LIMPOPO

PROVINCIAL GOVERNMENT

REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF

EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

JUNE 2025

MARKS: 100

TIME: 2hours

This question paper consists of 6 pages

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of FOUR questions.
2. Answer all questions.
3. Clearly show ALL calculations, diagrams, graphs, etc. which you have used in determining the answers.
4. Answers only will NOT necessarily be awarded full marks.
5. You may use an approved scientific calculator (non-programmable and non-graphical) unless stated otherwise.
6. If necessary, round off your answers to TWO decimal places, unless stated otherwise.
7. Diagrams are NOT necessarily drawn to scale.
8. Write neatly and legibly

QUESTION 1

1.1 *If* $x \in \{0; 2; 4; 6\}$ Determine the values of x for which $\sqrt{\frac{8}{4-x}}$ is

1.1.1 Undefined (1)

1.1.2 Irrational (1)

1.2 Solve for x

1.2.1 $x^2 - 4x = 0$ (2)

1.2.2 $3x^2 - 4 = 5x$ correct to 2 decimal places (5)

1.2.3 $2\sqrt{x-3} = x - 3$ (5)

1.2.4 $(x - 4)(x + 3) \geq -6$ (6)

1.3 Solve simultaneously for x *and* y

$3y = x + 1$ *and* $(x - y)(5y - 3x) = 0$ (6)

1.4 If $x = 8$ is one root of $x + \frac{48}{x} = 14$, determine one root of y for which

$3y - 4 + \frac{48}{3y-4} = 14$ (2)

[28]

QUESTION 2

2.1 Determine the value of $\frac{2^{2025}-2^{2023}}{2^{2021}-2^{2019}}$ without using a calculator. (4)

2.2 Simplify

2.2.1 $\frac{3^{x+4}-6.3^{x+1}}{7.3^{x+2}}$ (4)

2.2.2 $\sqrt{x+\sqrt{4x-4}} \times \sqrt{x-\sqrt{4x-4}}$ (4)

2.3 Solve for x

2.3.1 $5^{\sqrt{x}} = 125$ (3)

2.3.2 $5^{x} + 15.5^{-x} = 2$ (5)

[20]

QUESTION 3

Given the function $f(x)=\frac{4}{x-2}+4$ and $g(x)=2^x-2$

3.1 Write down the equations of the asymptotes of f. (2)

3.2 Calculate the x *and* y intercepts of f. (3)

3.3 Write down the domain of f. (1)

3.4 Determine the equation of the axis of symmetry of f which has a negative gradient (3)

3.5 Calculate the x *and* y intercepts of g. (2)

3.6 Write the equation of the asymptote of g. (1)

3.7 Sketch the graphs of f and g on the same system of axis.

Show all intercepts with axis and asymptotes. (6)

3.8 Determine the values of x for which $f(x)\geq g(x)$ for $x<2$ (2)

3.9 The graph of f has undergone transformation to form the graph of $h(x)=\frac{x+2}{x-2}$.

Determine

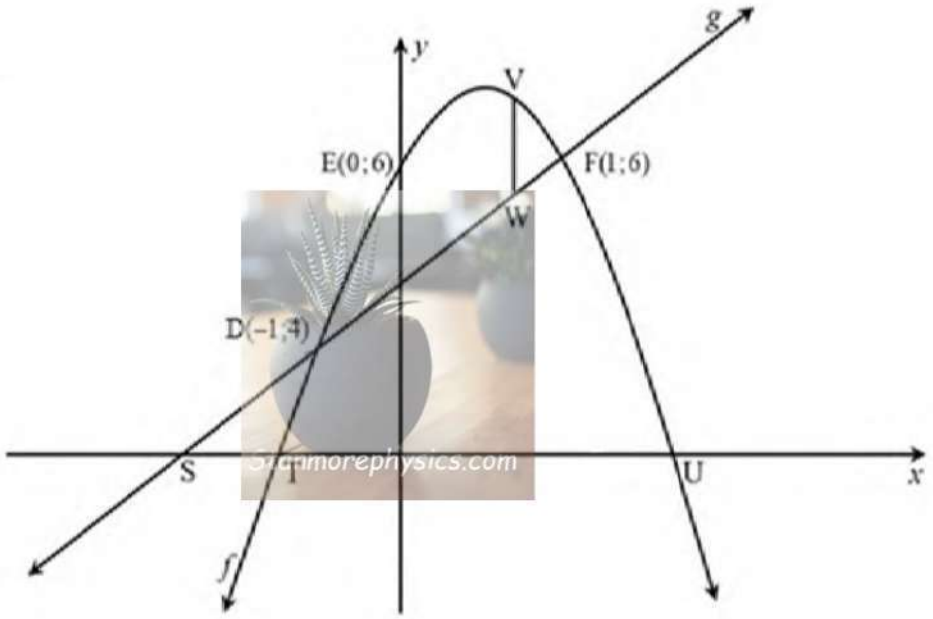
3.9.1 the horizontal asymptote of h. (3)

