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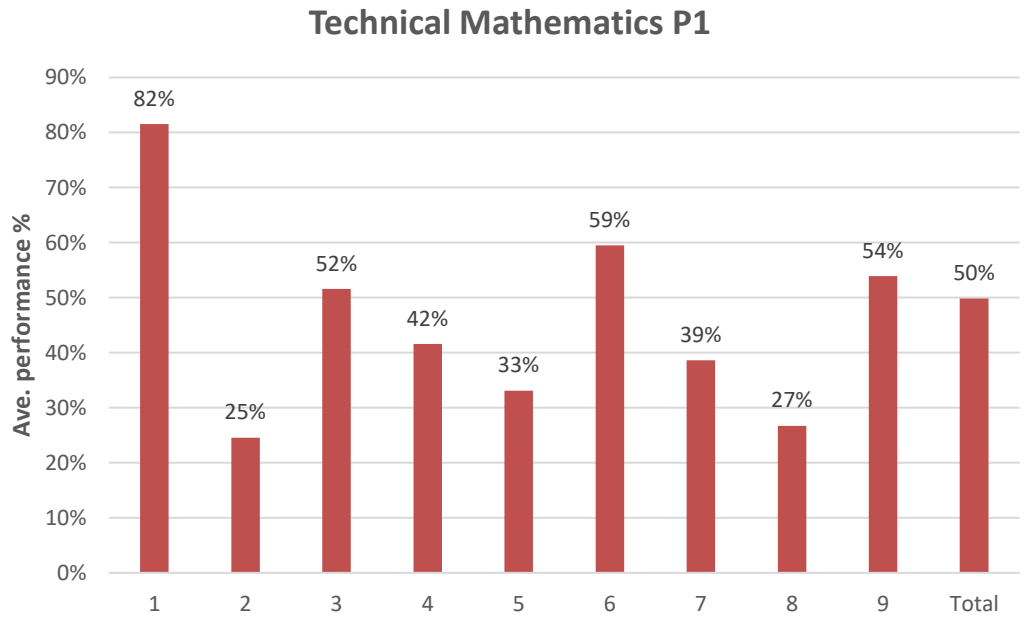
REPUBLIC OF SOUTH AFRICA, Website: www.ecdoe.gov.za

2024 NSC CHIEF MARKER'S REPORT

SUBJECT	**TECHNICAL MATHEMATICS**		
QUESTION PAPER	**1 X**	**2**	**3**
DURATION OF QUESTION PAPER	**3 HOURS**		
PROVINCE	**EASTERN CAPE**		
NAME OF THE INTERNAL MODERATOR	**MS N. TOM**		
NAME OF THE CHIEF MARKER	**MR A.E MAMPOFU**		
DATES OF MARKING	**29NOV – 9 DEC 2024**		
HEAD OF EXAMINATION:	**MR E MABONA**		

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

The graph below shows a RASCH analysis of learner performance based on the 100 scripts sample moderated.



erformance %

1	Equations, Inequalities and Binary numbers	82%
2	Nature of roots of quadratic equations	25%
3	Exponents, Surds, Logs and Complex numbers	52%
4	Functions and Graphs	42%
5	Finance, Growth and Decay	33%
6	Differential Calculus (Differentiation)	59%
7	Differential Calculus (Cubic Graph)	39%
8	Differential Calculus (Optimisation)	27%
9	Integration	54%
Total		**50%**

Candidates performed fairly well in this paper at an average of 50%. The question in which the candidates performed excellent was question 1 with an average that is above 80%. They were able to score marks in questions requiring knowledge and routine

procedures. Some candidates displayed limited algebraic skills required to

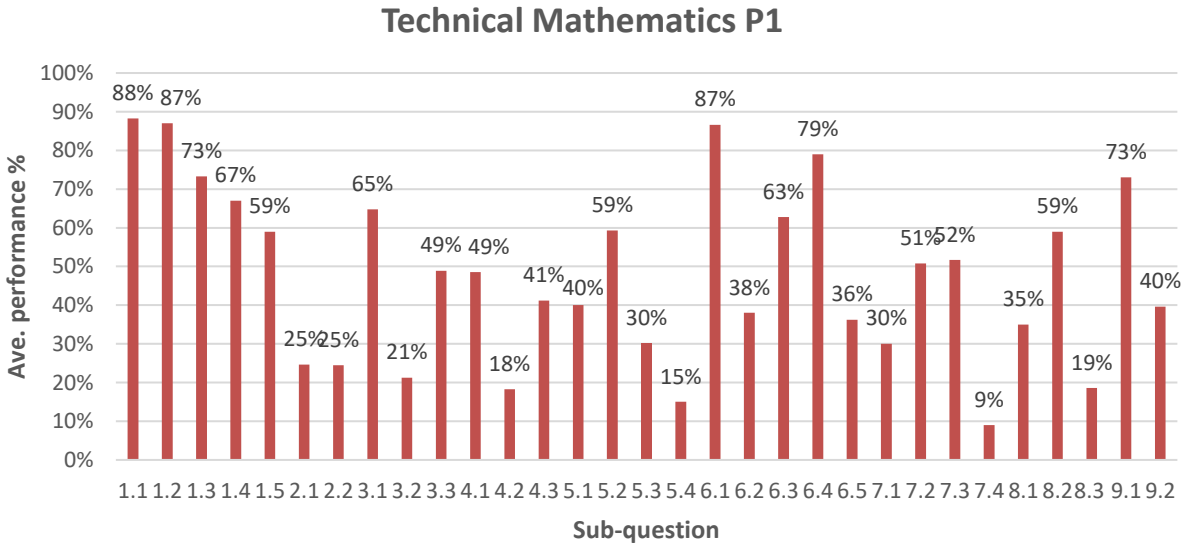
solve many mathematical problems.

The poorly performed questions below 40% with averages 25%, 27%, 33%, and 39% respectively were Q2, Q5, Q7 and Q8. Many candidates performed poorly in questions involving applications and problem solving mostly interpretation of graphs were either Some candidates did not adhere to the instructions as stipulated in the question

paper like correct numbering of questions, use of answer sheet for diagrams and submit with their answer book.

SECTION 2: Comment on candidates' performance in individual questions

The graph below shows a RASCH analysis of learner performance based on the 100 scripts sample moderated per sub-question.



