Province of the EASTERN CAPE EDUCATION

EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
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2022 NSC CHIEF MARKER'S REPORT

SUBJECT	**TECHNICAL MATHEMATICS**
QUESTION PAPER	1
DURATION OF QUESTION PAPER	**3 HOURS**
PROVINCE	**EASTERN CAPE**
DATES OF MARKING	**08 – 22 DECEMBER 2022**

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

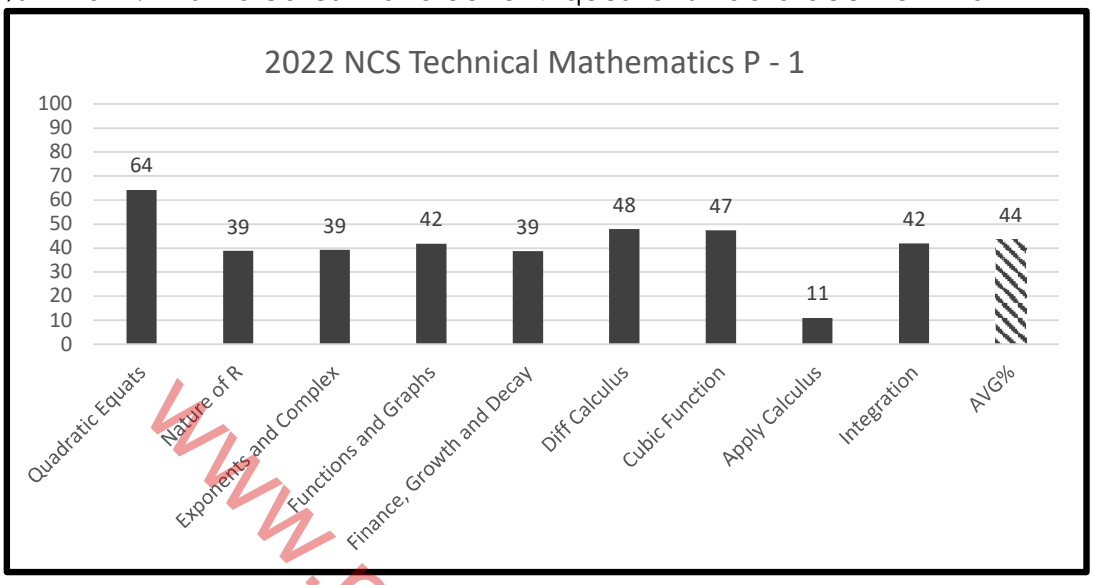
The performance of the paper as derived from the Rasch psychometric analysis of 100 scripts indicated that the average performance of the paper dropped by 5 % from 49% in 2021 to 44% in 2022. The spread of sampling of the scripts followed the following order, as required.

Sampling the scripts followed the Low, Middle and High order sampling.

Marks	**0-44**	**45-59**	**60-74**		**75-89**	**90-104**	**105-119**	**120+**
Required	15	15	20		20	20	5	5
Actual	15	15	20		20	20	5	5
Percentage	15	15	20		20	20	5	5

The 100 Sampled scripts spread over a range from 0 to 131 marks.
Performance across the 9 questions of Technical Mathematics Paper – 1 spread from 11% to 64%. The least performed question was the Applications of Calculus (Question 8) at 11% in 2022, an improvement of 1% from the performance of 2021 which was 10% on the same question.
Algebra was the best performed question at 64%, which is the same percentage compared to 2021 Algebra performance.
Question 2 on the Nature of Roots and Question 3 on Exponents, Surds, Logarithms and Complex numbers and Question 5 on Finance Growth and Decay, were the second least performed questions in 2022, at 39%.
Question 2 showed an improved percentage of 20% from 19% in 2021 to 39% in 2022.
Question 3 dropped from 46% in 2021 to 39% in 2022, a 7% decline.
Question 5 showed a significant improvement of 13% from 26% in 2021 to 39% in 2022.
Questions 4 and 9 were the next better performed questions at 42% in 2022.
Question 4 on Functions and Graphs declined from 48% to 42%, a 6% drop while **Question 9** on Integration decreased by 19% from 61% in 2021 to 42% in 2022.
Question 7 on Cubic functions and graphs was the third best performed

question in 2022 at 47% behind Question 6 at 48% and Question 1 at 64%.
Question 7 had a decline of 17% from 54% in 2011 to 47% in 2022.
Question 8 on Basic Differential Calculus dropped by 5% from 54 in 2021 to 48% in 2022. This indicates that 5 out of 9 questions had a decline in 2021



QUESTION	TOPIC	AVE. PERFORMANCE %
1	Quadratic Equations, Inequalities and Binary Numbers	64 %
2	Nature of the Roots	39 %
3	Exponents and Surds, Logs and Complex Numbers	39 %
4	Functions and Graphs	42 %
5	Finance, Growth and Decay	39 %
6	Differential Calculus	48 %
7	Cubic Function	47 %
8	Calculus Application	11 %
9	Integration	42 %
Average		**44 %**

General mistakes identified during marking were:

- Incorrect use of a calculator.
- Distributive errors evident on expanding expressions.
- Incorrect copying of formulas from the formula sheets.
- Ignoring instructions given for questions.
- Interpretation abilities lacking.
- Notational errors.
- Simplification processes and steps lacking.
- Confusing differentiation and integration.
- Leaving brackets when substituting, leading to incorrect solutions.
- Evidence of insufficient revision of the previous grade work, resulting to candidates losing marks set from grade 10 or 11.

SECTION 2: Comment on candidates' performance in individual questions (It is expected that a comment will be provided for each question on a separate sheet).

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

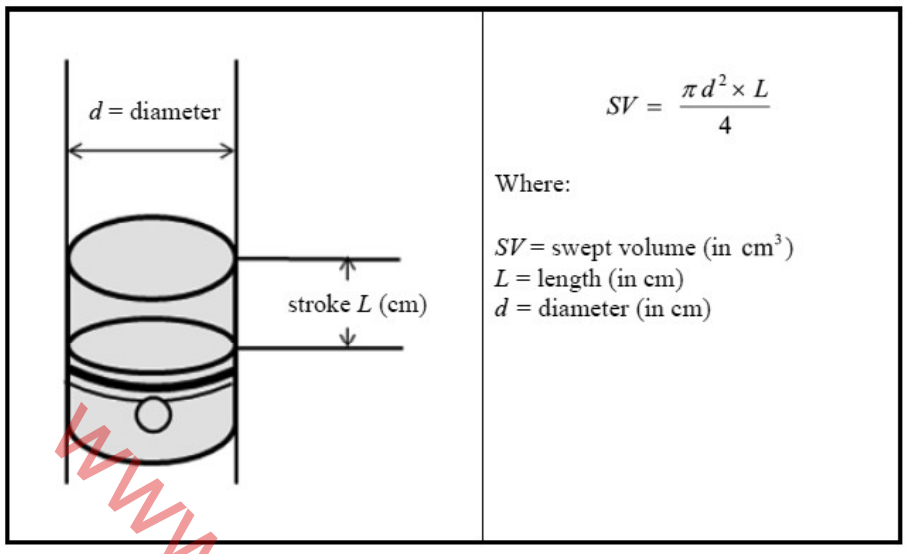
1.1.2 $4x^2 - 5x - 4 = 0$ (correct to TWO decimal places) (3)

1.1.3 $2x^2 - 8 > 0$ (3)

1.2 Solve for x and y if:

$y = 5x - 2$ and $y = x^2 + 4x - 8$ (5)

1.3 The diagram below shows the movement of a piston inside the engine cylinder of a car. Alongside is the formula for calculating the swept volume (SV), which is equal to the base area of the cylinder, multiplied by the length of the stroke (L).



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

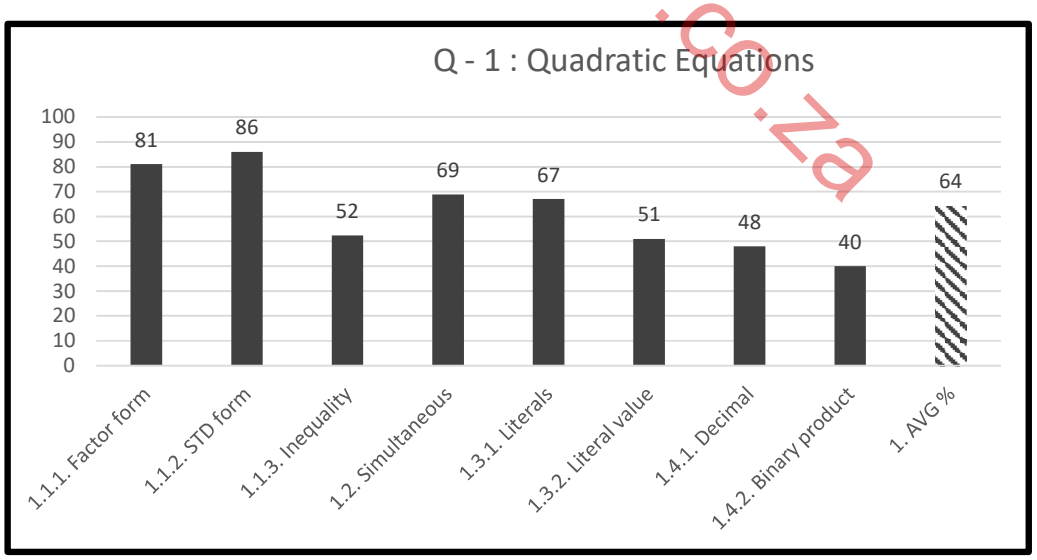
1.3.2 Hence, calculate (rounded to the nearest cm), the numerical value of L if $SV = 1\ 020,5\ cm^3$ and the diameter $d = 10$ cm. (2)

1.4 Given the binary numbers:

$$P = 1\ 010_2 \text{ and } Q = 10\ 000_2$$

1.4.1 Write P in decimal form. (1)

1.4.2 Determine P × Q in binary form. (2)
[20]



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

The average performance of Question 1 is at 64% with question 1.1.2 performed the highest at 86% with binary operations in 1.4.2 the least performed at 40%. Ironically question 1.1.1, the most basic question, which was given in factor form was not the highest performed.

- In 1.1.1 many candidates started by expanding the factor form quadratic equation and, in the process, some expanded incorrectly to $7x + x = 0$ which translated to $8x = 0$ and some gave an answer of $x = 8$.
- Some candidates expanded the factor form equation correctly then tried to factorize the quadratic binomial $7x + x^2 = 0$. A number of them factorized it as $(x +7)(lx+1) = 0$. All these methods led to loss of a mark or both.
- Other candidates tried to use a quadratic formula but in their substitution for the value of a constant c they substituted $c = 1$, which came from nowhere. This led to incorrect solutions as well.

1.1.2 was the best performed sub question across all sub questions in this paper.

- It was performed at 86%, however, there were candidates that ended up with incorrect solutions because of incorrect substitution.
- Some candidates did not use brackets when substituting the parameters and that resulted them subtracting the constant c from $-4a$ of the discriminant, getting $-4a - c = -4.4 - 4$, instead of it being $-4ac = -4(4)(-4)$.
- Calculator use was another problem, where candidates substituted correctly but

1.1.3: Well taught solutions to equations lead to well performed inequalities. This therefore requires that all different forms of simplifying and solving quadratic equations be taught well. The sub question was performed at 52%, the fifth best performed sub question out of 8 sub questions in question 1.

- Some candidates used the method of factorization but did not take out the common factor before factorizing the resulting difference of two squares in determining the critical values.
- Another group of candidates used the quadratic formula but substituted -8 for the parameter value of b instead of it being substituted for the value of c. This led to the loss of marks for the incorrect critical values.
- some candidates opted transposed 8 to the other side of the equation and divided by 2 to get $x^2 = 4$ then they applied the square root both side but their solution had only one critical value = 2, the second one was not written, but in 1.1.1 some of those candidates used a quadratic formula to solve the binomial $7x + x^2$. Many of the candidates that chose this method came up with one critical value.
- On writing solution sets there is a misunderstanding by some candidates on writing a disjoint solution set as if it is a joined solution set. An example is where the solution set is supposed to be $x < -2$ or $x > 2$ and the candidates write this solution set as $-2 > x > 2$. This is a notational error resulting from misunderstanding notations in inequalities.
- Furthermore, they demonstrated poor understanding of interval notation, they could not differentiate between "and "and "or". They left theirs solution as $x < -2$ **and** $x > 2$ instead of $x < -2$ **or** $x > 2$

1.2. was performed at 69%, the third best answered sub question in question 1.

- Route learning was seen as the major problem to this question as most candidates wanted to have a third equation even though the two given equations were in a ready state to be equated to each other. Some exchanged x and *y* in the first equation then substituted with x = 5y – 2, which never existed, into the second quadratic equation. This led to a stale mate as the equation ended up having cubic expression of *y*.
- Other candidates managed to get the values of x correctly and did not proceed to get the corresponding values of *y*, leading them to losing 1 mark out of 5.

1.3 and 1.4 were both averagely performed at around 50% and 40%, respectively.

- The two questions covered grade 10 work which is not taught in grade 12 but needs to be revised during the time leading to examinations.
- In Q1.3.1 many candidates had a challenge in making L the subject, they instead swopped the L and SV.
- Q1.3.2 Many candidates failed to follow the instruction of rounding off to the nearest cm.
- Q1.4.1 Few candidates wrote the decimal number with base 2 and in Q1.4.2 candidates failed to convert the product in decimal form to the binary number form and base 2 was omitted.

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

For 1.1.1 – Factor form

Teachers must ensure that all different forms of solving quadratic equations are taught in class, starting with the easiest, the factor form. In the process of teaching, it should not be mixed with any other form to be taught but all examples, exercises and problems must be based in factor form. This will help Learners not to get 0 mark in a Technical Mathematics P – 1. Secondly, confusion is eradicated if one form of quadratic equations is solved at a time, with many examples and exercises given to learners in class. This requires proper planning so that no congestion of different forms is ever presented in one class (period). Technical Mathematics or Pure Mathematics Departmental Head must be appointed in school so that constant monitoring and support, internally, is given to the Technical Mathematics Teachers. This is imperative because the Technical Mathematics HOD will ensure that indeed, on a period basis, only one form of quadratic equations is taught by the Teachers in their preparation books and is started from the most basic factor form quadratic equations.

For 1.1.2 – Standard form

Learners can easily recall if anything has been given to them several times as exercises. Class tests requiring substitution must be given to learners in class, wherein different formulas that need substitution can be tested. This can help learners a lot, as the subject is mostly formula based and so always requires substitution to form the basis of teaching.

1.1.3 – for Inequalities

Graphical notation is always a solution for notational errors, but it also needs emphasis on the included or shaded values and excluded or open values. Deriving a solution set from a graph is always the best method of avoiding notational errors.

