



education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

NATIONAL SENIOR CERTIFICATE EXAMINATION

MATHEMATICS P1

SEPTEMBER 2019

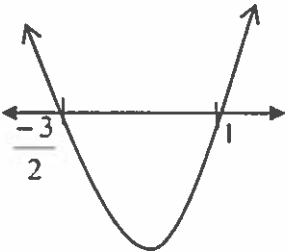
GRADE 12

MEMORANDUM

MARKS: 150

TIME: 3 HOURS

This MEMORANDUM consists of 12 pages

QUESTION 1		[26]
1.1.1	$x^2 - 2x = 0$ $x(x-2) = 0$ $x = 0 \text{ or } x = 2$	✓ Factors ✓✓ Answers (3)
1.1.2	$2x - \frac{8}{x+1} = 3$ $2x(x+1) - 8 = 3(x+1)$ $2x^2 - x - 11 = 0$ $x = \frac{1 \pm \sqrt{(1)^2 - 4(2)(-11)}}{2(2)}$ $x = \frac{1 \pm \sqrt{89}}{4}$ $x = 2,61 \text{ or } x = -2,11$	✓ LCD ✓ Standard form ✓ Substitution into correct formula ✓ $\sqrt{89}$ ✓ Answers (5)
1.1.3	$2x^2 + x - 3 > 0$ $(x-1)(2x+3) > 0$  OR  $x < -\frac{3}{2} \text{ or } x > 1$ OR $x \in \left(-\infty; -\frac{3}{2}\right) \cup (1; \infty)$	✓ Critical Values ✓✓ Notation (3)
1.1.4	$x^{\frac{2}{3}} - x^{\frac{1}{3}} = 6$ $x^{\frac{2}{3}} - x^{\frac{1}{3}} - 6 = 0$ $\left(x^{\frac{1}{3}} + 2\right)\left(x^{\frac{1}{3}} - 3\right) = 0$ $x^{\frac{1}{3}} = -2 \quad \text{or} \quad x^{\frac{1}{3}} = 3$ $x = -8 \quad \quad \quad x = 27$	✓ Standard form ✓ Factors ✓ Answers

	OR $x^{\frac{2}{3}} - x^{\frac{1}{3}} - 6 = 0$ Let $x^{\frac{1}{3}} = k$ $k^2 - k - 6 = 0$ $(k-3)(k+2) = 0$ $x^{\frac{1}{3}} = 3 \quad \text{or} \quad x^{\frac{1}{3}} = -2$ $x = 27 \quad x = -8$	(3) ✓ standard form ✓ factors ✓ Answers (3)
1.2.1	$4^{x+2} \cdot 8^{y+1} = 2^{1-x}$ $2^{2(x+2)} \cdot 2^{3(y+1)} = 2^{1-x}$ $2^{2x+4} \cdot 2^{3y+3} = 2^{1-x}$ $2^{2x+3y+7} = 2^{1-x}$ $3x+3y = -6$ $y = -x-2$	✓ Exponential Law ✓ Exponential Law ✓ Simplify (3)
1.2.2	$y = -x-2$ $x^2 + y^2 + xy = 7$ Substitute $y = -x-2$ in $x^2 + y^2 + xy = 7$ $x^2 + (-x-2)^2 + x(-x-2) = 7$ $x^2 + x^2 + 4x + 4 - x^2 - 2x - 7 = 0$ $x^2 + 2x - 3 = 0$ $(x-1)(x+3) = 0$ $x = 1 \quad \text{or} \quad x = -3$ $y = -1-2 \quad \text{or} \quad y = -(-3)-2$ $y = -3 \quad \text{or} \quad y = 1$	✓ Substitution ✓ Standard form ✓ Factors ✓ x-values ✓ y-values (5)
1.3	$mx^2 + 5x + 4 = 0$ $\Delta = (5)^2 - 4(m)(4)$ $\Delta = 25 - 16m$ For non-real roots $\Delta < 0$ $25 - 16m < 0$ $-16m < -25$ $m > \frac{25}{16}$ $\therefore m = 2$	✓ substitution in Δ ✓ $\Delta < 0$ ✓ Inequality ✓ answer (4)