Topic	Ave. performance %
Quadratic equations and Inequalities	88%
Simultaneous equations	87%
Literal equations	73%
Binary numbers	67%
Binary numbers	59%
Nature of roots	25%
Nature of roots	25%
Exponents,Surds and Logarithms	65%
Exponential Equations	21%
Complex Numbers	49%
Semi-circle and Exponential graphs	49%
Quadratic Function (Parabola)	18%
Hyperbolic Function	41%
Nominal Interest rate	40%
Population growth	59%
Period	30%
Timelines	15%
First Principles	87%
Differentiation rules	38%
Differentiation rules	63%
Differentiation rules	79%
Tangent to a curve	36%
Length	30%
x- ntercepts	51%
Application- turning points	52%
Interpretation in graphs	9%
Loss	35%
Differentiation rules	59%
Maximum Profit	19%
Indefinite integral	73%
Area bounded by a graph	40%

QUESTION 1

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

QUESTION 1

1.1 Solve for x:

1.1.1 $x(2x + 7) = 0$ (2)

1.1.2 $3x^2 + x = 6 + 5x$ (correct to TWO decimal places) (4)

1.1.3 $x^2 + 3x - 10 \leq 0$ (3)

1.2 Solve for x and y if:

$y - x = 2$ and $x^2 + y^2 = 20$ (6)

1.3 The formula used to determine CR (compression ratio) when combustion and swept volumes are given is:

$$CR = \frac{CV + SV}{SV}$$

Where:

CR = compression ratio
CV = combustion volume (cm^3)
SV = swept volume (cm^3)

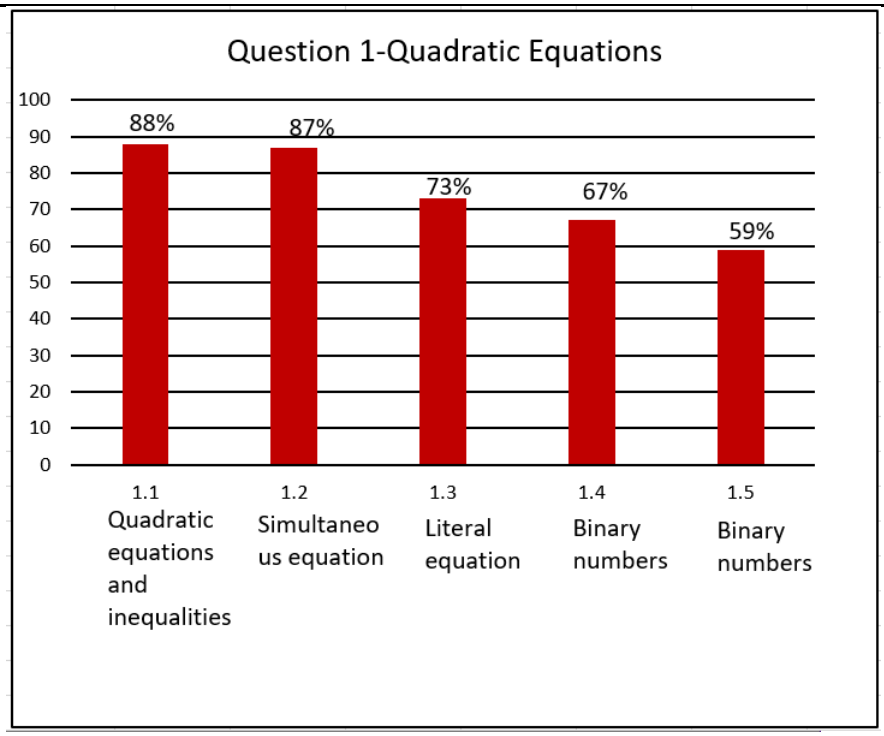
1.3.1 Make CV the subject of the formula. (2)

1.3.2 Hence, calculate the numerical value of CV if $SV = 48$ cm^3 and the compression ratio is equal to $9,5 : 1$. (2)

1.4 Express 1110_2 as a decimal number. (1)

1.5 Evaluate $1110_2 \times 35$ and leave your answer as a binary number. (2)

[22]



Q1.1.1 Some candidates find product of the given factors form and to get the correct standard form and fail to factorise again or substitute correctly into the quadratic formula.

Few candidates failed to solve $x(2x+7)=0$ they wrote $x=-2 \text{ or } x=-7$

others write $x=-7/2$ only omitting $x=0$

Q1.1.2 Few candidates failed to copy the quadratic formula correctly from the information sheet. They were also confused by the values of the a, b and c variables, some swopped them when they were substituting in the formula.

1.1.3 Most candidates wrote incorrect notation.

They displayed poor understanding of < and ≤ and ended up swapping critical values

for example, $2 \leq x \leq -5$, $-5 < x < 2$

Q1.2 Some candidates could not make x or y the subject. They experienced challenges with squaring a binomial.

Some candidates decided to make x the subject of the formula so that they remain with y as the only unknown variable to give rise to the equation $2y^2-4y-16=0$ or $y^2-2y-8=0$ 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 thus used values of x and y interchangeably.

Q1.3.1 Many candidates failed to make CV the subject of the formula and in Q 1.3.2 failed to substitute the given values. They lacked the necessary understanding of ration given. This is a result of not being able to manipulate fractions.

Q1.5 Some candidates multiply binary by decimal instead of converting binary to decimal or decimal to binary

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

Teachers should use different methods when teaching the concept of quadratic equations and inequalities. It should be explained thoroughly to Candidates the difference between a linear equation and quadratic equation.

Graphical approaches make it easier to explain the concept of whether the roots are real or non-real and where the solution lies in the case of inequalities. Revision of products and factors done in earlier grades should be done.

Teacher should emphasize to learners the different quadratic equations presentations so that learners can differentiate between standard form and factor form.

Revision of previous grades work is strongly advised.

Teachers need to thoroughly explain the differences in equality signs and their meaning using various representations integrating Algebra and Functions.

Emphasize that numbers are read from small number to bigger number.

Basics of simplification dividing by -1 and its effect in the inequality sign.

Emphasize that before doing anything, numbers must all be in the same format, be it binary form or decimal form.

Questions involving real-life technical applications should be given to Candidates during the teaching and learning process for Candidates to be able to link them with mathematics.

Workshops before the topic is taught must be adopted by the districts so that Teachers can share their good expertise on the topic and Chief Markers Report and the Diagnostic Analysis must be mediated continuously in such workshops.

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

1.1.1 The key CFS – BODMAS – ERS for solving Quadratic Equations and Inequalities is very important in trying to make the entire question 1 routine.

- Candidates in solving quadratic equations must start by checking the type of an equation given to them. This must be done in an orderly manner by testing for the easy to solve first, which is C – Common Factor form. If the equation does not have a common factor then they must test check if it is in factor form – F or Standard form – S or has Brackets – B or the variable being solved is in the denominator – D or there is anything to be transposed – A or S or the variable is at the exponent – E or there is a radical – R and Simultaneous Equations – S. This order can help Candidates know the type of a quadratic equation and their disposal and so can apply appropriate method to solve it.
- Candidates should be exposed to different forms of quadratic equation representation and methods of solving them. Correct use of calculators should be encouraged, and these be utilized during the teaching and learning process where necessary.

1.1.2 Training Learners on solving equations that require transposition is very vital in Technical Mathematics. This should not only be done during revision sessions but must be done throughout the year as all TMAT questions will always require transposition abilities. It should be treated as a separate sub topic that needs to be tested regularly throughout.

