GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION
2025

NAME OF SCHOOL	
CANDIDATE'S NAME	

DATE	D	D	M	M	Y	Y	Y	Y	BOOK NUMBER		OF		BOOK(S)
TEACHER									PAPER NUMBER	1		

SUBJECT NAME	MATHEMATICS (10611)

ANSWER ALL THE QUESTIONS IN THE QUESTION PAPER.

MARKER				MODERATOR'S INITIALS IN RELEVANT BLOCK						RE-MARK/RE-CHECK			
Question	Marks		Marker's Code & Initials	Marks						Question	Marks		Initials
1										1			
2										2			
3										3			
4										4			
5										5			
6										6			
7										7			
8										8			
9										9			
10										10			
11										11			
			TOTAL							TOTAL			

TIME: 3 hours

MARKS: 150

34 pages + 1 information sheet

P.T.O.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 11 questions. Answer ALL questions in the spaces provided.

2. Show ALL calculations clearly.

3. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

4. Round-off ALL final answers appropriately according to the given context, unless stated otherwise.

5. Indicate units of measurement, where applicable.

6. Diagrams are NOT necessarily drawn to scale, unless stated otherwise.
   Show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.

7. No pages may be torn from this question paper.

8. Candidates may not retain a question paper or remove it from the examination room. Question papers must be returned to the invigilator at the end of the examination session.

9. Answers must be written in black/blue ink as distinctly as possible. Do NOT write in the margins.

10. Indicate the questions you have answered by drawing a circle around the relevant numbers on the front cover of the question paper where marks are to be recorded.

11. Draw a neat line through any work/rough work that must NOT be marked.

12. In the event that you use the additional space provided:

    12.1 Write down the number of the question.

    12.2 Leave a line and rule off after your answer.

13. Write neatly and legibly.

QUESTION 1

1.1	Given: $f(x) = (x^2 - 3)(3x - 1)(x + 2)$ Solve $f(x) = 0$ if:	
1.1.1	x is an integer	
		(2)
1.1.2	x is a rational number	
		(1)
1.1.3	x is a real number	
		(1)
1.2	Solve for x:	
1.2.1	$-15x^2 - 9x + 4 = 0$ (Correct to TWO decimal places)	
		(3)
1.2.2	$(3x - 2)^2 \geq 3x$	
		(4)

1.2.3	$5^x = 5(4 + 5^{2-x})$	
		(4)
1.3	Solve for x and y: $\log_x 16 = 4$ and $y + \sqrt{x+7} = x+1 \quad ; \quad x \geq 0$	
		(6)
1.4	Calculate TWO numerical values for p so that $x^2 + p(2x+7) + 8$ is a perfect square.	
		(4)
		[25]

QUESTION 2

The following sequence of numbers forms a quadratic number pattern:

$-3;\ -2;\ -3;\ -6;\ -11;\ldots$

2.1 The first differences of the given sequence also form a sequence.
Determine an expression for the n^{th} term of the first differences.

(3)

2.2 Calculate the first difference between the 35^{th} and 36^{th} terms of the quadratic sequence.

(1)

2.3	Determine an expression for the n^{th} term of the quadratic sequence.	
		(4)
2.4	Explain why the sequence will never contain a POSITIVE term.	
		(2)
		[10]

QUESTION 3

3.1	The graphic below shows a dartboard from which patterns relevant to the different circles can be derived.  The radii of the largest circle and then moving consecutively to immediate inward circles is given by: 18 cm; $6\sqrt{3}$ cm; 6 cm ... The innermost circle has a radius of $\frac{2}{3}$cm.	
3.1.1	Show that the areas of the circles form a converging geometric sequence.	
		(3)