3.9.2 the type of transformation from f to h. (2)

[25]

QUESTION 4

The diagram below shows the graphs of $f(x) = ax^2 + bx + c$ and $g(x) = mx + q$. D(-1;4) and F(1;6) are points of intersection of f and g. T and U are the x intercepts of f. E(0;6) is the y-intercept of f and S is the x-intercept of g. VW is a straight line parallel to the y-axis



4.1 Write down the equation of the axis of symmetry of f. (1)

4.2 For which values of x is f increasing. (1)

4.3 Calculate the average gradient of f between D and E. (2)

4.4 Determine the equation of g. (3)

4.5 Show that $f(x) = -x^2 + x + 6$ (5)

4.6 Determine the range of f. (3)

4.7 Calculate the length of SU. (5)

4.8 Determine the values of x for which $f(x) - g(x) \leq 0$. (3)

4.9 Calculate the maximum length of VW. (4)

[27]

TOTAL 100

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Question 2

2.3	2.3.2	$5^x + 15.5^{-x} = 2$ $5^x + 15.\frac{1}{5^x} = 2$ $5^{2x} + 15 = 2.5^x$ $5^{2x} - 2.5^x + 15 = 0$ $\Delta = 2^2 - 4(1)(15) = -56$ $\Delta < 0$ No real values OR $5^x + 15.5^{-x} = 2$ $5^x + 15.\frac{1}{5^x} = 2$ $5^{2x} + 15 = 2.5^x$ $5^{2x} - 2.5^x + 15 = 0$ Let $5^x = k$ $k^2 - 2.k + 15 = 0$ $k = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(15)}}{2(1)}$ $\Delta < 0$ No real values	✓changing to positive exponents ✓multiplying by the denominator ✓standard form ✓$\Delta < 0$ ✓ No real values OR ✓changing to positive exponents ✓ multiplying by the denominator ✓standard form ✓$\Delta < 0$ ✓ No real values	(5) (5)

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MARKING GUIDELINES

MARKS: 100

These marking guidelines consist of 8 pages.

NOTE:

• If a candidate answered a question TWICE, mark only the FIRST attempt.

• If a candidate crossed out an answer and did not redo it, mark the crossed-out answer.

• Consistent accuracy applies to ALL aspects of the marking guidelines.

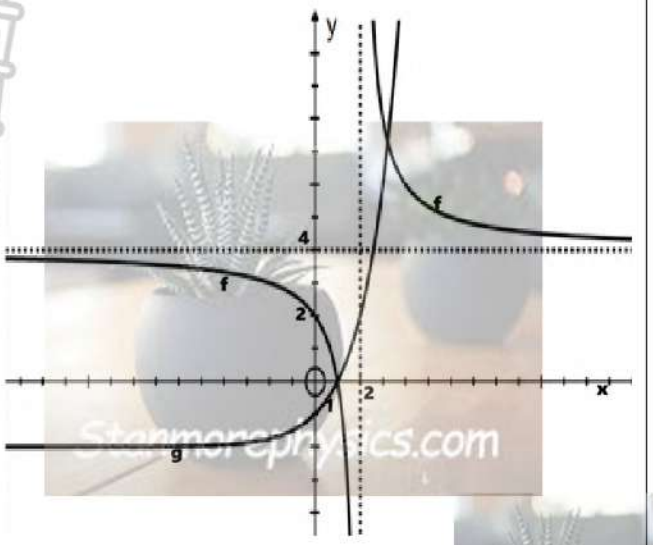
• Assuming values/answers in order to solve a problem is unacceptable.