QUESTION 2		[24]
2.1	8; 1; 18; 1; 30; 1; 44; 1; ...	
2.1.1	60, 1	✓ Answers (1)
2.1.2	$2a = 2$ $a = 1$ $3a + b = 10$ $b = 7$ $a + b + c = 8$ $c = 0$ $T_n = n^2 + 7n$	✓ Value of a ✓ Value of b ✓ Value of c ✓ Equation (4)
2.1.3	$T_n = n^2 + 7n$ $368 = n^2 + 7n$ $n^2 + 7n - 368 = 0$ $(n + 23)(n - 16) = 0$ $n = -23 \text{ or } n = 16$ $\therefore T_{31} = 368$	✓ Substitution ✓ Factors ✓ n values ✓ Answer (4)
2.2	$T_2 + T_3 = 280$ $ar + ar^2 = 280$ $a = \frac{280}{r + r^2}$ $\frac{280}{r + r^2} = \frac{4375}{r^4 + r^5}$ $4375(r + r^2) = 280(r^4 + r^5)$ $4375r(1 + r) = 280r^4(1 + r)$ $4375r = 280r^4$ $r^3 = \frac{125}{8}$ $= \left(\frac{5}{2}\right)^3$ $r = \frac{5}{2}$	$T_5 + T_6 = 4375$ $ar^4 + ar^5 = 4375$ $a = \frac{4375}{r^4 + r^5}$ ✓ Equation 1 ✓ Equation 2 ✓ Equating $\checkmark r^3 = \frac{125}{8}$ ✓ Answer (5)

[illegible]

	$2 - 8m = 3$ $m = \frac{-1}{8}$	✓ Simplify ✓ Answer (3)
QUESTION 3 [18]		
3.1	$g(x) = \log_m x$ $2 = \log_m 4$ $m^2 = 4$ $m = 2$	✓ Substitution ✓ Answer (2)
3.2	$x = \log_2 y$ $y = 2^x$	✓✓ Answer (2)
3.3	$R(-1; 0)$ $y = a(x - x_1)(x - x_2)$ $y = a(x + 1)(x - 5)$ $a = \frac{-2}{5}$ $y = \frac{-2}{5}(x + 1)(x - 5)$ $y = \frac{-2}{5}(x^2 - 4x - 5)$ $y = \frac{-2}{5}x^2 + \frac{8}{5}x + 2$	✓ Value of R ✓ Substitution (4 ;2) ✓ Value of a ✓ Expansion ✓ Equation (5)
3.4	$f(0) - g^{-1}(0)$ $= 2 - 1$ $= 1$	✓ Answer (1)
3.5	$y = \frac{-2}{5}x^2 + \frac{8}{5}x + 2$ $y = \frac{-2}{5}(2)^2 + \frac{8}{5}(2) + 2$ OR $x = \frac{-b}{2a}$ $y = \frac{18}{5}$ $x = \frac{-\left(\frac{8}{5}\right)}{2\left(\frac{-2}{5}\right)}$ $x = 2$ OR $y = \frac{-2}{5}(x^2 - 4x - 5)$ $y = \frac{-2}{5}[(x-2)^2 - 4 - 5]$	✓ Substitution of 2 ✓ $y = \frac{18}{5}$ ✓ Factorization ✓ Completing the square

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	$y = \frac{-2}{5}(x-2)^2 + \frac{18}{5}$ $\left(-1; \frac{18}{5}\right)$	✓✓ Answers (4)
3.6.1	$1 \leq x \leq 2$ OR $x \in [1; 2]$	✓✓ Answers (2)
3.6.2	$f(x) - g(x) = \frac{13}{5}$ $f(2) - g(2) = \frac{18}{5} - 1$ $= \frac{13}{5}$ $\therefore x = 2$	✓✓ Answers (2)

QUESTION 4 [14]		
4.1.1	$f(x) = m^x + k$ $-3 = m^0 + k$ $k = -4$ $5 = m^2 - 4$ $m^2 = 9$ $m = \pm 3$ $\therefore f(x) = 3^x - 4$	✓ Substitution ✓ Value of k ✓ Value of m ✓ Equation (4)
4.1.2	$h(x) = -x + c$ $-1 = -(-2) + c$ $c = -3$ $h(x) = -x - 3$	✓ Substitution ✓ Value of c ✓ Answers (3)
4.2	Five units up and 2 units to the left	✓✓ Answer (2)
4.3	$\frac{-4}{x+2} - 1 = -x - 3$ $(-x-2)(x+2) = -4$ $-x^2 - 4x - 4 = -4$ $-x(x+4) = 0$ $x = 0 \text{ or } x = -4$ $-4 \leq x < -2$ $x \geq 0$	✓ Equating ✓ Factors ✓ x values ✓✓ Answer (5)