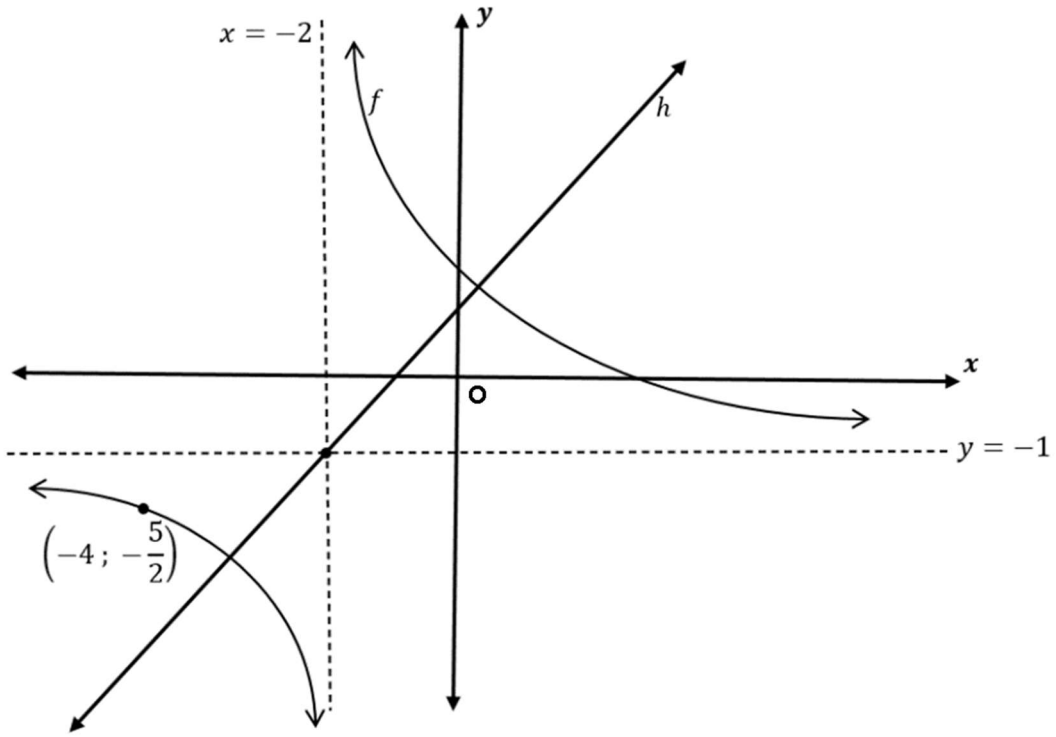
3.1.2	Calculate the number of circles in the sequence forming the dartboard.	
		(4)

3.2	Given the series: $(1\times2) + (5\times6) + (9\times10) + (13\times14) + \ldots + (81\times82)$ Write the series in sigma notation. (It is not necessary to calculate the value of the series.)	
		(4)

3.3	In the series $a+ar+ar^2+...$ the sum to infinity is 1. In the series where the terms are the squares of the above series, the sum to infinity is $\frac{5}{6}$. Determine the common ratio.	
		(5)
		[16]

QUESTION 4

The graphs of the functions $f(x)=\frac{a}{x+p}+q$ and $h(x)=mx+c$ are sketched below.



4.1	Write down values of p and q.	
		(2)
4.2	Calculate the value of a.	
		(1)
4.3	Write down the range of f.	
		(1)

4.4	Determine the equation of the line of symmetry of f for $m < 0$ in the form $y = \ldots$	
		(3)
4.5	Write down the equations of the asymptotes of $f\left(x + 4\frac{1}{2}\right)$.	
		(2)
		[9]

QUESTION 5

Given:

- $f(x) = 2x^2 - x - 15$
- $g(x) = 3x - \frac{9}{2}$
- $h(x) = \log_{\frac{1}{3}} x$

5.1	Write down the coordinates of the turning point of f.	
		(2)
5.2	Show that the x-coordinates of the x-intercepts of f are $-\frac{5}{2}$ and 3 respectively.	
		(1)

5.3	Sketch the graphs of f, g and h below. Clearly label ALL the intercepts with the axes and the asymptotes (where necessary) on the graph.	
		(5)

5.4	If point H is a point on g and point R is on f such that the abscissa of both points is 4, determine the length of line HR.	
		(3)
5.5	Write down the:	
5.5.1	Domain of h^{-1}	
		(1)
5.5.2	Range of h^{-1}	
		(1)
5.6	Determine the value(s) of k if the roots of $2x^2 - x + k = 0$ are equal.	
		(2)