- Formula sheets need not be given to candidates during examinations only. They should be having formula sheets pasted in their notes books and must be utilized all the time. This will help candidates get used to the use, selection and copying of the correct formula from the formula sheet.
- Informal assessments where Candidates are required to write different formulas prescribed for Technical Mathematics must be done. In that way Learners will be used to writing the formulae correctly.
- The use of quadratic formula in Grade 12 is encouraged from the beginning of the year but Learners must be exposed to various types of quadratic equations. Where a binomial is presented to the candidate to solve, they must make it a trinomial so that it resembles the general quadratic equation. Should.

1.1.3 Teachers should drill Candidates on the use of correct notation. Explain thoroughly what it means when the solution lies between the two critical values, the use of “and”, [ ], “or”,( )

- Graphical interpretation of the solution sets must be emphasized during teaching of inequalities.

Candidates be made aware the variable in their quadratic equation must be made the subject of the formula in the quadratic formula:

QUESTION 2 (Summary)

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

QUESTION 2

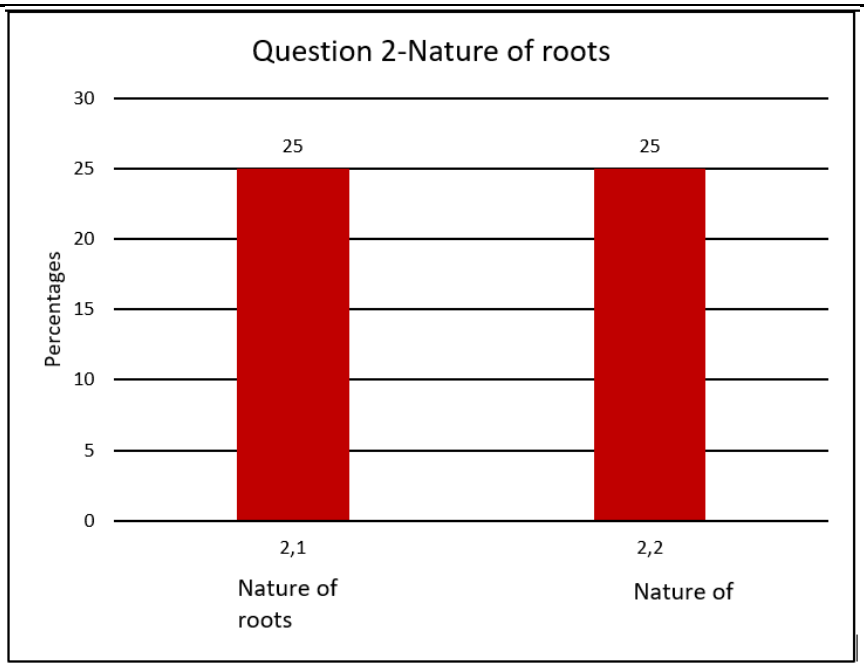
2.1 Given: $x = \frac{-2 \pm \sqrt{1-7p}}{3-p}$. Determine the numerical value(s) of p if x is:

2.1.1 Undefined (1)

2.1.2 Non-real (2)

2.2 Determine the numerical value(s) of t for which the equation $3(x+1) = x^2 + t$ will have real roots. (4)

[7]



Question 2 was poorly performed at an average of 25% in 2024 compared to an average of 50% of 2023.

Candidate's responses displayed a miunderstanding of the different condtions for the nature of roots.

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

Q2.1.1 Some candidates wrote $p = -3$ or $x = 3$ instead of $p = 3$

Q2.1.2 Many candidates used $\Delta = 0$ sign instead of $\Delta < 0$

Q2.2 Some candidates failed to get the correct standard form and solve for critical values from their incorrect standard forms.
Many candidates failed to interpret the meaning of real roots and used incorrect notation ($\Delta=0$), could not identify the correct values of a, b and c hence they substituted incorrectly.
They wrote $x^2 - 3x - 3t = 0$ and $\Delta = (-3)^2 + 4(1)(-3) = t$,
Some wrote $\Delta = x^2 - 3x - 3t = 0$

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

Teachers should emphasize to Candidates that $\Delta = b^2 - 4ac$ is used to calculate the discriminant to

describe the nature of roots. Candidates need to be taught that for real roots the discriminant is greater or equal to zero $\Delta \geq 0$.

Teachers should teach learners to understand the differences between notations with regards to nature of roots of quadratic equations.

They should explain to learners the origin of the discriminant and the order of variables and not switch them around. It should be emphasised that $x = \frac{-b \pm \sqrt{b^{2-4ac}}}{2a}$ could be written as $x = \frac{-b \pm \sqrt{b^{2-4ac}}}{2a}$

Learners be given more exercises involving application in nature of roots

Teachers should explain to learners that for

Real roots: $\Delta \geq 0$, non-real roots : $\Delta < 0$, equal roots: $\Delta = 0$

Furthermore, include rational, irrational and unequal roots.

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

- Integration of quadratic function with nature of roots is necessary for better understanding of the kind of roots a function or an equation has.
- It should be stressed to Candidates that in the quadratic formula the term under the radical sign is the discriminant and used to determine the nature of the roots of the equation.
- Teachers should integrate the teaching of nature of roots with the quadratic function to create a clear as visual representation and understanding.

Use of visual representation will better illustrate this leading to a better understanding of the concept

QUESTION 3

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

QUESTION 3

3.1 Simplify the following, **showing ALL calculations**, where applicable:

3.1.1 $27^{\frac{2}{3}}$ (1)

3.1.2 $\left(1+\sqrt{3}\right)^2 - \sqrt{12}$ (3)

3.1.3 $\log_p p$ (1)

3.1.4 $\log_3 81 - \log_2 \sin 30° - \log_5 \sqrt{5}$ (4)

