



EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE

Home of Examinations and Assessment, Zone 6, Zwelitsha, 5600

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2020 NSC CHIEF MARKER'S REPORT

SUBJECT:	Technical Mathematics
PAPER:	1
DURATION OF PAPER:	3 hours

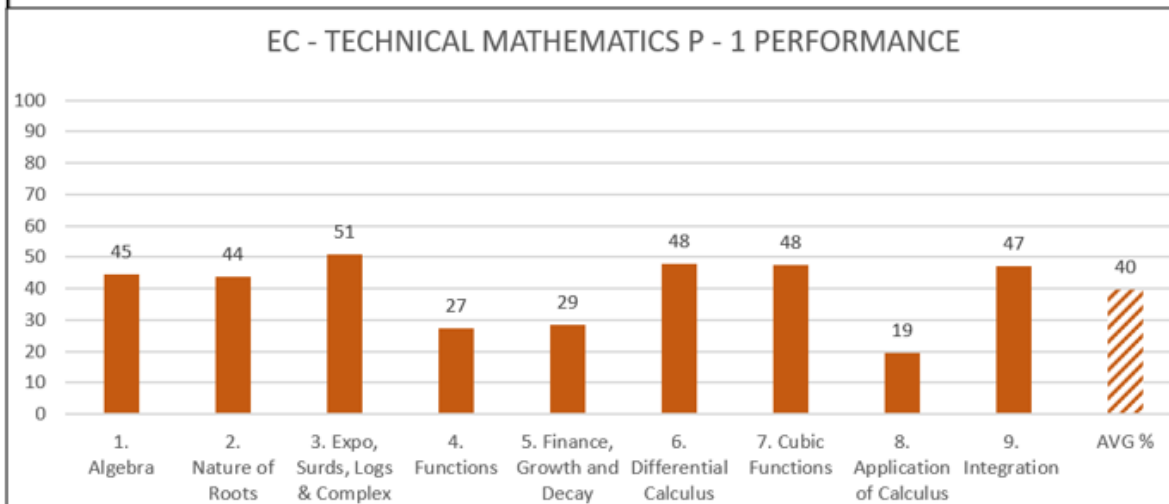
SECTION 1: (General overview of Learner Performance in the question paper as a whole)

LEARNER PERFORMANCE								
Following is a Rasch analysis taken from a sample of 100 scripts out of the whole population of 2020 Technical Mathematics Paper – 1 cohort.								
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+	Total
Required	15	15	20	20	20	5	5	100
Actual	34	6	18	18	17	5	2	100
Percentage	34	6	18	18	17	5	2	100
	LOW		MIDDLE			HIGH		

Exam	Senior Certificate/National Senior Certificate 2020
Date	Nov-20
Grade	12
Paper	Technical Mathematics P1

Technical Mathematics P1

EC - TECHNICAL MATHEMATICS P - 1 PERFORMANCE

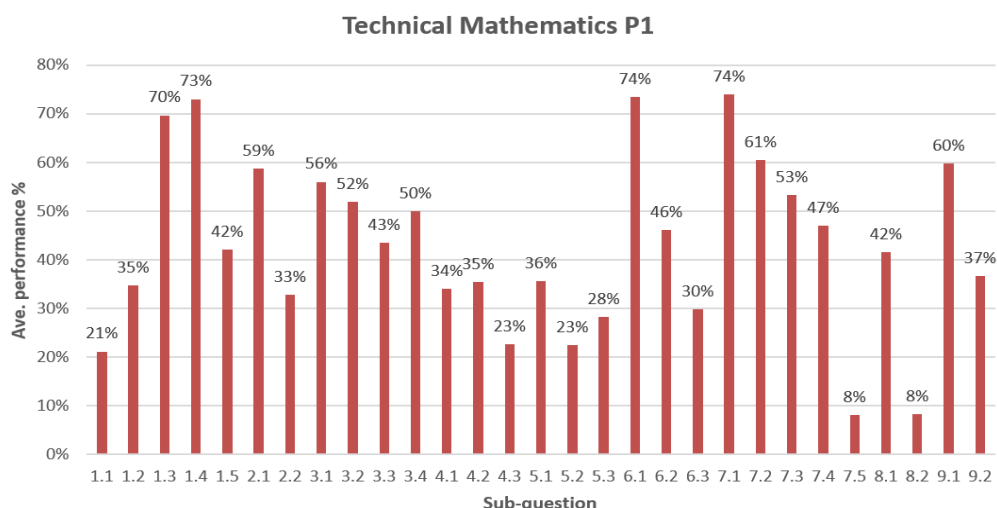


The performance of questions of the 2020 cohort of the 100 scripts sample ranged between 19% to 51%, an indication of better Rasch performance than 2019 Rasch which had questions ranging between 8% to 42%. Question 3, a question on Exponents, Surds, Logarithms and Complex numbers was a better performed question at 51% followed by Question 6 (Differential Calculus), Question 7 (Cubic Function) and Question 9 (Integration) at 48%, 48% and 47%, respectively.

Least performed questions were Question 8 (Application of Calculus), Question 4 (Functions and Graphs) and Question 5 (Finance, Growth and Decay) at 19%, 27% and 29%, respectively.

Generally, candidates did well in questions requiring Knowledge and Routine Procedures but struggled with questions on Complex Procedures. Furthermore, many candidates struggled in higher order question, fewer candidates managed to score marks in questions requiring Problem solving.

The average performance of 100 scripts for 2020 scripts is at 40% an increase of 9% from 31% of 2019 sample of 100 scripts.



There were notable errors that 2020 Candidates committed and some of them have been highlighted as challenges in the previous two years:

1. Candidates used calculators when they were instructed not to use calculators. This led to them losing marks in such questions.
2. Distributive law seems to be a common challenge amongst candidates of 2020. Distributing a negative term was the most notable challenge amongst candidates. This was evident with most candidates getting 5 out of 6 marks for sub-question 1.3 on solving simultaneous equations. Candidates lost a mark for simplification after they have substituted with the third equation into the second equation and sub-question 3.4 was also affected by the distributive law.
3. Candidates experienced challenges in answering questions that required integrated knowledge from other topics like question 1.2.2 based on Inequalities and Functions, 3.2.2 on Complex numbers and sub-question 3.3.2 on determining the argument of the complex number and Trigonometric Graphs.
4. Questions requiring applications and interpretation like sub-question 7.5 at 8%, sub-question 8.2 at 8%, sub-question 1.1 at 21%, sub-question 4.3 at 23%, sub-question 5.2 at 23%, sub-question 5.3 at 28% and sub-question 6.3 were poorly answered by the candidates.
5. Technical Mathematics as a subject does not conform to contrived scenarios, it is based on real-life contexts and so candidates should take note of solutions which are mathematically impossible. sub-questions like 1.1.3.
6. Performance in questions done in earlier grades was poor in most cases and those in grade 12 candidates didn't do well.
7. Some candidates did not follow the instructions, used incorrect notation, omitted important steps resulting in loss of marks.
8. Candidates had difficulty in handling integrated topics.
9. Candidates mixing working on their questions making it impossible to follow their solutions. Some candidates like vertically dividing the page into two columns, reducing their working area into half. On answering their questions on the two columns they end up mixing the working from one column to the next thereby mixing all their working. This should be discouraged at school level to avoid providing confusing solutions.

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?

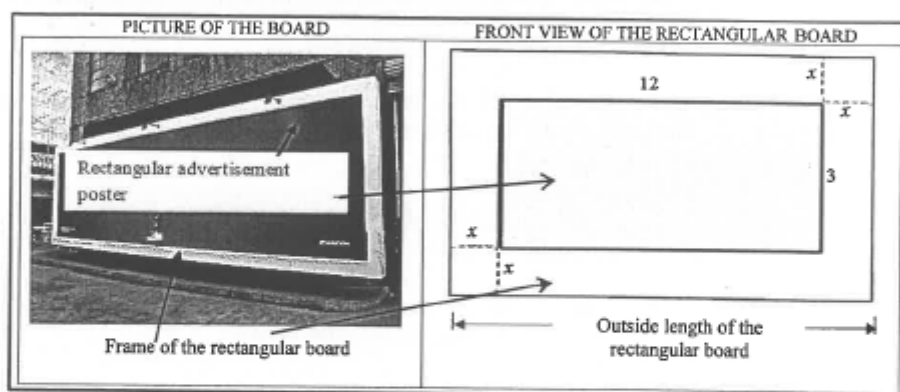
Technical Mathematics/PI

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SC/NSC

DBE/November 2020

QUESTION 1

- 1.1 The picture below shows a rectangular advertising board that consists of a frame and a rectangular area for placing an advertisement poster. (Note that the board is 3-dimensional.) The diagram next to the picture models the front view of the advertising board. The dimensions of the poster area are 12 metres by 3 metres. The frame has a uniform width of x metres, as shown in the diagram. The total front area of the rectangular board is 52 square metres.



The following formula may be used:

$$\text{Area of a rectangle} = \text{length} \times \text{breadth}$$

- 1.1.1 Write down the following in terms of x :

- (a) The outside length of the rectangular board (1)
(b) The outside breadth of the rectangular board (1)

- 1.1.2 Show that the total front area (A) of the rectangular board can be expressed as $A = 4x^2 + 30x + 36$ (2)

- 1.1.3 Hence, determine the outside length (in metres) of the rectangular board. (4)

1.2 Solve for $x \in \{\text{Real Numbers}\}$:

1.2.1 $\frac{3}{x} = 7x - 5, x \neq 0$ (correct to TWO decimal places) (3)

1.2.2 $x^2 + 4 > 0$ (1)

1.3 Solve for x and y if:

$y - x = 3$ and $3x^2 + xy - y^2 = -3$ (6)

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EASTERN CAPS

Please turn over

Technical Mathematics/P1

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1.4 The following formula represents the relationship between capacitive reactance, frequency and capacitance: $X_c = \frac{1}{2\pi fC}$

Where: X_c = capacitive reactance (in ohms)
 f = frequency (in hertz)
 C = capacitance (in farads)

1.4.1 Express f as the subject of the formula. (1)

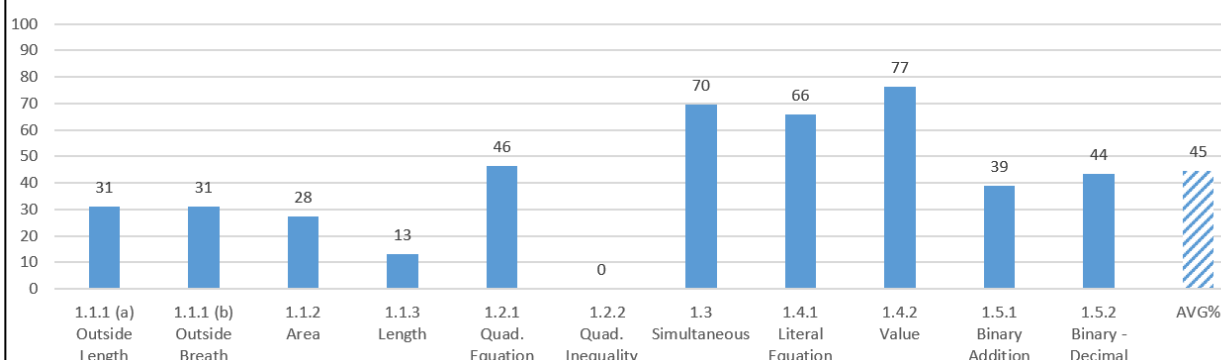
1.4.2 Hence, determine, to the nearest integer, the numerical value of f (in hertz) if $X_c = 63,66$ ohms and $C = 50 \times 10^{-6}$ farads. (2)

1.5 Given: 110011_2 and 111101_2

1.5.1 Determine the sum (in binary form) of the TWO binary numbers above. (1)

1.5.2 Hence, convert (clearly showing ALL calculations) the sum obtained in QUESTION 1.5.1 to its equivalent decimal number notation. (2)
[24]

Equations, Inequalities, Exponents and Binary Numbers

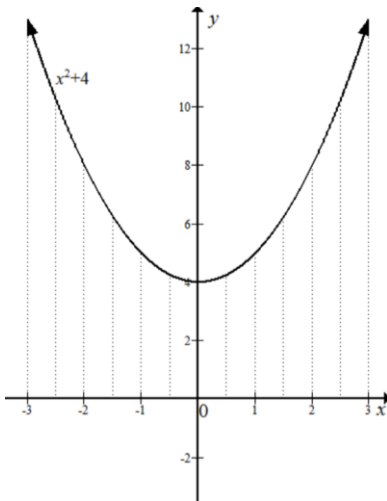


Question 1 was 5th best performed question out of 9 questions in the sample of 100 Candidates at 45%.

Language proficiency.

Language used in the question was appropriate but sub-question 1.1 required a lot of reading, which many learners found confusing and not easy to link to the image and its model.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.		
SUBQUESTION	IDENTIFIED COMMON CHALLENGES	(c) and (d) POSSIBLE CORRECTIVE MEASURES
1.1		
1.1.1 (a) and (b)	<ul style="list-style-type: none"> • Unable to interpret word problems and interpret them to suite the model. • Candidates failed to understand the word problem given and relate it to the diagram modelling the problem which was also provided. They failed to set up a length, breadth in terms of "x" and subsequently formulate the Area and use the area to find the values of "x" which was required to find the length of the rectangular board. 	<ul style="list-style-type: none"> • Teaching and accessing of word problems during teaching of Technical Mathematics should be done. This will help learners get used to the type of question that includes reading and interpretation.
1.2		
1.2.1	<ul style="list-style-type: none"> • Had problems in solving the fraction part with the following misconception: • They simplify $\frac{3}{x}$ as $3x^{-1}$, - getting: $3x^{-1} = 7x - 5$, then transposed to get $3x^{-1} - 7x + 5 = 0$. • Some candidates only multiplied $7x$ by the denominator x - getting $3 = 7x^2 - 5$, then ended up with a binomial $7x^2 - 8 = 0$. 	<ul style="list-style-type: none"> • Use of BODMAS in solving quadrating equations should be used, where the first step to do on solving the equation is to check if there are brackets that need to be simplified, a situation where the variable is in the denominator (division) and so on.
1.2.2	<ul style="list-style-type: none"> • No candidate scored a mark in this question. • This was the worst answered question in the entire paper. • It is covering the quadratic inequalities done in grade 11. 	<ul style="list-style-type: none"> • Integration of Functions in the teaching of inequalities should be done. Use of functions on teaching Equations and Inequalities should be used.

		 <p>From the above graph: $x^2 + 4 > 0$, the values of x satisfying the inequality are not imaginary but are all the elements of Real Numbers.</p> <ul style="list-style-type: none">Revision of previous grade work is necessary.
1.3	<ul style="list-style-type: none">Distribution challenge: Expanding terms with a negative outside their brackets seems to be confusing the Learners, eg. $-(x + 3)(x - 3)$, however, this question was the second best answered sub-question in question 1 at 70%.	<ul style="list-style-type: none">Step by step expansion should be used. BODMAS be applied appropriately.
1.4		
1.4.2	<ul style="list-style-type: none">Calculator use, which was a challenge in the previous years, seems to be getting better and better.	<ul style="list-style-type: none">This was the best answered question in the entire paper at 77%.
1.5		
1.5.1	<ul style="list-style-type: none">Candidates answer of 1.5.2 in here and left it blank in 1.5.2, indicating that they did not know what they were doing.All binary operations and manipulations seem to have been forgotten.	<ul style="list-style-type: none">Grade 10 and 11 revision should be done to remind candidates of previous grades work.
1.5.2		
1.2.2. Language of Mathematics not properly used in class as some candidates wrote the domain does not exist for the solution, yet there are infinitely many domain values.		