1.1	1.1.1	$x=4$	✓answer	(1)
	1.1.2	$x=0$	✓answer	(1)
1.2	1.2.1	$x(x-4)=0$ $x=0$ or $x=4$	✓factorization ✓both values of x	(2)
	1.2.2	$3x^2-5x-4=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $x=\frac{-(-5)\pm\sqrt{(-5)^2-4(3)(-4)}}{2(3)}$ $x=2,26$ or $x=-0,59$	✓standard form ✓correct formula ✓substitution ✓✓answers Penalize once for incorrect rounding	(5)
	1.2.3	$(2\sqrt{x-3})^2=(x-3)^2$ $4(x-3)=x^2-6x+9$ $4x-12=x^2-6x+9$ $x^2-10x+21=0$ $(x-3)(x-7)=0$ $x=3$ or $x=7$	✓squaring both sides ✓simplification ✓factorizing ✓both factors ✓both values	(5)
	1.2.4	$(x-4)(x+3)\geq -6$ $x^2-x-12+6\geq 0$ $x^2-x-6\geq 0$ $(x-3)(x+2)\geq 0$ $x\leq -2$ or $x\geq 3$	✓simplifying ✓standard form ✓factorization ✓critical values ✓✓answers	(6)

1.3		$(x-y)(5y-3x)=0$ $3y=x+1$ $x=3y-1$ $[3y-1-y][5y-3(3y-1)]=0$ $(2y-1)(-4y+3)=0$ $y=\frac{1}{2}$ or $y=\frac{3}{4}$ $x=\frac{1}{2}$ or $x=\frac{5}{4}$	✓ $x=3y-1$ ✓substitution ✓simplification ✓ $y-$values ✓✓ x-values	(6)
1.4		$3y-4=8$ $3y=12$ $y=4$	✓substitution ✓answers	(2)
				[28]
QUESTION 2				
2.1		$\frac{2^{2025}-2^{2023}}{2^{2021}-2^{2019}}$ $\frac{2^{2019}.2^6-2^{2019}.2^4}{2^{2019}.2^2-2^{2019}}$ $\frac{2^{2019}(2^6-2^4)}{2^{2019}(2^2-1)}$ $\frac{48}{3}$ 16	✓exponential laws ✓factorization ✓simplification ✓answer	(4)
2.2	2.2.1	$\frac{3^{x+4}-6.3^{x+1}}{7.3^{x+2}}$ $\frac{3^x.3^4-6.3^x.3}{7.3^x.3^2}$ $\frac{3^x(3^4-6.3)}{7.3^x.3^2}$ $\frac{81-18}{7\times 9}$ 1	✓Laws of exp ✓factors (common factor) ✓ simplification ✓answer	(4)

	2.2.2	$\sqrt{x+\sqrt{4x-4}} \times \sqrt{x-\sqrt{4x-4}}$ $\sqrt{x^2-(4x-4)}$ $\sqrt{x^2-4x+4}$ $\sqrt{(x-2)^2}$ $x-2$	✓nultiplying ✓simplification ✓factorization ✓answer	(4)
2.3	2.3.1	$5^{\sqrt{x}} = 5^3$ $\sqrt{x} = 3$ $x = 9$	✓same base ✓equating exponents ✓answer	(3)
	2.3.2	$5^x + 15.5^{-x} = 2$ $5^x + 15.\frac{1}{5^x} = 2$ $5^{2x} - 2.5^x + 15 = 0$ $(5^x - 5)(5^x + 3) = 0$ $5^x = 5 \text{ or } 5^x \neq -3$ $\therefore x = 1$ $5^x - 15.5^{-x} = 2$ $5^x - 15.\frac{1}{5^x} = 2$ Let $5^x = k$ $\therefore k - \frac{15}{k} = 2$ $k^2 - 2k - 15 = 0$ $(k-5)(k+3) = 0$ $k = 5 \text{ or } k = -3$ $5^x = 5 \text{ or } 5^x \neq -3$ $\therefore x = 1$	✓positive exponent ✓multiplying by 5^x ✓factorization ✓factors ✓answer ✓positive exponent ✓standard form ✓factorization ✓factors ✓answer	(5)
				[20]