3.2 Solve for x: $5^{x+2} - 5^x = \frac{24}{5}$ (3)

3.3 Given the complex number: $z_1 = \frac{1}{2} \times z_2$ where $z_2 = -2i + 2$

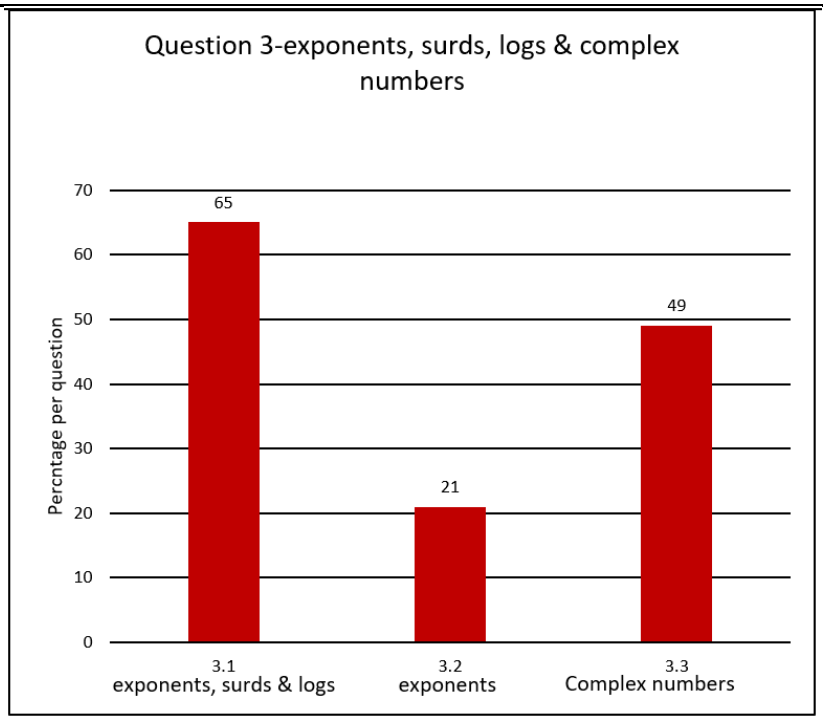
3.3.1 Express z_1 in the form $a + bi$. (1)

3.3.2 Write down $\bar{z}_1$ (conjugate of z_1). (1)

3.3.3 Represent $\bar{z}_1$ (conjugate of z_1) as an Argand diagram on the complex plane provided on the ANSWER SHEET. (3)

3.3.4 Express z_1 in the form $r\,cis\,\theta$, (θ in degrees). (5)

[22]



Candidates performed well at an average of 52% in Q3. They did exceptionally well in 3.1 & Q 3.3 which assessed exponents, surds and logs & Complex numbers. Questions where candidates performed well

above 60% average assessed logarithms and complex equations. Surds in Q 3.1.4 & 3.2 was the least performed question at 21% average.

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

Learners negated both the real part and the imaginary parts of the complex number on writing the conjugate of z_1. Q3.1.1 and Q.32 Candidates failed to simplify the exponents using the exponential laws. Wrote $5^{(x+2)} - 5^x = \frac{24}{5}$ as $5^x.5^2 - 5^x = 5^{24}$

$$x + 2 + x = 24$$

Q3.1.2 Some learners were unable to square a binomial with a term which is a surd. They managed to write it in exponential form though failed to square it.

Few were failed to write $\sqrt{12}$ as $2\sqrt{3}$

Q3.1.3 and Q3.1.4 Some candidates displayed limited understanding of log laws and failed to write $\sin 30^o$ as $\frac{1}{2}$

Q3.3.1 Candidates were able to make a substitution but failed to simplify to the required form.

Some candidates responded to Q 3.3.2 in Q3.3.1 and no answer in Q3.3.2.

There were candidates who did not know how to write the conjugate of the complex number, the changed signs in both terms. Furthermore, failed to draw the correct Argand diagram.

The Argand diagram was either drawn in a wrong quadrant which does not correspond with the conjugate or drawn in two quadrants. Others drew the parabolic graph or draw semi-circle.

Q3.3.4 Many candidates could not identify the correct quadrant. Some confused the reference angle with the actual angle. Some even went beyond the scope of curriculum.

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

Exponential and Surd expressions or equations can easily be simplified if Teachers train their Learners on using a calculator to express any numerical term as a product of its prime factors (Prime factorisation). The departure will always be in that simplifications the algebraic manipulation follows.

Teachers need to ensure a thorough revision of the application of laws of exponents, surds, and logarithms is done and expose Candidates to different forms of representations.

Teachers should intensify the revision of laws of exponents and logs.

Correct use of calculators is encouraged.

More activities requiring learners to write conjugate so that they be able to know which part to be changed between real or imaginary.

Plotting and labelling of diagrams should be demonstrated to learners using various graphing software. Teachers must teach the learners to determine the reference angle separately and write the reference angle as positive. Emphasis should be on the quadrants where the complex number Z lies.

Familiarize learners with special answer sheet during the writing of tests and internal examinations.

Candidates should be exposed to different types of problems involving complex numbers and forms of expressing complex numbers in polar form or rectangular form.

(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, an Argand diagram is useful in identifying the quadrant in which the real, imaginary part and angle are found.

Calculator use training is needed for the Learners to avoid the incorrect answers.

School managers must assist Technical Mathematics Teachers on making Learners buy their own calculators so that they are used to them. Borrowing a calculator on the day of examination makes Candidates get incorrect solutions.

Teachers should emphasise to learners to adhere to the given instructions, this should further be encouraged even during the writing of SBA tasks.

QUESTION 4

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

QUESTION 4

4.1 Given functions f and h defined by $f(x) = 3^x - 1$ and $h(x) = \sqrt{25 - x^2}$

4.1.1 Write down the equation of the asymptote of f. (1)

4.1.2 Write down the domain of h. (2)

4.1.3 Determine the x-intercept of f. (2)

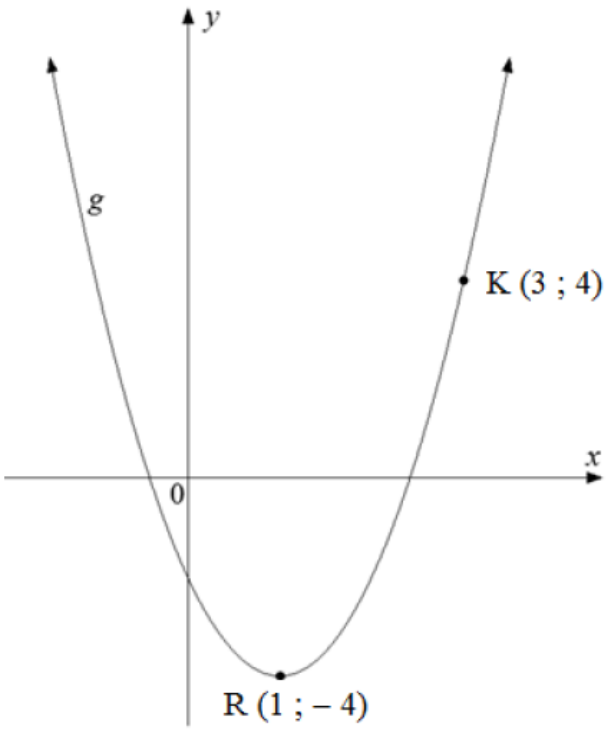
4.1.4 Determine the y-intercept of f. (2)

4.1.5 Draw sketch graphs of f and h on the same set of axes provided on the ANSWER SHEET. Clearly indicate ALL the intercepts with the axes and the asymptote. (5)