Evidence of inconsistency in teaching the same aspects was notable in this question when it was compared to 1.1.1, the question on factor form. Some candidates that expanded 1.1.1 to a binomial expression used a different approach (quadratic formula) in solving 1.1.1 but in 1.1.3, though it is a binomial expression as well, they opted not to use the quadratic formula. Different approaches lead to learners' confusion, particularly the low performing learners, so Teachers must ensure that there is uniformity in the methods used in solving quadratic equations and inequalities.

For 1.2 – Simultaneous equations

Varying exercises covering different exercises can help eradicate route learning by learners.

For 1.3 and 1.4 – Literal equations and binary numbers

Revision of grade 10 work is key because candidates struggle in the low-level grade 10 work.

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

Departmental Heads and Subject Advisors must organize the how I teach Algebra, equations and inequalities in their schools or districts to help consolidate the knowledge Teachers have so that it can be made easy to follow and solve by the learners.

Teaching Equations and inequalities must be approached starting with:

1. Factor form equations
2. Common factor equations
3. Standard form
4. BODMAS
   - 4.1. Those with Brackets
   - 4.2. Those where the variable being solved is in the denominator.
   - 4.3. Those that need simplification by multiplication.
   - 4.4. Those that need transposition in order to be simplified to standard form.

QUESTION 2

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

QUESTION 2

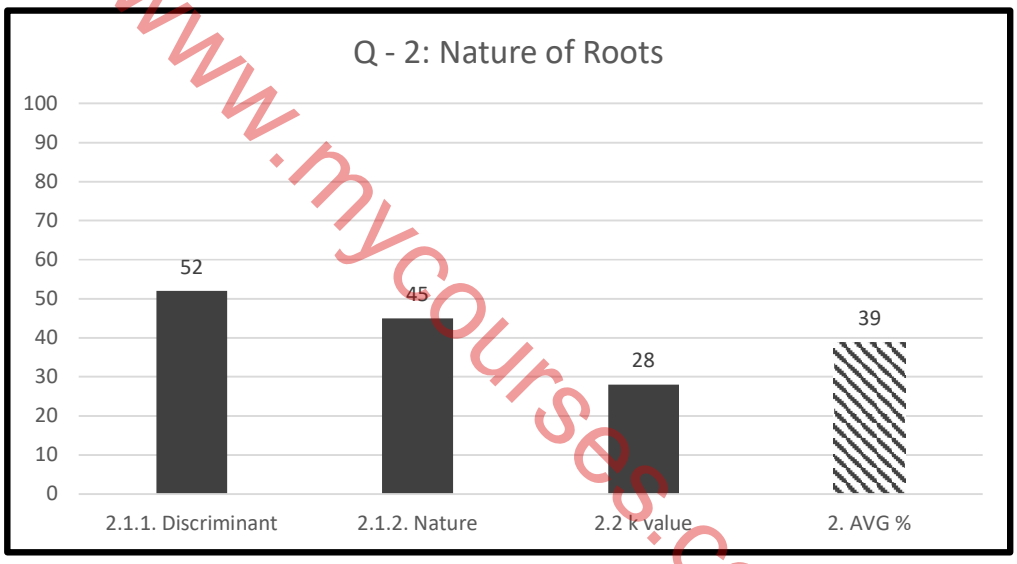
2.1 Given the equation: $x^2 - 2x + 6 = 0$

2.1.1 Determine the numerical value of the discriminant. (2)

2.1.2 Hence, describe the nature of the roots of the equation. (1)

2.2 Determine the numerical value of k for which the equation $x^2 + 2x + k = 0$ will have real roots. (3)

[6]



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

Question had an average of 39%.

2.1.1 was performed at 52%.

- In 2.1.1 most candidates tried to solve for the equation and they came up with incorrect solutions as they factorized $x^2 - 2x + 6$ as $(x - 3)(x + 2)$. This made them lose the marks for this question.
- Some candidates omitted brackets when substituting for the value of b in $b^2 - 4ac$. Substituting the parameter value of b they got $-2^2 - 4.2.6 = -24$. This is the same challenge noticed in 1.1.2.

2.1.2 was performed at 45% and the misconception identified in candidates responses show that there is less understanding of the meaning of the nature of roots and its conditions. Candidates were responding anyhow without considering the value calculated or determined above, yet this question indicated that they are supposed to use whatever they obtained in the previous question to respond to this one because it started with a "hence".

- 2.2 Lack of understanding of the basic conditions for the nature of roots was noticeable. Candidates simple substituted any value for *k* and started solving for x.
- Another group of candidates substituted correctly in the discriminant but were let down by their lack of understanding of how the discriminant behaves for real roots. Candidates used $b^2-4ac=0$ and some of them wrote $b^2-4ac>0$, thus losing one mark for incorrect notation.
- In Q2.2 many candidates did not realise that the given nature of roots of the equation to be real means the discriminant is greater or equal to zero, i.e. $b^2-4ac\geq 0$.
- Candidates used $b^2-4ac=0$ and some of them wrote $b^2-4ac>0$, thus losing one mark for incorrect notation.

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

For 2.1.1 – Value of the discriminant

Learners can easily recall if anything has been given to them several times as exercises. Class tests requiring substitution must be given to learners in class, wherein different formulas that need substitution can be tested. This can help learners a lot, as the subject is mostly formula based and so always requires substitution to form the basis of teaching.

For 2.1.2 – Nature of roots

The three conditions for the nature of roots must be dealt with using the number system of real numbers, the first bullet of the Grade 10 FET CAPS Topic Overview and Curriculum statement for Algebra. That first bullet is very important because it covers all the basics necessary for understanding the nature of roots at a later stage.

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

- Mediation of the policy documents, particularly CAPS document must be done to the newly appointed or novice Teachers so that all the important principles can be taught at an early stage. This is the responsibility of the curriculum drivers in the school or in the district.
- Preparation by Teachers for the teaching of Algebra should be derived from the relevant policy documents. Subject Advisors and HOD must see to it that all the bullets in the Topic Overview and the Curriculum statements of the CAPS document have been taught before a Teaches can say s/he has finished teaching Algebra.

QUESTION 3

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

QUESTION 3

3.1 Simplify the following **without the use of a calculator**:

3.1.1 $\frac{8x^3y^2}{16xy^4}$ (leave the answer with positive exponents) (2)

3.1.2 $\frac{\sqrt{48}+\sqrt{12}}{\sqrt{27}}$ (3)

3.2 If $\log 5 = m$, determine the following in terms of m:

3.2.1 $\log 25$ (2)

3.2.2 $\log 2$ (3)

3.3 Solve for x: $\log_2(x+3) - 3 = -\log_2(x-4)$ (5)

3.4 Given complex numbers: $z_1 = -1+3i$ and $z_2 = \sqrt{2}\ cis\ 135°$

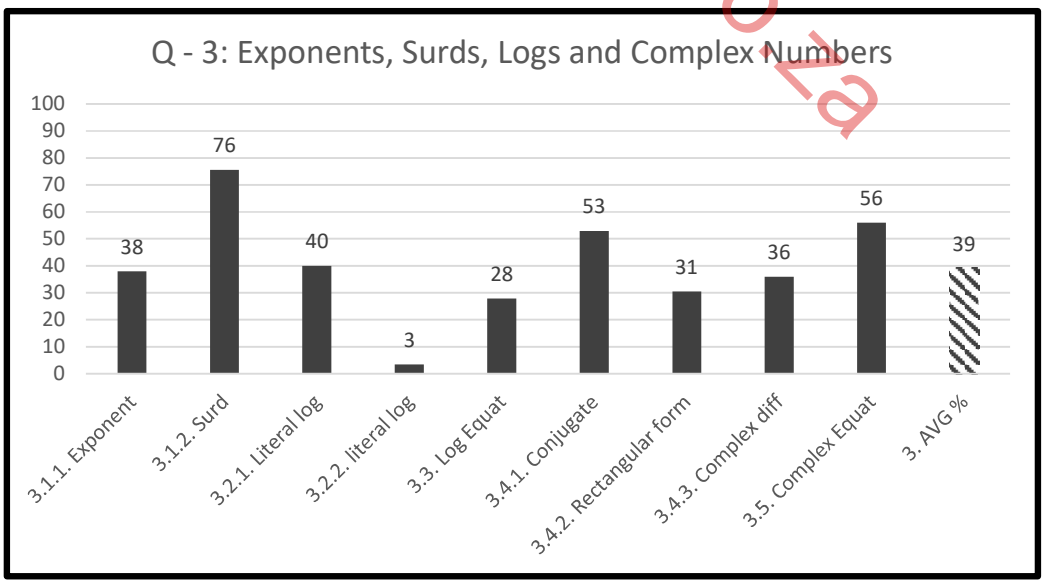
3.4.1 Write down the conjugate of z_1. (1)

3.4.2 Express z_2 in rectangular form. (2)

3.4.3 Evaluate $z_1 - z_2$. (2)

3.5 Solve for x and y if $x + yi - (1-i) = 4+5i$ (4)

[24]



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

Question 3 was averagely performed at 39%, with 3.2.2, the literal logarithm, being the least and the worst performed sub question at 2% in the question and the paper as a whole.

- 3.1.1 was performed at 38% because many candidates used short cuts in simplifying the sub question by writing the final solution without necessarily following the proper division exponential laws, as was expected. Such candidates got $\frac{x^2y^2}{2}$ instead of $\frac{x^2y^{-2}}{2}$, so that it can then be simplified to positive exponent. This was an indicator of shortfalls on simplifying exponential rules.
- In the other misconception, the candidates omitted the variables and only worked with the coefficients to get a half as the solution. This was an indicator that laws of exponents were not known by such candidates.

3.1.2, surds, were performed at 70%. This was the best performed sub question of question 3, however, some candidates chose to use calculators in solving this question.

- 3.2 as the lease performed sub question in question 3. This was caused by lack of understanding of the logarithm laws by candidates. On expressing log 2 in terms of *m*, candidates simply wrote log 2 as log 2 = log 5 – log 3 = m – log 3. This was a misconception that many candidates committed.
- Another group of candidates wrote log 2 as $\frac{\log 5}{\log 2}$. This was evidence of misunderstanding of the laws of logarithms.

3.3 was underperformed at 28% because candidates lacked understanding logarithm properties.

3.4.1 Learners negated both the real part and the imaginary parts of the complex number on writing the conjugate of z_1.

In 3.4.3 omitted brackets on finding the difference between the two complex numbers.

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

For 3.1.1 – Exponents

Completion of syllabus in grade 10 on exponents is imperative for eradication of the misconception highlighted above.

For 3.2, 3.3 and 3.4 – Laws and properties

Previous grade work must be revised during times leading to the examinations so that candidates can find questions from the lower grades familiar to them.

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

Monitored revision sessions for previous grade work must be done.

QUESTION 4

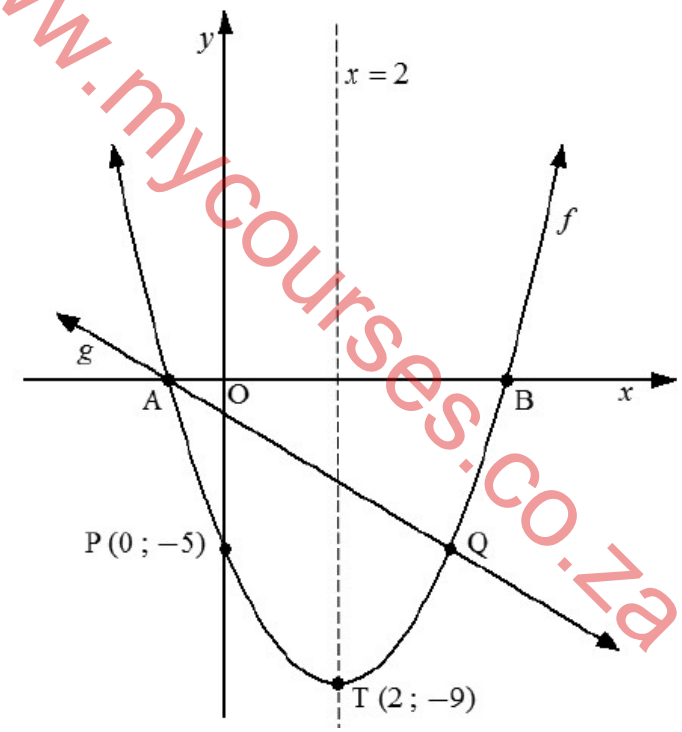
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

QUESTION 4

4.1 Sketched below are the graphs of functions f and g defined by:

$$f(x) = x^2 - 4x - 5 \text{ and } g(x) = mx + c$$

- $T(2;-9)$ is the turning point of f.
- Points A, B and $P(0;-5)$ are the intercepts of f.
- Q is the reflection of P about the line $x = 2$
- A and Q are the points where $f(x) = g(x)$



4.1.1 Write down:

(a) The range of f (1)

(b) The coordinates of Q (2)

4.1.2 (a) Determine the x-intercept(s) of f. (3)

(b) Hence, write down the length of AB. (1)

4.1.3 Determine the numerical values of m and c. (3)

4.1.4 Write down the value(s) of x for which $f(x) \times g(x) > 0$ (2)

4.2 Given: The functions defined by $h(x) = -\sqrt{13 - x^2}$ and $k(x) = \frac{3}{x} + 1$

4.2.1 Write down the domain of function h. (2)

4.2.2 Determine:

(a) The equations of the asymptotes of k (2)

(b) The x-intercept of k (2)

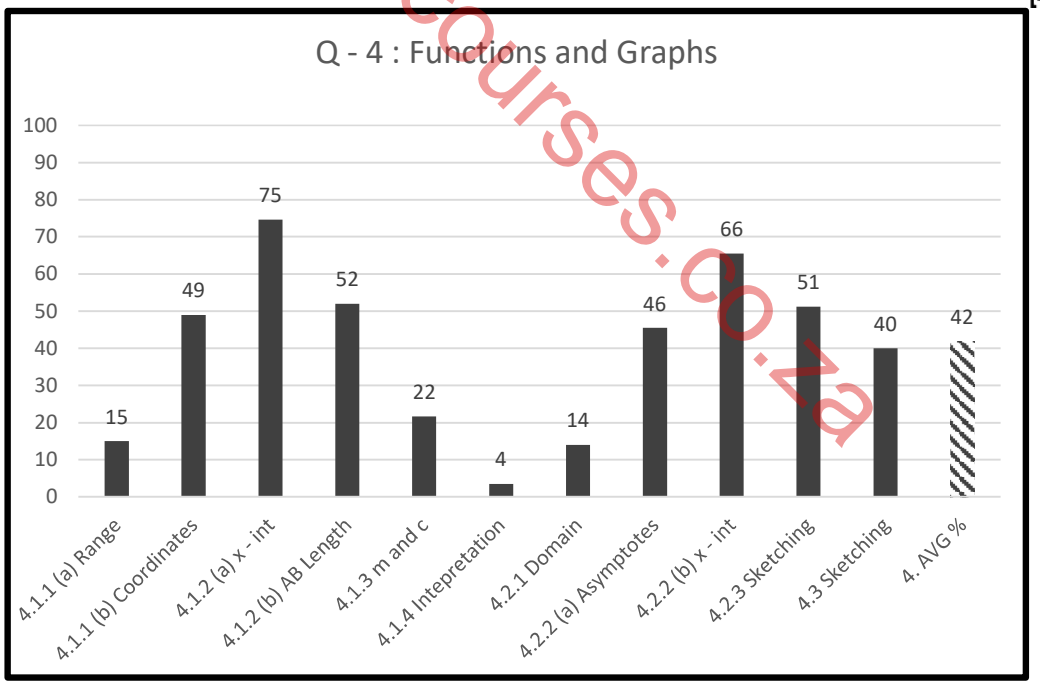
4.2.3 Hence, sketch the graphs of h and k on the same set of axes on the ANSWER SHEET provided. Clearly show the intercepts with the axes and any asymptotes. (5)

