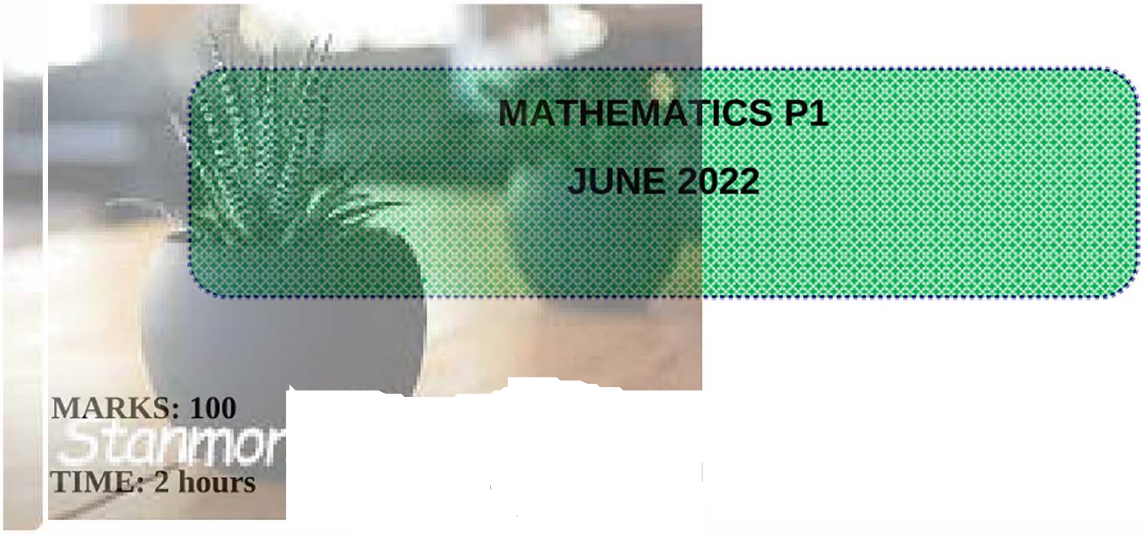
LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

VHEMBE EAST DISTRICT

NATIONAL
SENIOR CERTIFICATE

GRADE 11



This question paper consists of 6 pages

INSRUCTIONS AND INFORMATION

READ THE FOLLOWING INSTRUCTIONS CAREFULLY BEFORE ANSWERING THE QUESTIONS.

1. This question paper consists of 5 questions. Answer ALL the questions.
2. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining the answers.
3. An approved scientific calculator (non-programming and non-graphical) may be used, unless stated otherwise.
4. If necessary, answers should be rounded off to TWO decimal places, unless stated otherwise.
5. Diagrams are NOT necessary drawn to scale.
6. Number the answers correctly according to the numbering system used in this question paper.
7. It is in your own interest to write legibly and to present the work neatly.

QUESTION 1

1.1. Solve for x in each of the following:

1.1.1. $x^2 + x - 12 = 0$ (3)

1.1.2. $\sqrt{2x + 1} = x - 1$ (5)

1.1.3. $2^{x\sqrt{x}} = 2^{27}$ (4)

1.1.4. $x^2 - 2x - 8 < 0$ (3)

1.2. Given: $f(x) = 5x^2 + 6x - 7$

1.2.1. Solve for x if $f(x) = 0$ (correct to TWO decimal places). (4)

1.2.2. Hence, or otherwise, calculate the value of d for which $5x^2 + 6x - d = 0$ has equal roots (3)

1.3. Solve for x and y simultaneously:

$x - 2y = -3$ and $xy = 20$ (6)

[28]

QUESTION 2

2.1. The solution to a quadratic equation is $x = \frac{3 \pm \sqrt{4-8p}}{4}$ where $P \in \mathbf{Q}$.

Determine the value(s) of p such that:

2.1.1. The roots of the equation are equal (2)

2.1.2. The roots of the equation are non-real (2)

2.2. Given: $\sqrt{5 - x} = x + 1$

2.2.1. Without solving the equation, show that the solution to the above equation lies in the interval $-1 \leq x \leq 5$. (3)

2.2.2. Solve the equation. (5)

2.2.3. Without any further calculations, solve the equation $-\sqrt{5 - x} = x + 1$. (1)

[13]