4.1.6 Hence, use your graph to determine the values of x for which $f(x) \times h(x) \leq 0$ (2)

4.2 The graph below represents function g defined by $g(x) = a(x - p)^2 + q$

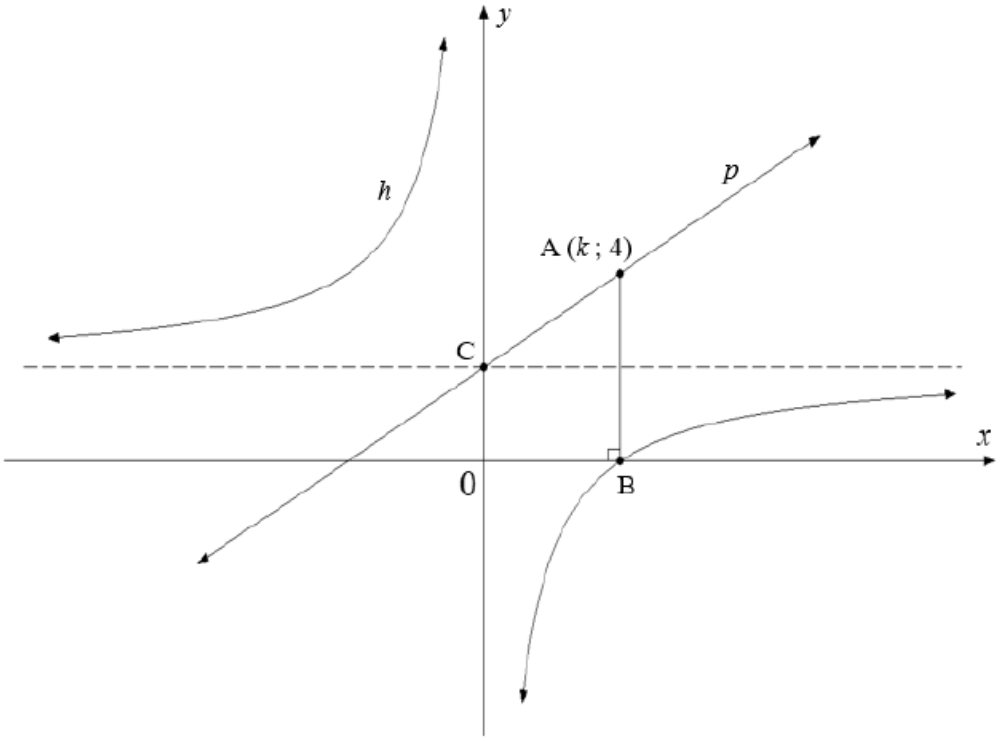
R(1 ; −4) is the turning point of g and K(3 ; 4) is a point on g.



Determine the equation of g in the form $g(x) = ax^2 + bx + c$ (4)

4.3 The graphs below represent functions h and p defined by $h(x) = \frac{a}{x} + q$ and $p(x) = x + 2$.

- A$(k\ ;\ 4)$ is a point on p and B is the x-intercept of h.
- The asymptote of h passes through C, the y-intercept of p.
- AB is perpendicular to the x-axis.



4.3.1 Write down the equations of the asymptotes of h. (2)

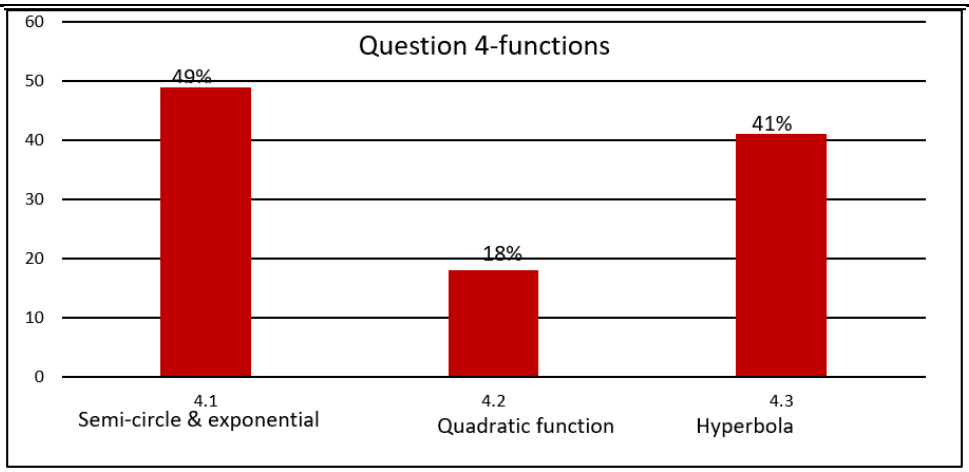
4.3.2 Determine the numerical value of k. (2)

4.3.3 Hence, write down the x-coordinate of B. (1)

4.3.4 Hence, determine the defining equation of h. (2)

[25]

Q4 was not well performed by the candidates. The average for this question was 42%. Six sub-questions' performance was below 30% and these questions were mainly assessing the interpretation of graphs. Candidates did well in questions where coordinates and lengths were required. The question assessed Functions and graphs which were done in lower grades



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

Q4.1.1 Some candidates wrote -1 instead of $y=-1$, they ignored the fact that an equation contains an equal sign. They also wrote the asymptote as a function of x, i.e $f(x)=-1$ or $f=-1$

Q4.1.2 Many candidates did not write the correct notation; they presented the solution as:
$-5\le 0\le 5$ or $-5\le x\ge 5$ or $x\in(-5;5)$
$-5\le x$ or $5\ge x$

Some candidates wrote domain in surd form, did not simply into the square root i.e $x\in[-\sqrt{25};\sqrt{25}]$

Q4.1.3Few candidates failed to substitute $y=0$ and apply laws of exponents to solve for x rather they wrote 3^x as $3x$ or divide by 3 i.e $3^x=1$ and therefore $x=\frac{1}{3}$

Q4.1.5 Some candidates drew a a parabola instead of a semi-circle as and some also seem not to be sure when an exponential function increasing or decreasing.

Few candidates did not plot their calculated intercepts hence they lost all the consistent accuracy marks.

Q4.2 Many candidates failed to identify and substitute the value of p and q.

Q4.3.1Some candidates instead of writing two equations of asymptotes they wrote coordinates (0; 2) or just 0 and 2.

Q4.3.2 Few candidates used the graph of h to solve the value of k instead of $p(x)=x+2$ and they did not conceptualise the answer as some got k as -2 but the quadrant has positive x -values.

Some calculated the x -intercept yet k is not an intercept but a point on the straight line and is positive: $0=k+2$
$\therefore k=-2$

or they substitute 4 in place of x and still solve the value of k i.e. $y=4+2=6$

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

- Teachers have a responsibility to train Learners to always start by stapling all diagram sheets at the back of their answer sheets during the teaching of graphs or the DBE Panel and Malusi have a responsibility to consider creating an answer sheet for this paper to curb the unnecessary loss of marks.
- Teaching interpretation lessons requires a well prepared Teacher with all the necessary teaching and learning aids to help Learners visually see the point being emphasized by the algebraic expression or the graphical representation at hand. Different coloured chalks or pens or markers are needed so that Learners can see the different regions on which changes occur. Class tests on interpretation and applications must be given to the Learners in class in order to train them on analyzing and interpreting statements given to them.