4.3 Given: $t(x) = a^x + c$ and the following additional information:

- $y = -1$ is the equation of the asymptote of t
- $a > 1$

Sketch the graph of function t on the set of axes on the ANSWER SHEET provided. Clearly show the intercepts with the axes and the asymptote. (3)

[26]



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

- 8 marks out of a total of 26 marks in this question was based on graphs sketching. Some answer sheets were without diagram sheets on which the 8 marks was supposed to have been drawn. This was a reason for underperformance in the question because the graphs were CAed and so even if candidates had incorrectly calculated critical values, their graph sketching was going to be marked by CA marking.
- The question was underperformed at 42% because of 6 of its 11 sub questions that were performed under 50%, with the worst performed sub question being 4.1.4 at 4%.
- The evidence of underperformance in the sub questions of question 4 point to those that required graphical interpretation of sketches like 4.1.1 (a) which was performed at 15%, 4.1.1 (b) which was performed at 49% 4.1.3 which was performed at 22%, 4.1.4 which was performed at 4%, 4.2.1 at 14%, 4.2.2 (a) at 46% and 4.3 performed at 40%. All these listed sub questions required graphical interpretation to answer them.
- In 4.2.2 (a) Candidates incorrectly wrote the equations asymptotes as parameters: $p = 0$ and $q = 1$, some candidates wrote the equations as vertical asymptote = 0 and horizontal asymptote = 1. All these methods led to loss of these marks.

(b) 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.
- 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

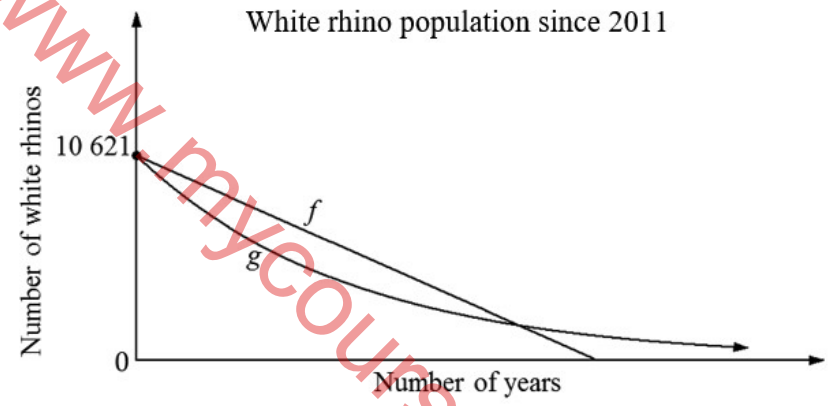
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?

QUESTION 5

5.1 A cellphone bought in 2022 costed R8 000. Determine the value of a similar cellphone at the end of 3 years if the inflation rate is 13% per annum. (3)

5.2 The white rhino population in the Kruger National Park depreciates at a rate of 12,8% per annum on the reducing-balance method over a period of time (in years).

The information below represents the statistics of a survey done since 2011.



5.2.1 How many white rhinos were there at the start of the survey in 2011? (1)

5.2.2 Which graph (f or g) represents the reducing-balance method ? (1)

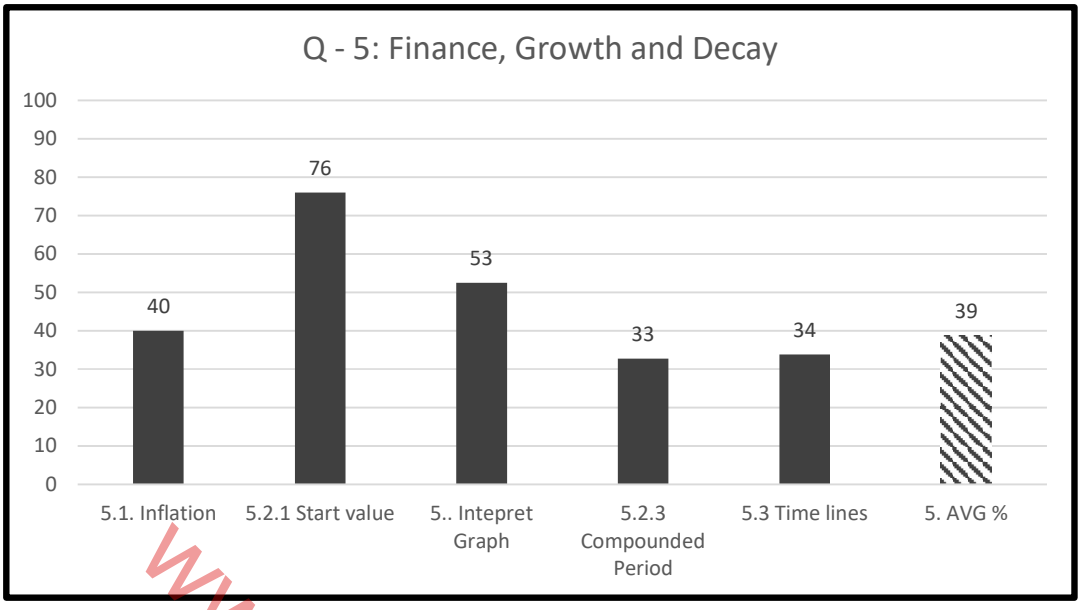
5.2.3 Determine (showing ALL calculations) how long it took for the population of white rhinos to decrease to 3 459. Give your answer correct to the nearest year. (5)

5.3 Samuel opened a savings account to save for a boat cruise that he wants to go on at the end of 5 years. He made an initial deposit of R20 000.

- The interest rate for the first 2 years was 6% per annum, compounded monthly.
- At the end of the first 2 years:
  - He deposited a further amount of R5 000
  - The interest rate changed to 5% per annum, compounded half-yearly

Determine (showing ALL calculations) whether he will have enough money in the savings account for the boat cruise will cost R35 000. (5)

[15]



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

- This question was performed at 39% because most candidates chose incorrect formula and that warranted a break down. This led to 4 of the 6 sub questions in this question to be performed below 50%.
- Incorrect substitution was another major setback in this question, where candidates substituted the values of *P* in the place of *A* and vice versa, in 5.2.3.
- Calculator use is another problem, where candidates would substitute correctly but supply an incorrect answer to the sub question.
- Some candidates would have disintegrated calculations on time lines, an indicator that they did not understand what was happening in the case given.
- Combining various methods in solving time lines.

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

- Algebraic skills must be taught well to the candidates
- The skill of calculator use must be intensified.
- Use of brackets when substituting is imperative in this topic.
- Teaching for understanding is important in Finance, Growth and Decay. Actual drawing of timelines is necessary for candidates that confuse and mix methods in this question.

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

QUESTION 6

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

QUESTION 6

6.1 Determine $f'(x)$ using FIRST PRINCIPLES if $f(x) = 5 - 8x$ (5)

6.2 Determine:

6.2.1 $f'(x)$ if $f(x) = 3x^5 + \pi x$ (2)

6.2.2 $\frac{dy}{dx}$ if $y = x^2\left(4x - 2x^{-1}\right)$ (3)

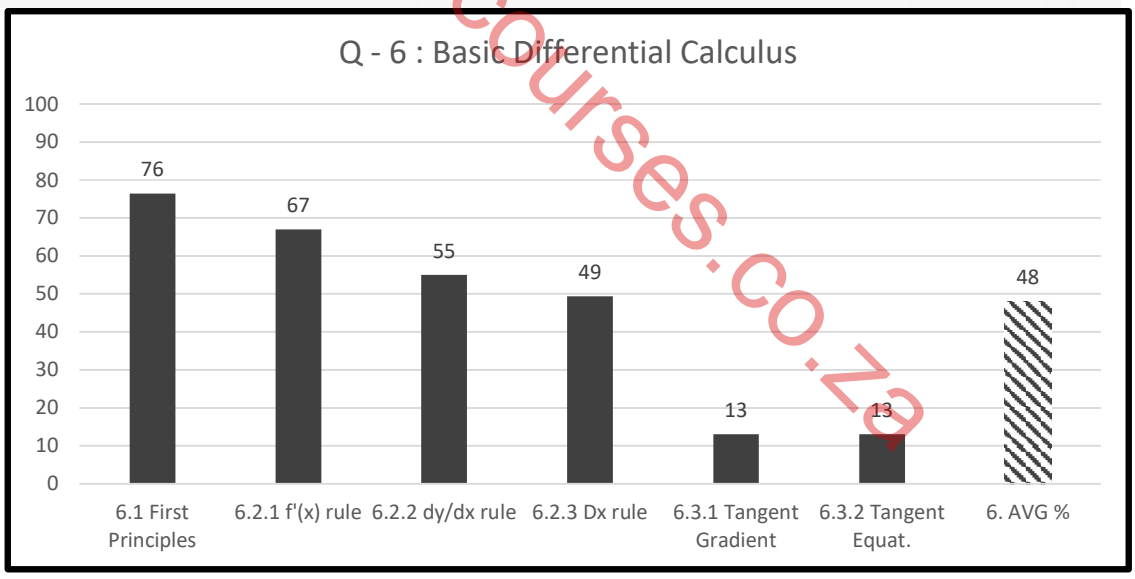
6.2.3 $D_x\left[\sqrt[5]{x^4} - \frac{2}{5x^2} + 8t^4x\right]$ (5)

6.3 The gradient of the tangent to the curve defined by $g(x) = 6x^2 + 3x$ at $x = p$ is -21.

6.3.1 Determine the numerical value of p. (3)

6.3.2 Hence, determine the equation of the tangent to curve g at $x = p$ in the form $y = ...$ (3)

[21]



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

- Incorrectly copying First Principles definition from the formula sheet was a common occurrence in this question, resulting to a notational error.
- Questions requiring simplification before solving were poorly done. Candidates simply differentiated while the expressions needed to be simplified first. That cause a bulk of marks that were lost in this question.
- Integrating while required to differentiate was noted amongst some candidates.

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

- Learners must be drilled through class test and exercises on questions that require copying of formulas from the formula sheet.
- SRFD key is important, where candidates start by S – simplification, followed by R – Radical simplification, F – simplifying a Fraction then D – Differentiate once all have been simplified.
- It is the responsibility of the Teachers to expose Learners to the style of the paper because integration is always in the last question 9.

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

Identify Teachers that need training on Calculus is very important as it was noted that there were some centres where all candidates obtained 0 mark in this question. This was a cause for concern as it somehow, indicating a need for development to the Teachers of such centres.

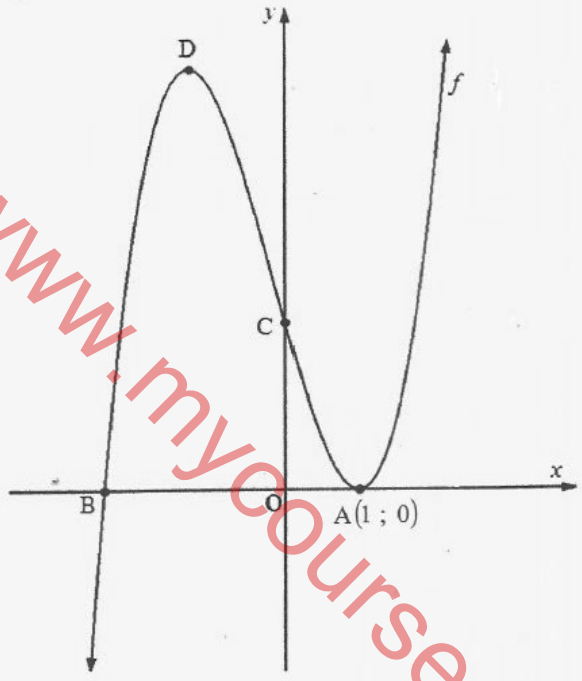
QUESTION 7

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

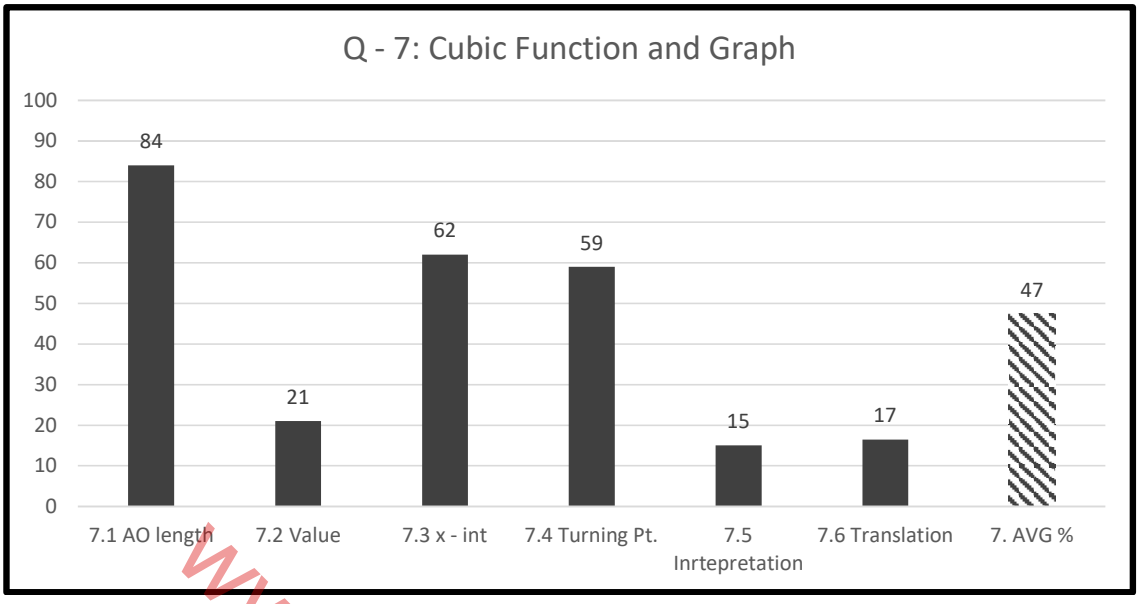
QUESTION 7

The graph below represents the function defined by $f(x) = x^3 + 3x^2 - 9x + k$ and cuts the x-axis at $A(1\ ;\ 0)$ and B.

