not too much of a challenge, except that the negative under the square root sign upset many candidates. This resulted in many candidates picking up the positive root for the final answer, i.e. $y=\sqrt{-\frac{1}{6}x}$.
-

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- Learners struggle with changing terms with the root sign into exponential terms.
- If the exponential term is in the denominator, learners struggle to rewrite such terms as numerators.
- In first principles, the candidates skipped some stages, especially substituting $f(x)$ into the first principles formula.

**(c) Provide suggestions for improvement in relation to Teaching and Learning**

- Educators are encouraged to teach how to convert terms of the form $\frac{k}{x^2}$ to $kx^{-n}$.
- Likewise, they should help learners convert terms with root signs into terms with fractional exponents.
- Educators should explain the conceptual meaning of a derivative in relation to functions of order 2 and more.
- Educators should emphasise on correct substitution into first principles formula to gain full marks.

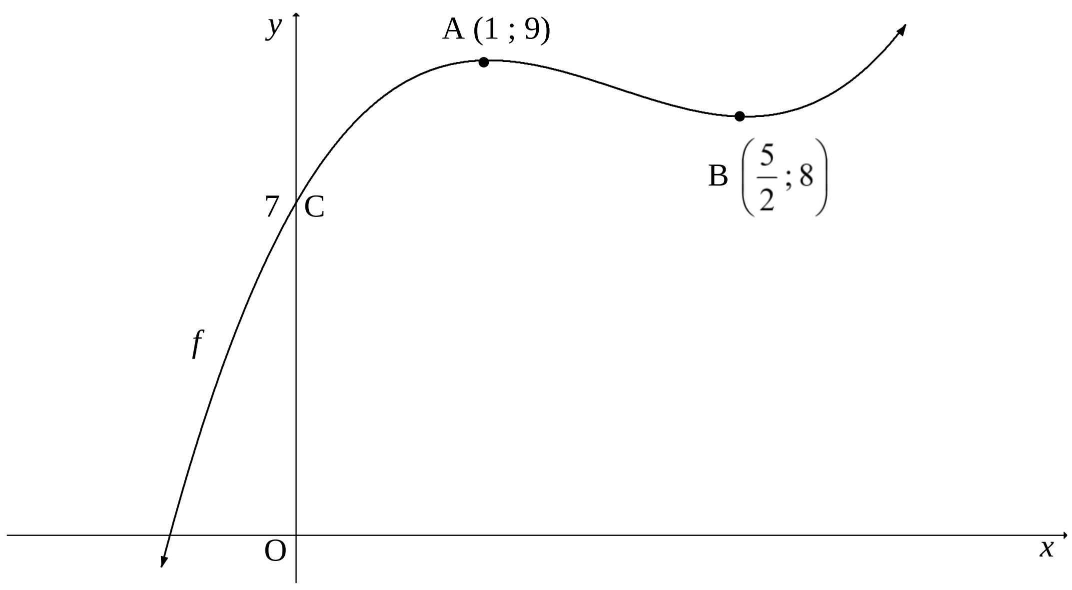
**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- Educators should teach concepts collaboratively, and avoid treating them in isolation at all times.

**QUESTION 9**

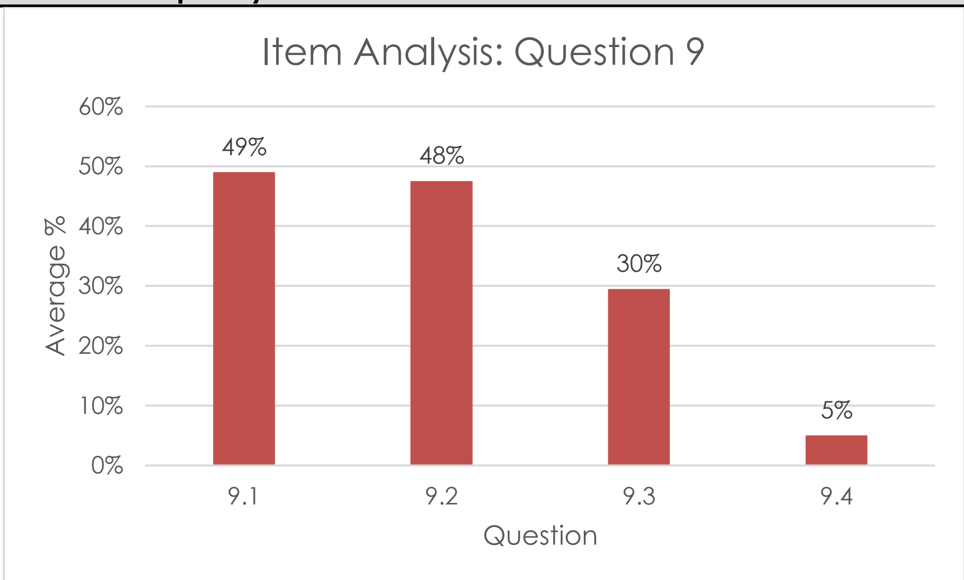
A(1 ; 9) and B$\left(\frac{5}{2};8\right)$ are the turning points of graph $f$ below.