Technology integration, in which various geometric applets can be used to facilitate the teaching and learning of graphs is necessary. Apps like Geogebra, Geometric Sketch Pads, Phatom software, Graph software can help in the facilitation of the lessons on interpretation.

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

Subject Advisors must always remind the school principals of the importance of creating systems where Learners know the importance of stapling their diagram sheets even before they start answering the questions in the question paper.

Subject Advisors must work collaboratively with the e-Learning section so that they may train Teachers on the available graph applets that can help our Learners understand interpretation questions.

Teachers should emphasize to learners that they cannot only write the value of p rather they should write $y = -1$

A thorough emphasis should be made on the difference of a function and an asymptote.

Educators should further put an emphasis on when to include and exclude critical values in graphical interpretation.

A clear distinction on the use of parentheses () and square [] brackets and link them to included and excluded as well as “or” and “ and ”.
Also, inequality signs never face each other rather face the same direction.
Learners should always encourage to provide simplified roots as in Q1.1.2

Revision of laws of exponents and not assume that learners know them. They be reminded about the use of logs when solving as exponential equation where bases or exponents cannot be made the same

Different forms of expressing a quadratic function should be revised well before exams (x-intercept form, turning point form and standard form) and be given enough exercises on graphical interpretation.
Educators should also stress that the given points on the graph give a hint on the form to use to determine the function. i.e if x -intercepts and a point on the graph are given the x -intercept form should be used as so on.

Candidates should be made aware that the turning point coordinates are linked to p and q, also be taught the correct way to substitute them on the turning point form.

$$y = a(x-p)^2 + q$$
$$-1 - p = 0$$

- i.e Turning Point (-1 , 4) then $p = -1$

$$y = a(x-(-1))^2 + 4$$
$$y = a(x+1)^2 + 4$$

How I teach functions and graphs, particularly interpretation questions must be organized by all districts or schools in order to elevate the performance in this question.

QUESTION 5

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

QUESTION 5

5.1 The annual effective interest rate charged by a financial institution is 9,1%. Calculate the nominal interest rate charged per annum if it is compounded quarterly. (4)

5.2 A town's population increased from 50 000 at a compound rate of 3% per annum over a five-year period. Determine the population of the town at the end of five years. (3)

5.3 In 2018, engineering equipment costed R260 000.

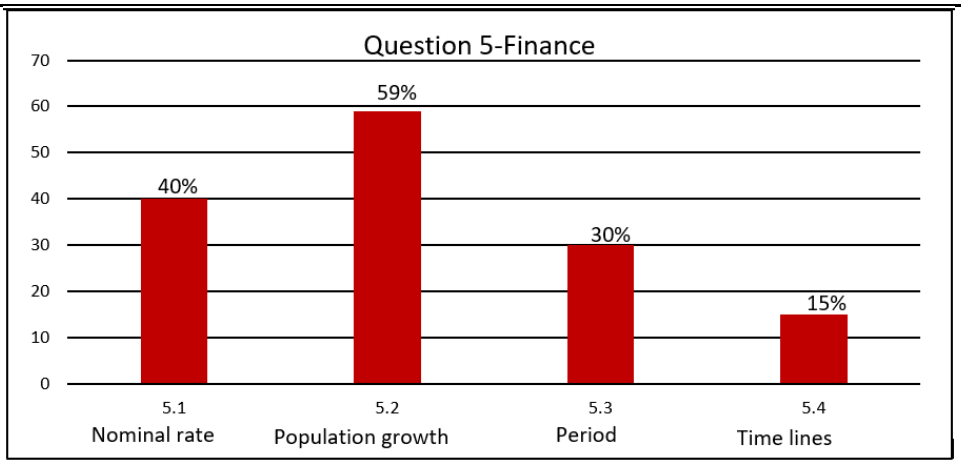
5.3.1 If the equipment bought in 2018 depreciated to 25% of its original value, calculate the current value of the equipment. (1)

5.3.2 The equipment depreciated at a rate of 14% per annum using the reducing-balance method. Determine how long (to the nearest year) it took for the equipment to depreciate to the value calculated in QUESTION 5.3.1. (4)

5.4 An amount of R20 000 is invested into an account that offers an interest rate of 10% per annum, compounded monthly.

- At the end of 18 months, the interest rate changed to 8% per annum, compounded quarterly.
- The interest rate then remained unchanged for the remaining years.
- An amount of R3 000 was withdrawn from the account at the end of the 3rd year.

Determine the amount of money in the investment account at the end of the 4th year. (5)



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

Q5.1 Some candidates failed to identify and use the correct formula from the information sheet.

Some substituted the given effective rate in a place of a nominal rate. i.e. $i_{eff} = \left(1+\frac{0,091}{4}\right)^4 - 1$

Q5.2 Some candidates omitted the % or failed to divide by 100 when substituting in A. i.e $A = 5000(1+3)^5$

Q5.3.1 Few candidates wrote 260000×25 instead of $260000 \times 0,25$ or $260000 \times 25\%$

Q5.3.2 Many candidates failed to make n the subject of the formula and working with logs to find n.

Calculator use was a challenge in this question.

Q.5.4 Most candidates had limited understanding of timelines. They used incorrect compounding periods and did not divide the rate by the compounding period. i.e.

$A = 20000(1+10\%)^{1,5\times 12}(1+8\%)^{2,5\times 4}$

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

Candidates should be trained to make use of the information sheet.

Teachers should emphasise the identification of key words like 'effective and nominal rate", depreciate, reducing- balance, increase and growth so that an appropriate formula is used in solving the problem.

learners should be encouraged to divide the rate by 100 before substituting

Teachers should stress that to calculate % of a certain quantity use $\frac{\%\text{ given}}{100} \times \text{total amount}$

Teachers should expose learners to various types of questions where rates do not change exactly after years and coach learners on how to analyse correctly.

Teachers should encourage learners to write the compound formula as $A = P\left(1+\frac{i}{m}\right)^{n\times m}$ so that they will know that compounding periods (m) need to divide the rate as well.

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

Grade 10 Literal equations must be revised with the Learners to avoid the challenges of making any

variable or parameter the subject of the formula.

Candidates should be encouraged to read and interpret what they have read even during teaching and learning in class.