The graph cuts the y-axis at C and has turning points at A and D.



7.1	Write down the length of OA.	(1)
7.2	Show that $k = 5$	(1)
7.3	Hence, determine the coordinates of point B.	(4)
7.4	Determine the coordinates of turning point D.	(5)
7.5	Write down the value(s) of x for which $f'(x) \leq 0$	(2)
7.6	If $g(x) = f(x) - 2$, then write down the new coordinates of point A.	(2)
		[15]



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

Interpretation questions were poorly performed, just as was the case with the functions and graphs topic in question 4.

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

- 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 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.
- 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 8

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

QUESTION 8

An experiment is conducted in which the temperature (T) in degrees Celsius (^{o}C) varies with time (t) in seconds according to the formula:

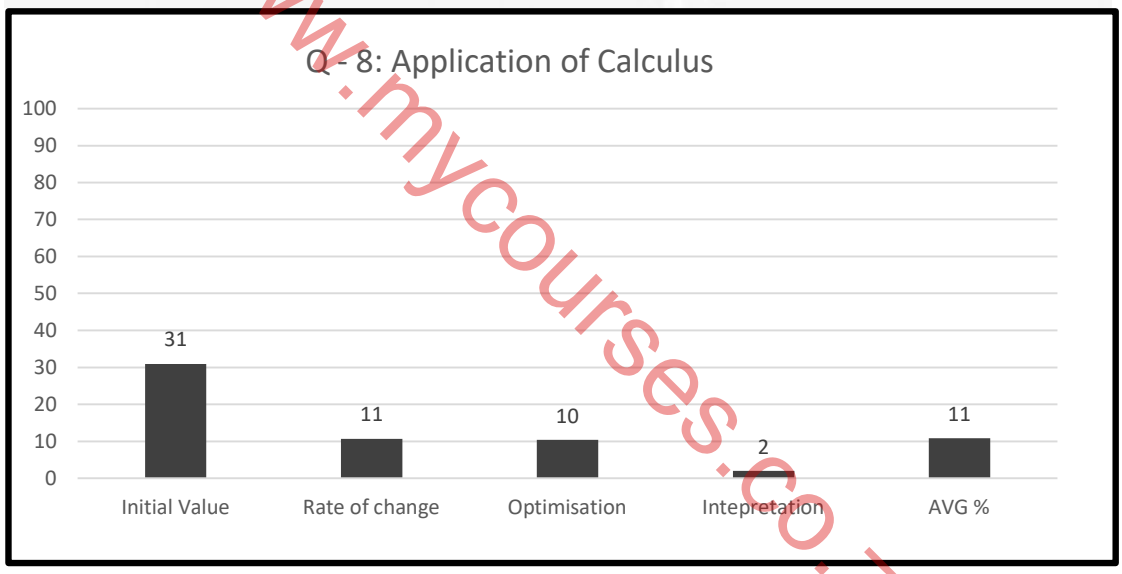
$$T(t) = 37{,}5 + 7t - 0{,}5t^2 \quad \text{where } 0 \le t \le 10$$

8.1 Write down the initial temperature. (1)

8.2 Determine the rate of change of the temperature with respect to time when $t = 4$ seconds. (3)

8.3 Determine the maximum temperature reached during the experiment. (3)

8.4 During which time interval was the temperature decreasing? (2)
[9]



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

- This question was the worst performed question at an average of 11%, with all sub questions performing below 32%.
- In question 8.1 many candidates just added the coefficients of the formula, getting no mark.
- Candidates did not analyse what is asked in the questions, instead they substituted whatever variable value that was given to the given formulae irrespective of whether they needed to differentiate first and solve or not.

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

Variety of exercises, real life, must be given to Learners during the teaching and learning of the applications of Calculus.

(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 encourage our EC Learners to participate in Quizzes, Olympiads and all Mathematics related competitions that will elevate the cognitive thinking and enhance analysis ability in our candidates.

QUESTION 9

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

QUESTION 9

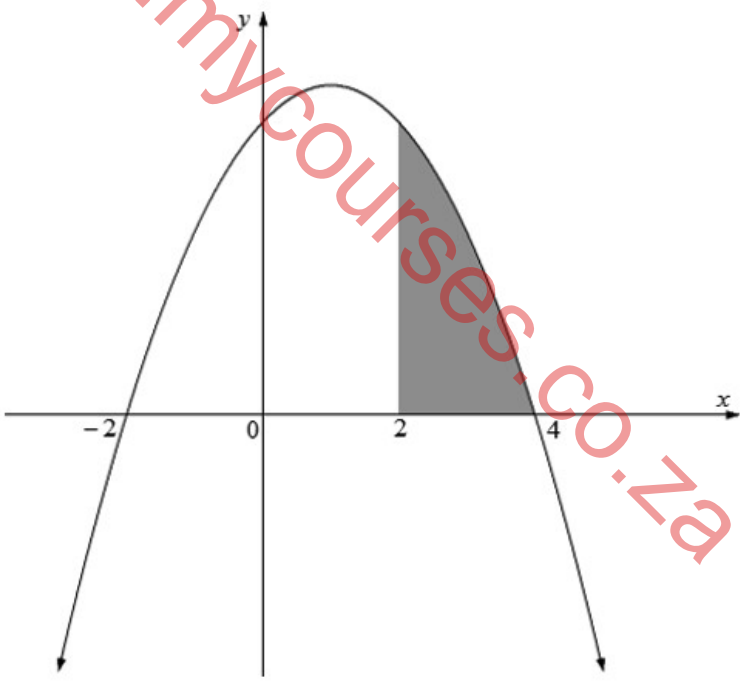
9.1 Determine the following integrals:

9.1.1 $\int 3x^{-1}\,dx$ (2)

9.1.2 $\int \left(4+2^{-x}\right)dx$ (2)

9.1.3 $\int \frac{8x^4 - x^2}{2x}\,dx$ (3)

9.2 The sketch below shows the shaded area bounded by function h defined by $h(x) = -x^2 + 2x + 8$ and the x-axis between the points where $x = 2$ and $x = 4$
The graph of h cuts the x-axis at $x = -2$ and $x = 4$
The area bounded by function h and the x-axis between the x-intercepts is 36 square units.

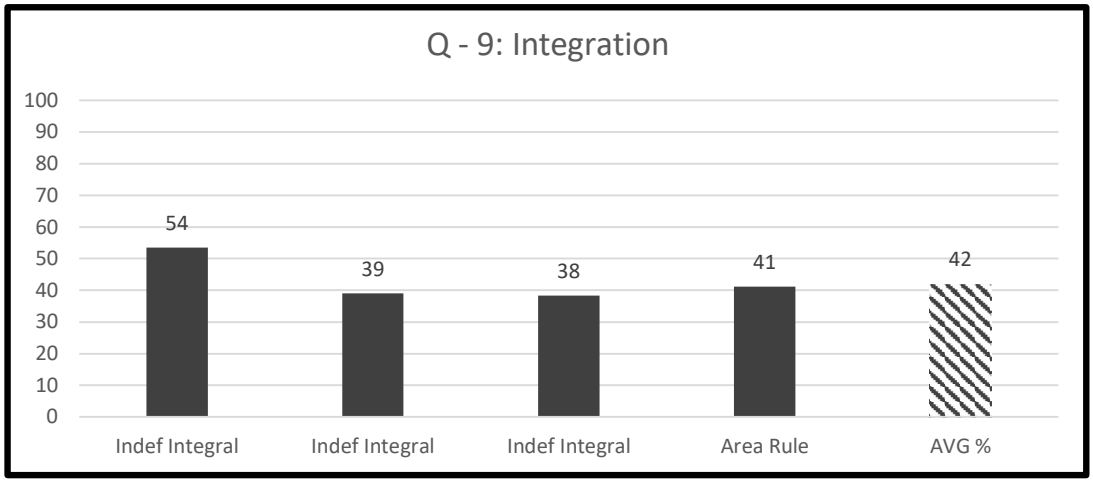


A learner at a technical high school states that the shaded area is 20% of the area bounded by function h and the x-axis between the x-intercepts.

Is the learner's statement CORRECT? Justify your answer by showing ALL calculations. (7)

[14]

TOTAL: 150



MAJOR

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

- In 9.1.1 candidates integrated the questions as if it was a normal integral and, in the act, ended up having a division by 0. They did not notice that its integral is 3ln x.
- Different forms of integration must be taught. It was vivid from the way candidates responded to 9.1.2 that in some schools, exponential integrals were not taught properly. In some schools or batches, it was noted that candidates obtained zero in this sub question and most of them integrated it as if it is a normal integral.
- Where candidates needed to simplify first before integrating there were challenges, just as it was the case with differentiation in 6.2. Candidates simple integrated all the terms, including the denominator 2x in 9.1.3. This led to incorrect solutions.
- The majority of candidates in the EC could not properly write the first step of the area rule. Responses which gave no meaning were written for this question, indicating urgent need of development to the Teachers of Technical Mathematics on this aspect.

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

- Various representations must be done in class so that candidates are not found wanting in examinations when the representation they are used to is changed to another form.
- SRFI must be followed when teaching the concept of integration. This must be done routinely so that Learners are used to it.

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

- Calculus as a whole is a big topic covering 50 marks out of 150, it is recommended that district Subject Advisors and school Departmental Heads pay attention in developing Teachers in the content and methodology of teaching this topic.
- LAIS coordinators and plans must include Algebra and Calculus throughout the year because these topics carry the bulk of marks in Technical Mathematics paper 1.

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

TECHNICAL MATHEMATICS P1

NOVEMBER 2022

MARKS: 150

TIME: 3 hours

This question paper consists of 11 pages, a 2-page information sheet and 2 answer sheets.

* T M A T E 1 *

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of NINE questions.
2. Answer ALL the questions.
3. Answer QUESTIONS 4.2.3 and 4.3 on the ANSWER SHEETS provided. Write your centre number and examination number in the spaces provided on the ANSWER SHEETS and hand in the ANSWER SHEETS with your ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.
6. Answers only will NOT necessarily be awarded full marks.
7. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
8. If necessary, round off answers to TWO decimal places, unless stated otherwise.
9. Diagrams are NOT necessarily drawn to scale.
10. An information sheet with formulae is included at the end of the question paper.
11. Write neatly and legibly.

QUESTION 1

1.1 Solve for x:

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

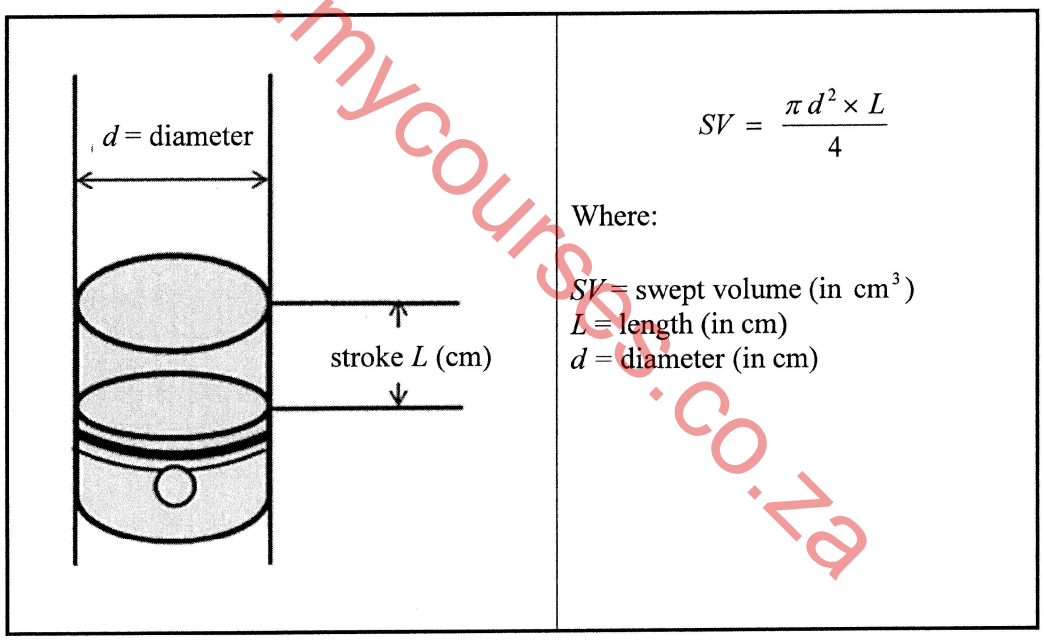
1.1.2 $4x^2 - 5x - 4 = 0$ (correct to TWO decimal places) (3)

1.1.3 $2x^2 - 8 > 0$ (3)

1.2 Solve for x and y if:

$y = 5x - 2$ and $y = x^2 + 4x - 8$ (5)

1.3 The diagram below shows the movement of a piston inside the engine cylinder of a car. Alongside is the formula for calculating the swept volume (SV), which is equal to the base area of the cylinder, multiplied by the length of the stroke (L).