C(0 ; 7) is the $y$-intercept of $f$.



| | | |
|---|---|---|
| 9.1 | For which values of $x$ is $f$ decreasing? | (2) |
| 9.2 | Write down the $x$-intercepts of $f'$, the derivative of $f$. | (2) |
| 9.3 | For which values of $x$ will $f$ be concave up? | (2) |
| 9.4 | Determine the value of $k$ for which $y = f(x) + k$ will have THREE positive $x$-intercepts. | (2) **[8]** |

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 9.1**

- Out the whole question, this part was done better compared to the rest. The only challenge is that learners struggle with when to use a >, <, ≤ or ≥.
- Many candidates did not understand how to identify a decreasing graph from a diagram. They were just writing random inequalities.

**QUETSION 9.2**

- This was not easy for most candidates as could not establish the relationship between the turning points of a cubic function and the intercepts of its derivative,
- The fact that the equation of the function was not given made it very difficult for candidates who do not understand how a derivative relates to its parent function.

**QUESTION 9.3**

- Once again, candidates struggled with understanding the relationship between a point of inflection and the second derivative of a function.
- The concept of concavity is not fully developed in our learners.

**QUESTION 9.4**

- This question extremely poorly answered.

- The concept of understanding inequalities versus an answer with negative numbers was quite a challenge.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- Learners usually get confused between concave up and concave down.
- They do not know the relationship between a point of inflection and concavity.
- Many candidates had an idea on this question but they were probably confused by one '*a value of k*'
- Also the fact that the lies between two consecutive integers made it as how they can identify a value of k.

**(c) Provide suggestions for improvement in relation to Teaching and Learning**

- Educators are encouraged to teach different formats of writing inequalities and make their learners get used to move from one notation to another.
- The relationship between a cubic function and its two derivatives must be emphasized. Learners should be able to get a function from its point of intersection and intercepts

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- When teaching functions in general, teachers need to try by all means possible to use visual impact to explain their graphs. The relationship between a cubic function, its first derivative and its graph and the second derivative and its graph can be explained better that way.