NSC-Memorandum

	OR $650000 \left(1 + \frac{0,143}{12}\right)^{240} = \frac{x \left[\left(1 + \frac{0,143}{12}\right)^{240} - 1 \right]}{\frac{0,143}{12}}$ $x = R8224,89$ No, they can not	✓ Substitution in correct formula ✓ Simplification ✓ Value of x ✓ Answer (4)
5.4	$P = \frac{x[1-(1+i)^{-n}]}{i}$ $1000000 = \frac{25000 \left[1 - \left(1 + \frac{0,095}{12}\right)^{-n} \right]}{\frac{0,095}{12}}$ $0,683333333 = 1,007916667^n$ $-n = \frac{\log 0,683333333}{\log 1,007916667}$ $= -48,287712$ $n = 48,29$ months	✓ Substitution into correct formula ✓ Use of logs ✓ 48,287712 ✓ Answer (4)

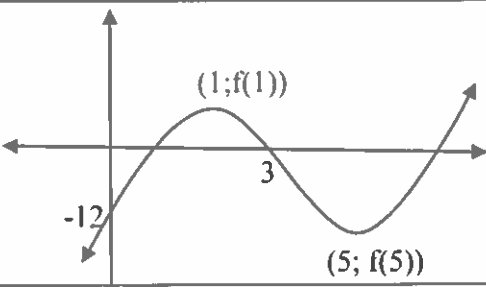
QUESTION 6

Penalty of -1 for notation in Question 6

[12]

6.1	$f(x) = -2x^2 + 2$ $f(x+h) = -2(x+h)^2 + 2$ $f(x+h) = -2(x^2 + 2xh + h^2) + 2$ $= -2x^2 - 4xh - 2h^2 + 2$ $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 2 - (-2x^2 + 2)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-2x^2 - 4xh - 2h^2 + 2 + 2x^2 - 2}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{-4xh - 2h^2}{h}$	✓ Finding $f(x+h)$ ✓ Correct substitution into formula and notation ✓ Simplification ✓ Common factor
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	$f'(x) = \lim_{h \rightarrow 0} \frac{h(-4x-2h)}{h}$ $= -4x$	✓ Answer (5)
6.2.1	$y = (x-2)^2$ $y = (x-2)(x-2)$ $y = x^2 - 4x + 4$ $\frac{dy}{dx} = 2x - 4$	✓ Removing the brackets ✓ ✓ Derivative (3)
6.2.2	$f(x) = \frac{2x^2 + \sqrt{x^5}}{6x}$ $f(x) = \frac{1}{3}x + \frac{1}{6}x^{\frac{3}{2}}$ $f'(x) = \frac{1}{3} + \frac{1}{4}x^{\frac{3}{2}}$	✓ ✓ Simplification ✓ ✓ Derivative (4)

QUESTION 7 [19]		
7.1		✓ Turning points ✓ x - intercepts ✓ y - intercept ✓ Shape (4)
7.2.1	$h(x) = -x^3 - 2x^2 + cx$ $-36 = -(-3)^3 - 2(-3)^2 + c(-3)$ $3c = 45$ $c = 15$	✓ Substitution ✓ Simplification (2)
7.2.2	$-x^3 - 2x^2 + 15x = 0$ $-x(x^2 + 2x - 15) = 0$ $-x(x+5)(x-3) = 0$ $x = 0 \text{ or } x = -5 \text{ or } x = 3$ $AB = 8 \text{ units}$	✓ Factors ✓ Value of x ✓ Answer (3)
7.2.3	$n > 14$	✓ ✓ Answer (2)
7.2.4	$h''(x) = -6x - 4 > 0$	✓ $h''(x)$