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

1.3.2 Hence, calculate (rounded to the nearest cm), the numerical value of L if $SV = 1\,020{,}5\ \text{cm}^3$ and the diameter $d = 10$ cm. (2)

1.4 Given the binary numbers:

$$P = 1\,010_2 \text{ and } Q = 10\,000_2$$

1.4.1 Write P in decimal form. (1)

1.4.2 Determine P × Q in binary form. (2)

[20]

QUESTION 2

2.1 Given the equation: $x^2 - 2x + 6 = 0$

2.1.1 Determine the numerical value of the discriminant. (2)

2.1.2 Hence, describe the nature of the roots of the equation. (1)

2.2 Determine the numerical value of k for which the equation $x^2 + 2x + k = 0$ will have real roots. (3)
[6]

QUESTION 3

3.1 Simplify the following **without the use of a calculator**:

3.1.1 $\dfrac{8x^3y^2}{16xy^4}$ (leave the answer with positive exponents) (2)

3.1.2 $\dfrac{\sqrt{48}+\sqrt{12}}{\sqrt{27}}$ (3)

3.2 If $\log 5 = m$, determine the following in terms of m:

3.2.1 $\log 25$ (2)

3.2.2 $\log 2$ (3)

3.3 Solve for x: $\log_2(x+3) - 3 = -\log_2(x-4)$ (5)

3.4 Given complex numbers: $z_1 = -1 + 3i$ and $z_2 = \sqrt{2}\ cis\ 135°$

3.4.1 Write down the conjugate of z_1. (1)

3.4.2 Express z_2 in rectangular form. (2)

3.4.3 Evaluate $z_1 - z_2$. (2)

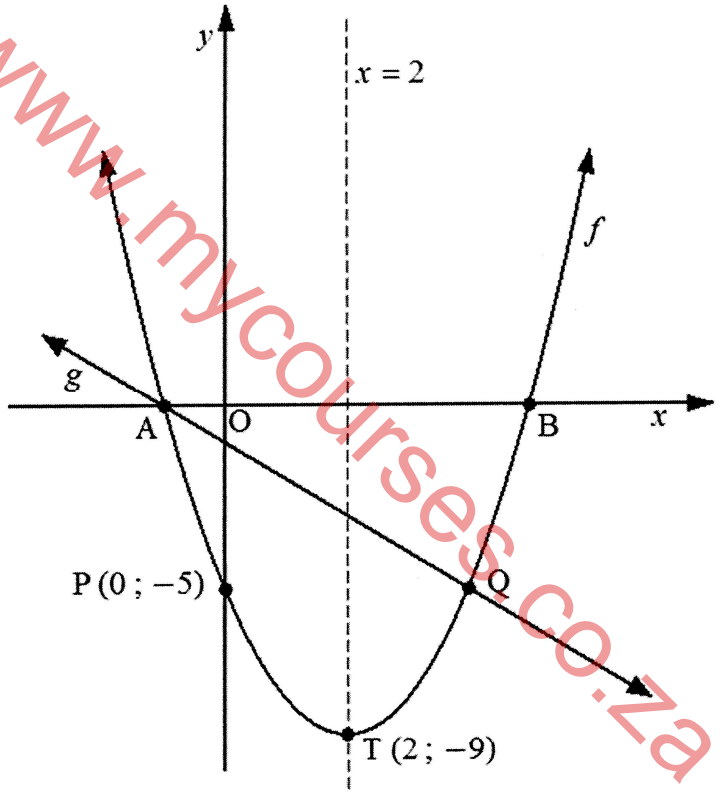
3.5 Solve for x and y if $x + yi - (1 - i) = 4 + 5i$ (4)
[24]

QUESTION 4

4.1 Sketched below are the graphs of functions f and g defined by:

$f(x) = x^2 - 4x - 5$ and $g(x) = mx + c$

- $T(2;-9)$ is the turning point of f.
- Points A, B and $P(0;-5)$ are the intercepts of f.
- Q is the reflection of P about the line $x = 2$
- A and Q are the points where $f(x) = g(x)$



4.1.1 Write down:

(a) The range of f (1)

(b) The coordinates of Q (2)

4.1.2 (a) Determine the x-intercept(s) of f. (3)

(b) Hence, write down the length of AB. (1)

4.1.3 Determine the numerical values of m and c. (3)

4.1.4 Write down the value(s) of x for which $f(x) \times g(x) > 0$ (2)

4.2 Given: The functions defined by $h(x) = -\sqrt{13 - x^2}$ and $k(x) = \frac{3}{x} + 1$

4.2.1 Write down the domain of function h. (2)

4.2.2 Determine:

(a) The equations of the asymptotes of k (2)

(b) The x-intercept of k (2)

4.2.3 Hence, sketch the graphs of h and k on the same set of axes on the ANSWER SHEET provided. Clearly show the intercepts with the axes and any asymptotes. (5)

4.3 Given: $t(x) = a^x + c$ and the following additional information:

- $y = -1$ is the equation of the asymptote of t
- $a > 1$

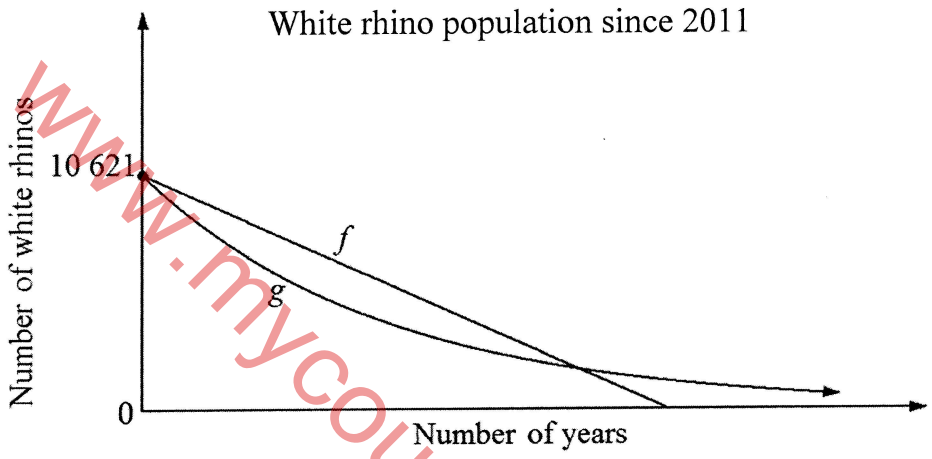
Sketch the graph of function t on the set of axes on the ANSWER SHEET provided. Clearly show the intercepts with the axes and the asymptote. (3)
[26]

QUESTION 5

5.1 A cellphone bought in 2022 costed R8 000. Determine the value of a similar cellphone at the end of 3 years if the inflation rate is 13% per annum. (3)

5.2 The white rhino population in the Kruger National Park depreciates at a rate of 12,8% per annum on the reducing-balance method over a period of time (in years).

The information below represents the statistics of a survey done since 2011.



5.2.1 How many white rhinos were there at the start of the survey in 2011? (1)

5.2.2 Which graph (f or g) represents the reducing-balance method ? (1)

5.2.3 Determine (showing ALL calculations) how long it took for the population of white rhinos to decrease to 3 459. Give your answer correct to the nearest year. (5)

5.3 Samuel opened a savings account to save for a boat cruise that he wants to go on at the end of 5 years. He made an initial deposit of R20 000.

- The interest rate for the first 2 years was 6% per annum, compounded monthly.
- At the end of the first 2 years:
  - He deposited a further amount of R5 000
  - The interest rate changed to 5% per annum, compounded half-yearly

Determine (showing ALL calculations) whether he will have enough money in the savings account for the boat cruise will cost R35 000. (5)
[15]

QUESTION 6

6.1 Determine $f'(x)$ using FIRST PRINCIPLES if $f(x) = 5 - 8x$ (5)

6.2 Determine:

6.2.1 $f'(x)$ if $f(x) = 3x^5 + \pi x$ (2)

6.2.2 $\frac{dy}{dx}$ if $y = x^2\left(4x - 2x^{-1}\right)$ (3)

6.2.3 $D_x\left[\sqrt[5]{x^4} - \frac{2}{5x^2} + 8t^4x\right]$ (5)

6.3 The gradient of the tangent to the curve defined by $g(x) = 6x^2 + 3x$ at $x = p$ is -21.

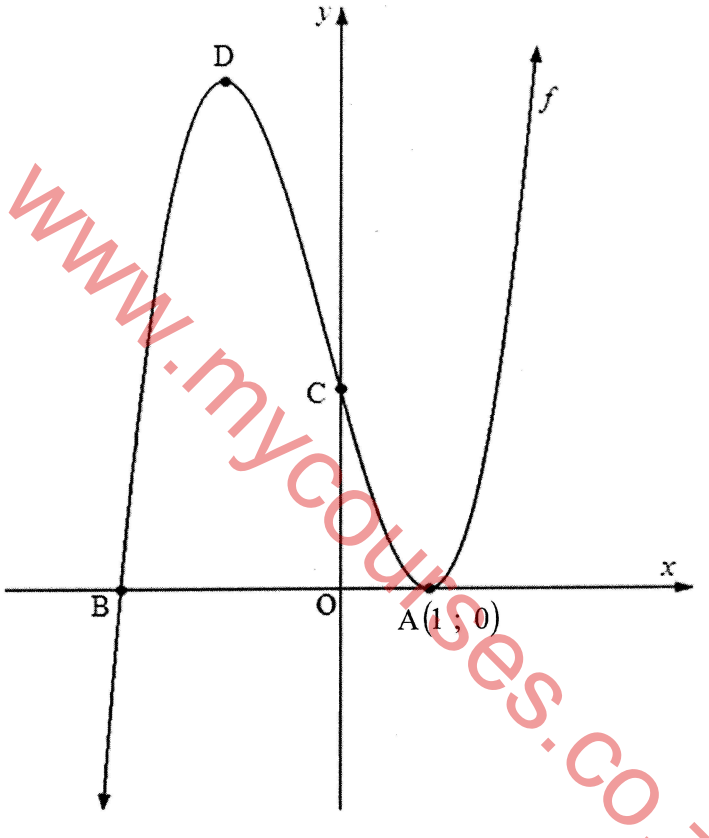
6.3.1 Determine the numerical value of p. (3)

6.3.2 Hence, determine the equation of the tangent to curve g at $x = p$ in the form $y = ...$ (3)
[21]

QUESTION 7

The graph below represents the function defined by $f(x) = x^3 + 3x^2 - 9x + k$ and cuts the x-axis at $A(1\ ;\ 0)$ and B.

The graph cuts the y-axis at C and has turning points at A and D.



7.1 Write down the length of OA. (1)

7.2 Show that $k = 5$ (1)

7.3 Hence, determine the coordinates of point B. (4)

7.4 Determine the coordinates of turning point D. (5)

7.5 Write down the value(s) of x for which $f'(x) \leq 0$ (2)

7.6 If $g(x) = f(x) - 2$, then write down the new coordinates of point A. (2)

[15]

QUESTION 8

An experiment is conducted in which the temperature (T) in degrees Celsius (^{o}C) varies with time (t) in seconds according to the formula:

$$T(t) = 37{,}5 + 7t - 0{,}5t^2 \quad \text{where} \quad 0 \leq t \leq 10$$

8.1 Write down the initial temperature. (1)

8.2 Determine the rate of change of the temperature with respect to time when $t = 4$ seconds. (3)

8.3 Determine the maximum temperature reached during the experiment. (3)

8.4 During which time interval was the temperature decreasing? (2)
[9]

QUESTION 9

9.1 Determine the following integrals:

9.1.1 $\int 3x^{-1}\,dx$ (2)

9.1.2 $\int \left(4+2^{-x}\right)dx$ (2)

9.1.3 $\int \frac{8x^4 - x^2}{2x}\,dx$ (3)

9.2 The sketch below shows the shaded area bounded by function h defined by $h(x) = -x^2 + 2x + 8$ and the x-axis between the points where $x = 2$ and $x = 4$
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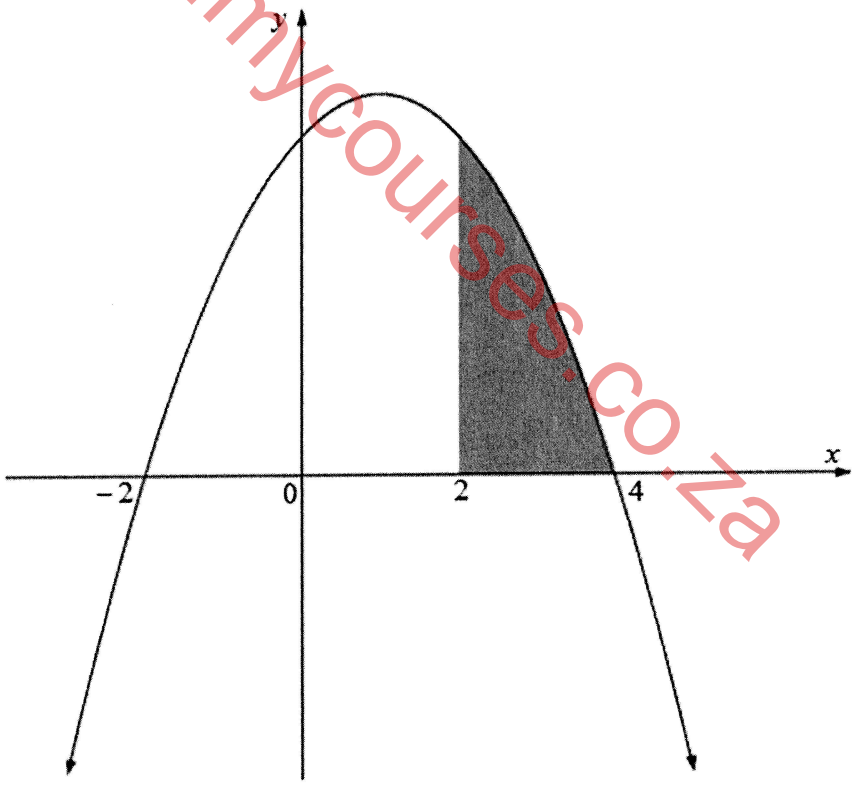
The area bounded by function h and the x-axis between the x-intercepts is 36 square units.



A learner at a technical high school states that the shaded area is 20% of the area bounded by function h and the x-axis between the x-intercepts.