QUESTION 2

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

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QUESTION 2

2.1 Given: $3x^2 + 2x + 2 = 0$

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

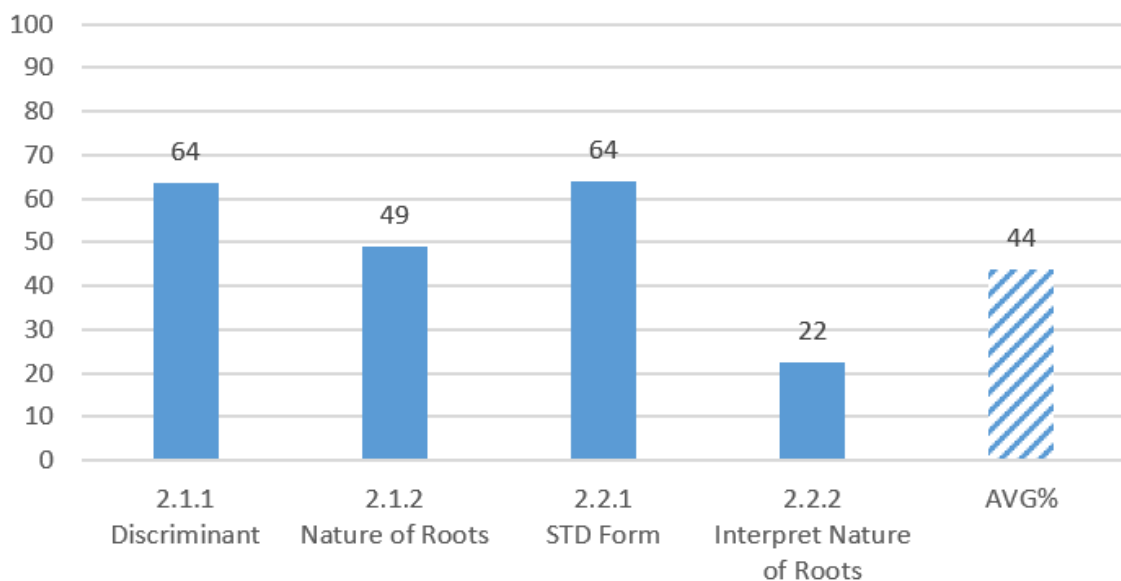
2.1.2 Hence, describe the nature of the roots of the equation. (1)

2.2 Given: $x^2 - 2px = 3p^2$ where $p \in \{\text{Real numbers}\}$

2.2.1 Write the equation in the form $ax^2 + bx + c = 0$ (1)

2.2.2 Hence, without solving the equation, show that the roots of the equation are rational. (3)
[7]

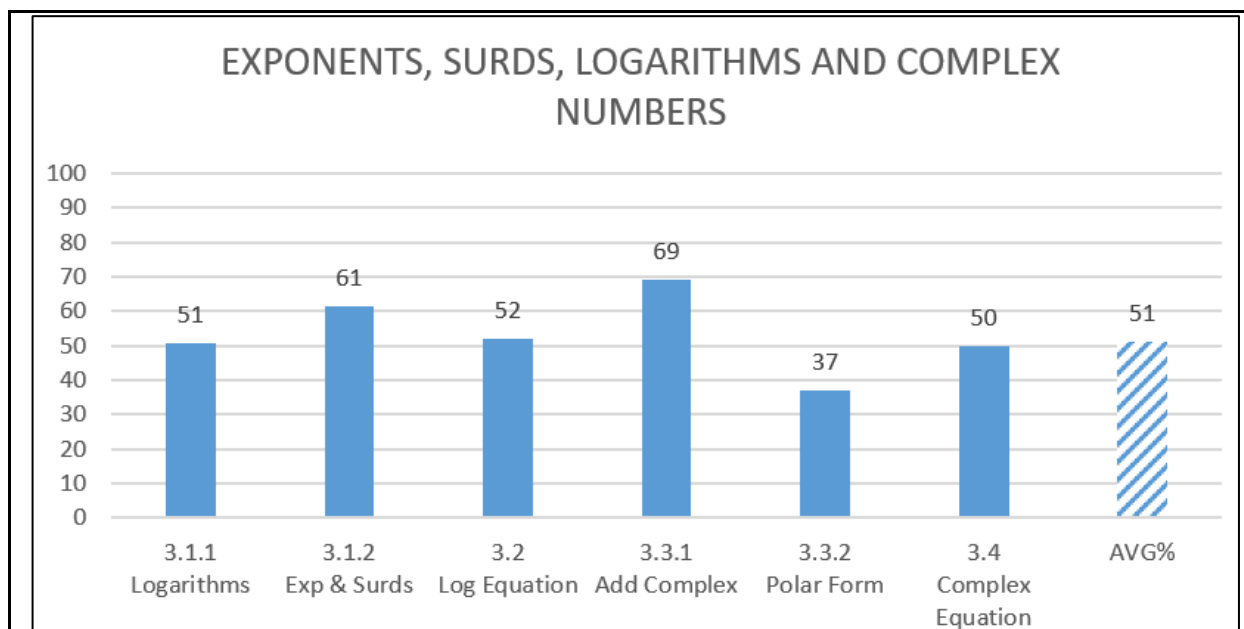
NATURE OF ROOTS



The question was the 6th performed question out of 9 question of the 100 sampled scripts in terms of position.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.		
SUBQUESTION	IDENTIFIED COMMON CHALLENGES	(c) and (d) POSSIBLE CORRECTIVE MEASURES
2.1		
2.1.1	<ul style="list-style-type: none"> In this subquestion some learners used the quadratic formula and solved for x instead of substituting in the discriminant. 	<ul style="list-style-type: none"> Use of Tech Maths language in class is encouraged. Learners should know all the commonly used terms so as to be able to understand what is needed in every question they may come across.

QUESTION 3		
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?		
<p>QUESTION 3</p> <p>3.1 Simplify the following WITHOUT using a calculator:</p> <p>3.1.1 $\frac{\log 3 + \log 27}{\log 81 - \log 9}$ (4)</p> <p>3.1.2 $\frac{2^n \sqrt{32} + 2^n \sqrt{2}}{2^n \sqrt{50}}$ (4)</p> <p>3.2 Solve for x: $\log_x 32 + \log_x 4 - \log_x 16 = \log_x 125$ (5)</p> <p>3.3 Two alternating-current circuits, connected in series, have impedances $Z_1 = 4 + 5i$ and $Z_2 = -4 - 4i$. The total impedance $Z_T = Z_1 + Z_2$</p> <p>3.3.1 Calculate the total impedance Z_T (1)</p> <p>3.3.2 Hence, express the total impedance in the form $Z_T = r(\cos \theta + i \sin \theta)$. Show ALL calculations. (4)</p> <p>3.4 Solve for k and m if $k = 6 + 4(i - 9) + 2mi$ (4)</p> <p>[22]</p>		



The question was the best performed question at 51% in 2020. It has shown a significant improvement of 26% from 25% of 2019.

Candidates have improved a lot on logarithm properties and laws. However, there were noticeable common mistakes that candidates performed.

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

SUBQUESTION	IDENTIFIED CHALLENGES	COMMON	(c) and (d) POSSIBLE CORRECTIVE MEASURES
3.1			
3.1.1	<ul style="list-style-type: none"> Learners skip many steps and writing the solution an indicator that they used a calculator, thereby losing a lot of marks. Prime factorisation seems a challenge. 		<ul style="list-style-type: none"> Following instructions for each subquestion is key in TMA. Teachers should always emphasise reading of instructions for every question to the Learners. Learners need to be taught on how to do prime factorization for terms.
3.1.2	<ul style="list-style-type: none"> Identifying common factors for exponential terms proved a challenge. Inability to simplify a surd has been identified. Learners end out opting to use a calculator to solving the surd. Learners confused laws of exponents and laws of logs. 		<ul style="list-style-type: none"> Various expressions on factorisation should be used in class to get learners acquainted with all forms. Expressing terms as prime factors is key.
3.2	<ul style="list-style-type: none"> Changing logs to exponents proved to be an impediment to some Candidates. 		<ul style="list-style-type: none"> Simple log – exponents manipulation is needed.

3.3.2	<ul style="list-style-type: none"> Learners failed to identify the real part since it was 0. That led to them not being able to determine the tan ratio. 	<ul style="list-style-type: none"> General form of complex numbers should be the departure point of expressing any specific complex number.
3.4	<ul style="list-style-type: none"> Challenge of distributive law over Monomial and a Binomial. Candidates could not find the argument when the tan function had a denominator 0. BODMAS was a challenge in solving the question. Candidates could not identify the like terms and add or subtract them. Most of them managed to get $k = -30$ but could not add the imaginary terms in order to compare their coefficients. 	<ul style="list-style-type: none"> Step by step processes of distribution should be done. Integrated teaching across topics should be done in Tech Maths.

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 Given functions f and k defined by $f(x) = -x + 4\frac{1}{2}$ and $k(x) = \sqrt{r^2 - x^2}$ respectively. Functions f and k have the same y -intercept.

4.1.1 Write down the length of the radius of k . (1)

4.1.2 Sketch the graphs of f and k on the same set of axes provided on the ANSWER SHEET. Clearly show ALL intercepts with the axes. (5)

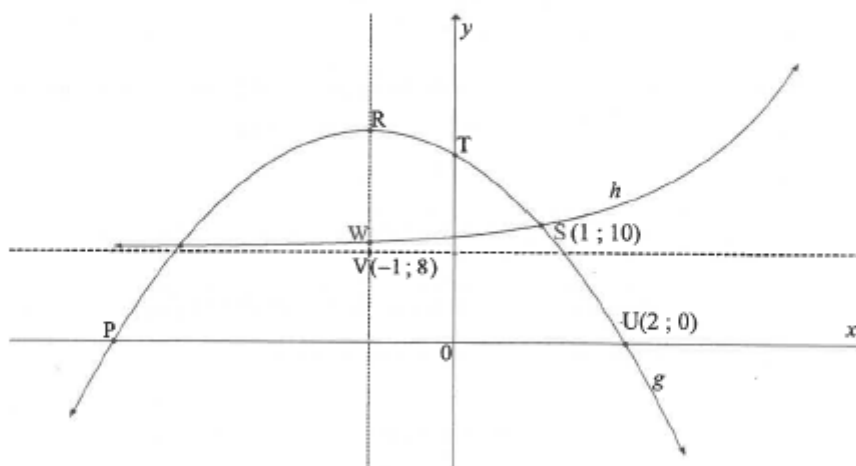
4.1.3 Give the domain of k . (2)

4.2 Sketch, on the axes provided on the ANSWER SHEET, the graph of function p defined by $p(x) = \frac{-4}{x} + q$ satisfying the following properties:

- $x \neq 0$
- $p(x) \neq -2$
- $p(-2) = 0$

Clearly show the asymptote(s) and the intercept(s) with the axes. (3)

4.3 The diagram below shows the graphs of functions g and h defined by $g(x) = ax^2 + bx + 16$ and $h(x) = k^x + q$ respectively. P and U(2; 0) are the x -intercepts of g and R is the turning point of g . T is the y -intercept of g . V(-1; 8) is the point of intersection of the axis of symmetry of g and the asymptote of h . S(1; 10) is the point of intersection of g and h . W is the point of intersection of h and the axis of symmetry of g .

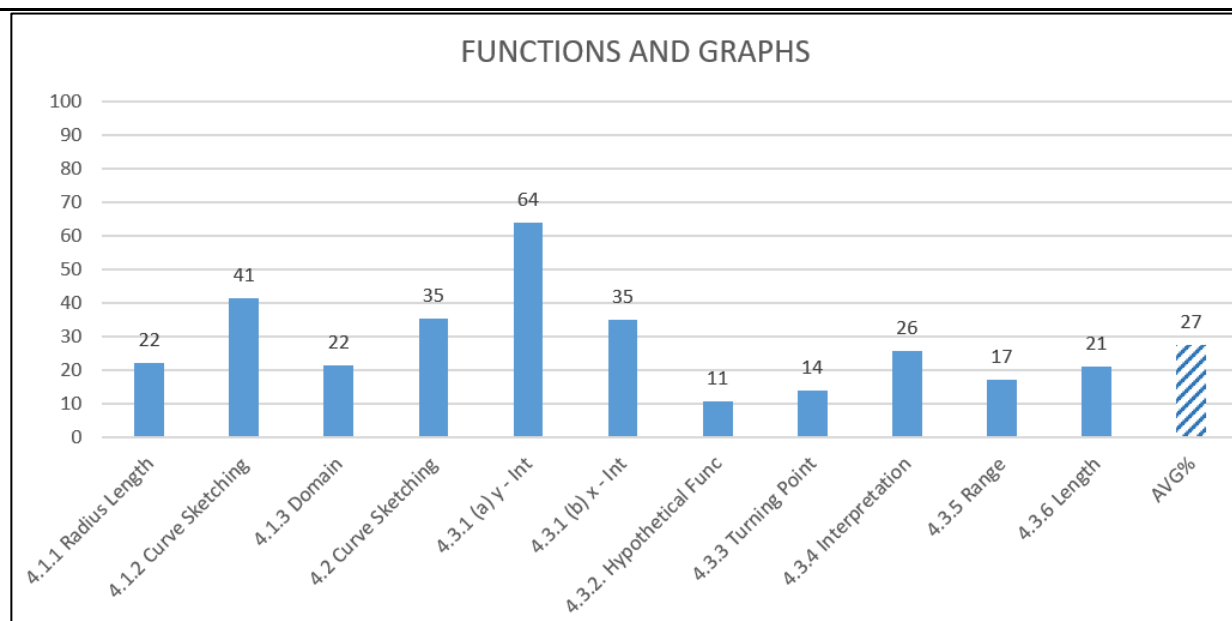


4.3.1 Write down the coordinates of:

(a) T (1)

(b) P (2)

4.3.2	Determine the numerical value(s) of a and b .	(4)
4.3.3	Determine the y -coordinate of R .	(2)
4.3.4	Show that $h(x) = 2^x + 8$	(3)
4.3.5	Write down the range of h .	(1)
4.3.6	Determine the length of VW .	(3)
		[27]



This has been one of the worst performed questions at 27%. The question dropped from 35% of 2019 to 27% in 2020.

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

SUBQUESTION	IDENTIFIED COMMON CHALLENGES	(c) and (d) POSSIBLE CORRECTIVE MEASURES
4.1.1	<ul style="list-style-type: none"> Semi Circles seem not to have been revised by the teachers because candidates did not understand that the radius of the circle is obtainable as an x – intercept or y – intercept. 	<ul style="list-style-type: none"> More exercises on circles and semi circles should be done. Integrative approach of teaching graphs should be done so that Learners are not only used to plotting and interpreting a single graph on the system of axis.
4.1.3	<ul style="list-style-type: none"> Interpretation questions on domain and range are a challenge. 	<ul style="list-style-type: none"> Use of a ruler to explain the concept.
4.3.1	<ul style="list-style-type: none"> (a) and (b) was missed by many learners. 	<ul style="list-style-type: none"> Step by step reading and understanding of critical points of a graph is needed. Different methods of

		determining critical points of a graph should be done in class. (Factor methods, Square methods, General methods, etc.)
4.3.4	<ul style="list-style-type: none"> Learners used what was given to prove what was required. 	<ul style="list-style-type: none"> Varied type of questioning should be employed in teaching Learners so that they can be exposed to all forms of questioning before they write their examinations.
4.3.5	<ul style="list-style-type: none"> Interpretation questions are a challenge. 	<ul style="list-style-type: none"> Use of rulers to determine the required values of is needed.
4.3.6	<ul style="list-style-type: none"> Interpreting different critical points of the graph was a challenge. 	<ul style="list-style-type: none"> Individually interpreting each point given in a graph is key when analysing a given graph.

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

An artisan wants to buy a car after seeing the advertisement alongside.

SPECIAL DEAL

- New car for R250 000.
- Pay only 10% deposit!
- Take out a loan for the balance.
- Pay the loan with equal monthly instalments over 5 years, at an interest rate of 6,3% per annum, compounded monthly!

5.1.1 Determine the loan amount that the artisan had to take out for this deal. (1)

5.1.2 Calculate, correct to ONE decimal place, the annual effective interest rate. (3)

5.2

An engineering company conducted an audit of the number of its unskilled workers during March 2019. Due to the Fourth Industrial Revolution (4IR), it is estimated that by April 2023, the number of unskilled workers employed by the company will decrease at a compound rate of 5,43% per annum, to 60 unskilled workers.

Calculate how many unskilled workers were employed by the engineering company during April 2019. Show ALL calculations. (4)

5.3

Bongi received a bonus of R85 000 and decided to invest the bonus for a period of 6 years. The interest rate for the first two years was 5,4% per annum, compounded semi-annually, and for the remaining years changed to 6% per annum, compounded monthly. At the end of the 4th year, he withdrew R20 000 from the investment account to pay his daughter's school fees.

5.3.1 Calculate the value of the investment at the end of the first two years. (2)

5.3.2 Hence, determine whether the final amount that Bongi will receive at the end of the investment period, will be more than the amount he originally invested. (6)

[16]

Although Q 5.1.1 was based on work done in earlier grades and a knowledge-based question, candidates failed to get the correct loan value. It was the worst performed subquestion in Q5.

Language could have played a role in their understanding of what was required especially in Q5.2. The candidates confused the P, A and n values.

Splitting the problem into smaller parts and then consolidate the information for the final conclusion many candidates had difficulty in handling the timelines.

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

SUBQUESTION	IDENTIFIED CHALLENGES	COMMON	(c) and (d) POSSIBLE CORRECTIVE MEASURES
5.1.1	<ul style="list-style-type: none"> Some candidates failed to calculate the loan amount, they merely calculated the deposit and did not subtract it from the value of the car to get the loan amount. 		<ul style="list-style-type: none"> The topic, Financial mathematics (interest, higher purchase, inflation, population, exchange rates) is introduced in the earlier grades and should be where a good foundation is laid.

		<ul style="list-style-type: none"> Open discussions in class to expose learners to financial terminology (i, n, P, A, nominal interest rate, effective interest rate etc.
5.2	<ul style="list-style-type: none"> Not understanding what is needed, whether it is months or is the workers. 	<ul style="list-style-type: none"> Key words should be emphasised in the teaching of this topic. Stress the importance of correct rounding, how, when, where in the calculation. Expose learners to different terms used in the Finance world, meaning real life applications should be employed in the teaching of Finance. Encourage learners to discuss and draw conclusions based on their discussions and findings through calculations. Projects involving in real-life context upon which learners can apply what they have learnt in class should be given to learners. Let them explore with money, census and any other environmental issues from where they are coming from.
5.3.2	<ul style="list-style-type: none"> The different compounding periods (Timelines) are a challenge to most candidates. Candidates confused and mixed-up different methods of analyzing timelines and compounding periods. Some candidates struggled with using calculators where fractions are involved. They key in e.g., $\frac{5.4}{100}$ and the $\frac{2}{2}$ calculator gives an error response and they write it as a correct response without realizing that it is incorrect. Candidates just calculating anything without knowing what they are calculating. 	<ul style="list-style-type: none"> Visually drawing of the Time Lines could help clarify all different instantaneous transactions within the time line.