QUESTION 3

3.1. Consider the following number pattern: 4; 9; 14; ……

3.1.1. Write down the next two terms of the pattern. (2)

3.1.2. Determine the expression for the n^{th} term of the pattern. (2)

3.1.3. Determine if 1099 is a term of the number pattern. (3)

3.2. Consider the following quadratic number pattern: 6; 10; 18; …..

3.2.1. Write down the following two terms of the pattern. (2)

3.2.2. Determine the equation of the general term in the form:

$$T_{n=an^2+bn+c}$$ (4)

3.2.3. Calculate the value of T_{12} (2)

3.2.4. What term of the pattern will have a value of 766? (4)

3.3. A certain number pattern has the following properties:

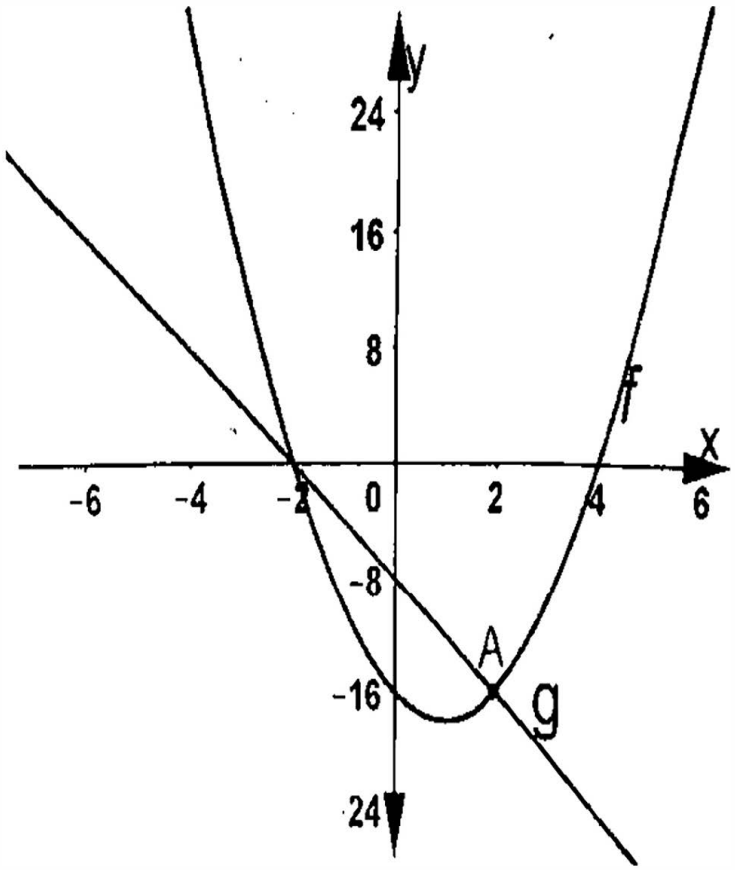
- $T_{1=k}$
- $T_{2=14}$
- $T_4 = 7\,T_1$
- $T_3 - T_2 = 10$

Determine the value of *k*. (5)

[24]

QUESTION 4

The diagram represents the functions $f(x) = ax^2 + bx + c$ and g$(x) = mx + k$



4.1. Calculate the values of a, b and c. (5)

4.2. Find the equation of $g(x)$. (5)

4.3. Calculate the co-ordinates of A, a point of intersection of f and g. (6)

[16]

QUESTION 5

Given: $f(x) = \frac{-3}{x+2} + 1$ and $g(x) = 2^{-x} - 4$

5.1. Determine $f(-3)$ (2)

5.2. Determine $x \; if \; g(x) = 4$ (3)

5.3. Write down the asymptotes of $f(x)$ (2)

5.4. Write the range of g (1)

5.5. Determine the coordinates of the x and y- intercepts of f (4)

5.6. Sketch the graphs of f and g on the same system of axes. Clearly show ALL the intercepts with the axes and any asymptotes. (4)

5.7. If it is given that $f(-1) = g(-1)$, determine the values of x for which $g(x) \geq f(x)$ (3)

[19]