Is the learner's statement CORRECT? Justify your answer by showing ALL calculations. (7)

[14]

TOTAL: 150

INFORMATION SHEET: TECHNICAL MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x = -\frac{b}{2a} \qquad y = \frac{4ac - b^2}{4a}$$

$$a^x = b \Leftrightarrow x = \log_a b, \quad a > 0, a \neq 1 \text{ and } b > 0$$

$$A = P(1 + ni) \qquad A = P(1 - ni) \qquad A = P(1 + i)^n \qquad A = P(1 - i)^n$$

$$i_{eff} = \left(1 + \frac{i}{m}\right)^m - 1$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$\int k x^n dx = \frac{k x^{n+1}}{n+1} + C \quad , n, k \in \mathbb{R} \text{ with } n \neq -1 \text{ and } k \neq 0$$

$$\int \frac{k}{x} dx = k \ln x + C \quad , x > 0 \text{ and } k \in \mathbb{R}\ ;\ k \neq 0$$

$$\int k a^{nx} dx = \frac{k a^{nx}}{n \ln a} + C \quad , a > 0\ ;\ a \neq 1 \text{ and } k, a \in \mathbb{R}\ ;\ k \neq 0$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad M\left(\frac{x_2 + x_1}{2}; \frac{y_2 + y_1}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad \tan\theta = m$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$$\text{In } \Delta ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{area of } \Delta ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin^2\theta + \cos^2\theta = 1 \qquad 1 + \tan^2\theta = \sec^2\theta \qquad 1 + \cot^2\theta = \text{cosec}^2\theta$$

$\pi\, rad = 180°$

Angular velocity $= \omega = 2\,\pi\, n$ where n = rotation frequency

Angular velocity $= \omega = 360°\, n$ where n = rotation frequency

Circumferential velocity $= v = \pi\, D\, n$ where D = diameter and n = rotation frequency

Circumferential velocity $= v = \omega\, r$ where ω = angular velocity and r = radius

Arc length $= s = r\theta$ where r = radius and θ = central angle in radians

Area of a sector $= \dfrac{r\,s}{2}$ where r = radius, s = arc length

Area of a sector $= \dfrac{r^2\,\theta}{2}$ where r = radius and θ = central angle in radians

$4h^2 - 4dh + x^2 = 0$ where h = height of segment, d = diameter of circle and x = length of chord

$A_T = a\left(m_1 + m_2 + m_3 + \ldots + m_n\right)$ where a = number of equal parts, $m_1 = \dfrac{o_1 + o_2}{2}$ $O_n = n^{th}$ ordinate and n = number of ordinates

OR

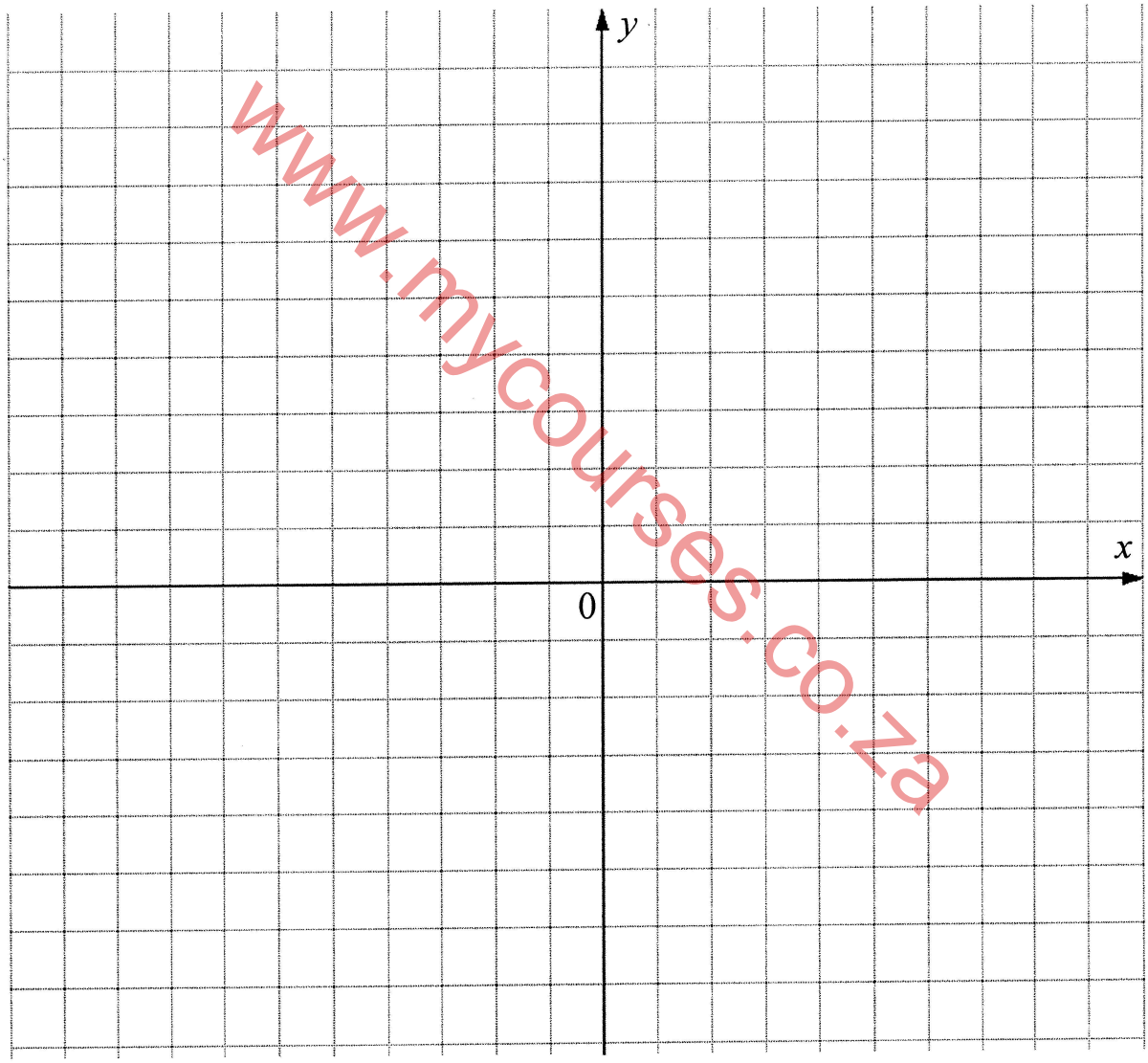
$A_T = a\left(\dfrac{o_1 + o_n}{2} + o_2 + o_3 + \ldots + o_{n-1}\right)$ where a = number of equal parts, $o_n = n^{th}$ ordinate and n = number of ordinates

ANSWER SHEET

CENTRE NUMBER							

EXAMINATION NUMBER													

QUESTION 4.2.3

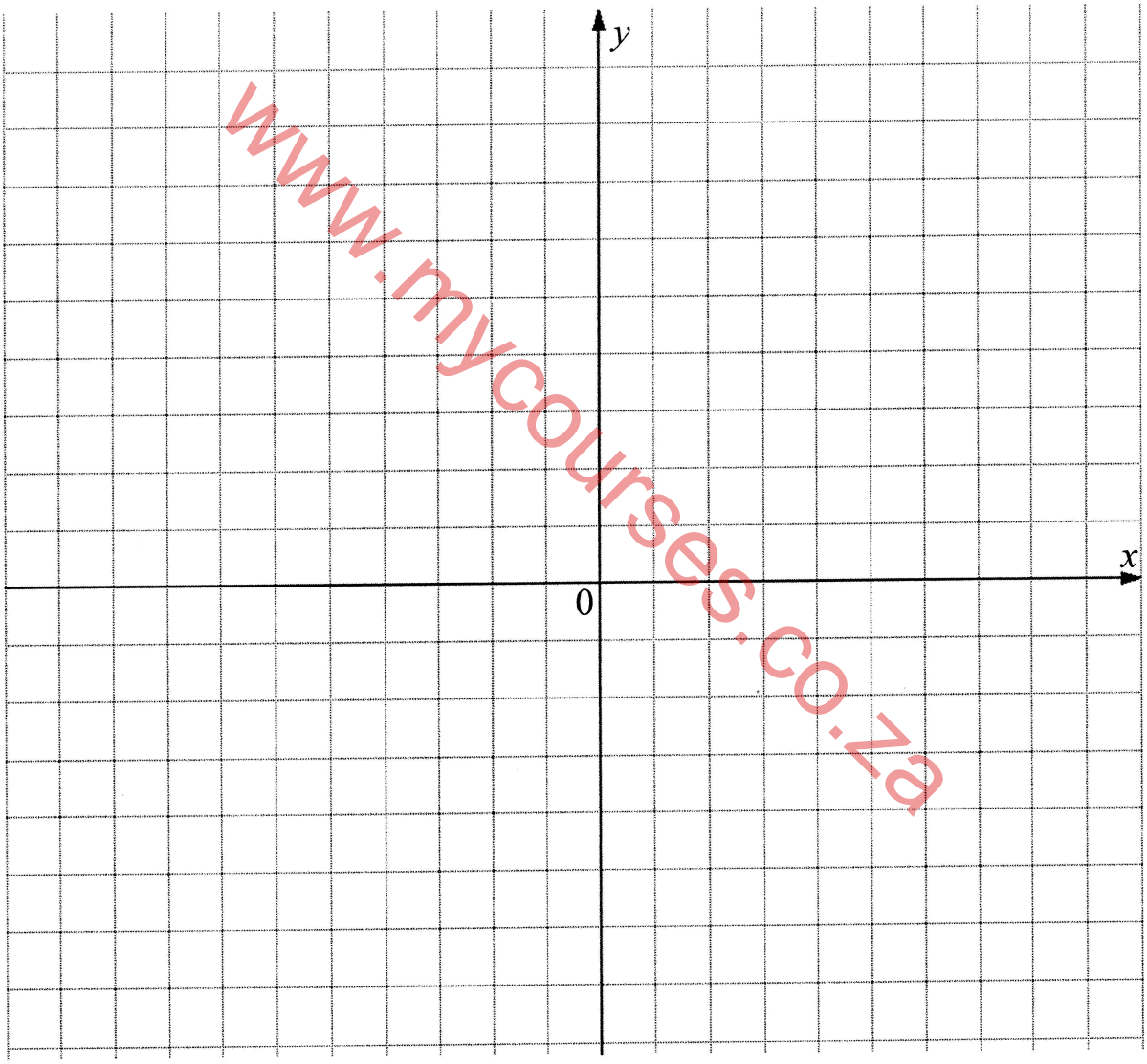


ANSWER SHEET

CENTRE NUMBER							

EXAMINATION NUMBER													

QUESTION 4.3



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE 12/*GRAAD* 12

TECHNICAL MATHEMATICS P1/*TEGNIESE WISKUNDE V1*

NOVEMBER 2022

FINAL MARKING GUIDELINES/*FINALE NASIENRIGLYNE*

MARKS/*PUNTE*: 150

MARKING CODES/*NASIENKODES*	
A	Accuracy/*Akkuraatheid*
CA	Consistent accuracy/*Volgehoue akkuraatheid*
M	Method/*Metode*
R	Rounding/*Afronding*
NPR	No penalty for rounding/*Geen penalisering vir afronding nie*
NPU	No penalty for units omitted / *Geen penalisering vir eenhede weggelaat nie*
S	Simplification/*Vereenvoudiging*
SF	Substitution in correct formula/*Vervanging in korrekte formule*
PR	Penalty for rounding/*Penalisasie vir afronding*

These marking guidelines consist of 19 pages.
Hierdie nasienriglyne bestaan uit 19 bladsye.

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DATE APPROVED/ DATUM GOEDGEKEUR	15 NOVEMBER 2022

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NOTE:

- If a candidate answers a question TWICE, only mark the FIRST attempt.
- Consistent accuracy marking to be applied where indicated.
- # Shows questions where Tolerance Range will be applied:
  Q 3.3 ; Q 5.3 ; Q 6.2.3 ; Q 9.1.3

LET WEL:

- *Indien 'n kandidaat 'n vraag TWEE keer beantwoord, sien slegs die EERSTE poging na.*
- *Volgehoue akkuraatheidnasien moet toegepas word soos aangedui.*
- *# Toon vrae waar Toleransie Wydte (Verdraagsaamheids omvang) toegepas word:*
  V 3.3 ; V 5.3 ; V 6.2.3 ; V 9.1.3

QUESTION/*VRAAG* 1

1.1.1	$x(7+x)=0$ $x=0$ or/*of* $x=-7$	✓ $x=0$ ✓ $x=-7$	**A** **A** (2)
1.1.2	$4x^2-5x-4=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-(-5)\pm\sqrt{(-5)^2-4(4)(-4)}}{2(4)}$ **OR/*OF*** $=\frac{-(5)\pm\sqrt{(5)^2-4(-4)(4)}}{2(-4)}$ $\therefore x\approx 1,80$ or / *of* $x\approx -0,55$	✓ **SF** ✓ positive x- value / *positiewe x- waarde* ✓ negative x- value / *negatiewe x- waarde* **NPR** **AO** full marks /*volpunte*	**A** **CA** **CA** (3)
1.1.3	$2x^2-8>0$ $\quad 2(x^2-4)>0$ $2(x-2)(x+2)>0$ **OR/OF** $(x-2)(x+2)>0$ Critical values/*kritiese waardes*: 2 and/*en* -2 $\therefore x<-2$ or/*of* $x>2$ **OR/*OF*** $x\in(-\infty;-2)$ or/*of* $x\in(2;\infty)$ **OR/*OF***  	✓ factors/*faktore* Formula / *Formule* ✓Both critical values/ *beide kritiese waardes* ✓ notation/*notasie* **AO** full marks /*volpunte*	**A** **CA** **A** (3)

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1.2

$y = 5x - 2$ and/*en* $y = x^2 + 4x - 8$

$x^2 + 4x - 8 = 5x - 2$

$x^2 - x - 6 = 0$

$(x-3)(x+2) = 0$ **OR/*OF*** $x = \dfrac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-6)}}{2(1)}$

$\therefore \quad x = 3 \quad$ or/*of* $\quad x = -2$

OR/*OF*

$y = 5(3) - 2$ or/*of* $y = 5(-2) - 2$

OR / *OF* $y = (3)^2 + 4(3) - 8$ or/*of* $y = (-2)^2 + 4(-2) - 8$

$\therefore \quad y = 13 \quad$ or/*of* $\quad y = -12$

OR/*OF*

$x = \dfrac{y+2}{5}$

$y = \left(\dfrac{y+2}{5}\right)^2 + 4\left(\dfrac{y+2}{5}\right) - 8$

$y = \dfrac{y^2 + 4y + 4}{25} + \dfrac{4y + 8}{5} - 8$

$25y = y^2 + 4y + 4 + 20y + 40 - 200$

$y^2 - y - 156 = 0$

$(y-13)(y+12) = 0$ **OR/*OF*** $y = \dfrac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-156)}}{2(1)}$

$\therefore y = 13 \quad$ or / *of* $\quad y = -12$

$x = \dfrac{13+2}{5}$ *or / of* $x = \dfrac{-12+2}{5}$

$\therefore x = 3 \quad$ and / *en* $\quad x = -2$

✓ equating/*gelykstel* **A**

✓ standard form/ *standaardvorm* **CA**
✓ factors or formula/ *faktore of formule* **CA**
✓ both x-values/ *beide x- waardes* **CA**

✓both y-values/ *beide y-waardes* **CA**

OR/*OF*

✓ substitution/ *vervanging* **A**

✓standard vorm/ *standaardvorm* **CA**
✓ factors or formula/ *faktore of formule* **CA**

✓both y-value/ *beide y-waardes* **CA**

✓both x values/ *beide x-waardes* **CA**
(5)

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1.3.1	$SV = \frac{\pi d^2 \times L}{4}$ $4SV = \pi d^2 \times L$ $\therefore L = \frac{4SV}{\pi d^2}$ **OR/*OF*** $\therefore L = \frac{SV}{\frac{\pi d^2}{4}}$	✓ **M** **A** ✓ *L* subject/*L-onderwerp* **CA** **AO** full marks /*volpunte* (2)
1.3.2	$L = \frac{4SV}{\pi d^2}$ $= \frac{4 \times 1020,5}{\pi \times (10)^2}$ **OR / OF** $= \frac{4 \times 1020,5}{3,14 \times (10)^2}$ $\approx 13\ cm$ **OR/*OF*** $L = \frac{SV}{\frac{\pi d^2}{4}}$ $= \frac{1020,5}{\frac{\pi (10)^2}{4}}$ $\approx 13\ cm$ **OR/*OF*** $SV = \frac{\pi d^2 \times L}{4}$ $1020,5 = \frac{\pi (10)^2 \times L}{4}$ $L \approx 13\ cm$	✓ **SF** **CA** ✓ value of *L*/ *waarde v L* **CA** **OR/*OF*** ✓ **SF** **CA** ✓value of *L*/ *waarde v L* **CA** **OR/*OF*** ✓ **SF** **A** ✓value of *L*/ *waarde v L* **CA** **PR** *in this question only/ slegs in hierdie vraag* (2)