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 $f(x) = \frac{1}{2}x$ (4)

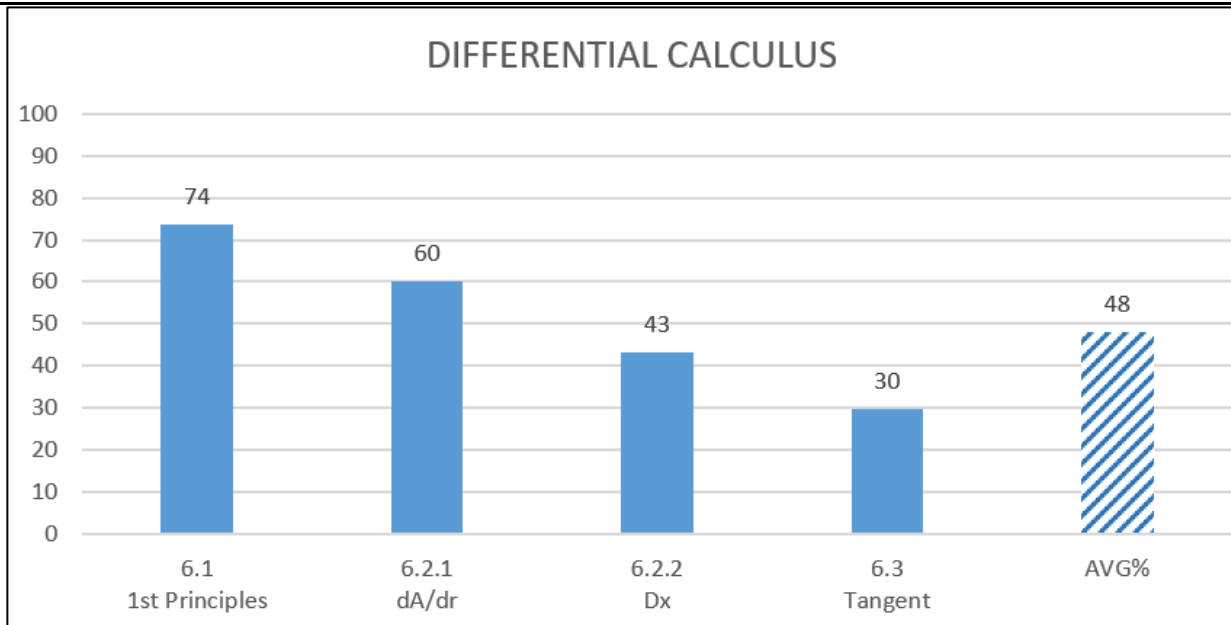
6.2 Determine EACH of the following:

6.2.1 $\frac{dA}{dr}$ if $A = \pi r^2$ (1)

6.2.2 $D_x \left[(x - \sqrt{x})^2 \right]$ (5)

6.3 The equation of a tangent to the curve of function g defined by $g(x) = ax^2 - x$ is $3x - y + 2 = 0$,

The point of contact of the tangent and the curve of g is $(-1; -1)$. Determine the numerical value of a . (5)
[15]



This is a question in which most learners wrote something. The only subquestion which proved challenging to some was 6.3. The challenge had to do with the inability to link information provided for the two questions.

The question improved by 9% from the 39% of 2019.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.		
SUBQUESTION	IDENTIFIED COMMON CHALLENGES	(c) and (d) POSSIBLE CORRECTIVE MEASURES
6.1	<ul style="list-style-type: none"> The question was well answered, but some learners had notational errors in which they wrote $\lim = \dots\dots$. In that way they lost a mark for notation. 	<ul style="list-style-type: none"> Emphasis in class should be done to avoid notational errors.
6.2.1	<ul style="list-style-type: none"> Identifying the variable to differentiate the term with respect to was a challenge with some of the learners. Some still treated π as a variable. 	<ul style="list-style-type: none"> Basic definitions of calculus terminology should be taught in class.
6.2.2	<ul style="list-style-type: none"> Candidates did not follow the SRFD – Simplify – Radical – Fraction then Derive key for solving derivative rules. Candidates have a tendency of integrating while they are supposed to differentiate. 	<ul style="list-style-type: none"> SRFD should be used when teaching and assessing Learners at school. This has to be done step by step in order not to commit notational errors and to avoid double differentiation of some terms. D should be emphasised as Differentiate and I should be emphasised as Integration in SRFI.
6.3	<ul style="list-style-type: none"> Candidates could not interpret and integrate tangents and the derivative of the curve at a point of contact. 	<ul style="list-style-type: none"> Integrative approach in teaching should be employed. All related topics should be taught collaboratively to avoid Learners treating different topics as silo topics.

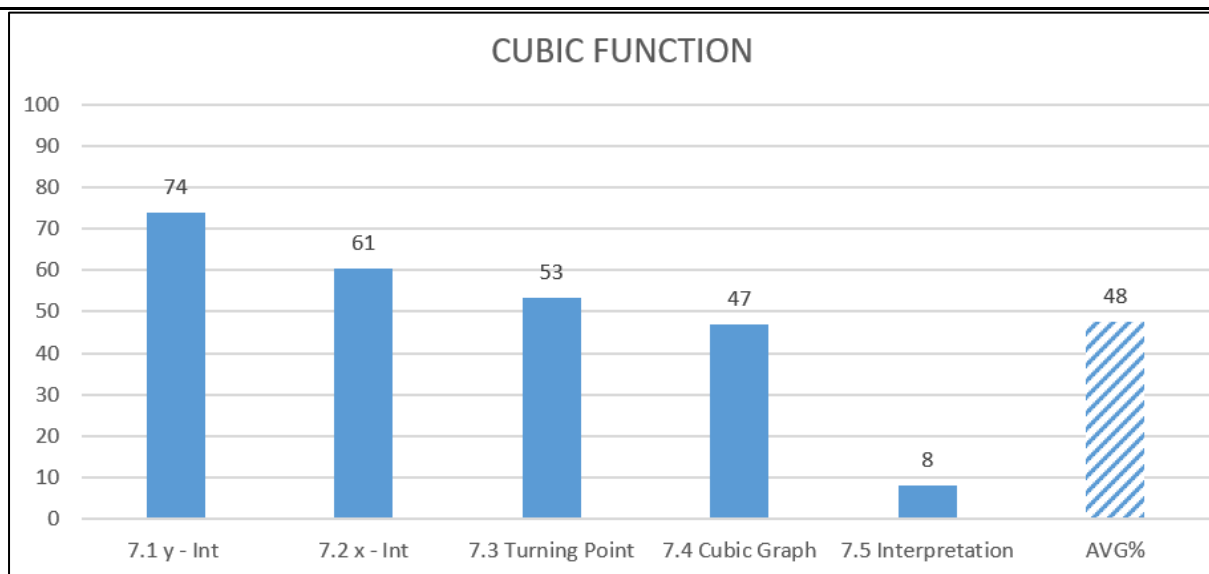
QUESTION 7

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

QUESTION 7

Given: Function f defined by $f(x) = -(x-1)^2(x+3) = -x^3 - x^2 + 5x - 3$

- | | | |
|-----|---|-------------|
| 7.1 | Write down the y -intercept of f . | (1) |
| 7.2 | Determine the x -intercepts of f . | (2) |
| 7.3 | Determine the coordinates of the turning points of f . | (5) |
| 7.4 | Sketch the graph of f on the ANSWER SHEET provided. Clearly show ALL the intercepts with the axes and the turning points. | (4) |
| 7.5 | Determine the values of x for which $f'(x) > 0$ | (2) |
| | | [14] |



There has been an improvement of 25% from 2019 Rasch to 48% of 2020 Rasch in this question. Most candidates attempted 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.		
SUBQUESTION	IDENTIFIED COMMON CHALLENGES	(c) and (d) POSSIBLE CORRECTIVE MEASURES
7.3	<ul style="list-style-type: none"> An obvious mark of $f'(x) = 0$ for the turning point was not obtained by some Candidates. 	<ul style="list-style-type: none"> Teachers should have target marks in each sub-topic and should make sure they intensify it with Learners.
7.4	<ul style="list-style-type: none"> Some Candidates did not attempt sketching this graph yet they had written the critical points in 7.1 – 7.3. 	<ul style="list-style-type: none"> Attempting all questions should be encouraged by teachers to their Learners during the course of the year.
7.5	<ul style="list-style-type: none"> Most Candidates thought that the question was $f(x) > 0$, as a result they gave incorrect answers. The other group of Candidates did not attempt this question pointing to the fact that they could not interpret what was needed. 	<ul style="list-style-type: none"> Interpretation questions should be tested most often in class so that Learners can be used to such questions.

QUESTION 8

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

QUESTION 8

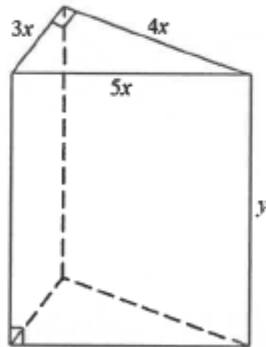
8.1 The distance (D), in metres, covered by a car in t seconds, before reaching a certain point on a straight road, is given by the equation $D(t) = -0,5t^2 + 20t$

Determine:

8.1.1 The distance covered by the car in $t = 10$ seconds (1)

8.1.2 The velocity of the car where $t = 12$ seconds (3)

8.2 The diagram below represents a wooden block in the shape of a triangular right prism. The right-angled triangular faces have side lengths $3x$ cm, $4x$ cm and $5x$ cm. The height of the wooden block is y cm. The total surface area of the wooden block is $3\,600\text{ cm}^2$.



The following formulae may be used:

Volume of a right prism = (area of base) \times height

Total surface area of a right prism = $2 \times$ (area of base) + (perimeter of base) \times height

8.2.1 Show that:

(a) The height (in cm) of the block is represented by:

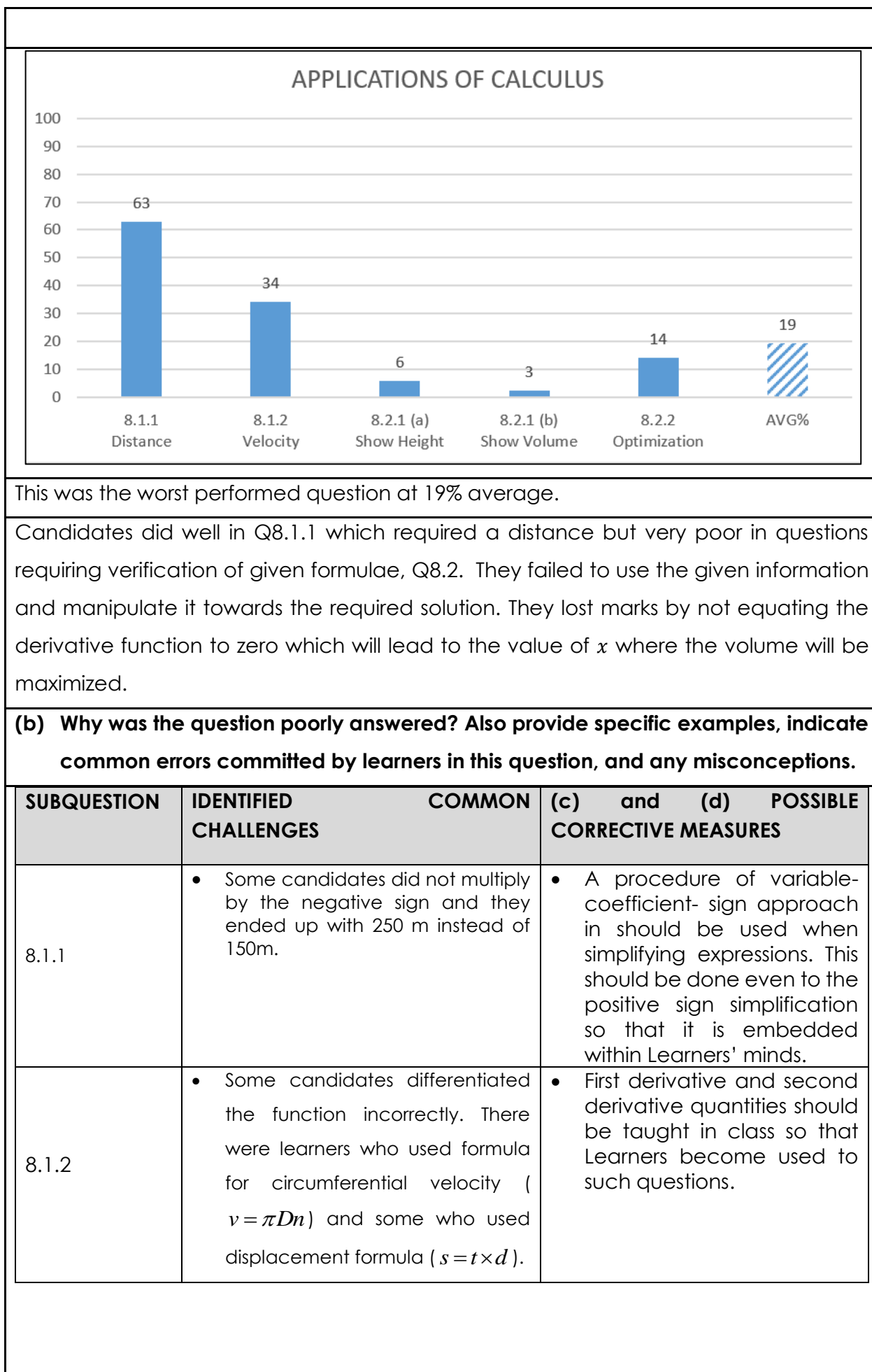
$$y = \frac{300 - x^2}{x} \quad (3)$$

(b) The volume (in cm^3) of the block is represented by:

$$V = 1\,800x - 6x^3 \quad (2)$$

8.2.2 Hence, calculate the value of x that will maximise the volume of the block.

(3)
[12]



SUBQUESTION	IDENTIFIED COMMON CHALLENGES	(c) and (d) POSSIBLE CORRECTIVE MEASURES
8.2.1	<ul style="list-style-type: none"> Finding the height in terms of x and use it to find the equation for Volume of the container. 	<ul style="list-style-type: none"> Provide learners with different questions involving applications of calculus methods, working with decimal, common fractions and brackets for a specific quantity expressed with more than one term for adequate practice. Teachers should point out key items and terms used in Calculus of motion to learners that should be associated with the first derivative as prescribed in CAPS.
8.2.2	<ul style="list-style-type: none"> Few candidates understood the method of finding the value of x that will maximise the volume of the block. 	<ul style="list-style-type: none"> Expose learners to various applications involving real-life context whereby the concept of optimization is addressed. The use of correct notation should be emphasized.

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:

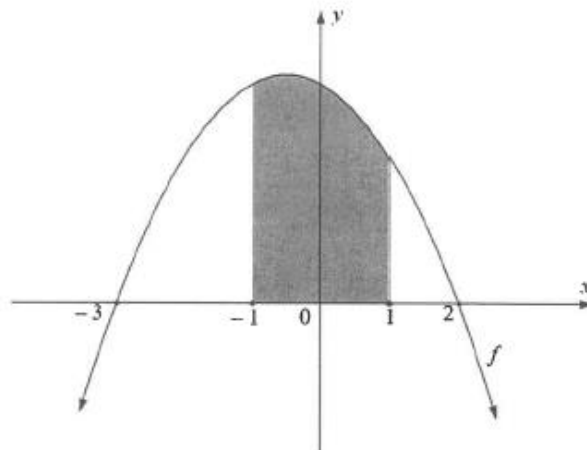
9.1.1 $\int 2^x dx$ (2)

9.1.2 $\int \left(\sqrt{x} + \frac{7}{x} + 4x^{-5} \right) dx$ (4)

9.2 The sketch below represents function f , defined by $f(x) = -x^2 - x + 6$, with x -intercepts at $(-3; 0)$ and $(2; 0)$.

The shaded area, bounded by the curve and the x -axis between the points $x = -1$ and $x = 1$, is shown in the sketch.

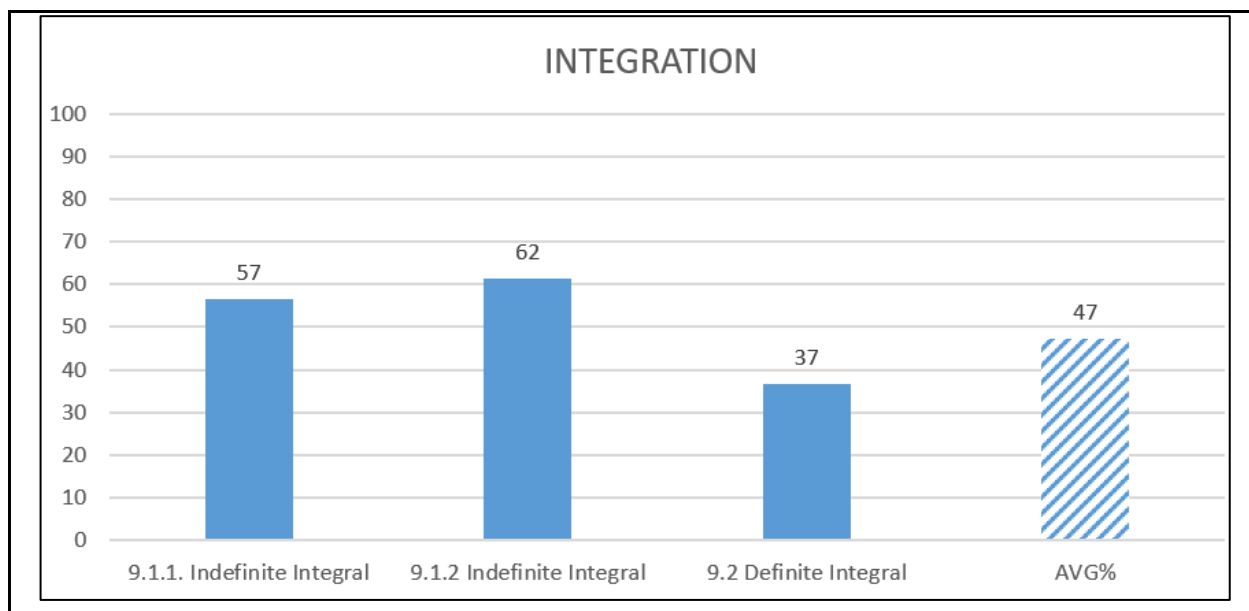
The area of the shaded part is $\frac{34}{3}$ square units.