TOTAL: 100

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GRADE 11

MATHEMATICS P1
MEMORANDUM
JUNE 2022

MARKS: 100

TIME: 2 hours

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

QUESTION 1

1.1.1	$x^2 + x - 12 = 0$ $(x + 4)(x - 3) = 0$ $x = -4$ or $x = 3$	✓ factors ✓ answer ✓ answer (3)
1.1.2	$\sqrt{2x + 1} = x - 1$ $2x + 1 = (x - 1)^2$ $2x + 1 = x^2 - 2x + 1$ $x^2 - 4x = 0$ $x(x - 4) = 0$ $x = 0$ or $x = 4$ n/a	✓ squaring both sides ✓ standard form ✓ factors ✓ answer ✓ $x = 4$ (correct selection) (5)
1.1.3	$2^{x\sqrt{x}} = 2^{27}$ $2^{x^{\frac{3}{2}}} = 2^{27}$ $x^{\frac{3}{2}} = 27$ $x = 27^{\frac{2}{3}}$ $x = 9$	✓ $2x^{\frac{3}{2}}$ ✓ $x^{\frac{3}{2}} = 27$ ✓ Raise both sides to $\frac{2}{3}$ ✓ Answer (4)
1.1.4	$x^2 - 2x - 8 \leq 0$ $(x - 4)(x + 2) < 0$ $-2 < x < 4$ OR/OF $x \in (-2; 4)$	✓ $(x - 4)(x + 2) < 0$ ✓ Critical values ✓ Inequalities (3)

1.2.1	$5x^2 + 6x - 7 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-6 \pm \sqrt{6^2 - 4(5)(-7)}}{2(5)}$ = 0, 73 or - 1, 93	✓ Formula ✓ Substitution ✓ Answers ✓ (4)

1.2.2	$5x^2 + 6x - d = 0$ $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $x = \frac{-6 \pm \sqrt{6^2-4(5)(-d)}}{2(5)}$ $36 + 20d = 0$ $d = -\frac{9}{5}$ **OR** for equal roots: $\Delta = 0$ $\Delta = b^2 - 4ac$ $= (6)^2 - 4(5)(-d)$ $36 + 20d = 0$ $d = -\frac{9}{5}$ **OR** $5x^2 + 6x - d = 0$ $x^2 + \frac{6x}{5} = \frac{d}{5}$ $(x + \frac{3}{5})^2 = \frac{d}{5} + \frac{9}{25}$ $= \frac{5d+9}{25}$ For equal roots $\frac{5d+9}{25} = 0$ $\therefore = \frac{-9}{5}$	✓ Substitution ✓ $36 + 20d = 0$ ✓ Answer (3) ✓ Substitution ✓ $36 + 20d = 0$ ✓ answer (3) ✓ completing the square ✓ $5d + 9 = 0$ ✓ Answer (3)

1.3	$x = 2y - 3$ …. (1) $xy = 20$ …. (2) Substitute (1) into (2): $(2y - 3)y = 20$ $2y^2 - 3y - 20 = 0$ $(2y + 5)(y - 4) = 0$ $y = -\frac{5}{2}$ or $y = 4$ $x = -8$ or $x = 5$	✓ Making x the subject ✓ Substitution ✓ Standard form ✓ Factors ✓ y – values ✓ x – values (6)
	OR $x + 3 = 2y$ $y = \frac{x+3}{2}$ .....(1) $xy = 20$ .....(2) Substitute (1) into (2) : $x\left(\frac{x+3}{2}\right) = 20$ $x^2 + 3x = 40$ $x^2 + 3x - 40 = 0$ $(x + 8)(x - 5) = 0$ $x = -8$ or $x = 5$ $y = \frac{5}{2}$ or $y = 4$	✓ Making *y* the subject ✓ Subst ✓ Standard form ✓ Factors ✓ x – values ✓ y – values (6)
	OR $x - 2y = -3$ ..... (1) $y = \frac{20}{x}$ ..... (2) Substitute (2) into (1) $x - 2(\frac{20}{x}) = -3$ $x^2 - 40 = -3x$ $x^2 + 3x - 40 = 0$ $(x + 8)(x - 5) = 0$ $x = -8$ or $x = 5$ $y = -\frac{5}{2}$ or $y = 4$	✓ Making y the subject ✓ Substitution ✓ Standard form ✓ Factors ✓ x – values ✓ y – values (6)
	OR	

	$x - 2y = -3$ .....(1) $x = \frac{20}{y}$ .....(2) Substitute (2) into (1): $\frac{20}{y} - 2y = -3$ $20 - 2y^2 = -3y$ $0 = 2y^2 - 3y - 20$ $0 = (2y + 5)(y - 4)$ $y = -\frac{5}{2}$ or $y = 4$ $x = -8$ or $x = 5$	✓ Making x the subject ✓ Subst ✓ Standard form ✓ Factors ✓ y values ✓ x values (6) **[28]**