1.4.1	<table><tr><td></td><td>2^5</td><td>2^4</td><td>2^3</td><td>2^2</td><td>2^1</td><td>2^0</td><td></td></tr><tr><td>P</td><td></td><td></td><td>1</td><td>0</td><td>1</td><td>0</td><td>=10</td></tr></table>	✓ 10	**A** (1)
1.4.2	$1010_2 \times 10000_2 = 10100000_2$ **OR/OF** <table><tr><td></td><td>2^5</td><td>2^4</td><td>2^3</td><td>2^2</td><td>2^1</td><td>2^0</td><td></td></tr><tr><td>Q</td><td></td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>=16</td></tr></table> $P \times Q = 10 \times 16 = 160 = 10100000_2$ <table><tr><td>2^7</td><td>2^6</td><td>2^5</td><td>2^4</td><td>2^3</td><td>2^2</td><td>2^1</td><td>2^0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>	✓✓ **AO** full marks /*volpunte* ✓ 16 ✓ 10100000_2	**A** **A** **CA** (2)
			[20]

QUESTION/*VRAAG* 2

2.1.1	$x^2 - 2x + 6 = 0$ $\Delta = b^2 - 4ac$ $= (-2)^2 - 4(1)(6)$ $= -20$	✓ **SF** ✓ **S** **AO** full marks /*volpunte*	**A** **CA** (2)
2.1.2	Non-real/Imaginary/*Nie-reël/imaginêr*	✓ non-real/imaginary/ *nie-reël/imaginêr*	**CA** (1)
2.2	$x^2 + 2x + k = 0$ $\Delta = (2)^2 - 4(1)(k)$ $(2)^2 - 4(1)(k) \geq 0$ $4 - 4k \geq 0$ $k \leq 1$	✓ **SF** ✓ $\Delta \geq 0$ ✓ value(s) of k/ *waarde(s) van k*	**A** **A** **CA** (3)
			[6]

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QUESTION/*VRAAG* 3

3.1.1	$\frac{8x^3y^2}{16xy^4}$ $=\frac{x^2}{2y^2}$	✓ x^2 or/*of* $\frac{1}{2}x^2$ **A** ✓ $2y^2$ or/*of* y^2 **A** (2)
3.1.2	$\frac{\sqrt{48}+\sqrt{12}}{\sqrt{27}}$ $=\frac{4\sqrt{3}+2\sqrt{3}}{3\sqrt{3}}$ **OR/*OF*** $=\frac{2^2\sqrt{3}+2\sqrt{3}}{3\sqrt{3}}$ **OR/*OF*** $=\frac{4\cdot 3^{\frac{1}{2}}+2\cdot 3^{\frac{1}{2}}}{3\cdot 3^{\frac{1}{2}}}$ $=\frac{6\sqrt{3}}{3\sqrt{3}}$ $=\frac{\sqrt{3}(4+2)}{3\sqrt{3}}$ $=\frac{3^{\frac{1}{2}}(4+2)}{3.3^{\frac{1}{2}}}$ $=2$ **OR/*OF*** $\frac{\sqrt{48}+\sqrt{12}}{\sqrt{27}}$ $=\frac{4\sqrt{3}}{3\sqrt{3}}+\frac{2\sqrt{3}}{3\sqrt{3}}$ $=\frac{6}{3}$ $=2$	✓simplified surd forms/ *vereenvoudigde wortelvorme* **A** ✓ **S** **CA** ✓ **S** **CA** **OR/*OF*** ✓simplified surd forms/ *vereenvoudigde wortelvorme* **A** ✓ **S** **CA** ✓ **S** **CA** **AO** one mark/*slegs een punt* (3)
3.2.1	$\log 25$ $=\log 5^2$ **OR/*OF*** $2\log 5$ **OR/*OF*** $\log 5+\log 5$ $=2m$	✓ log(exp) property/- *log(eksp,)eienskap* **A** ✓ **S** **CA** **AO** full marks /*volpunte* (2)
3.2.2	$\log 2$ $=\log\left(\frac{10}{5}\right)$ **OR/*OF*** $=\log 2+\log 5-\log 5$ $=\log 10-\log 5$ $=1-m$	✓ **M** **A** ✓log property/ *eienskap* **A** ✓ **S** **CA** **AO** full marks /*volpunte* (3)

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3.3 #

$$\log_2(x+3) - 3 = -\log_2(x-4)$$

$$\log_2(x+3) + \log_2(x-4) = 3$$

$$\log_2(x+3)(x-4) = 3$$

$$(x+3)(x-4) = 2^3 = 8$$

$$x^2 - x - 12 = 8$$

$$x^2 - x - 20 = 0$$

$$(x+4)(x-5) = 0 \quad \textbf{OR/}\textit{OF}$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-20)}}{2(1)}$$

$$\therefore x = 5 \quad \text{or/}of \quad x \neq -4$$

✓ log property/*-eienskap* **A**

✓ exponential form/ *eksponentvorm* **CA**

✓ standard form/ *standaardvorm* **CA**

✓ factors or formula/ *faktore of formule* **CA**

✓ correct value of/ *korrek waarde van x* **CA**

OR/*OF*

$$\log_2(x+3) - 3 = -\log_2(x-4)$$

$$\log_2(x+3) - 3\log_2 2 = \log_2(x-4)^{-1}$$

$$\log_2(x+3) - \log_2 8 = \log_2(x-4)^{-1}$$

$$\log_2 \frac{(x+3)}{8} = \log_2 \frac{1}{(x-4)}$$

$$\frac{x+3}{8} = \frac{1}{x-4}$$

$$(x+3)(x-4) = 1 \times 8$$

$$x^2 - x - 12 = 8$$

$$x^2 - x - 20 = 0$$

$$(x+4)(x-5) = 0 \quad \textbf{OR/}\textit{OF}$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-20)}}{2(1)}$$

$$\therefore x = 5 \quad \text{or/}of \quad x \neq -4$$

✓ log property/*-eienskap* **A**

✓ log property/*-eienskap* **CA**

✓ standard form/ *standaardvorm* **CA**

✓ factors or formula/ *faktore of formule* **CA**

✓ correct value of/ *korrek waarde van x* **CA**

OR/*OF*

OR/*OF*

	$\log_2(x+3) = 3 - \log_2(x-4)$ $\log_2(x+3) = \log_2 8 - \log_2(x-4)$ $\log_2(x+3) = \log_2 \frac{8}{(x-4)}$ $\frac{x+3}{1} = \frac{8}{x-4}$ $(x+3)(x-4) = 8$ $x^2 - x - 12 = 8$ $x^2 - x - 20 = 0$ $(x+4)(x-5) = 0$ **OR/*OF*** $x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-20)}}{2(1)}$ $\therefore x = 5$ or/*of* $x \neq -4$	✓ log property/*-eienskap* **A** ✓ log property/*-eienskap* **CA** ✓ standard form/ *standaardvorm* **CA** ✓ factors or formula/ *faktore of formule* **CA** ✓ correct value of/ *korrek waarde van x* **CA** (5)
3.4.1	$\bar{z} = -1 - 3i$	✓conjugate/*toegevoegde* **A** (1)
3.4.2	$z_2 = \sqrt{2}\,cis\,135° = \sqrt{2}\cos 135° + i\sqrt{2}\sin 135°$ $= -1 + i$	✓ expansion/*uitbreiding* **A** ✓ $-1+i$ **A** **AO** full marks /*volpunte* (2)
3.4.3	$z_1 - z_2$ $= -1 + 3i - (-1+i)$ **OR/*OF*** $-1 + 3i - \sqrt{2}\,cis135°$ $= 2i$	✓substitution/*vervanging* **CA** ✓**S** **CA** **AO** full marks /*volpunte* (2)
3.5	$x + yi - (1-i) = 4 + 5i$ $x + yi - 1 + i = 4 + 5i$ $x + yi = 5 + 4i$ $\therefore x = 5$ and/*en* $y = 4$ **OR/*OF*** $x + yi - (1-i) = 4 + 5i$ $x + yi - 1 + i = 4 + 5i$ $(x-1) + (y+1)i = 4 + 5i$ $x - 1 = 4$ and/*en* $y + 1 = 5$	✓ **S** **A** ✓ **S** **CA** ✓ value of *x/waarde van x* **CA** ✓ value of *y/waarde van y* **CA** **OR/*OF*** ✓ **S** **A** ✓ **S** **CA** ✓ value of *x/waarde van x* **CA** ✓ value of *y/waarde van y* **CA** (4)
		[24]

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QUESTION/*VRAAG* 4

4.1.1(a)	$y \geq -9$ **OR/OF** $y \in [-9;\infty)$ **OR/OF** $-9 \leq y < \infty$	✓ $y \geq -9 / y \in [-9;\infty)$ / $-9 \leq y < \infty$	**A** (1)
4.1.1(b)	$Q(4;-5)$	✓ $x = 4$ ✓ $y = -5$	**A** **A** (2)
4.1.2(a)	$f(x) = x^2 - 4x - 5$ x–int s./ *afsn.*: $x^2 - 4x - 5 = 0$ $(x+1)(x-5) = 0$ **OR/*OF*** $x = \dfrac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-5)}}{2(1)}$ $x = -1$ *or / of* $x = 5$	✓ $y = 0$ ✓ factors/form/ *faktore/formule* ✓ both values of x/ *beide waardes van x* **AO** full marks /*volpunte*	**A** **A** **CA** (3)
4.1.2(b)	The length of/*lengte van* AB = 6 units/*eenhede*	✓6	**CA** (1)
4.1.3	$g(x) = mx + c$ through/*deur* $A(-1;0)$; Q (4;–5) $m = \dfrac{y_1 - y_2}{x_1 - x_2} = \dfrac{-5-0}{4-(-1)}$ $= -1$ $g(x) = -1x + c$ **OR/*OF*** $y - y_1 = -1(x - x_1)$ subst./ *verv.*: $(-1;0)$ $0 = -1(-1) + c$ $\quad y - 0 = -1(x+1)$ $c = -1$ **OR/*OF*** subst./ *verv.*: $(4;-5)$ $-5 = -1(4) + c$ **OR/*OF*** $y - (-5) = -1(x-4)$ $c = -1$	✓ **SF** ✓ $m = -1$ **Must be negative/ *Moet negatief wees*** ✓ $c = -1$	**CA** **CA** **CA** (3)

4.1.4	$x<5\ ;\ x\neq -1$ **OR/*OF*** $x\in(-\infty;5);\ x\neq -1$ **OR/*OF*** $x\in(-\infty;-1)$ or/*of* $(-1\ ;\ 5)$	✓ $x<5$ ✓ $x\neq -1$ **OR/*OF*** ✓ $(-\infty;5)$ ✓ $x\neq -1$ **OR/*OF*** ✓ $(-\infty;-1)$ ✓ $(-1\ ;\ 5)$	**CA** **CA** **CA** **CA** **CA** **CA** (2)
4.2.1	$-\sqrt{13}\leq x\leq\sqrt{13}$ **OR/*OF*** $x\in[\ -\sqrt{13}\ ;\ \sqrt{13}\ ]$ **OR/*OF*** $-3,61\leq x\leq 3,61$ **OR/*OF*** $x\in[-3,61\ ;\ 3,61\ ]$ **OR/OF** $x\geq -3,61$ and/*en* $x\leq 3,61$ **OR/OF** $x\geq -\sqrt{13}$ and/*en* $x\leq\sqrt{13}$	✓ critical values/ *kritiese waardes* ✓ notation/*notasie*	**A** **A** (2)
4.2.2(a)	$x=0\ ;\ y=1$	✓ $x=0$ ✓ $y=1$	**A** **A** (2)
4.2.2(b)	$0=\frac{3}{x}+1$ $-1=\frac{3}{x}$ $x=-3$	✓ $y=0$ ✓value of *x/waarde van x* **AO** full marks /*volpunte*	**A** **A** (2)

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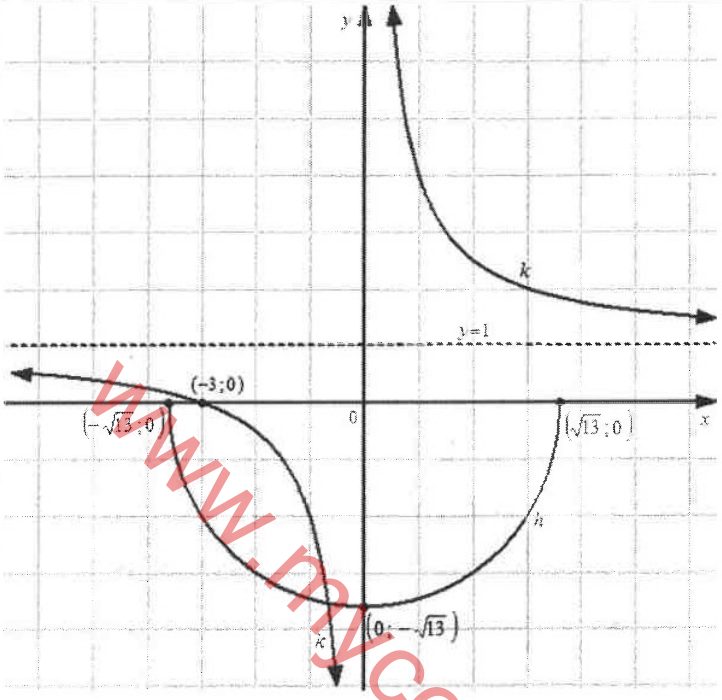
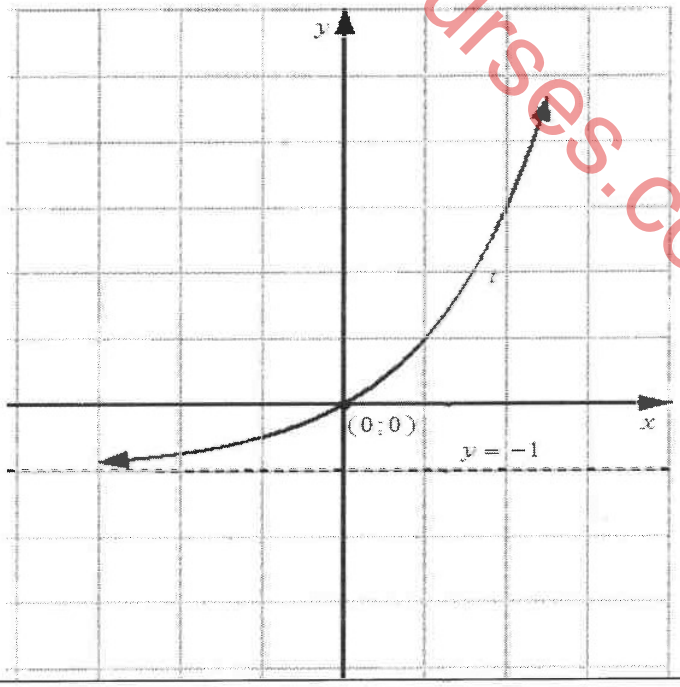
4.2.3		*k*: ✓ shape/*vorm* **A** ✓ *x*-int./*afsn.* **CA** ✓ asymptote/*asimptote* **CA** *h*: ✓ shape/*vorm* **A** ✓ both/*beide x*-int./*afsn.* **CA** (5)
4.3		✓ shape/*vorm* **A** ✓ (0;0) **A** ✓ asymptote/*asimptoot* **A** (3)
		[26]