Determine whether the unshaded area, bounded by the curve and the x -axis between the points $x = -3$ and $x = 2$, is less than the shaded area.

(7)
[13]

TOTAL: 150



Performance of candidates in this question was fair at 47%. Many candidates scored marks in this question.

Some candidates confused the integration and differentiation. Notation errors were also noted.

The definite integral in Q 9.2 with performance below 40%, some candidates had difficulties in handling it because of the way the question was asked. Candidates could not set the integral up within the boundaries required however they understood that they were supposed to substitute and simply and marks were awarded.

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

SUBQUESTION	IDENTIFIED COMMON CHALLENGES	(c) and (d) POSSIBLE CORRECTIVE MEASURES
9.1	<ul style="list-style-type: none"> Some candidates were finding the derivative of the function instead of the integral. This is an indication that they do not know the difference between the two. 	<ul style="list-style-type: none"> Teachers need to emphasise to learners that that integration is the reversal of differentiation and more activities be given for adequate practice.
9.2	<ul style="list-style-type: none"> Many candidates failed to set up the area notation using integrals. They omit the upper and lower boundaries only to remember them at the step where they are supposed to substitute them. This question was set in a different 	<ul style="list-style-type: none"> The use of correct notation during teaching and learning will lead to learners using integral notation correctly. Teachers to stress the importance of changing the surd form to exponential form and simplify before finding the integral. SRFI key should be used in simplifying integrals.

	<p>way, the area of the shaded part was given but some candidates still took the route of finding the shaded area before they find the unshaded area which might have been time consuming for them.</p> <ul style="list-style-type: none"> • Incorrect notation used by most candidates. • Many candidates did not make conclusions based on their findings thus lost a mark. 	<ul style="list-style-type: none"> • Expose learners to modeling type of questions so that they are able to interpret given information and be able to read from the given diagram, do calculations and draw conclusion.
<p>(d) Describe any other specific observations relating to responses of candidates and comments that are useful to teachers, subject advisors, teacher development etc.</p>		
<p>When done with teaching the topics that is Calculus and integration give a task to learners so that they can identify differences and similarities between the two topics and represent them on a table.</p>		
<p>It should be emphasised that answers only will not be necessarily be awarded marks; they need to show all calculations in order to score marks.</p>		
<p>The topic is still confusing to some teachers and should be part of topics to be covered in content workshops.</p>		



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE/ NATIONAL SENIOR CERTIFICATE

GRADE 12

TECHNICAL MATHEMATICS P1

NOVEMBER 2020

MARKS: 150

TIME: 3 hours

This question paper consists of 11 pages, 2 information sheets and 3 answer sheets.



INSTRUCTIONS AND INFORMATION

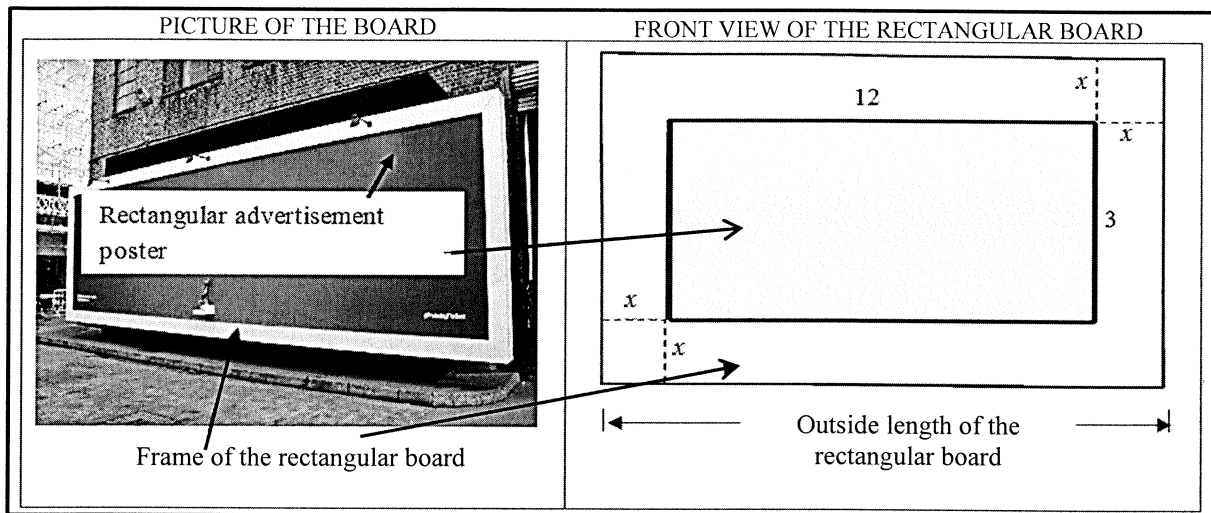
Read the following instructions carefully before answering the questions.

1. This question paper consists of NINE questions.
2. Answer ALL the questions.
3. Answer QUESTIONS 4.1.2, 4.2 and 7.4 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 The picture below shows a rectangular advertising board that consists of a frame and a rectangular area for placing an advertisement poster. (Note that the board is 3-dimensional.) The diagram next to the picture models the front view of the advertising board. The dimensions of the poster area are 12 metres by 3 metres. The frame has a uniform width of x metres, as shown in the diagram. The total front area of the rectangular board is 52 square metres.



The following formula may be used:

$$\text{Area of a rectangle} = \text{length} \times \text{breadth}$$

- 1.1.1 Write down the following in terms of x :

- (a) The outside length of the rectangular board (1)
- (b) The outside breadth of the rectangular board (1)

- 1.1.2 Show that the total front area (A) of the rectangular board can be expressed as $A = 4x^2 + 30x + 36$ (2)

- 1.1.3 Hence, determine the outside length (in metres) of the rectangular board. (4)

- 1.2 Solve for $x \in \{\text{Real Numbers}\}$:

1.2.1 $\frac{3}{x} = 7x - 5$, $x \neq 0$ (correct to TWO decimal places) (3)

1.2.2 $x^2 + 4 > 0$ (1)

- 1.3 Solve for x and y if:

$$y - x = 3 \text{ and } 3x^2 + xy - y^2 = -3 \quad (6)$$



- 1.4 The following formula represents the relationship between capacitive reactance, frequency and capacitance: $X_c = \frac{1}{2\pi f C}$

Where: X_c = capacitive reactance (in ohms)
 f = frequency (in hertz)
 C = capacitance (in farads)

- 1.4.1 Express f as the subject of the formula. (1)

- 1.4.2 Hence, determine, to the nearest integer, the numerical value of f (in hertz) if $X_c = 63,66$ ohms and $C = 50 \times 10^{-6}$ farads. (2)

- 1.5 Given: 110011_2 and 111101_2

- 1.5.1 Determine the sum (in binary form) of the TWO binary numbers above. (1)

- 1.5.2 Hence, convert (clearly showing ALL calculations) the sum obtained in QUESTION 1.5.1 to its equivalent decimal number notation. (2)
[24]



QUESTION 2

2.1 Given: $3x^2 + 2x + 2 = 0$

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

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

2.2 Given: $x^2 - 2px = 3p^2$ where $p \in \{\text{Real numbers}\}$

2.2.1 Write the equation in the form $ax^2 + bx + c = 0$ (1)

2.2.2 Hence, without solving the equation, show that the roots of the equation are rational. (3)
[7]

QUESTION 3

3.1 Simplify the following WITHOUT using a calculator:

3.1.1
$$\frac{\log 3 + \log 27}{\log 81 - \log 9}$$
 (4)

3.1.2
$$\frac{2^n \sqrt{32} + 2^n \sqrt{2}}{2^n \sqrt{50}}$$
 (4)

3.2 Solve for x : $\log_x 32 + \log_x 4 - \log_x 16 = \log_5 125$ (5)

3.3 Two alternating-current circuits, connected in series, have impedances $Z_1 = 4 + 5i$ and $Z_2 = -4 - 4i$. The total impedance $Z_T = Z_1 + Z_2$

3.3.1 Calculate the total impedance Z_T (1)

3.3.2 Hence, express the total impedance in the form $Z_T = r(\cos \theta + i \sin \theta)$
Show ALL calculations. (4)

3.4 Solve for k and m if $k = 6 + 4(i - 9) + 2mi$ (4)
[22]

QUESTION 4

4.1 Given functions f and k defined by $f(x) = -x + 4\frac{1}{2}$ and $k(x) = \sqrt{r^2 - x^2}$ respectively. Functions f and k have the same y -intercept.

4.1.1 Write down the length of the radius of k . (1)

4.1.2 Sketch the graphs of f and k on the same set of axes provided on the ANSWER SHEET. Clearly show ALL intercepts with the axes. (5)

4.1.3 Give the domain of k . (2)

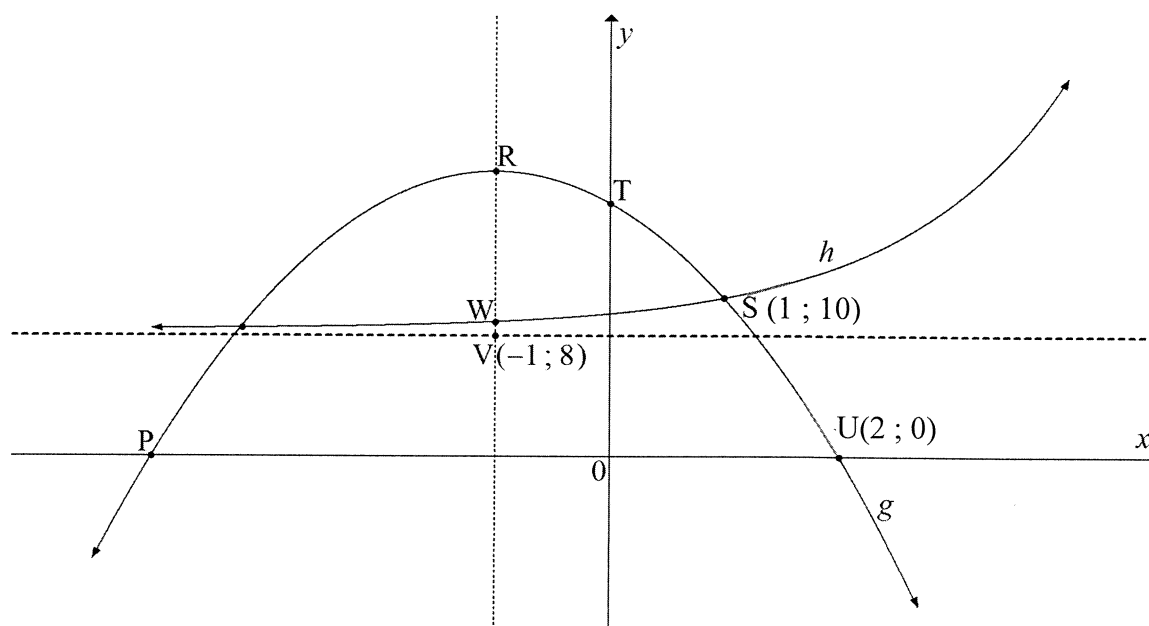
4.2 Sketch, on the axes provided on the ANSWER SHEET, the graph of function p defined by $p(x) = \frac{-4}{x} + q$ satisfying the following properties:

- $x \neq 0$
- $p(x) \neq -2$
- $p(-2) = 0$

Clearly show the asymptote(s) and the intercept (s) with the axes. (3)



- 4.3 The diagram below shows the graphs of functions g and h defined by $g(x) = ax^2 + bx + 16$ and $h(x) = k^x + q$ respectively.
- P and U(2 ; 0) are the x -intercepts of g and R is the turning point of g .
- T is the y -intercept of g .
- V(-1 ; 8) is the point of intersection of the axis of symmetry of g and the asymptote of h .
- S(1 ; 10) is the point of intersection of g and h .
- W is the point of intersection of h and the axis of symmetry of g .



- 4.3.1 Write down the coordinates of:
- (a) T (1)
- (b) P (2)
- 4.3.2 Determine the numerical value(s) of a and b . (4)
- 4.3.3 Determine the y -coordinate of R. (2)
- 4.3.4 Show that $h(x) = 2^x + 8$ (3)
- 4.3.5 Write down the range of h . (1)
- 4.3.6 Determine the length of VW. (3)
- [27]

QUESTION 5

5.1

An artisan wants to buy a car after seeing the advertisement alongside.

SPECIAL DEAL

- New car for **R250 000.**
- Pay only **10%** deposit!
- Take out a loan for the balance.
- Pay the loan with equal monthly instalments over **5** years, at an interest rate of **6,3%** per annum, compounded monthly!

5.1.1 Determine the loan amount that the artisan had to take out for this deal. (1)

5.1.2 Calculate, correct to ONE decimal place, the annual effective interest rate. (3)

5.2

An engineering company conducted an audit of the number of its unskilled workers during March 2019.

Due to the Fourth Industrial Revolution (4IR), it is estimated that by April 2023, the number of unskilled workers employed by the company will decrease at a compound rate of 5,43% per annum, to 60 unskilled workers.

Calculate how many unskilled workers were employed by the engineering company during April 2019. Show ALL calculations. (4)

5.3

Bongi received a bonus of R85 000 and decided to invest the bonus for a period of 6 years. The interest rate for the first two years was 5,4% per annum, compounded semi-annually, and for the remaining years changed to 6% per annum, compounded monthly. At the end of the 4th year, he withdrew R20 000 from the investment account to pay his daughter's school fees.

5.3.1 Calculate the value of the investment at the end of the first two years. (2)

5.3.2 Hence, determine whether the final amount that Bongi will receive at the end of the investment period, will be more than the amount he originally invested. (6)
[16]



QUESTION 6

6.1 Determine $f'(x)$ using FIRST PRINCIPLES if $f(x) = \frac{1}{2}x$ (4)

6.2 Determine EACH of the following:

6.2.1 $\frac{dA}{dr}$ if $A = \pi r^2$ (1)

6.2.2 $D_x \left[(x - \sqrt{x})^2 \right]$ (5)

6.3 The equation of a tangent to the curve of function g defined by $g(x) = ax^2 - x$ is $3x - y + 2 = 0$,

The point of contact of the tangent and the curve of g is $(-1; -1)$. Determine the numerical value of a . (5)
[15]

QUESTION 7

Given: Function f defined by $f(x) = -(x - 1)^2(x + 3) = -x^3 - x^2 + 5x - 3$

7.1 Write down the y -intercept of f . (1)

7.2 Determine the x -intercepts of f . (2)

7.3 Determine the coordinates of the turning points of f . (5)

7.4 Sketch the graph of f on the ANSWER SHEET provided. Clearly show ALL the intercepts with the axes and the turning points. (4)

7.5 Determine the values of x for which $f'(x) > 0$ (2)
[14]



QUESTION 8

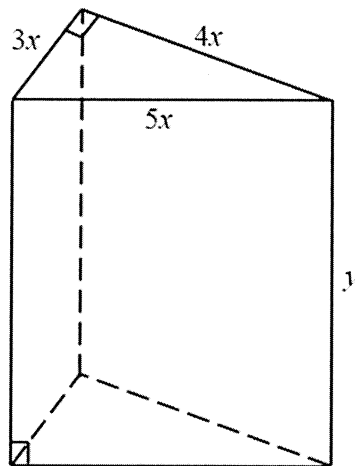
- 8.1 The distance (D), in metres, covered by a car in t seconds, before reaching a certain point on a straight road, is given by the equation $D(t) = -0,5t^2 + 20t$

Determine:

- 8.1.1 The distance covered by the car in $t = 10$ seconds (1)

- 8.1.2 The velocity of the car where $t = 12$ seconds (3)

- 8.2 The diagram below represents a wooden block in the shape of a triangular right prism. The right-angled triangular faces have side lengths $3x$ cm, $4x$ cm and $5x$ cm. The height of the wooden block is y cm. The total surface area of the wooden block is $3\,600\text{ cm}^2$.



The following formulae may be used:

Volume of a right prism = (area of base) \times height

Total surface area of a right prism = $2 \times$ (area of base) + (perimeter of base) \times height

- 8.2.1 Show that:

- (a) The height (in cm) of the block is represented by:

$$y = \frac{300 - x^2}{x} \quad (3)$$

- (b) The volume (in cm^3) of the block is represented by:

$$V = 1\,800x - 6x^3 \quad (2)$$

- 8.2.2 Hence, calculate the value of x that will maximise the volume of the block.