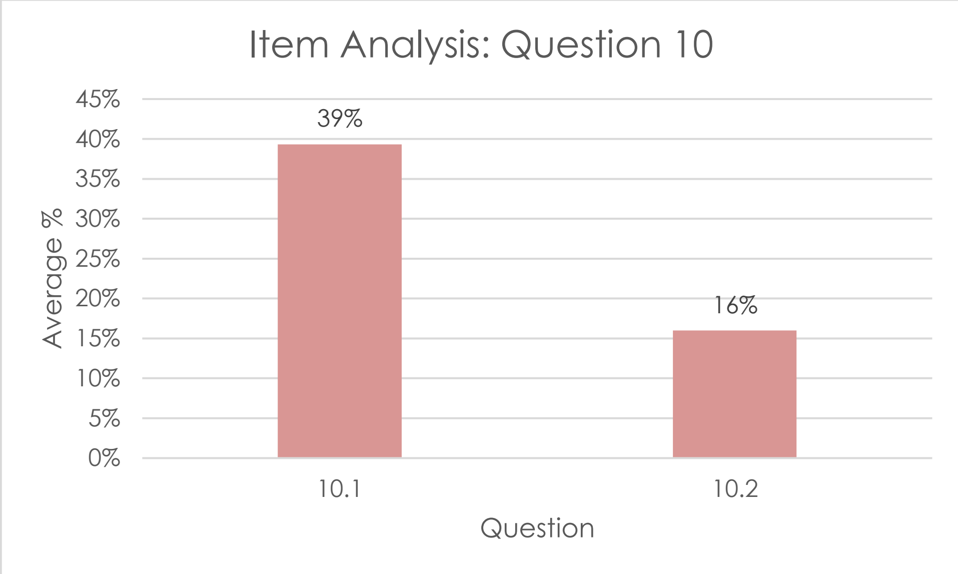
**QUESTION 10**

A cyclist rode from town P and stopped at town T. The speed (in km/h) at which this cyclist rode, is represented by the equation $s'(t) = -3t^2 + 18t$.

**NOTE:** Speed is the rate of change in distance with respect to time.

| | | |
|---|---|---|
| 10.1 | Calculate the maximum speed that the cyclist reached on this ride. | (3) |
| 10.2 | Calculate the distance between town P and town T. | (5) |
| | | **[8]** |

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 10.1**

- The breaking of the application of differential calculus into two was highly welcome. It made the question as a whole to be accessible to many of our learners. This sub question assisted a lot of candidates to acquire at least a mark in this question.
- Most of the learners did not understand the link between the maximum ia parabola and maximum speed of an object that describes the equation of a parabolic function.
- Many candidates found the second derivative, s''(t) simply because they were taught to find the first derivative, equate to 0 and then solve. They did not realise that s'(t) was already a velocity/speed function.

**QUESTION 10.2**

- This was a very challenging question mainly because the original function was not given.
- Most learners could not reverse the first derivative back to the original function mainly because they are not versed with intergration. Yes they could have used inspection but it is difficult if it is not actively done in class.
- For the few who managed to get some marks in this sub question, they got them mostly from finding the values of t, otherwise they could not proceed beyond that stage.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- While it is true that candidates could have used inspection in Question 10.2, the question was probably somewhat unfair because anti derivatives are not actively done at school. There were a number of instances in which candidates just froze after finding the values of *t*.
- Many learners used what they call estimate methods from Physical Sciences and ended up getting inaccurate answers.
- Generally, there is a tendency by many educators to skip application of calculus on the

grounds that it is a very difficult topic, so even if the question is not that challenging, they still fail to answer it.

- Candidates did not know the relationship between distance, speed/velocity and acceleration in terms of derivatives. This could have helped them to find s(t) much easier.

**(c) Provide suggestions for improvement in relation to Teaching and Learning.**

- It is important for educators to teach all topics that are in the syllabus regardless of how difficult or easy they are perceived to be.
- A lot of examples that can relate to real life should be used to teach application of calculus.
- Always teach for conceptual understanding so that learners can be able to deal with different types of application problems.

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

- We came across a lot of instances where the candidate treated the problem as if there was a constant acceleration, which is not correct but the answer would be the same.

**QUESTION 11**

A certain number of learners are sitting for examinations in Mathematics, Tourism and Geography.

- All these learners sit for at least one of these examinations.
- The total number of learners who sit for Mathematics (M), is 22.
- The total number of learners sitting for Tourism (T), is 16.
- The total number of learners sitting for Geography (G), is 18.
- 5 learners sit for Mathematics and Tourism, but not Geography.
- 4 learners sit for Mathematics and Geography, but not Tourism.
- 3 learners sit for Tourism and Geography, but not Mathematics.
- 6 learners sit for only Tourism.