QUESTION 3				
3.1		$x = 2$ $y = 4$	✓answer ✓answer	(2)
3.2		$y\text{ int}, x = 0 \therefore y = \frac{4}{0-2} + 4$ $y = 2$ $x\text{ int}, y = 0 \therefore 0 = \frac{4}{x-2} + 4$ $-4 = \frac{4}{x-2}$ $-4x + 8 = 4$ $x = 1$	✓y=2 ✓simplification ✓x = 1	(3)
3.3		$x \in \Re, x \neq 2$	✓answer	(1)
3.4		$(2;4);\ m = -1$ $y = mx + c$ $4 = -1(2) + c$ $\therefore c = 6$ $\therefore y = -x + 6$	✓ (2;4) ✓value of c ✓answer	(3)
3.5		$y = 2^x - 2$ $y\text{ int}, x = 0$ $y = 2^0 - 2$ $\therefore y = -1$ $x\text{ int}, y = 0$ $2^x - 2 = 0$ $2^x = 2$ $\therefore x = 1$	✓ $y = -1$ ✓ $x = 1$	(2)
3.6		$y = -2$	✓answer	(1)

3.7			Hyperbola ✓asymptotes ✓intercepts ✓shape Exponential ✓asymptote ✓intercepts ✓shape	(6)
3.8		$x \leq 1$	✓✓answer	(2)
3.9	3.9.1	$h(x) = \frac{x+2}{x-2}$ $\frac{x-2+4}{x-2}$ $\frac{x-2}{x-2} + \frac{4}{x-2}$ $= \frac{4}{x-2} + 1$ $\therefore y = 1$	✓simplification ✓standard form ✓answer	(3)
	3.9.2	Shifted 3 units down	✓3 units ✓down	(2)
				[25]

QUESTION 4				
4.1		$x = \frac{1}{2}$	✓answer	(1)
4.2		$x < \frac{1}{2}$	✓answer	(1)
4.3		$D(-1;4) \quad E(0;6)$ $m = \frac{y_2 - y_1}{x_2 - x_1}$ $m = \frac{6-4}{0-(-1)}$ $\therefore m = 2$	✓substitution in correct formula ✓answer	(2)
4.4		$m = \frac{6-4}{1-(-1)}$ $m = 1$ $y = mx + c$ $6 = 1(1) + c$ $c = 5$ $y = x + 5$	✓ $m = 1$ ✓ $c = 5$ ✓answer	(3)
4.5		$y = ax^2 + bx + c$ for $(0;6)$ $\therefore c = 6$ $4 = a(-1)^2 + b(-1) + 6$ for $(-1;4)$ $a - b = -2$ $6 = a + b + 6$ for $(1;6)$ $\therefore a = -b$ $-b - b = -2$ $-2b = -2$ $b = 1$ $\therefore a = -1$ $\therefore y = -x^2 + x + 6$	✓c = 6 ✓ $a - b = -2$ ✓ $a = -b$ ✓ $b = 1$ ✓ $a = -1$	(5)

4.6		$x = \frac{-b}{2a}$ $x = \frac{-1}{2(-1)}$ $x = \frac{1}{2}$ $y = -\left(\frac{1}{2}\right)^2 + \frac{1}{2} + 6$ $y = 6{,}25$ $\therefore$ Range: $y \leq 6{,}25$	✓value of x ✓value of y ✓answer	(3)
4.7		$-x^2 + x + 6 = 0$ $x^2 - x - 6 = 0$ $(x-3)(x+2) = 0$ $x = 3$ or $x = -2$ $U(3;0)$ $S(-5;0)$ $SU = x_U - x_S$ $SU = 3 - (-5)$ $SU = 8 units$	✓ $y = 0$ ✓factors ✓both values of x ✓x values at S and U ✓answer	(5)
4.8		$f(x) - g(x) \leq 0$ $f(x) \leq g(x)$ $x \leq -1$ or $x \geq 6$	✓ $f(x) \leq g(x)$ ✓✓answer	(3)
4.9		$VW = y_V - y_W$ $VW = -x^2 + x + 6 - (x+5)$ $VW = -x^2 + x + 6 - x - 5$ $= -x^2 + 1$ $x = \frac{-b}{2a}$ $x = \frac{0}{2(-1)} = 0$ $y = 1$ The maximum length of VW is 1unit	✓$VW = -x^2 + x + 6 - (x+5)$ ✓simplification ✓value of x ✓answer	(4)
				[27]

TOTAL: 100