(3)
[12]

QUESTION 9

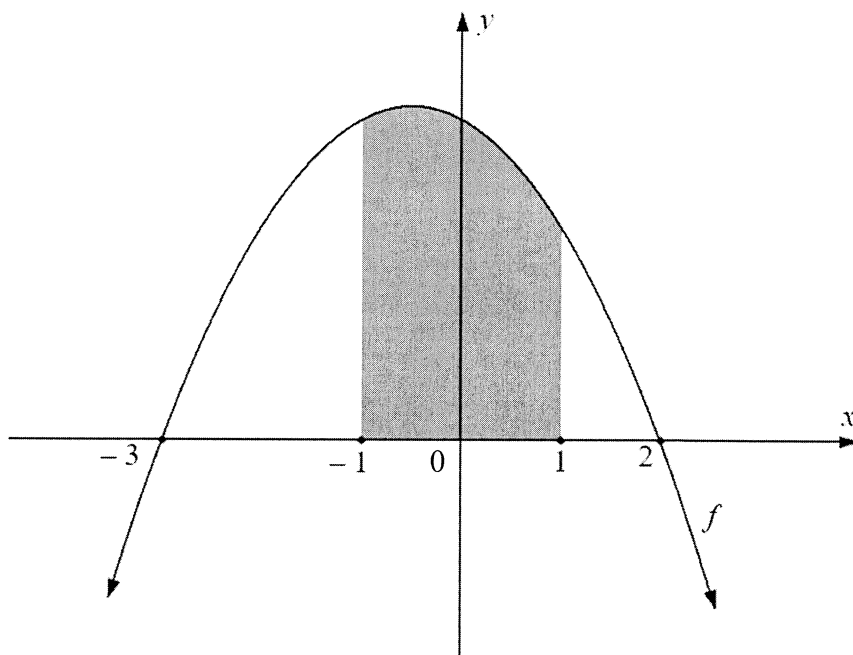
9.1 Determine the following:

9.1.1 $\int 2^x dx$ (2)

9.1.2 $\int \left(\sqrt{x} + \frac{7}{x} + 4x^{-5} \right) dx$ (4)

9.2 The sketch below represents function f , defined by $f(x) = -x^2 - x + 6$, with x -intercepts at $(-3; 0)$ and $(2; 0)$. The shaded area, bounded by the curve and the x -axis between the points $x = -1$ and $x = 1$, is shown in the sketch.

The area of the shaded part is $\frac{34}{3}$ square units.



Determine whether the unshaded area, bounded by the curve and the x -axis between the points $x = -3$ and $x = 2$, is less than the shaded area.

(7)
[13]

TOTAL: 150



INFORMATION SHEET: TECHNICAL MATHEMATICS

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

$$x = -\frac{b}{2a}$$

$$y = \frac{4ac - b^2}{4a}$$

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

$$A = P(1 + ni)$$

$$A = P(1 - ni)$$

$$A = P(1 - i)^n$$

$$A = P(1 + i)^n$$

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

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

$$\int x^n dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$$

$$\int \frac{1}{x} dx = \ln x + C, \quad x > 0$$

$$\int a^x dx = \frac{a^x}{\ln a} + C, \quad a > 0$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c$$

$$y - y_1 = m(x - x_1)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \tan \theta$$

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

$$\text{In } \triangle ABC: \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\text{Area of } \triangle ABC = \frac{1}{2} ab \cdot \sin C$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$\cot^2 \theta + 1 = \operatorname{cosec}^2 \theta$$



$$\pi \text{ rad} = 180^\circ$$

$$\text{Angular velocity} = \omega = 2\pi n = 360^\circ n \quad \text{where } n = \text{rotation frequency}$$

$$\text{Circumferential velocity} = v = \pi Dn \quad \text{where } D = \text{diameter and } n = \text{rotation frequency}$$

$$s = r\theta \quad \text{where } r = \text{radius and } \theta = \text{central angle in radians}$$

$$\text{Area of a sector} = \frac{rs}{2} = \frac{r^2\theta}{2} \quad \text{where } r = \text{radius, } s = \text{arc length and}$$

$$\theta = \text{central angle in radians}$$

$$4h^2 - 4dh + x^2 = 0 \quad \text{where } h = \text{height of segment, } d = \text{diameter of circle and}$$

$$x = \text{length of chord}$$

$$A_T = a(m_1 + m_2 + m_3 + \dots + m_n) \quad \text{where } a = \text{equal parts, } m_1 = \frac{o_1 + o_2}{2} \text{ and}$$

$$n = \text{number of ordinates}$$

OR

$$A_T = a \left(\frac{o_1 + o_n}{2} + o_2 + o_3 + o_4 + \dots + o_{n-1} \right) \quad \text{where } a = \text{equal parts, } o_i = i^{\text{th}} \text{ ordinate and}$$

$$n = \text{number of ordinates}$$

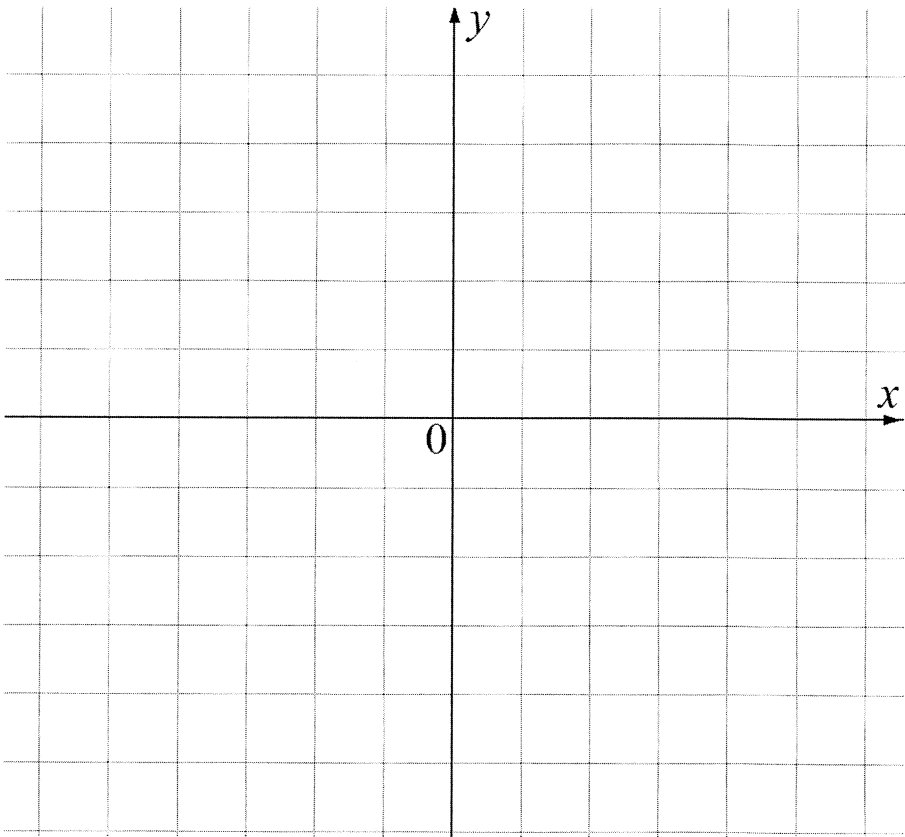


ANSWER SHEET

CENTRE NUMBER							
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EXAMINATION NUMBER													
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QUESTION 4.1.2

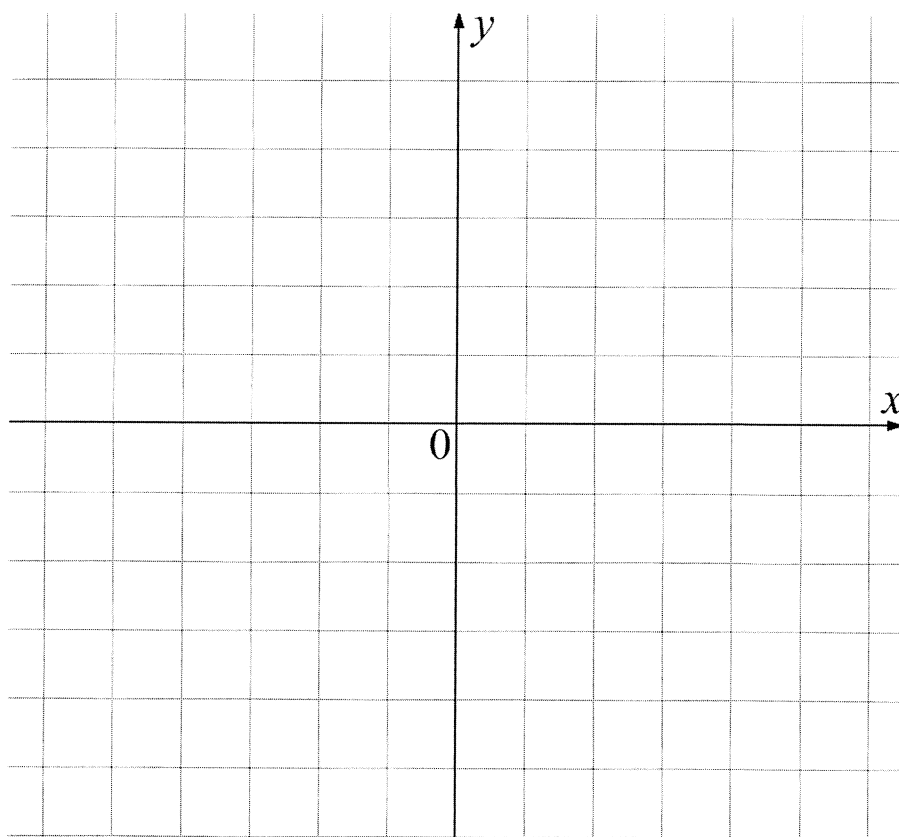


ANSWER SHEET

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EXAMINATION NUMBER													
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QUESTION 4.2

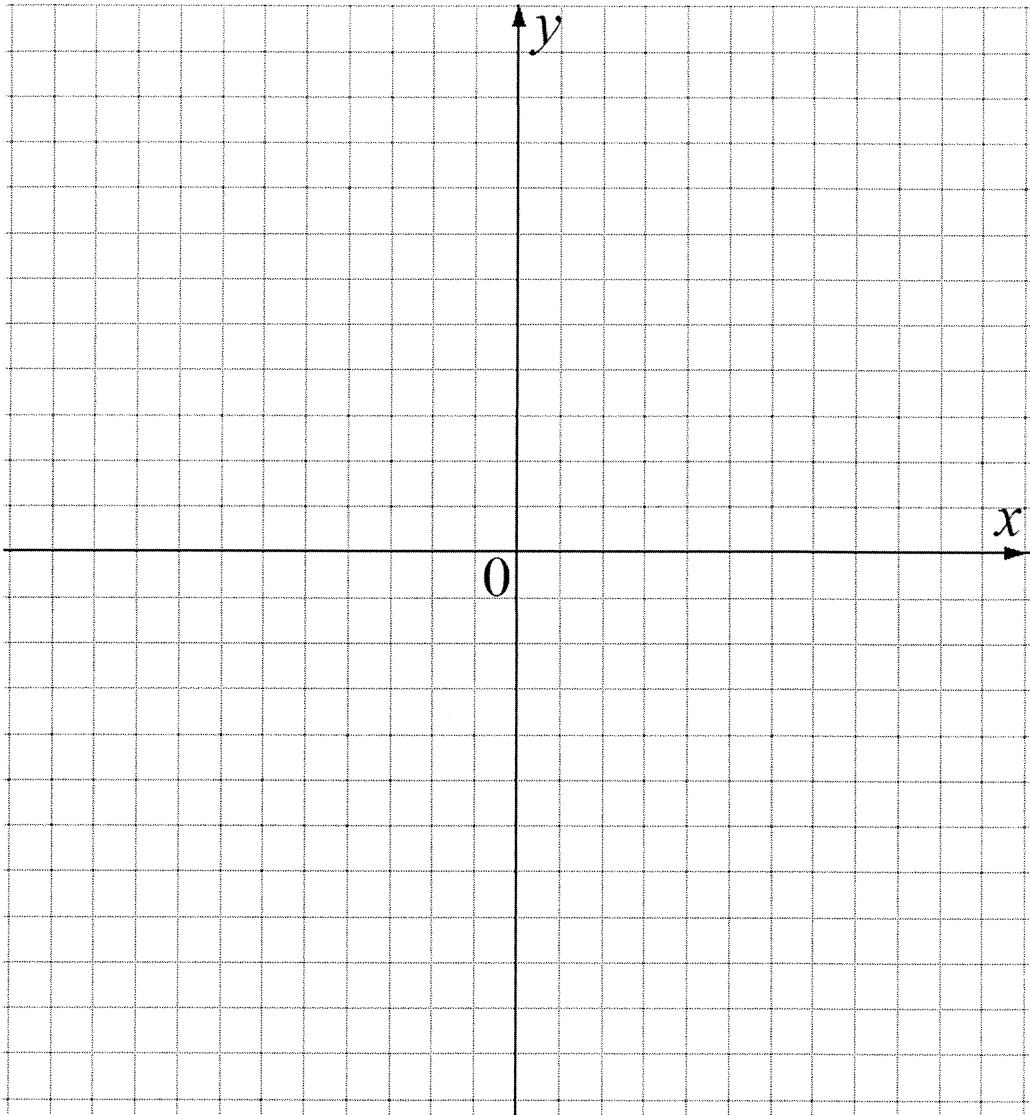


ANSWER SHEET

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EXAMINATION NUMBER													
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QUESTION 7.4





basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**SENIOR CERTIFICATE/SENIOR SERTIFIKAAT
NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT**





TECHNICAL MATHEMATICS P1/TEGNIJSE WISKUNDE VI

**NOVEMBER 2020
FINAL/ FINALE**

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

MARKING CODES/NASIENKODES	
A	Accuracy/Akkuraatheid
AO	Answer only/Slegs antwoord
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 omitting unit/Geen penalisering vir eenhede weggelaat nie
S	Simplification/Vereenvoudiging
F	Correct formula/Korrekte formule
SF	Substitution in correct formula/Vervanging in korrekte formule

Date approved/ Datum goedgekeur: 25 November 2020 DEPARTMENT OF BASIC EDUCATION PRIVATE BAG X395, PRETORIA 0001 2020 -11- 25 APPROVED MARKING GUIDELINE PUBLIC EXAMINATION	EXTERNAL MODERATOR M.A. HENDRICKS  	INTERNAL MODERATOR N. TOM  
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**These marking guidelines consist of 26 pages./
Hierdie nasienriglyne bestaan uit 26 bladsye.**

NOTE:

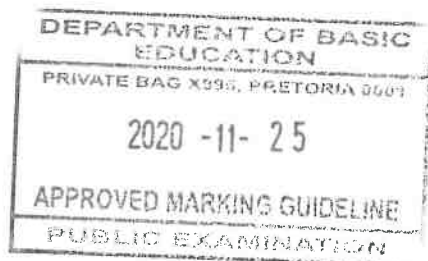
- If a candidate answers a question **TWICE**, only mark the **FIRST** attempt.
- Consistent accuracy to be applied as indicated on the marking guidelines.
- # Shows questions where a Tolerance Range will be applied are **Q3.1; Q3.3.2; Q4.1.2 & Q5.3.2**

LET WEL:

- Indien 'n kandidaat 'n vraag **TWEE** keer beantwoord, sien slegs die **EERSTE** poging na.
- Volgehoue akkuraatheid sal toegepas word soos op die nasienriglyne aangedui.
- # Toon vrae waar Toleransie Wydte (Verdraagsaamheids omvang) toegepas word is **Q3.1; Q3.3.2; Q4.1.2 & Q5.3.2**

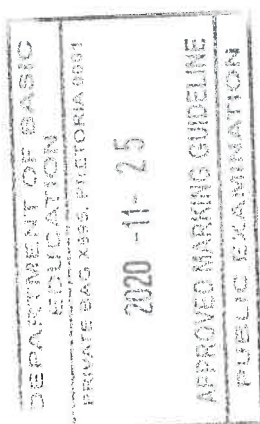
QUESTION/VRAAG 1

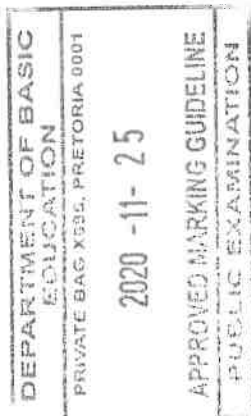
1.1.1(a)	$(12 + 2x)$ OR/OF $(12 + x + x)$	✓ length/lengte A (1)
1.1.1(b)	$(3 + 2x)$ OR/OF $(3 + x + x)$	✓ breadth/breedte A (1)
1.1.2	$\text{Area} = \text{length} \times \text{breadth/lengte} \times \text{breedte}$ $= (12 + 2x)(3 + 2x)$ $= 36 + 24x + 6x + 4x^2$ $= 4x^2 + 30x + 36$	✓✓ SF CA (2)
1.1.3	$4x^2 + 30x + 36 = 52$ $4x^2 + 30x - 16 = 0$ OR/OF $2x^2 + 15x - 8 = 0$ $2(2x-1)(x+8) = 0$ OR/OF $x = \frac{-(15) \pm \sqrt{(15)^2 - 4(2)(-8)}}{2(2)}$ $x = \frac{1}{2}$ or/of $x \neq -8$ $\text{Outside length / buite lengte} = 12\text{ m} + 2\left(\frac{1}{2}\right)\text{ m} = 13\text{ m}$	✓ equation/vergelyking CA ✓ factors/formula faktore/formule CA ✓ both x values/beide x-waardes CA ✓ length/lengte CA <div style="border: 1px solid black; padding: 2px; display: inline-block;">NPU</div> (4)