5.7	Determine the maximum value of $g(x)-f(x)$.	
		(3)
		[18]

QUESTION 6

Given: $f(x) = 3^x$		
6.1	Determine the equation for f^{-1} in the form $f^{-1}(x) = \ldots$	
		(1)
6.2	Sketch the graphs of f and f^{-1}. Clearly show ALL intercepts with the axes and the asymptote.	
		(4)
6.3	Write down the equation of the line of symmetry between the two graphs you have drawn.	
		(1)
6.4	For which values of x will $f(x) \times f^{-1}(x) \leq 0$?	
		(1)

6.5	Write down the range of $h(x) = 3^{-x} - 4$.	
		(1)
6.6	Write down an equation for g, if the graph of g is the image of the graph of f after f has been translated two units to the right and reflected about the x-axis.	
		(2)
		[10]

QUESTION 7

7.1	A business buys a machine that costs R120 000. The value of the machine depreciates at 9% per annum according to the diminishing-balance method.	
7.1.1	Determine the scrap value of the machine at the end of 5 years.	
		(2)
7.1.2	After 5 years the machine needs to be replaced. During this time, inflation remained constant at 7% per annum. Determine the cost of a new machine at the end of 5 years.	
		(2)

7.1.3	The business estimates that it will need approximately R90 000 by the end of 5 years. A sinking fund for approximately R90 000, into which equal monthly instalments must be paid, is set up. Interest on this fund is 8,5% per annum, compounded monthly. The first payment will be made immediately and the last payment will be made at the end of the 5-year period. Calculate the value of the monthly payments into the sinking fund.	
		(3)

7.2	Kasala receives an amount of R900 000 upon her retirement. She invests this amount immediately at an interest rate of 10,5% per annum, compounded monthly. She needs an amount of R18 000 per month to maintain her current lifestyle and plans to withdraw the first amount at the end of the month. For how many months will she be able to live off her investment?	
		(5)
		[12]

QUESTION 8

8.1	Given: $f(x) = -2x^2 + 1$.	
8.1.1	Determine $f'(x)$ from first principles.	
		(4)
8.1.2	Hence, calculate the gradient of the tangent to f at $x = -\frac{1}{2}$.	
		(1)

8.2 Determine the derivative of $f(x) = \sqrt[3]{x^2} + \frac{1}{4x^4}$.

(3)

8.3 Given: $h(x) = ax^2, \quad a > 0.$

Determine the value of a if it is given that $h^{-1}(8) = h'(4)$.

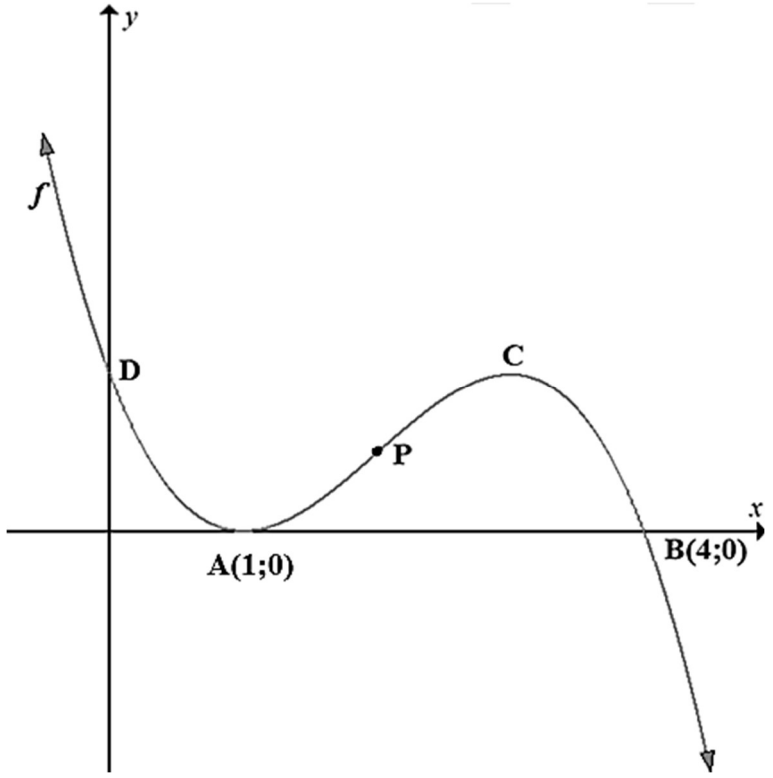
(5)

[13]

QUESTION 9

The graph of the function $f(x) = -2x^3 + ax^2 + bx + c$ is sketched below.
The following properties of f are given below:

- Point A(1 ; 0) is a stationary point.
- Point B(4 ; 0) is an x-intercept.
- Point P is the point of inflection.
- Point C is the turning point.
- Point D is the y-intercept.