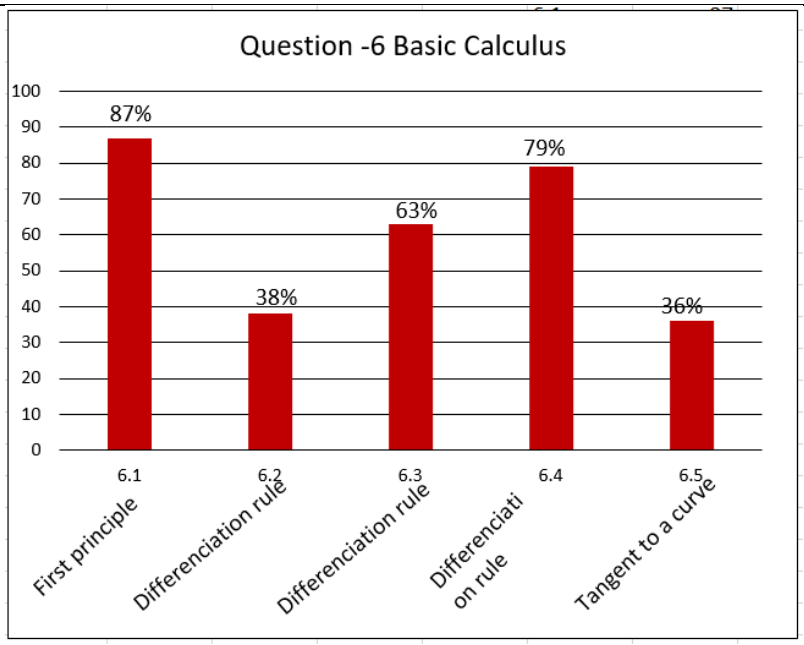
Teachers should ensure that learners have calculators when Finance is taught and demonstrate to them on how to use the keys. Further, instil to learners the culture of not rounding early in the calculation but at the final answer.

Mathematics has its own language which Candidates should be exposed to as well as to the day-to-day language used at school, home and communities where they reside. They should be able to link what they know at home with what they learn in class for better understanding of Financial Mathematics concept including population.

As part of SBA, a project involving Finance, Growth and Decay should be given to Candidates to cover the aspect of real- life applications as one of the specific aims of Technical Mathematics. This can help make Learners see the essential importance of Finance, growth and decay in their lives

QUESTION 6

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



The question was well performed at an average of 59%. Basic calculus, a topic done in grade 12 was assessed in this question.

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

Q6.1 Few candidates incorrectly copied the definition and were penalise for notational error in this question.
A variety of notation errors were done by candidates.
Some candidates failed to substitute correctly leading to incorrect simplification

$f\ (x\ +h) = f(9x-6)$ or $f(x+h) = 9x-6(x+h)$.

Q6.2 Many candidates did not realise that $11\pi^2$ is a constant, the differentiated with respect to π instead of x.

Q6.3.1 Some candidates had difficulty in simplifying the fraction as a result they were unable to find the derivative thereafter.

Q6.4.2 Learners had difficulty changing the surd form to exponential form and to detect the final stage of the derivative, i.e. when to drop the Dx.

Q6.5. Many candidates did not realise that they needed to use the derivative function found in Q6.5.1, they instead substituted in the given function. They had $g(x) = -(-2)^3 + 6(-2)^2 = 32$ instead of $g'(x) = -3(-2)^2 + 12(-2) = -36$

The displayed poor understanding of what a gradient of the tangent to curve is.

Some candidates decided to equate $g(x)$ to -36, i.e. they wrote $-x^3 + 6x^2 = -36$ instead of $-3x^2 + 12x = -36$.

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

Expose Candidates to the information sheet; the definition can be copied from it. Teachers should emphasize correct use of notation.

Provide Candidates with drill and practise exercises determining the derivative from first principles and applying the rules of differentiation. The original function must be in the differentiable form before the rules of differentiation can be applied.

Teachers need to demonstrate to learners the meaning of function values and give examples that are not limited to numbers.

Emphasis must be made as to what variable should differentiation be made with respect to.

Learners should be taught to differentiate between the different forms of differentiation, terms and their connection used in Calculus.

$\frac{dy}{dx}$ means differentiate y with respect to x and $\frac{dy}{dr}$ means differentiate y with respect to r.

Application of Calculus should be taught to learners, relate these to real- life scenarios. Exercises on rates of change and calculus of motion should be given to learners involve practical examples where applicable.

First principles are used when requested to differentiate the given function using First Principles. The definition can be copied directly from the information sheet.

Revision of algebraic fractions is strongly advised.

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

Basic algebraic manipulation in earlier grades should be taught properly and be revised on an on-going basis, including exponential laws and changing the terms from surd form to exponential form.

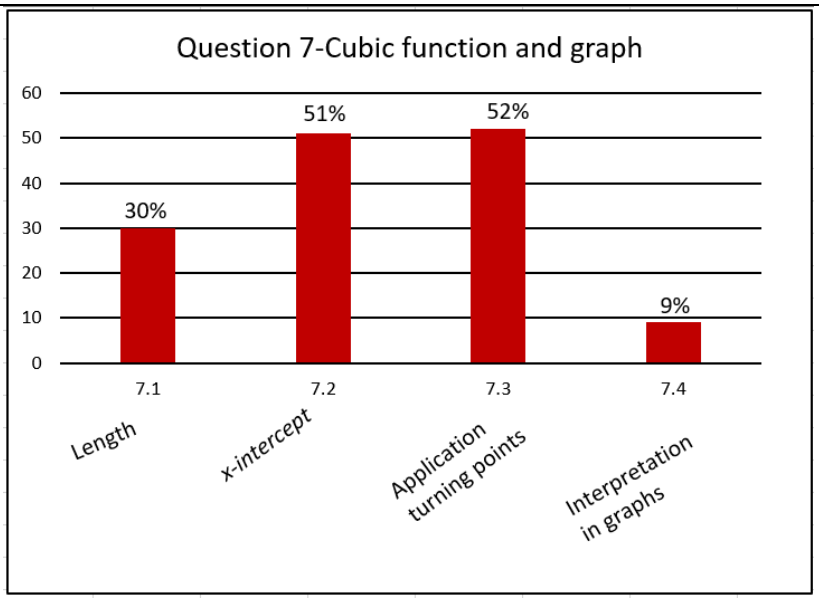
There is still work to be done by Subject Advisors to train teachers on how to teach Calculus applications.

Candidates should be provided with an information sheet when writing assessment to familiarize them with it instead of only getting it in the final NSC papers.

Activities given for revision should not be limited to those where the variable to differentiated with respect to, is the subject, they should be given equations or expressions where they have to manipulate first and variables used should not be limited to x and y

QUESTION 7

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



The question assessed cubic graphs and candidates performed poorly at an average of 39 %. This topic is covered in grade 12.

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

Q7.1 Candidates did not realise that the length should be positive, they wrote the length of OD = - 60

Q7.2 Some candidates confused the x-intercepts with turning points, they used differentiation to find the points. Few candidates used midpoint formulae to find the x-intercepts. Some candidates managed to determine the other two points as $(-5;0)$ and $(6;0)$ but they did not label them specify as to which one belongs to A and which one belongs to C.