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1.2.1	$\frac{3}{x} = 7x - 5$ $7x^2 - 5x - 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(7)(-3)}}{2(7)}$ $x = \frac{5 \pm \sqrt{109}}{14}$ $x \approx 1,10 \text{ or/of } x \approx -0,39$	✓ standard form/ standaardvorm A ✓ SF CA ✓ both values of x/beide x-waardes CA <div style="border: 1px solid black; padding: 2px; display: inline-block;">NPR</div> (3)
1.2.2	$\therefore x \in \left\{ \text{Real numbers / Reële getalle} \right\}$ $\text{OR/OF } x \in (-\infty ; \infty) \quad \text{OR/OF } x \in \square$	✓ $x \in \text{Real Numbers / Reële getalle}$ A (1)
1.3	$y - x = 3 \text{ and/en } 3x^2 + xy - y^2 = -3$ $y = x + 3$ $3x^2 + x(x+3) - (x+3)^2 = -3$ $3x^2 + x^2 + 3x - (x^2 + 6x + 9) + 3 = 0$ $3x^2 - 3x - 6 = 0 \quad \text{OR/OF} \quad x^2 - x - 2 = 0$ $3(x-2)(x+1) = 0 \quad \text{OR/OF} \quad x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-2)}}{2(1)}$ $\therefore x = 2 \text{ or/of } x = -1$ $y = 2 + 3 = 5 \text{ or/of } y = -1 + 3 = 2$ OR/OF $y - x = 3 \text{ and/en } 3x^2 + xy - y^2 = -3$ $x = y - 3$ $3(y-3)^2 + y(y-3) - y^2 = -3$ $3y^2 - 18y + 27 + y^2 - 3y - y^2 + 3 = 0$ $3y^2 - 21y - 30 = 0 \quad \text{OR/OF} \quad y^2 - 7y - 10 = 0$ $3(y-2)(y-5) = 0 \quad \text{OR/OF} \quad y = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(1)(-10)}}{2(1)}$ $\therefore y = 2 \text{ or/of } y = 5$ $x = 2 - 3 = -1 \text{ or/of } x = 5 - 3 = 2$	✓ subject/onderwerp A ✓ substitution/vervanging CA ✓ S CA ✓ factors/faktore or/of formula CA ✓ both x-values/ beide x-waardes CA ✓ both y-values/ beide y-waardes CA OR/OF ✓ subject/onderwerp A ✓ substitution/vervanging CA ✓ S CA ✓ factors/faktore or/of formula CA ✓ both y-values/beide y-waardes CA ✓ both x-values/beide x-waardes CA (6)

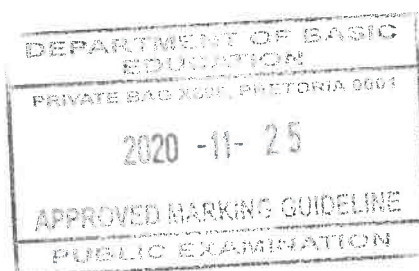

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1.4.1	$X_c = \frac{1}{2\pi f C}$ $f = \frac{1}{2\pi X_c C} \quad \text{OR/OF} \quad f = (2\pi X_c C)^{-1}$	✓ making f the subject/maak f die onderwerp A (1)																																
1.4.2	$f = \frac{1}{2\pi X_c C}$ $= \frac{1}{2\pi \times 63,66 \times 50 \times 10^{-6}} \quad \text{OR/OF} \quad (2\pi \times 63,66 \times 50 \times 10^{-6})^{-1}$ $\approx 50 \text{ hertz}$ <div style="text-align: center;">OR/OF</div> $X_c = \frac{1}{2\pi f C}$ $63,66 = \frac{1}{2\pi f \times 50 \times 10^{-6}}$ $f = \frac{1}{2\pi \times 63,66 \times 50 \times 10^{-6}}$ $\approx 50 \text{ hertz}$ <div style="text-align: center;"></div>	✓ substitution/vervanging CA ✓ value of/waarde van f CA <div style="text-align: center;">OR/OF</div> ✓ substitution/vervanging CA ✓ value of/waarde van f CA <div style="display: flex; justify-content: space-around;"><div style="border: 1px solid black; padding: 2px;">NPR</div><div style="border: 1px solid black; padding: 2px;">NPU</div></div> <div style="text-align: right;">(2)</div>																																
1.5.1	$110011_2 + 111101_2 = 1110000_2$ <div style="text-align: center;">OR/OF</div> $32 + 16 + 2 + 1 + 32 + 16 + 8 + 1 = 112 = 1110000_2$	✓ correct sum/korrekte som A (1)																																
1.5.2	<table border="1" style="width: 100%; text-align: center;"><tr><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>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table> $= 64 + 32 + 16 = 112$ <div style="text-align: center;">OR/OF</div> <table border="1" style="width: 100%; text-align: center;"><tr><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>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr></table> $51 + 61 = 112$	2^6	2^5	2^4	2^3	2^2	2^1	2^0	1	1	1	0	0	0	0	2^5	2^4	2^3	2^2	2^1	2^0	1	1	0	0	1	1	1	1	1	1	0	1	✓ M CA ✓ decimal/desimaal CA <div style="text-align: center;">OR/OF</div> ✓ M CA ✓ decimal/desimaal CA <div style="border: 1px solid black; padding: 2px; display: inline-block;">AO: Full marks/ Volpunte</div> <div style="text-align: right;">(2)</div>
2^6	2^5	2^4	2^3	2^2	2^1	2^0																												
1	1	1	0	0	0	0																												
2^5	2^4	2^3	2^2	2^1	2^0																													
1	1	0	0	1	1																													
1	1	1	1	0	1																													

[24]

QUESTION/VRAAG 2

2.1.1	$3x^2 + 2x + 2 = 0$ $\Delta = b^2 - 4ac$ $= (2)^2 - 4 \times 3 \times 2$ $= -20$	✓ substitution/vervanging A ✓ value of/waarde van Δ CA <div style="border: 1px solid black; padding: 2px; display: inline-block;">AO: Full marks/ Volpunte</div> (2)
2.1.2	non-real/ <i>nie-reël</i>	✓ description/beskrywing CA <div style="border: 1px solid black; padding: 2px; display: inline-block;">Accept imaginary/ aanvaar imaginêr</div> (1)
2.2.1	$x^2 - 2px = 3p^2$ $x^2 - 2px - 3p^2 = 0$ OR/OF $-x^2 + 2px + 3p^2 = 0$	✓ standard form/ standaardvorm A (1)
2.2.2	$\Delta = (-2p)^2 - 4(1)(-3p^2)$ $\Delta = 4p^2 + 12p^2$ $= 16p^2$ Δ is a perfect square \therefore roots will be rational / Δ is volkome vierkant \therefore die wortels is rasionaal	✓ subst. in discriminant/ vervanging in dikriminant CA ✓ S CA ✓ perfect square/ Volkome vierkant CA (3) [7]

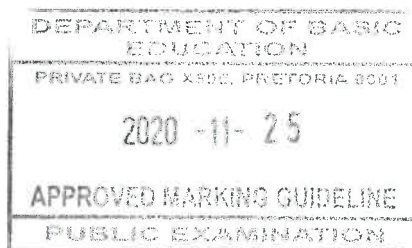


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QUESTION/VRAAG 3

3.1.1 #	$\frac{\log 3 + \log 27}{\log 81 - \log 9}$ $= \frac{\log 3 + \log 3^3}{\log 3^4 - \log 3^2}$ $= \frac{\log 3 + 3 \log 3}{4 \log 3 - 2 \log 3}$ $= \frac{4 \log 3}{2 \log 3}$ $= 2$ <p style="text-align: center;">OR/OF</p> $\frac{\log 3 + \log 27}{\log 81 - \log 9}$ $= \frac{\log (3 \times 27)}{\log \left(\frac{81}{9} \right)}$ $= \frac{\log 81}{\log 9}$ $= \frac{\log 3^4}{\log 3^2} \quad \text{OR / OF} \quad \frac{\log 9^2}{\log 9} \quad \text{OR / OF} \quad \log_9 81$ $= \frac{4 \log 3}{2 \log 3} \quad \text{OR / OF} \quad \frac{2 \log 9}{\log 9} \quad \text{OR / OF} \quad \log_9 9^2 = 2 \log_9 9$ $= 2$	\checkmark prime bases/ <i>Priem grondtalle</i> A \checkmark log property/eienskap CA \checkmark S CA \checkmark S CA <p style="text-align: center;">OR/OF</p> \checkmark log property/eienskap A \checkmark prime bases or log prop/ <i>Priemgrondtalle of log eienskap</i> CA \checkmark S CA \checkmark S CA <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">AO: 1 mark/ punt</div>
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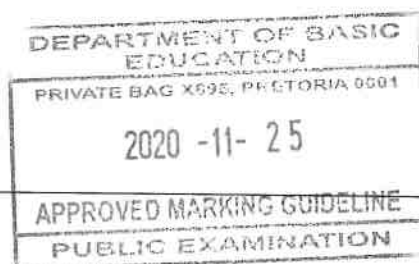
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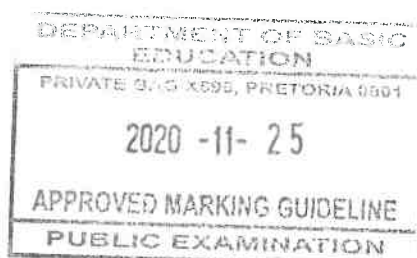
3.1.2 #	$\frac{2^n \sqrt{32} + 2^n \sqrt{2}}{2^n \sqrt{50}} = \frac{2^n \sqrt{2 \times 16} + 2^n \sqrt{2}}{2^n \sqrt{2 \times 25}}$ $= \frac{2^n 4\sqrt{2} + 2^n \sqrt{2}}{2^n \cdot 5\sqrt{2}}$ $= \frac{2^n \sqrt{2} (4 + 1)}{2^n \cdot 5\sqrt{2}}$ $= 1$ <p style="text-align: center;">OR/OF</p> $\frac{2^n \sqrt{32} + 2^n \sqrt{2}}{2^n \sqrt{50}} = \frac{2^n \sqrt{32}}{2^n \sqrt{50}} + \frac{2^n \sqrt{2}}{2^n \sqrt{50}}$ $= \frac{4\sqrt{2}}{5\sqrt{2}} + \frac{\sqrt{2}}{5\sqrt{2}}$ $= \frac{4}{5} + \frac{1}{5}$ $= 1$ <p style="text-align: center;">OR/OF</p> $\frac{2^n \sqrt{32} + 2^n \sqrt{2}}{2^n \sqrt{50}} = \frac{2^n (2^5)^{\frac{1}{2}} + 2^n 2^{\frac{1}{2}}}{2^n (5^2 \cdot 2)^{\frac{1}{2}}}$ $= \frac{2^n 2^{\frac{5}{2}} + 2^n 2^{\frac{1}{2}}}{2^n 5 \cdot 2^{\frac{1}{2}}}$ $= \frac{2^n 2^{\frac{1}{2}} (2^2 + 1)}{2^n 5 \cdot 2^{\frac{1}{2}}}$ $= 1$ <p style="text-align: center;">OR/OF</p> $\frac{2^n \sqrt{32} + 2^n \sqrt{2}}{2^n \sqrt{50}} = \frac{2^n (\sqrt{32} + \sqrt{2})}{2^n (\sqrt{50})}$ $= \frac{4\sqrt{2} + \sqrt{2}}{5\sqrt{2}}$ $= \frac{5\sqrt{2}}{5\sqrt{2}}$ $= 1$	<p>✓ simplified surds/vereenv. wortelvorm A</p> <p>✓ S CA</p> <p>✓ common factor or like terms /gemene faktor of gelyke terme CA</p> <p>✓ S CA</p> <p style="text-align: center;">OR/OF</p> <p>✓ Separating terms/ skei terme A</p> <p>✓ S CA</p> <p>✓ S CA</p> <p>✓ S CA</p> <p style="text-align: center;">OR/OF</p> <p>✓ exponent form/eksponent vorm A</p> <p>✓ S CA</p> <p>✓ common factor/gemene faktor CA</p> <p>✓ S CA</p> <p style="text-align: center;">OR/OF</p> <p>✓ Common factor/gemene faktor A</p> <p>✓ S CA</p> <p>✓ common factor/gemene faktor CA</p> <p>✓ S CA</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> AO: 1 mark/ Punt </div>
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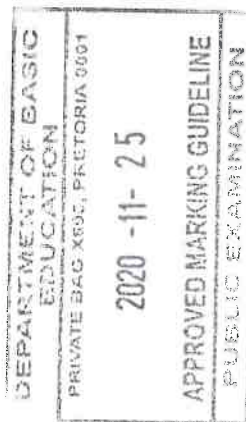
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3.2	$\log_x 32 + \log_x 4 - \log_x 16 = \log_5 125$ $\log_x \frac{32 \times 4}{16} = \log_5 5^3$ $\log_x 8 = 3$ $x^3 = 8 = 2^3$ $\therefore x = 2$ <p style="text-align: center;">OR/OF</p> $\log_x 32 + \log_x 4 - \log_x 16 = \log_5 125$ $5 \log_x 2 + 2 \log_x 2 - 4 \log_x 2 = 3 \log_5 5$ $3 \log_x 2 = 3$ $\log_x 2 = 1$ $\therefore x = 2$ <p style="text-align: center;">OR/OF</p> $\log_x 32 + \log_x 4 - \log_x 16 = \log_5 125$ $\log_x \frac{32 \times 4}{16} = \log_5 5^3$ $\log_x 8 = 3$ $x^3 = 2^3 \quad \text{OR/OF} \quad \log_x 2^3 = \log_x x^3$ $\therefore x = 2$	\checkmark log property/eienskap A \checkmark power form/magte vorm A \checkmark S CA \checkmark exp form/eksp. vorm CA \checkmark value of/waarde van x CA <p style="text-align: center;">OR/OF</p> \checkmark log property/eienskap A \checkmark log identity/identiteit A \checkmark S A \checkmark S CA \checkmark value of/waarde van x CA <p style="text-align: center;">OR/OF</p> \checkmark log property/eienskap A \checkmark power form/magte vorm A \checkmark S CA \checkmark exp form/eksp. vorm CA \checkmark value of/waarde van x CA <p style="text-align: right;">(5)</p>
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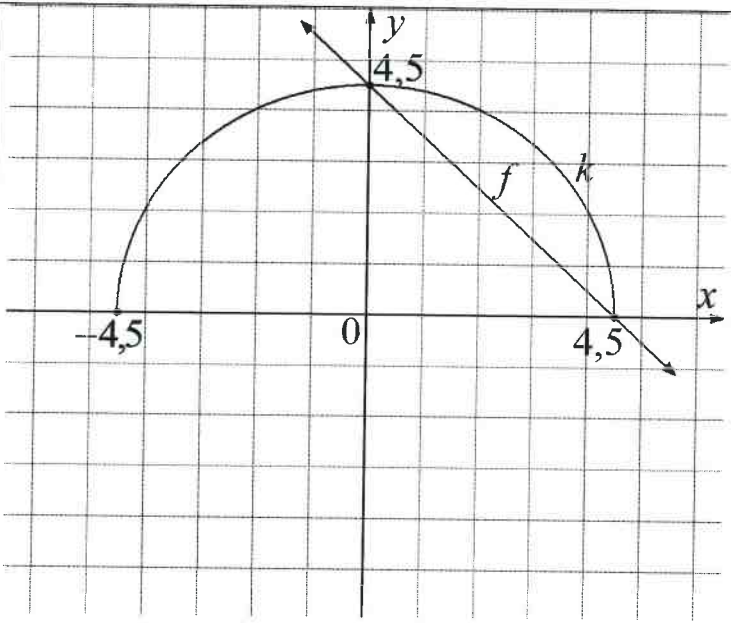
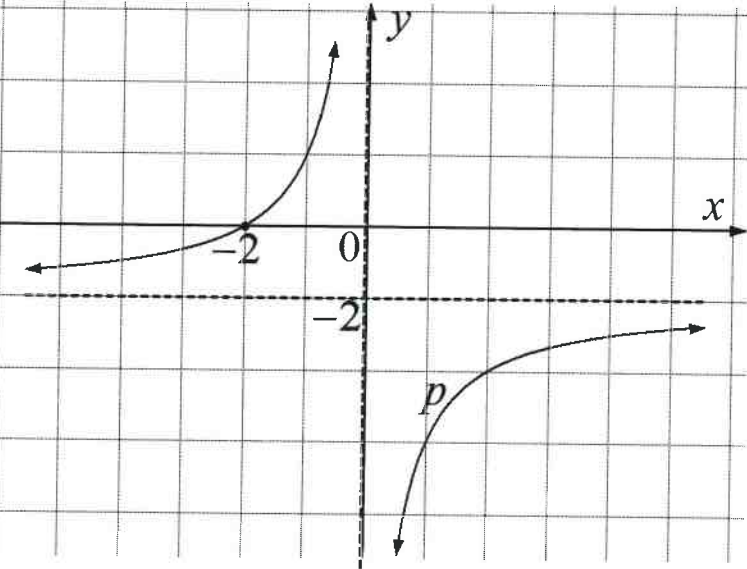


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3.3.1	$Z_T = 4 + 5i - 4 - 4i$ $= i$	✓ total impedance/totale impedansie A (1)
3.3.2 #	$z_T = i$ $r = 1$ $\tan \theta = \frac{1}{0}$ $\theta = 90^\circ \quad \text{OR/OF} \quad \theta = \frac{1}{2}\pi$ $z_T = 1(\cos 90^\circ + i \sin 90^\circ) \quad \text{OR/OF} \quad z_T = 1(\cos \frac{1}{2}\pi + i \sin \frac{1}{2}\pi)$	✓ value of modulus/ waarde van modulus CA ✓ tan ratio/verhouding CA ✓ correct angle/korrekte hoek CA ✓ z in polar vorm/polêre vorm CA <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> AO: 1 mark/punt </div>
3.4	$k = 6 + 4(i - 9) + 2mi$ $k - 2mi = 6 + 4i - 36$ $k - 2mi = -30 + 4i$ $\therefore k = -30 \quad \text{and/en} \quad -2m = 4$ $\therefore k = -30 \quad \text{and/en} \quad m = -2$ <div style="text-align: center;">OR/OF</div> $k = 6 + 4(i - 9) + 2mi$ $k - 6 = 4i - 36 + 2mi$ $k = -30 + (2m + 4)i$ $\therefore k = -30 \quad \text{and/en} \quad -2m = 4$ $\therefore k = -30 \quad \text{and/en} \quad m = -2$ <div style="text-align: center;">OR/OF</div> $k = 6 + 4(i - 9) + 2mi$ $k - 6 - 2mi = 4i - 36$ $k - 6 - 2mi = -36 + 4i$ $k - 6 = -36 \quad \text{and/en} \quad -2mi = 4i$ $\therefore k = -30 \quad \text{and/en} \quad m = -2$	✓ product/produk A ✓ S CA ✓ value of/waarde van k CA ✓ value of/waarde van m CA <div style="text-align: center;">OR/OF</div> ✓ product/produk A ✓ S CA ✓ value of/waarde van k CA ✓ value of/waarde van m CA <div style="text-align: center;">OR/OF</div> ✓ product/produk A ✓ S CA ✓ value of/waarde van k CA ✓ value of/waarde van m CA (4) [22]