9.1	Show that $a = 12,\ b = -18$ and $c = 8$.	
		(3)

9.2	Kusal states that a tangent to the curve of f can be drawn through points C and D. Validate this statement using an appropriate calculation.	
		(3)
9.3	Points A, P and B are joined to form ΔAPB. Calculate the area of ΔAPB.	
		(4)
9.4	For which values of x is f concave down?	
		(1)

9.5	Write down the values of x for which f is strictly increasing.	
		(1)
9.6	Write down the coordinates of the turning points of $h(x) = f(x) - 3$.	
		(2)
		[14]

QUESTION 10

A metal box (without a top) is to be constructed, from a square metal sheet with sides of 20 cm, by cutting square pieces of equal size from the corners of the sheet and then folding up the sides. Calculate the dimensions of the box with the largest volume that can be constructed in this manner.

(7)

[7]

QUESTION 11

11.1	A six-sided die is rolled and the number of dots landing face up is noted. Consider the following events: • Event A: The number observed is 2 at the most. • Event B: The number that landed face up is an even number. • Event C: The number 6 is facing up. Use the given information to:	
11.1.1	Determine, separately, the probability of event A and event B.	
		(2)
11.1.2	Use $P(A)$ and determine $P(A')$.	
		(1)
11.1.3	Are the events mutually exclusive? Give a reason for your answer.	
		(2)

11.1.4	Calculate $P(A \text{ or } C)$.	
		(2)
11.1.5	Are B and C independent events? Give a reason for your answer.	
		(3)

11.2	The probability of getting the first answer in a quiz correct, is 0,6. If the first answer is correct, the probability of getting the next answer correct rises to 0,7. However, if the first answer is incorrect, the probability of getting the next answer correct is 0,4. With the use of a tree diagram, determine the probability of getting the second answer correct.	
		(3)

11.3	The discus cage on an athletics field must be moved to a different position. Five boys from a group of fifteen boys must be selected to perform this task. How many different groups of five boys can be selected?	
		(3)
		[16]

	Additional space	

	Additional space	

	Additional space	

TOTAL: 150

END

INFORMATION SHEET

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

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

$T_n = a + (n-1)d$ $\quad$ $S_n = \frac{n}{2}[2a + (n-1)d]$ $\quad$ $T_n = ar^{n-1}$

$S_n = \frac{a(r^n - 1)}{r - 1}$; $r \neq 1$ $\quad$ $S_\infty = \frac{a}{1-r}$; $-1 < r < 1$

$F = \frac{x[(1+i)^n - 1]}{i}$ $\quad$ $P = \frac{x[1-(1+i)^{-n}]}{i}$ $\quad$ $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

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

$y - y_1 = m(x - x_1)$ $\quad$ $m = \frac{y_2 - y_1}{x_2 - x_1}$ $\quad$ $m = \tan\theta$

$(x-a)^2 + (y-b)^2 = r^2$ $\quad$ In ΔABC: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$a^2 = b^2 + c^2 - 2bc.\cos A$ $\quad$ $\text{area}\,\Delta ABC = \frac{1}{2}ab.\sin C$

$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$ $\quad$ $\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$

$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$ $\quad$ $\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases}$$

$\sin 2\alpha = 2\sin\alpha.\sin\alpha$

$\bar{x} = \frac{\sum x}{n}$ $\quad$ $\sigma^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n}$

$P(A) = \frac{n(A)}{n(S)}$ $\quad$ P(A or B) = P(A) + P(B) – P(A and B)

$\hat{y} = a + bx$ $\quad$ $b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$

PREPARATORY EXAMINATION
2025

MATHEMATIC
PAPER 1 (10611)

MATHEMATICS: Paper 1

10611E

X05