QUESTION/*VRAAG* 5

5.1	$A = P(1+i)^n$ $= R\,8\,000\,(1+13\%)^3$ $\approx$ R 11 543,18	✓**F** ✓**SF** ✓ **S** **NPR**	**A** **A** **CA** (3)
5.2.1	10 621	✓ 10 621	**A** (1)
5.2.2	g	✓ g	**A** (1)
5.2.3	$A = P(1-i)^n$ $3459 = 10\,621(1-0{,}128)^n$ $\frac{3459}{10621} = (0{,}872)^n$ $n = \frac{\log\left(\frac{3459}{10621}\right)}{\log(0{,}872)}$ **OR/OF** $n = \log_{0{,}872}\frac{3459}{10621}$ $\therefore\ n \approx 8{,}1905$ years/*jaar*	✓**F** ✓ **SF** ✓ **S** ✓ log form/*-vorm* ✓ value of/*waarde van n* **NPR**	**A** **A** **CA** **CA** **CA** (5)
5.3 #	Value of investment end of 24 months/ *Waarde van belegging einde van 24 maande:* $A = P(1+i)^n = R20\,000\left(1+\frac{6\%}{12}\right)^{2\times12}$ $\approx$ R22 543,19552 Invested/*Belê* R5 000 R22 543,19552 + R 5 000 $\approx$ R27 543,19552 Value of investment end of 5 years/ *Waarde van belegging einde van 5 jaar:* $A = P(1+i)^n = 27\,543{,}19552\left(1+\frac{5\%}{2}\right)^{3\times2}$ $\approx$ R31 941,66 $\therefore$ R31 941,66 < R 35 000 He will **NOT** have enough money/*Hy sal **NIE** genoeg geld hê NIE.* **OR/*OF***	✓ **SF** ✓**M** + R5 000 ✓ **SF** ✓ R 31 941, 66 ✓conclusion/*gevolgtrekking* **OR/*OF***	**A** **A** **CA** **CA** **CA**

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	$A = R20\,000\left(1+\frac{6\%}{12}\right)^{2\times12}\left(1+\frac{5\%}{2}\right)^{2\times3}$ $+ R5\,000\left(1+\frac{5\%}{2}\right)^{2\times3}$ $\approx R31\,941,66$ $\therefore$ R 31 941,66 < R 35 000 He will **NOT** have enough money/*Hy sal* ***NIE*** *genoeg geld hê NIE.* **OR/*OF*** $P = \frac{R35\,000}{\left(1+\frac{6\%}{12}\right)^{2\times12}\left(1+\frac{5\%}{2}\right)^{2\times3}}$ $= \frac{5\,000}{\left(1+\frac{6\%}{12}\right)^{2\times12}}$ $\approx$ R 22 339,68 $\therefore$ R 20 000 < R 22 339,68 He will **NOT** have enough money/*Hy sal* ***NIE*** *genoeg geld hê NIE.*	✓ $\left(1+\frac{6\%}{12}\right)^{2\times12}$ **A** ✓ $\left(1+\frac{5\%}{2}\right)^{2\times3}$ **A** ✓ **M** + R5 000 **A** ✓ R31941, 66 **CA** ✓conclusion/*gevolgtrekking* **CA** **OR/*OF*** ✓ $\left(1+\frac{6\%}{12}\right)^{2\times12}$ **A** ✓ $\left(1+\frac{5\%}{2}\right)^{2\times3}$ **A** ✓ **M** – R5 000 **A** ✓ R 22 339,68 **CA** ✓conclusion/*gevolgtrekking* **CA** **NPR** (5)
			[15]

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QUESTION/*VRAAG* 6

6.1	$f(x)=5-8x$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$ $=\lim_{h\to 0}\frac{5-8(x+h)-(5-8x)}{h}$ $=\lim_{h\to 0}\frac{5-8x-8h-5+8x}{h}$ $=\lim_{h\to 0}\frac{-8h}{h}$ $=\lim_{h\to 0}(-8)$ $f'(x)=-8$	✓ definition/*definisie* ✓ **SF** ✓ **S** ✓ **S** ✓ -8 **Penalty** of one mark for incorrect notation *Penaliseer een punt indien notasie foutief is.* **AO** only one mark/*slegs een punt*	**A** **A** **CA** **CA** **CA** (5)
6.2.1	$f(x)=3x^5+\pi x$ $f'(x)=15x^4+\pi$	✓ $15x^4$ ✓ π	**A** **A** (2)
6.2.2	$y=x^2\left(4x-2x^{-1}\right)$ $y=4x^3-2x$ $\frac{dy}{dx}=12x^2-2$	✓ **S** ✓ $12x^2$ ✓ -2	**A** **CA** **CA** (3)
6.2.3 #	$D_x\left[\sqrt[5]{x^4}-\frac{2}{5x^2}+8t^4x\right]$ $=D_x\left[x^{\frac{4}{5}}-\frac{2}{5}x^{-2}+8t^4x\right]$ $=\frac{4}{5}x^{-\frac{1}{5}}+\frac{4}{5}x^{-3}+8t^4$	✓ $x^{\frac{4}{5}}$ ✓ $-\frac{2}{5}x^{-2}$ ✓ $\frac{4}{5}x^{-\frac{1}{5}}$ ✓ $\frac{4}{5}x^{-3}$ ✓ $8t^4$	**A** **A** **CA** **CA** **CA** (5)
6.3.1	$g'(x)=12x+3$ $\therefore 12(p)+3=-21$ $12p=-24$ $p=-2$	✓ derivative of/*afgeleide van g* ✓ equat.deriv/*afgeleide* $=-21$ ✓ $p=-2$	**A** **A** **CA** (3)
6.3.2	$y=6(-2)^2+3(-2)$ $\therefore y=18$ $y=mx+c$ **OR/*OF*** $y-y_1=m(x-x_1)$ $18=-21(-2)+c$ $y-18=-21(x+2)$ $c=-24$ $y-18=-21-42$ $\therefore y=-21x-24$	✓ y coordinate/*y-koördinaat* ✓ **SF** ✓ eqn. of tangent/*vergelyk. van raaklyn*	**CA** **CA** **CA** (3)
			[21]

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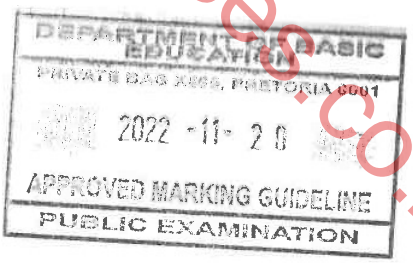
QUESTION/*VRAAG* 7

7.1	OA = 1 unit/*eenheid*	✓length/*lengte*	**A** (1)
7.2	$0 = (1)^3 + 3(1)^2 - 9(1) + k$ $\therefore k = 5$	✓ subst./*verv.* $A(1;0)$	**A** (1)
7.3	x - intercepts/*afsnitte*; $y = 0$ $(x-1)(x-1)(x+5) = 0$ $\therefore B(-5;0)$ **OR/*OF*** $(x-1)(x^2+4x-5) = 0$ **OR/*OF*** $(x+5)(x^2-2x+1) = 0$ $(x-1)(x-1)(x+5) = 0$ $\therefore x = 1$ or/*of* $x = -5$ $\therefore B(-5;0)$	✓ $(x-1)$ **A** ✓ $(x-1)(x+5)$ **A** ✓ x- coordinates of B/ *koördinate van B* **CA** ✓ y-coordinates of B/ *koördinate van B* **A** **OR/*OF*** ✓ linear factor/ **A** ✓ quadratic factor/ **A** ✓ x- coordinates of B/ *koördinate van B* **CA** ✓ y-coordinates of B/ *koördinate van B* **A** **AO** full marks /*volpunte* (4)	
7.4	$f'(x) = 3x^2 + 6x - 9 = 0$ $x^2 + 2x - 3 = 0$ $(x+3)(x-1) = 0$ **OR/*OF*** $x = \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(-3)}}{2(1)}$ $\therefore x = -3$ or/*of* $x = 1$ $f(-3) = (-3)^3 + 3(-3)^2 - 9(-3) + 5$ $= 32$ $\therefore D(-3;\ 32)$	✓derivative/*afgeleide* **A** ✓ equating derivative to 0/ *stel afgeleide gelyk aan 0* **A** ✓factors/formula/*faktore/ formule* **CA** ✓x value of D/ *x-waarde van D* **CA** ✓ y value of D/ *waarde van D* **CA** **AO** two marks/*twee punte* (5)	

Please turn over/*Blaai om asseblief*

7.5	$-3 \leq x \leq 1$ **OR/*OF*** $x \in [-3\ ;\ 1]$ **OR/*OF*** $x \geq -3$ and/*en* $x \leq 1$	✓ critical values/ *kritiese waardes* ✓ notation/*notasie*	**CA** **A** (2)
7.6	$(1\ ;-2)$	✓ x coordinate/ *-koördinaat* ✓ y coordinate/ *-koördinaat*	**A** **A** (2)
			[15]



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QUESTION/*VRAAG* 8

8.1	$37,5\ ^\circ C$	✓ $37,5\ ^\circ C$ **NPU**	**A** (1)
8.2	$T'(t) = 7 - t$ $T'(4) = 7 - (4)$ $= 3\ ^\circ C/s$	✓ derivative/*afgeleide* ✓ Subst./*verv.* $t = 4$ ✓ $3\ ^\circ C/s$ **NPU**	**A** **A** **CA** (3)
8.3	$7 - t = 0$ **OR/*OF*** $t = \frac{-(7)}{2\left(-\frac{1}{2}\right)}$ $\therefore t = 7s$ $T(7) = 37,5 + 7(7) - 0,5(7)^2 = 62\ ^\circ C$	✓ $7 - t = 0$ / $t = \frac{-(7)}{2\left(-\frac{1}{2}\right)}$ ✓ $t = 7s$ ✓ $62\ ^\circ C$ **NPU**	**A** **CA** **CA** (3)
8.4	$7 - t < 0$ $\therefore t > 7$ $7 < t \leq 10$ **OR/*OF*** $t \in (7;10]$ **OR/OF** $t > 7$ and/*en* $t \leq 10$	✓ $t > 7$ ✓ restricting to 10/ *beperking tot* 10 **AO** full marks /*volpunte*	**CA** **A** (2)
			[9]

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QUESTION/*VRAAG* 9

9.1.1	$\int 3x^{-1}\,dx$ $= 3\ln x + C$	✓ $3\ln x$ ✓ C	**A** **A** (2)
9.1.2	$\int\left(4+2^{-x}\right)dx$ $=4x-\frac{2^{-x}}{\ln 2}+C$ **OR/*OF*** $4x+\frac{2^{-x}}{\ln 2^{-1}}+C$ **OR/*OF*** $=4x-\frac{\left(\frac{1}{2}\right)^x}{\ln 2}+C$ **OR/*OF*** $4x+\frac{\left(\frac{1}{2}\right)^x}{\ln\frac{1}{2}}+C$	✓ $4x$ ✓value of 2nd integral/ *waarde van die tweede integraal* If C is omitted : NO penalty/ *Indien C weggelaat is : GEEN penalisering*	**A** **A** (2)
9.1.3 #	$\int\frac{8x^4-x^2}{2x}\,dx$ $=\int\left(4x^3-\frac{1}{2}x\right)dx$ $=x^4-\frac{1}{4}x^2+C$	✓ **S** ✓ x^4 ✓ $-\frac{1}{4}x^2$ **No simplification: 0 marks/** ***Geen vereenvoudiging: 0 punte*** No penalty if C omitted/*Geen penalisering indien C uitgelaat*	**A** **CA** **CA** (3)
9.2	A $=\int_2^4 h(x)\,dx = \int_2^4\left(-x^2+2x+8\right)dx$ $=\left[-\frac{x^3}{3}+x^2+8x\right]_2^4$ $=\left[-\frac{(4)^3}{3}+(4)^2+8(4)\right]-\left[-\frac{(2)^3}{3}+(2)^2+8(2)\right]$ $=\frac{28}{3}\approx 9{,}33$ $\therefore\frac{\left(\frac{28}{3}\right)}{36}\times 100\,\%\approx 25{,}93\,\%$ **OR/*OF*** $20\%\times 36=\left(\frac{36}{5}\right)=7{,}2$ 25,93 % > 20 % 7,2 < 9,33 ∴ The learner's statement is **NOT** correct/ *Die leerder se bewering is **NIE** korrek nie.*	✓Area notation using integrals/*Oppervlakte-notasie met gebruik van integrale* ✓ $-\frac{x^3}{3}+x^2+8x$ ✓ ✓**SF** ✓ area /*oppervlakte* ✓ % calculation / *berekening* ✓conclusion/ *Afleiding.*	**A** **A** **CA** **CA** **CA** **CA**

	OR/*OF*	**OR/*OF***	
	$A = 36 - \int_{-2}^{2} h(x)\,dx = 36 - \int_{-2}^{2} \left(-x^2+2x+8\right)dx$	✓Area notation using intergrals/ *Oppervlakte - notasie met gebruik van integrale*	**A**
	$=36 - \left[-\frac{x^3}{3}+x^2+8x\right]_{-2}^{2}$	✓ $-\frac{x^3}{3}+x^2+8x$	**A**
	$=36 - \left[-\frac{(2)^3}{3}+(2)^2+8(2)\right] - \left[-\frac{(-2)^3}{3}+(-2)^2+8(-2)\right]$	✓ ✓**SF**	**CA**
	$= \frac{28}{3} \approx 9,33$	✓ area/*oppervlakte*	**CA**
	$\therefore \frac{\left(\frac{28}{3}\right)}{36} \times 100\% \approx 25,93\%$ **OR/*OF*** $20\% \times 36 = \left(\frac{36}{5}\right) = 7,2$ 25,93 % > 20 % 7,2 < 9,33	✓ % calculation / *berekening*	**CA**
	∴ The learner's statement is **NOT** correct/ *Die leerder se bewering is **NIE** korrek nie.*	✓conclusion/ afleiding	**CA** (7)
			[14]
			TOTAL/*TOTAAL*: 150

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