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QUESTION/VRAAG 4

4.1.1	radius / radius = 4,5 units / eenhede	✓ length of radius/lengte van radius A (1)
4.1.2 #		CA from/vanaf Q/V4.1.1 f: ✓ both intercepts/beide afsnitte CA ✓ negative straight line /negatiewe reguitlyn CA k: ✓ x-intercepts/afsnitte CA ✓ y-intercept/afsnitte CA ✓ semi-circle/ halfsirkel CA (5)
4.1.3	$x \in [-4,5; 4,5]$ OR/OF $-4,5 \leq x \leq 4,5$	✓ end points/eindpunte CA ✓ correct notation/ korrekte notasie A (2)
4.2		✓ Horizontal asymptote/ horisontale asimptoot A ✓ x-intercept/afsnit A ✓ shape/vorm (both sections) A (3)

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4.3.1(a)	T (0 ; 16)	✓ coordinates of/ <i>koördinate van</i> T A (1)
4.3.1(b)	P (- 4 ; 0)	✓ - 4 A ✓ 0 A (2)
4.3.2	$g(x) = a(x - x_1)(x - x_2)$ $g(x) = a(x + 4)(x - 2)$ $16 = a(0 + 4)(0 - 2)$ $\therefore a = -2$ $g(x) = -2(x + 4)(x - 2)$ OR/OF $-\frac{b}{2a} = -1$ $\therefore g(x) = -2x^2 - 4x + 16$ $-\frac{b}{2(-2)} = -1$ $\therefore g'(x) = 2ax + b = 0$ OR/OF $2(-2)(-1) + b = 0$ $\therefore b = -4$ OR/OF subst./ <i>verv.</i> U (2 ; 0): $0 = a(2)^2 + b(2) + 16$ $4a + 2b = -16$(1) subst./ <i>verv.</i> S (1 ; 10): $10 = a(1)^2 + b(1) + 16$ $a + b = -6 \Rightarrow 2a + 2b = -12$(2) (1) - (2): $2a = -4$ $\therefore a = -2$ $2(-2) + 2b = -12$ $\therefore b = -4$ OR/OF	✓ substitution in intercept form/ <i>vervanging in afsnitvorm</i> CA ✓ value of/ <i>waarde van</i> a CA ✓ substitution/ <i>vervanging</i> CA ✓ value of/ <i>waarde van</i> b CA OR/OF ✓ substitution/ <i>vervanging</i> A ✓ substitution/ <i>vervanging</i> A ✓ value of/ <i>waarde van</i> a CA ✓ value of/ <i>waarde van</i> b OR/OF

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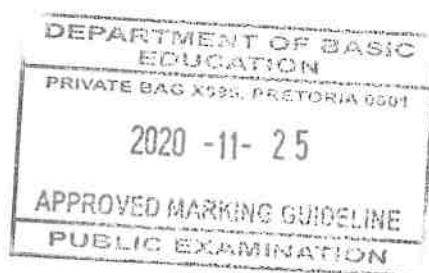
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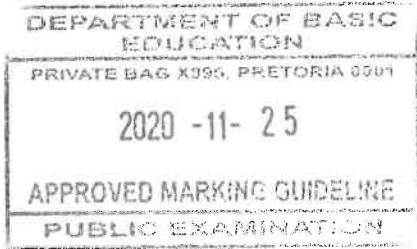
$y = a(x + p)^2 + q$ $y = a(x + 1)^2 + q$ <p>Subst./verv. (2;0) : $0 = a(2 + 1)^2 + q$ $0 = 9a + q \dots \dots \dots (1)$</p> <p>Subst./verv. (1;10) : $10 = a(1 + 1)^2 + q$ $10 = 4a + q \dots \dots \dots (2)$</p> <p>(1) - (2) $-10 = 5a$ $\therefore a = -2$</p> <p>$10 = 4a + q$ $10 = 4(-2) + q$ $\therefore q = 18$</p> <p>$y = -2(x + 1)^2 + 18$ $= -2x^2 - 4x - 16$ $\therefore b = -4$</p> <p>OR/OF</p> <p>$y = -2(x + 1)^2 + 18$ $y = ax^2 + 2ax + 16$ $0 = a(2)^2 + 2a(2) + 16$ $-16 = 8a$ $a = -2$ $b = 2(-2) = -4$</p>	<p>✓ substitution/vervanging A</p> <p>✓ substitution/vervanging A</p> <p>✓ value of/waarde van a CA</p> <p>✓ value of/waarde van b</p> <p>OR/OF</p> <p>✓ substitution/vervanging A</p> <p>✓ substitution/vervanging A</p> <p>✓ value of/waarde van a CA</p> <p>✓ value of/waarde van b CA (4)</p>
<p>4.3.3</p> <p>$g(x) = -2x^2 - 4x + 16$ subst. / verv. $x = -1$ $g(-1) = -2(-1)^2 - 4(-1) + 16$ $y = 18$</p> <p>OR/OF</p> <p>(R(-1;18))</p>	<p>✓ substitution/vervanging CA (Q4.3.2)</p> <p>✓ y-coordinate of/ koördinate van R CA</p> <p>OR/OF</p> <p>✓ y-coordinate of/ koördinate van R CA (2)</p>
<p>4.3.4</p> <p>$h(x) = k^x + 8$ $10 = k^1 + 8$ $\therefore k = 2$ $h(x) = 2^x + 8$</p>	<p>✓ value of/waarde van q A</p> <p>✓ substitution/ vervanging A</p> <p>✓ value of/waarde van k A (3)</p>

4.3.5	$y > 8$ OR/OF $y \in (8; \infty)$	✓ range/waarde-versameling A (1)
4.3.6	<p>subst. / verv. $x = -1$</p> <p>At W : $y = 2^{-1} + 8 = \frac{17}{2} = 8,5$</p> <p>$VW = \frac{17}{2} - 8$ OR/OF $VW = 8,5 - 8$ $= 0,5$ units / eenhede</p> <p>OR/OF</p> <p>At W : $y = 2^{-1} + 8 = \frac{17}{2} = 8,5$</p> <p>$VW = \sqrt{(1-1)^2 + (8,5-8)^2}$ $= \sqrt{0,25}$ $= 0,5$ units/eenhede</p> <p>OR/OF</p> <p>$h(x) = 2^x + 8$ eq. of the asympt. / verg. van asimpt. $y = 8$</p> <p>$VW = 2^x + 8 - 8 = 2^x$</p> <p>$x = -1$</p> <p>$\therefore VW = 2^{-1} = 0,5$ units/eenhede</p>	<p>✓ value of/waarde van y at/by W A</p> <p>✓ M CA</p> <p>✓ length of/lengte van VW CA</p> <p>OR/OF</p> <p>✓ value of/waarde van y at/by W A</p> <p>✓ M CA</p> <p>✓ length of/lengte van VW CA</p> <p>OR/OF</p> <p>✓ value of/waarde van y at/by W A</p> <p>✓ M CA</p> <p>✓ length of/lengte van VW CA</p> <p>AO: Full marks/ Volpunte</p> <p>(3) [27]</p>

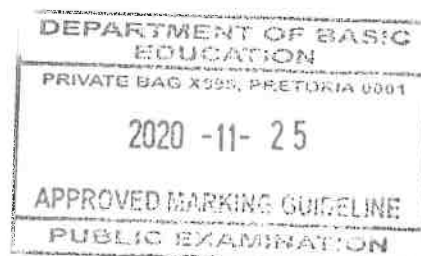


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QUESTION/VRAAG 5

5.1.1	<p>90 % of / van R 250 000 = R 225 000</p> <p style="text-align: center;">OR/OF</p> <p>10 % of / van R 250 000 = R 25 000</p> <p>Loan value/leningswaarde:</p> <p>R 250 000 – R25 000 = R 225 000</p>	<p>✓ Loan value/waarde van lening A</p> <p style="text-align: center;">OR/OF</p> <p>✓ Loan value/waarde van lening A (1)</p>
5.1.2	<p>$i_{eff} = \left(1 + \frac{i_{nom.}}{m}\right)^m - 1$</p> <p>$i_{eff} = \left(1 + \frac{6,3\%}{12}\right)^{12} - 1$</p> <p>$\therefore i_{eff} \approx 6,5\%$</p> <p style="text-align: center;">OR/OF</p> <p>$A = P(1 + i)^n$</p> <p>Let/ Laat $P = R100$</p> <p>$A = 100 \left(1 + \frac{6,3\%}{12}\right)^{12}$</p> <p>= R106,49</p> <p>interest / rente = R106,49 – R100</p> <p>= 6,49</p> <p>$\therefore i \approx 6,49 \approx 6,5$</p> <div style="text-align: center;">  </div>	<p>✓ F A</p> <p>✓ SF A</p> <p>✓ value of i_{eff} greater than. / waarde van i_{eff} groter as 6,3% CA</p> <p style="text-align: center;">OR/OF</p> <p>✓ F A</p> <p>✓ SF A</p> <p>✓ value of i_{eff} greater than. / waarde van i_{eff} groter as 6,3% CA</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>AO: Full marks /Volpunte</p> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <p>NPR</p> </div> </div> <p style="text-align: right;">(3)</p>

5.2	$A = P(1 - i)^n$ $60 = P(1 - 5,43\%)^4$ $\frac{60}{(1 - 5,43\%)^4} = P$ $\therefore P \approx 75,01$ <p> \therefore There were 75 unskilled workers during April 2019 <i>Daar was 75 ongeskoolde werkers gedurende April 2019</i> </p> <div style="border: 1px solid black; padding: 5px; margin-top: 20px;"> <p>Incorrect formula: one mark for value of n/ verkeerde formule: een punt vir die waarde van n</p> </div>	<div style="display: flex; justify-content: space-between;"> <div> ✓F ✓n = 4 ✓SF </div> <div> A A A </div> </div> <p> ✓ Number of unskilled Workers/ aantal ongeskoolde werkers </p> <p style="text-align: right;">CA</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Accept/ aanvaar 76 </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> NPR </div> <p style="text-align: right;">(4)</p>
5.3.1	<p>Value of the investment at the end of the first 2 years /waarde van belegging einde van eerste 2 jare :</p> $A = P(1 + i)^n$ $= R 85\,000 \left(1 + \frac{5,4\%}{2}\right)^{2 \times 2}$ $\approx R 94\,558,53$	<div style="display: flex; justify-content: space-between;"> <div> ✓SF ✓R 94 558,53 </div> <div> A CA </div> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> NPR </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>Incorrect formula: no marks / verkeerde formule: geen punte</p> </div> <p style="text-align: right;">(2)</p>



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5.3.2 #	<p>Value of the investment after change in interest rate for 2 years/ waarde van belegging na rentekoersverandering vir 2 jaar:</p> $A = R94558,53 \left(1 + \frac{6\%}{12}\right)^{2 \times 12}$ $\approx R106582,57$ <p>Value of the investment after withdrawing/waarde van belegging na onttrekking:</p> $P = R106582,57 - R20\,000 = R86582,57$ <p>YES it will be more./JA dit sal meer wees.</p> <p style="text-align: center;">OR/OF</p> $A = R94558,53 \left(1 + \frac{6\%}{12}\right)^{4 \times 12} - 20000 \left(1 + \frac{6\%}{12}\right)^{2 \times 12}$ $\approx R97592,39$ <p>YES, it will be more./JA dit sal meer wees.</p> <p style="text-align: center;">OR/OF</p> $A = \left[R94558,53 \left(1 + \frac{6\%}{12}\right)^{2 \times 12} - 20000 \right] \times \left(1 + \frac{6\%}{12}\right)^{2 \times 12}$ $\approx R97592,39$ <p>YES, it will be more./JA dit sal meer wees.</p>	<p>CA from/vanaf Q/V 5.3.1</p> <p>✓✓SF CA</p> <p>✓R106582,57 CA</p> <p>✓M subtracting/ af trek 20000 A</p> <p>✓difference/ Verskil CA</p> <p>✓conclusion/ gevolgtrekking CA</p> <p style="text-align: center;">OR/OF</p> <p>✓M A</p> <p>✓SF CA</p> <p>✓ $\left(1 + \frac{6\%}{12}\right)^{4 \times 12}$ A</p> <p>✓ $\left(1 + \frac{6\%}{12}\right)^{2 \times 12}$ A</p> <p>✓ value of/ waarde van A_{final} CA</p> <p>✓conclusion/ gevolgtrekking CA</p> <p style="text-align: center;">OR/OF</p> <p>✓M A</p> <p>✓SF CA</p> <p>✓✓value of/waarde van i and n A</p> <p>✓value of/waarde van A_{final} CA</p> <p>✓conclusion/ gevolgtrekking CA</p> <p style="border: 1px solid black; padding: 2px; display: inline-block;">NPR</p> <p style="text-align: right;">(6) [16]</p>
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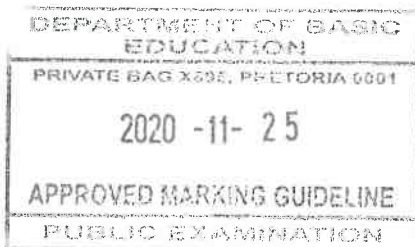
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Please turn over/Blaai om asseblief

QUESTION/VRAAG 6

6.1	$f(x) = \frac{1}{2}x$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{\left(\frac{1}{2}(x+h)\right) - \left(\frac{1}{2}x\right)}{h}$ $= \lim_{h \rightarrow 0} \frac{\frac{1}{2}x + \frac{1}{2}h - \frac{1}{2}x}{h}$ $= \lim_{h \rightarrow 0} \frac{\frac{1}{2}h}{h}$ $\therefore f'(x) = \lim_{h \rightarrow 0} \frac{1}{2} = \frac{1}{2}$	<p>✓ definition/definisie A</p> <p>✓ SF A</p> <p>✓ S CA</p> <p>$\frac{1}{2}$ CA</p> <p>Penalty of 1 mark if incorrect notation used/ 1 punt penaliseering vir verkeerde notasie</p> <p>AO: 0 marks/ punte (4)</p>
6.2.1	$\frac{dA}{dr} = 2\pi r$	<p>✓ derivative/afgeleide A</p> <p>(1)</p>
6.2.2	$D_x \left[(x - \sqrt{x})^2 \right]$ $= D_x \left[\left(x - x^{\frac{1}{2}} \right) \left(x - x^{\frac{1}{2}} \right) \right]$ $= D_x \left[x^2 - 2x^{\frac{3}{2}} + x \right]$ $= 2x - 3x^{\frac{1}{2}} + 1$	<p>✓ exponent vorm/ eksp vorm A</p> <p>✓ S CA</p> <p>✓ 2x CA</p> <p>✓ $-3x^{\frac{1}{2}}$ CA</p> <p>✓ 1 CA</p> <p>No Penalty for incorrect notation used/ geen penaliseering vir verkeerde notasie (5)</p>



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<p>6.3</p>	$g(x) = ax^2 - x \quad \text{sub}(-1; -1)$ $-1 = a(-1)^2 - (-1)$ $-1 = a + 1$ $a = -2$ <p style="text-align: center;">OR/OF</p> $3x - y + 2 = 0$ $y = 3x + 2$ $\therefore m_{\text{tan/raakl.}} = 3$ $g(x) = ax^2 - x$ $g'(x) = 2ax - 1$ $2a(-1) - 1 = 3$ $-2a = 3 + 1$ $a = -2$ <p style="text-align: center;">OR/OF</p> $ax^2 - x = 3x + 2$ $ax^2 - 4x - 2 = 0$ $b^2 - 4ac = 0 \quad (\text{equal roots}) \text{ tangent touches}$ $(-4)^2 - 4(a)(-2) = 0$ $16 + 8a = 0$ $a = -2$	$\checkmark\checkmark$ subst/ verv A \checkmark S CA $\checkmark\checkmark$ value of/ waarde van A CA <p style="text-align: center;">OR/OF</p> \checkmark gradient of tan./grad van A \checkmark derivative/afgeleide A \checkmark $g'(x) = 3$ CA \checkmark substitution/vervanging CA \checkmark value of/ waarde van a CA <p style="text-align: center;">OR/OF</p> \checkmark equating/ vergelyk A \checkmark std form/ vorm A \checkmark equal roots/ gelyke wortels CA \checkmark S CA \checkmark value of/ waarde van a CA (5) [15]
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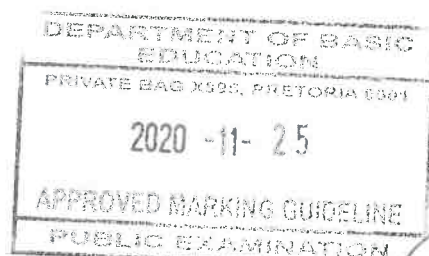
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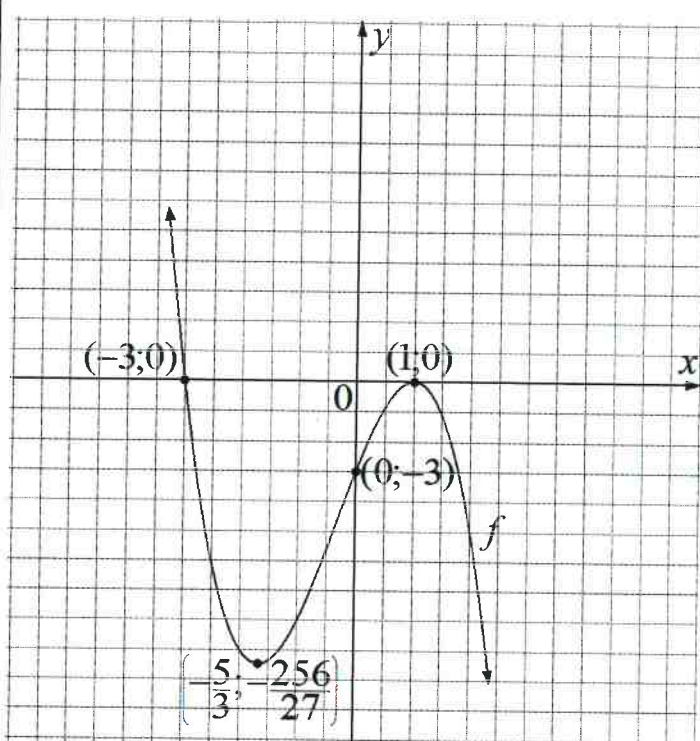
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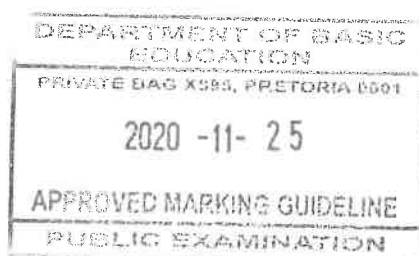
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QUESTION/VRAAG 7