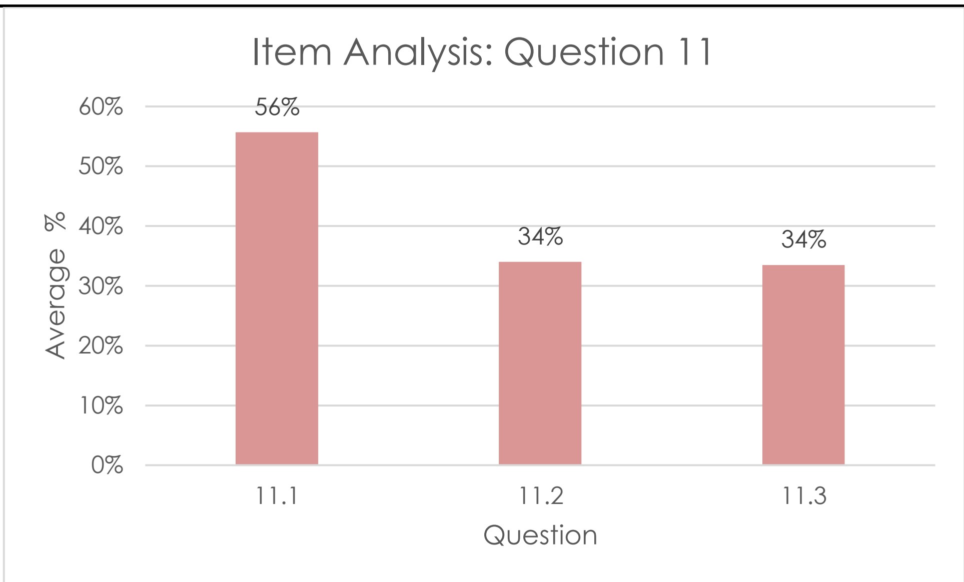
11.1 Draw a Venn diagram to represent ALL the learners sitting for these examinations. (3)

11.2 Calculate the probability that a learner, chosen at random, will sit for examinations in at least TWO of the subjects. (2)

11.3 Determine if the events: sitting for examinations in Mathematics and sitting for examinations in Tourism are independent. Support your answer with the necessary calculations. (4)

**[9]**

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**




**QUESTION 11.1**

- This was the most accessible sub question. Most candidates managed to score high, as is supported by the sample average of 56%.
- Most candidates managed to score 2 out of the 3 marks because they could not find $n(M \cap T \cap G)$. The other reason was that they created a figure other than 0 outside the union of the 3 sets but inside the universal set by subtracting 40 from the raw total of the sets, i.e. 56.

**QUESTION 11.2**

- The question was not well answered as many learners did not get the right sample space and could not identify the intersection of the 3 sets as part of the '.... at least two subjects....'
- In addition, for those who could not find the value of the intersection of the 3 sets, they did not know how to deal with it in finding the required probability.

**QUESTION 11.3**

- This was also not done well mainly because after failing to find the numerical value of the intersection of the 3 sets, many candidates did not how to proceed from there.
- The majority could not remember the condition for independence, i.e. P(A and B) = P(A) x P(B), hence they lost all the marks in this sub question.
- In this question again, most candidates did not include the intersection of the 3 sets in finding P(M and T) from the Venn diagram.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

- As stated above, this question was poorly done mainly due to the omissions and due to misconceptions about intersection of sets on a Venn diagram.
- Since this topic was covered in Grade 11, some of the candidates could have forgotten

the basic concepts about Venn diagrams.

- Proof of independence is also covered in Grade 11 and it is not so common in the past exam papers for Grade 12, as such many candidates were caught unaware.

**(c) Provide suggestions for improvement in relation to Teaching and Learning**

- Teachers should conscientise their learners of the fact that any concept can be tested in the exam regardless of it not having been covered in Grade 12.

**(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.**

**QUESTION 12**

A company generates a 4-character code using the 26 letters of the alphabet and the 10 digits, from 0 to 9.

The code is in the form:

| letter | digit | letter | digit |
|---|---|---|---|

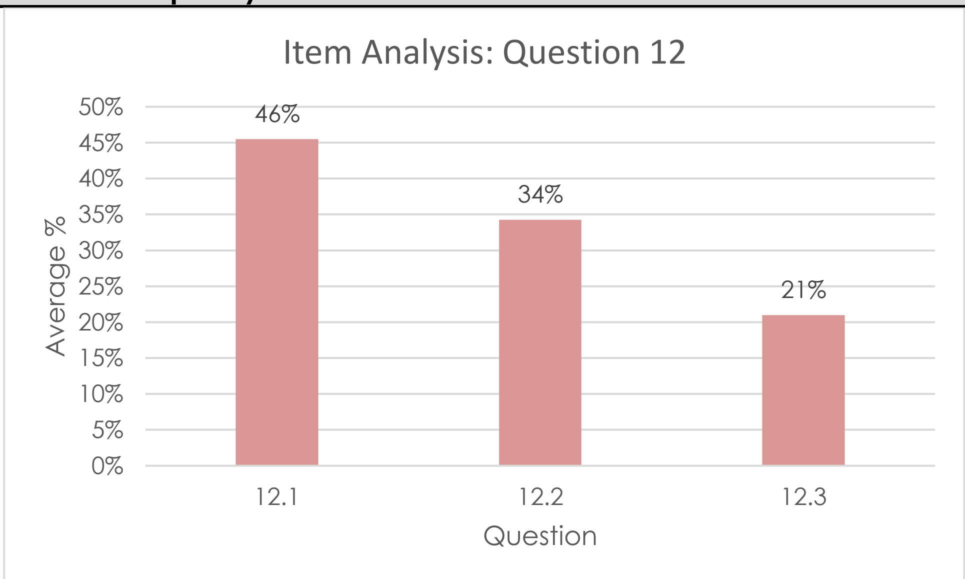
12.1 Determine how many different codes can be formed if letters and digits may be repeated. (2)

12.2 Determine how many different codes can be formed if:

- The letters D, F, I, Q, U and V may NOT be used
- The code may NOT start with a W or a Z
- Letters or digits may NOT be repeated
- The code ends with an odd digit (4)

12.3 The company wishes to increase the number of 4-character codes formed in QUESTION 12.2 by allowing the letters D, F, I, Q, U and V to be used. Calculate the percentage increase in the number of different codes that can now be formed. (2)
**[8]**

**(a) General comment on the performance of candidates in the specific question. Was the question well answered or poorly answered?**



Candidates did better in this question compared to the previous year. It was interesting though to note that the average for Question 12.1 was below 50%. This was the most accessible part of the question. The last sub question was challenging and depended on Question 12.2. Maybe asking for a percentage instead of probability directly could have unsettled some candidates. Otherwise this was an accessible question to most of the candidates although some of them could have been lost in the many conditions associated with making the code.

**(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**

The question was not as challenging but yes, it was not well answered. Besides the fact that it is once off the last question in the paper, it is possible that some candidates could not get to it, although they could have answered some of the sub questions correctly.

**QUESTION 12.1**

- As is normally the case, this question is usually well answered. Those candidates who failed to get it right do not understand the concept of factorial versus exponents.
- Some of the answers we got include $26!\times10!\times26!\times10!$, with some even adding the factorials.
- The last group went with $26!^2\times10!^2$.

**QUESTION 12.2**

- Some candidates who got this question wrong did not understand the order of occurrence of the events. They did not know what should occur first in terms of placing the W and the Z versus the rest of the letters.
- A number of candidates used the factorial notation where it was not needed.
- The placing of the first odd digit was also a challenge because candidates placed it before realising that the odd digit cannot be the last. e.g. 18 x 10 x 19 x 5.

**QUESTION 12.3**

- In Question 12.3, candidates did not understand the question and did not realise that percentage can be another way of writing probability.
- Most of what was done by those who struggled with the question did not make sense although they went on to calculate some percentage.
- Most of the candidates could not obtain 27 000, which made it difficult for them to make sense of the question.

**(c) Provide suggestions for improvement in relation to Teaching and Learning**

- While the teaching of this topic can be a challenge, teachers are encouraged to teach the topic in conjunction with probability in Grade 11.
- Teachers should focus on conceptual understanding first before asking our learners to use past exam papers.
- Teachers should not discourage learners from focusing on topics that are unusual have

higher order questions because sometimes the questions will be straight forward, which is the case in this case.

| **(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.** |
|---|
| • There is no harm in using a calculator as a tool, but it does not help the learner if he relies on it and skip stages in solving problems. The learners must understand that answers only will not necessarily result if full marks, more so if the answer is wrong, then he will automatically lose the marks for the working.<br>• Learners should be helped to understand that there is no stipulation from the CAPS documents as to which topic Level 3 and 4 questions should come from. Easier questions can come from these difficult topics, like in this case this year. So if they would not have been taught, they will not be able to answer even if the questions are easy. |