QUESTION 2

2.1.1	$4 - 8P = 0$ $-8P = -4$ $P = \frac{1}{2}$	✓ $4 - 8P = 0$ ✓ Answer (2)
2.1.2	$4 - 8p < 0$ $p > \frac{1}{2}$	✓ $4 - 8p < 0$ ✓ Answer (2)
2.2.1	$\sqrt{5 - x} = x + 1$ $5 - x \geq 0$ and $x + 1 \geq 0$ $x \leq 5$ and $x \geq -1$ Hence $-1 \leq x \leq 5$	✓ $5 - x \geq 0$ ✓ $x + 1 \geq 0$ ✓ And (3)
2.2.2	$5 - x = x^2 + 2x + 1$ $x^2 + 3x - 4 = 0$ $(x + 4)(x - 1) = 0$ $x = -4$ or $x = 1$ Since $-1 \leq x \leq 5$, $x = 1$ only	✓ Square both sides ✓ Standard form ✓ Factors ✓ Answers ✓ Selection of 1 (5)
2.2.3	$x = -4$	✓ Answer (1) **[13]**

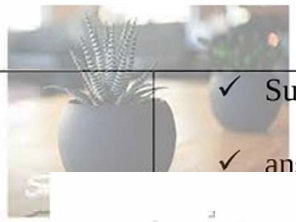
QUESTION 3

3.1.1	19 ; 24	✓ 19 ✓ 24 (2)
3.1.2	$T_n = 5n - 1$	✓ $5n - 1$ (2)
3.1.3	$T_n = 1099$ $5n - 1 = 1099$ $5n = 1100$ $n = 220$ $\therefore T_{220} = 1099$ $\therefore$ it is in the sequence	✓ Equating ✓ Simplification $5n = 1100$ ✓ Answer (3)
3.2.1	30 ; 46	✓ 30 ✓ 46 (2)
3.2.2	$T_n = an^2 + bn + c$ $2a = 4$ $\therefore a = 2$ $3a + b = 4$ $\therefore 3(2) + b = 4$ $\therefore b = -2$ $a + b + c = 6$ $2 - 2 + c = 6$ $c = 6$ $\therefore T_n = 2n^2 - 2n + 6$	✓ Second difference = 4 ✓ $a = 2$ ✓ $b = -2$ ✓ $c = 6$ (4)
3.2.3	$T_{12} = 2(12)^2 - 2(12) + 6$ $= 270$	✓ Correct substitution in T_n ✓ Answer (2)
3.2.4	$T_n = 766$ $2n^2 - 2n + 6 = 766$ $2n^2 - 2n + 760 = 0$ $n^2 - n - 380 = 0$ $(n - 20)(n + 19) = 0$ $n = 20$ $\therefore$ it is term number 20	✓ Equating ✓ Standard form = 0 ✓ Factors ✓ n = 20 (4)
3.3	T_1 ; T_2 ; T_3 ; T_4 k ; 14 ; 24 ; $7k$ $-4 + k = 7k - 24$ $6k = 30$ $K = 5$	✓ First difference ✓ Second differences ✓ Equating ✓ $6k$ = 30 ✓ Answer (5) **[24]**