7.1	$y = f(0) = -(0-1)^2(0+3) = -3$ OR/OF $(0; -3)$	✓ y-intercept / Afsnit A (1)
7.2	$f(x) = -(x-1)^2(x+3)$ $x = 1$ or/of $x = -3$ OR/OF $(1; 0)$ or/of $(-3; 0)$	✓ $x = 1$ A ✓ $x = -3$ A (2)
7.3	$f(x) = -x^3 - x^2 + 5x - 3$ $f'(x) = -3x^2 - 2x + 5$ $-3x^2 - 2x + 5 = 0$ $3x^2 + 2x - 5 = 0$ $(3x+5)(x-1) = 0$ OR/OF $x = \frac{-(2) \pm \sqrt{(2)^2 - 4(3)(-5)}}{2(3)}$ $x = -\frac{5}{3}$ or/of $x = 1$ $y = -\frac{256}{27} \approx -9,5$ or / of $y = 0$ OR/OF	✓ derivative/afgeleide A ✓ $f'(x) = 0$ A ✓ factors/formula faktore/formule CA ✓ both values of/beide waardes van x CA ✓ both values of y/ beide y-warrdes CA If derivative is first degree then Max 2 marks/ Indien afgeleide eerste order dan Mak. 2 punte (5)



7.4		<p>✓ cubic shape/vorm A</p> <p>✓ y-intercepts/afsnitte CA from/vanaf QV7.1</p> <p>✓ both/albei x-intercepts/afsnitte CA from/vanaf QV7.2</p> <p>✓ both turning points/ draaipunte CA from/vanaf QV7.3</p> <p style="text-align: right;">(4)</p>
7.5	$-\frac{5}{3} < x < 1$ OR/OF $x \in \left(-\frac{5}{3}; 1\right)$	<p>CA from/vanaf Q/V7.4</p> <p>✓ both end points/beide eindpunte CA</p> <p>✓ notation/notasie A</p> <p style="text-align: right;">(2)</p> <p style="text-align: right;">[14]</p>



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8.1.1	$D(10) = -0,5(10)^2 + 20(10)$ $= 150 \text{ m}$	✓distance/afstand A <div style="border: 1px solid black; padding: 2px; display: inline-block;">NPU</div> (1)
8.1.2	velocity = $D'(t) = -t + 20$ $D'(12) = -(12) + 20$ $= 8 \text{ m/s}$	✓derivative/afgeleide A ✓substitution in derivative/ Vervangingin afgeleide CA ✓velocity/snelheid CA <div style="border: 1px solid black; padding: 2px; display: inline-block;">NPU</div> (3)
8.2.1(a)	$\text{TSA/TBO} = (4x)(3x) + (5x)(y) + (4x)(y) + (3x)(y)$ $= 12x^2 + 5xy + 4xy + 3xy$ $3600 = 12x^2 + 12xy$ $300 = x^2 + xy$ $xy = 300 - x^2$ $\therefore y = \frac{300 - x^2}{x}$ <p style="text-align: center;">OR/OF</p> $\text{TSA/TBO} = (3x + 4x + 5x)y + 2\left(\frac{1}{2} \cdot 3x \cdot 4x\right)$ $12xy + 12x^2 = 3600$ $300 = x^2 + xy \quad \text{OR/OF} \quad xy = 300 - x^2$ $\therefore y = \frac{300 - x^2}{x}$	✓area/oppervlakte A ✓equat. area to/stel oppervl gelyk 3 600 A ✓S CA <p style="text-align: center;">OR/OF</p> ✓area/oppervlakte A ✓equat. area to 3 600/stel oppervl gelyk A ✓S CA (3)
8.2.1(b)	$V = \frac{1}{2}(3x)(4x)\left(\frac{300 - x^2}{x}\right)$ $= 6x(300 - x^2)$ $= 1800x - 6x^3$	✓SF CA ✓S CA (2)



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QUESTION/VRAAG 8

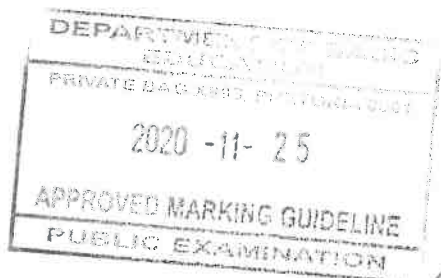
8.1.1	$D(10) = -0,5(10)^2 + 20(10)$ $= 150 \text{ m}$	✓ distance/afstand A <div style="border: 1px solid black; padding: 2px; display: inline-block;">NPU</div> (1)
8.1.2	velocity = $D'(t) = -t + 20$ $D'(12) = -(12) + 20$ $= 8 \text{ m/s}$	✓ derivative/afgeleide A ✓ substitution in derivative/ <i>Vervangingin afgeleide</i> CA ✓ velocity/snelheid CA <div style="border: 1px solid black; padding: 2px; display: inline-block;">NPU</div> (3)
8.2.1(a)	$\text{TSA/TBO} = (4x)(3x) + (5x)(y) + (4x)(y) + (3x)(y)$ $= 12x^2 + 5xy + 4xy + 3xy$ $3600 = 12x^2 + 12xy$ $300 = x^2 + xy$ $xy = 300 - x^2$ $\therefore y = \frac{300 - x^2}{x}$ <p style="text-align: center;">OR/OF</p> $\text{TSA/TBO} = (3x + 4x + 5x)y + 2\left(\frac{1}{2} \cdot 3x \cdot 4x\right)$ $12xy + 12x^2 = 3600$ $300 = x^2 + xy \quad \text{OR/OF} \quad xy = 300 - x^2$ $\therefore y = \frac{300 - x^2}{x}$	✓ area/oppervlakte A ✓ equat. area to/stel oppervl gelyk 3 600 A ✓ S CA <p style="text-align: center;">OR/OF</p> ✓ area/oppervlakte A ✓ equat. area to 3 600/stel oppervl gelyk A ✓ S CA (3)
8.2.1(b)	$V = \frac{1}{2}(3x)(4x)\left(\frac{300 - x^2}{x}\right)$ $= 6x(300 - x^2)$ $= 1800x - 6x^3$	✓ SF CA ✓ S CA (2)
8.2.2	$V = 1800x - 6x^3$ $\frac{dV}{dx} = 1800 - 18x^2$ $1800 - 18x^2 = 0 \quad \text{OR/OF} \quad 18(100 - x^2) = 0$ $x^2 = 100$ $\therefore x = 10$	✓ derivative/afgeleide CA ✓ equating derivative to 0/gelykstel van afgeleide aan 0 A ✓ value of/waarde van x CA (3) [12]

QUESTION/VRAAG 9

Penalize for constant C in either Q 9.1.1 or Q 9.1.2 / Penaliseer vir konstante C in of V9.1.1 of V9.1.2		
9.1.1	$\int 2^x dx$ $= \frac{2^x}{\ln 2} + C$	$\checkmark \frac{2^x}{\ln 2}$ $\checkmark C$ <p style="text-align: right;">A A (2)</p>
9.1.2	$\int \left(\sqrt{x} + \frac{7}{x} + 4x^{-5} \right) dx$ $= \int \left(x^{\frac{1}{2}} + \frac{7}{x} + 4x^{-5} \right) dx$ $= \frac{2}{3} x^{\frac{3}{2}} + 7 \ln x - x^{-4} + C$ <p style="text-align: center;">OR/OF</p> $= \frac{2}{3} x^{\frac{3}{2}} + 7 \ln x - \frac{1}{x^4} + C$ <p style="text-align: center;">OR/OF</p> $= \frac{x^{\frac{3}{2}}}{\frac{3}{2}} + 7 \ln x - \frac{1}{x^4} + C$	$\checkmark \text{power vorm/magte vorm}$ <p style="text-align: right;">A</p> $\checkmark \frac{2}{3} x^{\frac{3}{2}}$ $\text{OR/OF } \frac{x^{\frac{3}{2}}}{\frac{3}{2}}$ <p style="text-align: right;">CA</p> $\checkmark 7 \ln x$ <p style="text-align: right;">A</p> $\checkmark -x^{-4}$ <p style="text-align: right;">A</p> $\text{OR / OF } -\frac{1}{x^4} \dots$ <p style="text-align: right;">A</p> <p style="text-align: right;">(4)</p>
9.2	<p>Area above the x - axis/ oppervlakt e bo die x - as :</p> $= \int_{-3}^2 (-x^2 - x + 6) dx$ $= \left[-\frac{x^3}{3} - \frac{x^2}{2} + 6x \right]_{-3}^2$ $= \left(-\frac{(2)^3}{3} - \frac{(2)^2}{2} + 6(2) \right) - \left(-\frac{(-3)^3}{3} - \frac{(-3)^2}{2} + 6(-3) \right)$ $= \frac{125}{6} \text{ square units/vk. eenhede}$ <p>Unshaded area / ongearsede oppvlk = $\frac{125}{6} - \frac{34}{3}$</p> $= \frac{19}{2} \text{ square units /}$ <p style="text-align: right;">vk.eenhede</p> <p>∴ the unshaded area is LESS than the shaded area/Die ongearsede oppvlk is MINDER as die gearsede oppervlakte.</p>	$\checkmark \text{area notation using integrals/oppervl notasie deur integrale}$ <p style="text-align: right;">A</p> $\checkmark \text{integration/integrasie}$ <p style="text-align: right;">A</p> $\checkmark \checkmark \text{subst./verv.}$ <p style="text-align: right;">CA</p> $\checkmark S$ <p style="text-align: right;">CA</p> <p>M unshaded area/ ongearsede oppvlk</p> <p style="text-align: right;">CA</p> $\checkmark \text{conclusion/gevolgtrkng}$ <p style="text-align: right;">CA</p> <p style="text-align: center;">OR/OF</p>

	<p>Unshaded area above the x - axis/ongearseerde oppvlk bo die x - as :</p> $= \left[\int_{-3}^{-1} (-x^2 - x + 6) dx \right] + \left[\int_1^2 (-x^2 - x + 6) dx \right]$ <p>Unshaded area/ongearseerde oppvlk 1:</p> $= \left[-\frac{x^3}{3} - \frac{x^2}{2} + 6x \right]_{-3}^{-1}$ $= \left[\left(-\frac{(-1)^3}{3} - \frac{(-1)^2}{2} + 6(-1) \right) - \left(-\frac{(-3)^3}{3} - \frac{(-3)^2}{2} + 6(-3) \right) \right]$ $= \frac{22}{3} \text{ square units/vk.eenhede}$ <p>Unshaded area/ongearseerde oppvlk 2:</p> $= \left[-\frac{x^3}{3} - \frac{x^2}{2} + 6x \right]_1^2$ $= \left[\left(-\frac{(2)^3}{3} - \frac{(2)^2}{2} + 6(2) \right) - \left(-\frac{(1)^3}{3} - \frac{(1)^2}{2} + 6(1) \right) \right]$ $= \frac{13}{6} \text{ square units/vk.eenhede}$ <p>\therefore Total unshaded area $= \frac{22}{3} + \frac{13}{6} = \frac{19}{2}$ square units</p> <p><i>MA Hendricks</i></p> <p>\therefore The unshaded area is LESS than the shaded area. Die ongearseerde oppervlakte is MINDER as die gearseerde oppervlakte.</p> <p><i>MA HENDRICKS</i> External Moderator UMALUSI</p>	<p>✓ area notation using Integrals/oppervl notasie deur integrale A</p> <p>✓ integration/integrasie A</p> <p>✓ subst./verv. CA</p> <p>✓ subst./verv CA</p> <p>✓ S CA</p> <p>✓ M unshaded area/ongearseerde opperv CA</p> <p>✓ conclusion/gevolgtrkng CA</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>AO (conclusion gevolgtrekking): 1 mark/ punt</p> </div> <p style="text-align: right;">(7) [13]</p>
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TOTAL/TOTAAL 150


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ADDENDUM

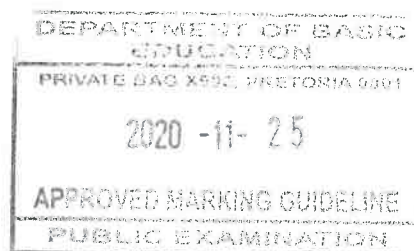
TECHNICAL MATHEMATICS/ TEGNIESE WISKUNDE

Paper 1/ Vraestel 1 November 2020

FINAL MARKING GUIDELINES (ADDITIONAL NOTES)

FINALE NASIEN RIGLYNE (ADDISIONELE NOTAS)

ITEM	DESCRIPTION/ VERKLARING
1.1.2	Factors must have a variable x and product should lead to a quadratic equation. <i>Faktore moet 'n onbekende x en die produk moet lei na 'n kwadratiese vergelyking</i>
1.1.3	If $4x^2 + 30x - 16 = 0$ is used and leading to negative x -values with not valid conclusion, maximum 2 marks <i>Indien $4x^2 + 30x - 16 = 0$ gebruik word en lei na negatiewe x-waardes met nie geldige gevolgtrekking, maksimum 2 punte</i>
1.2.1	Linear equation, no marks / liniêre vergelyking: geen punt
1.3	If simplification leads to linear equation, maximum 3 marks <i>Indien vereenvoudiging lei na 'n liniêre vergelyking; maksimum 3 punte</i>
1.5.1	If base 2 is omitted, no penalty / indien grondtal 2 uitgelaat is; geen penalisering
2.2.1	Order of terms not necessary/ orde van terme nie belangrik
2.2.2.	<ul style="list-style-type: none"> If p is omitted, accept $\Delta = 16$, maximum 3 marks/ indien p uitgelaat is aanvaar $\Delta = 16$ maksimum 3 punte If Δ is irrational based on CA from Q2.2.1, maximum 3 marks/ Indien Δ irrasionaal is gebaseer op CA vanaf Q2.2.1, maksimum 3 punte
3.3.2 #	<ul style="list-style-type: none"> $\tan \theta = \frac{1}{0}$ can be implied/ kan geïmpliseer word If 1 is omitted, no penalty/ indien 1 uitgelaat is, geen penalisering Accept/ aanvaar $Z_T = 1 \text{ cis } 90^\circ$

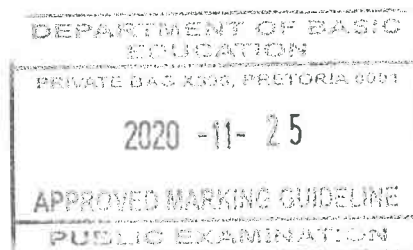


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External Moderator
UMALUSI

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ITEM	DESCRIPTION/ VERKLARING	
5.2	<ul style="list-style-type: none"> If: Year 1: $60 \div (1 - 5,3\%) = 63,45$ Year 2: $63,45 \div (1 - 5,3\%) = 67,09$ Year 3: $67,09 \div (1 - 5,3\%) = 70,94$ Year 4: $70,94 \div (1 - 5,3\%) = 75,01$ $\therefore 75$ workers/werkers 	✓ F ✓ SF ✓ $n = 4$ ✓ Number of skilled workers/ <i>aantal geskoolde werkers</i> Maximum 4 marks/ maksimum 4 punte
	<ul style="list-style-type: none"> Simple interest used , maximum 3 marks/<i>Enkelvoudige rente; maksimum 3 punte</i> Depreciation Compound used,maximum 4 marks/ <i>Waardevermindering gebruik dan maksimum 3 punte</i> 	
7.3	If derivative is first degree,maximum 2 marks/ <i>Indien afgeleide 'n eerste graadsvergelyking is maksimum 3 punte</i>	
7.4	<ul style="list-style-type: none"> If point by point plotted and Turning Point not shown maximum 3 marks/ <i>indien punt-vir-punt geplot en draaipunt nie getoon maksimum 3 punte</i> If 2 Turning points are correctly plotted, award a mark./ <i>As twee draaipunte korrek geplot is, gee 'n punt</i> 	



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