Q7.3 Many candidates were unable to find the coordinates of G, they used quadratic factor to find the coordinates of G and some ended up with equation of a straight line . Few candidates simplified up to the step where they get a surd and did not simplify further.

Some candidates were able to work this question out up until they reached the stage where they got the values of x but ended there,

$$f'(x) = 3x^2 + 2x - 32 = 0$$

$$x = \frac{-(2) \pm \sqrt{(2)^2 - 4(3)(-32)}}{2(3)}$$

$$\therefore x \approx -3,62 \text{ or } x \approx 2,95$$

Q7.4 Most candidates were greatly challenge by this question as it required interpretation of graphs. They displayed poor understanding of notation used when a function is increasing or decreasing. Candidates were unable to interpret the inequality signs like greater than (>) and less that (<). Some candidates left this question unanswered.

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

Revision of real number system is greatly advised to assist leaners with the understanding of the order of numbers including notation used to indicate greater than or less than.

Although the drawing of graphs is required, teachers need to include interpretation when teaching functions.

Teachers should expose leaners to a variety of questioning strategies.

Use of a variety of available software by teachers will enable Candidates to clearly see where the graph is decreasing and increasing will greatly assist in the interpretation of functions.

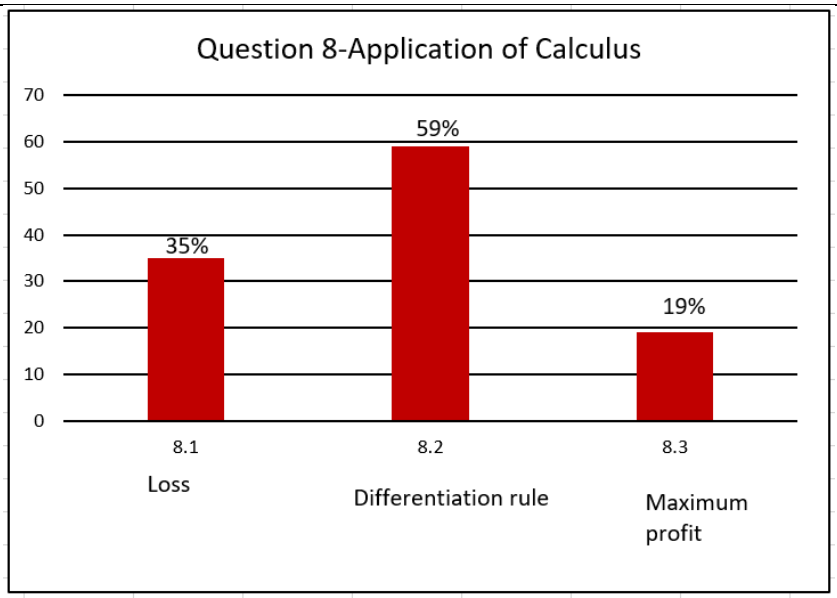
(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

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

Teachers should explain and demonstrate to learners where the graph is increasing, constant and decreasing with the aid of the diagrams. The use of software, like GeoGebra and Geometry Sketch Pad and Graph can be useful for teaching functions.

QUESTION 8

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



This question was poorly performed at 27% average. The question assessed maximum cost (optimisation) and is covered in grade 12 however the concept of cost is not foreign to learners since it is covered in lower grades.

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

Q8.3 Many candidates could not optimize correctly and those who did failed to choose the correct value of x that will maximise the profit, they instead chose the incorrect value $x = -10$.
Candidates tend to substitute the chosen value on the derivate and not the original function.

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

Educators should demonstrate to learners when one gets maximum or minimum value. Integration within and outside topics is recommended

In this case if candidates understood that the cubic function would be decreasing, they would've understood that at $x = -10$ there will be a minimum profit without having guess or do trial and error.

The concept of Minimum and maximum should be thoroughly explained to Candidates. The procedure should be clearly illustrated. Different questioning strategies should be employed by teachers in class activities, tests and examinations

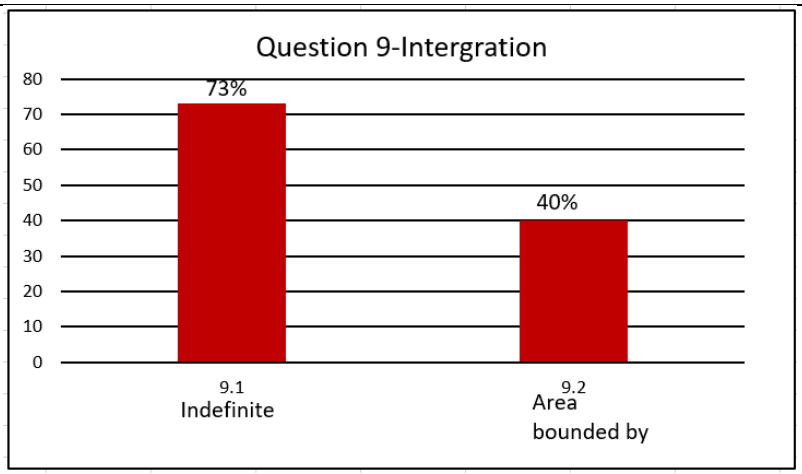
(d)Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

Teachers need to expose learners to as many contextual application questions testing the concepts of optimisation.

Subject advisors need to intensify workshops on the Calculus applications.

QUESTION 9

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



Candidates performed well in this question. Integration, a topic covered in grade 12 was assessed in this question.

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

Q9.1.1 Some candidates omitted "+C" while many learners omitted the negative sign.

Q9.1.2 Many candidates failed to find the product of the two binomials.
Some candidates used the Quadratic formula trying to solve for x instead of integrating after simplification.
Few candidates confused integration with differentiation as a result they did both within one expression.

Q9.2.1 Many learners failed to identify correct rule.
Most learners integrated $\int 2^x \ dx$ $\int \frac{2^x}{x \ln 2} \ dx$ or $\int \frac{2^x}{2 \ln x} \ dx$

Q9.2.2 Learners substituted limits without integrating.
Many learners swopped the upper and lower limits and neglected to change negative area to a positive value.

Learners added the two areas instead of answering the question.
Some candidates correctly worked out the area of A to be $1{,}08$ units^2 and the area of B to be $5{,}34$ units^2 but there was no any verification shown to help them to draw up the conlusion if a learner's claims were valid.

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

Learners should be reminded to refer to formulae sheet at the back of the question paper and pay attention to "+C"

Teachers should emphasize to learners that the given function MUST be integrated BEFORE substituting the limits. Learners should be made aware that area should always be positive. It must not be a habit to add two different areas as the question might be to compare one area to another like 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.
Practical applications should also be used to enhance understanding of integration, therefore learners need to be exposed to many examples involving real-life applications.