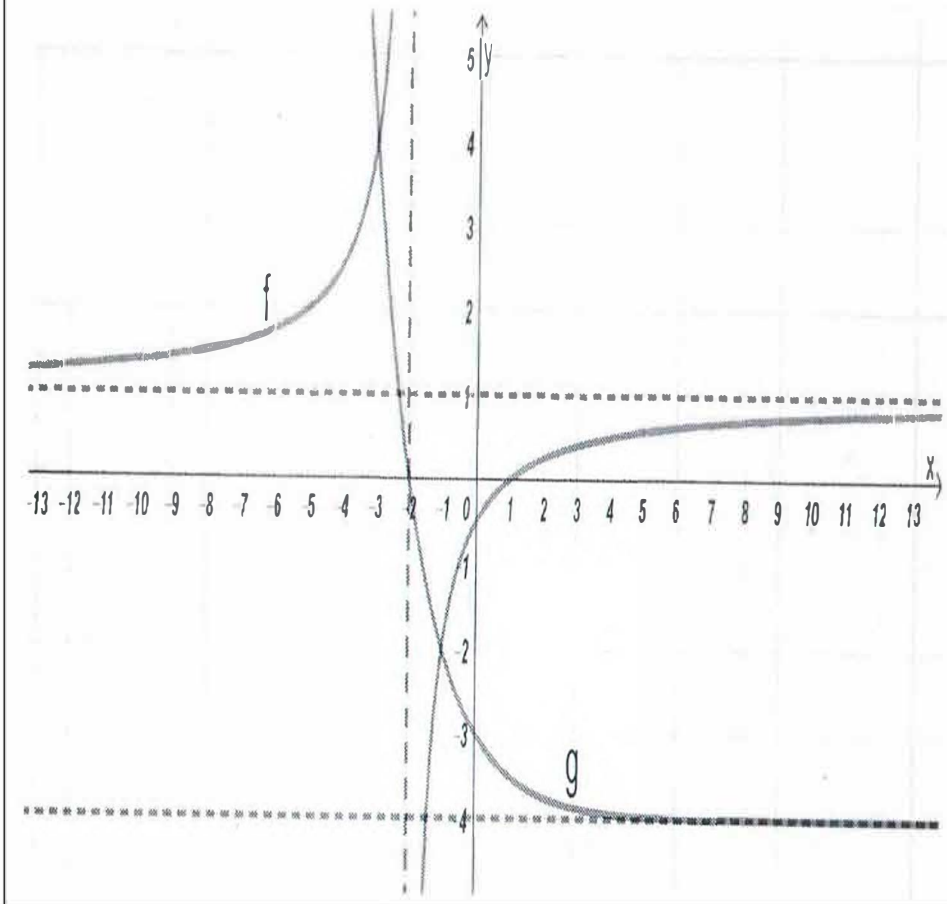
QUESTION 4

4.1	$y = a(x - x_1)(x - x_2)$ $y = a(x - (-2))(x - 4)$ $y = a(x + 2)(x - 4)$ Substituting (0 ; -16), we have : $-16 = a(0 + 2)(0 - 4)$ $-16 = -8a$ $2 = a$ Substituting 2 for a : $y = 2(x + 2)(x - 4)$ $y = 2(x^2 - 2x - 8)$ $y = 2x^2 - 4x - 16$ $\therefore a = 2, \quad b = -4, \quad c = -16$	✓ Substitution ✓ Value of a ✓ Substitution & simplification ✓ Value of b ✓ Value of c (5)
4.2	The points (-2 ; 0)(0 ; -8) lie on g $m = \frac{y_2 - y_1}{x_2 - x_1}$ $m = \frac{-8 - 0}{0 - (-2)}$ $= -4$ $\therefore y = -4x + c$ Substituting (0 ; -8) , we have : $-8 = -4(0) + c$ $\therefore -8 = c$ $\therefore g(x) = -4x - 8$	✓ Substitution ✓ Gradient ✓ Value of c ✓ Equation of g (4)
4.3	At A, $2x^2 - 4x - 16 = -4x - 8$ $2x^2 - 8 = 0$ $x^2 - 4 = 0$ $(x - 2)(x + 2) = 0$ $x = 2 \quad or \quad x = -2$ $y = 4(2) - 8 \qquad y = -4(-2) - 8$ $y = -8 - 8 \quad$ or $\quad y = 8 - 8$ $y = -16 \quad$ or $\quad y = 0$ $\therefore y = -16$ $\therefore A(2 ; -16)$	✓ Equating equations ✓ Factorization ✓ Values of x ✓ Substitution ✓ y value ✓ Coordinate of A (6) **[15]**

QUESTION 5



5.1	$f(-3) = \frac{-3}{-3+2} + 1$ $= 4$	✓ Substitution ✓ answer (2)
5.2	$4 = 2^{-x} - 4$ $8 = 2^{-x}$ $2^3 = 2^{-x}$ $\therefore x = -3$	✓ Substitution ✓ Raise to exponent ✓ x – value (3)
5.3	$x = -2$ $y = 1$	✓ x values & ✓ y value (2)
5.4	$y \geq -4$	✓ Answer (1)
5.5	$f(x) = \frac{-3}{x+2} + 1$ $0 = \frac{-3}{x+2} + 1$ $-1 = \frac{-3}{x+2}$ $-1(x+2) = -3$ $-x - 2 = -3$ $x = 1$ $y = \frac{-3}{0+2} + 1$ $y = -\frac{1}{2}$	✓ Substitution ✓ (1 ; 0) Multiplication ✓ x – value ✓ $(0 ; -\frac{1}{2})$ or y – value (4)

5.6\		✓ Asymptotes ✓ ✓ Correct ✓ (4)
5.7	$x \leq -3$ or $-2 \leq x \leq -1$	✓ $-2 \leq x \leq -1$ ✓ ✓ $x \leq -3$ (3) **[19]**