	$-6x > 4$ $x < -\frac{2}{3}$ OR $x \in \left(-\infty; -\frac{2}{3}\right)$	✓✓ Answer (3)
7.2.5	$m_{AP} = \frac{y_2 - y_1}{x_2 - x_1}$ $m_{AP} = \frac{14 - 0}{2 - (-5)}$ $m_{AP} = 2$ $-3x^2 - 4x + 15 = 2$ $3x^2 + 4x - 13 = 0$ $x = \frac{-4 \pm \sqrt{(4)^2 - 4(3)(-13)}}{2(3)}$ $x = \frac{-4 \pm \sqrt{172}}{6}$ $x = -2,85 \text{ or } 1,52$	✓ M_{AP} ✓ Equating ✓ Substitution ✓ Simplify ✓ Answers (5)

QUESTION 8

[6]

8.1	$d = 86 \text{ mm}$	✓ Answers (1)
8.2	$D' = -\frac{1}{8} - \frac{3}{4}t^2$ $D' = -\frac{1}{8} - \frac{3}{4}(2)^2$ $= -3,125 \text{ or } -3\frac{1}{8}$	✓ d' ✓ $d'(2)$ ✓ Answer (3)
8.3	$-\frac{1}{8} - \frac{3}{4}t^2 = -12\frac{1}{8}$ $-\frac{3}{4}t^2 = -12$ $t^2 = 16$ $t = 4$ After 4 minutes	✓ Equation ✓ Answer (2)

QUESTION 9

[15]

9.1.1	$12 + x + 5 + 23 = 49$ $x = 9$	✓✓ Value of x
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	$3y + 12 + 9 + 8 = 74$ $3y = 45$ $y = 15$	✓✓ Value of y (4)
9.1.2	$P(G' \cap M \cap H) = \frac{12}{150} = \frac{2}{25} = 0,08$	✓✓ Answer (2)
9.1.3	$P(G) = \frac{50}{150}$ $P(H) = \frac{49}{150}$ $P(G) \times P(H) = \frac{50}{150} \times \frac{49}{150} = \frac{49}{450} = 0,1088$ $P(G) \cap P(H) = \frac{14}{150} = \frac{7}{75} = 0,090,1$ ☐ Not independent	✓ P(G) & P(H) ✓ P(G) x P(H) ✓ P(G) ∩ P(H) ✓ Answer (4)
9.2.1	7! = 5040	✓ 7! ✓ Answer (2)
9.2.2	$7! - 6! 2! = 3600$ OR Sit together $= 6! \times 2!$ $= 1440$ Not together $5\,040 - 1\,440 = 3\,600$	✓ 7! ✓ 6!2! ✓ Answer (3) ✓ 6!2! ✓ Subtraction ✓ Answer (3)

TOTAL: 150



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ANALYSIS OF MATHEMATICS GR12 Paper 1

Sep-19						
Question	TOPIC	MARKS	Knowledge	Routine	Complex	Problem
			Procedure	Procedure	Procedure	Solving
			$\pm 20\%$	$\pm 35\%$	$\pm 30\%$	$\pm 15\%$
			25-30	50-60	40-50	15-25
1.1.1	Quadratic equation: factors	3	3			
1.1.2	Quadratic equation : formula	5		5		
1.1.3	Inequality	3		3		
1.1.4	Exponential Equation:	3		3		
1.2.1	Exponential Equation	3		3		
1.2.2	Equation:Two Unknowns	5		5		
1.3	Nature of roots	4			4	
2.1.1	Combination of AP & quadrTIC. Next	1	1			
2.1.2	General term	4		4		
2.1.3	Quadratic term	4			4	
2.2	Geometric series: ratio	5			5	
2.3	Arithmetic series: Sum	4			4	
2.4.1	Converging	3	3			
2.4.2	Sum to infinity (GP) and summation o	3		3		
3.1	Log Equation	2		2		
3.2	Determining the inverse of Log Equati	2	2			
3.3	Equation of parabola	5		5		
3.4	y - intercepts	1	1			
3.5	Turning point	4			4	
3.6.1	Interpreting of graph	2				2
3.6.2	Interpreting of graph	2				2
4.1.1	Equation of expenential	4		4		
4.1.2	Axis of symmetry	3		3		
4.2	Tranformation	2	2			
4.3	Interpretation	5				5
5.1	Final amount	4		4		
5.2	Calculate rate	4		4		
5.3	Calculate payment per period	4			4	
5.4	Value of n	4			4	
6.1	First Principle	5		5		
6.2.1	Differentiation (Products)	3		3		
6.2.2	Differentiation	4			4	
7.1	Cubic Function sketch	4				4
7.2.1	Equation	2	2			
7.2.2	x-intercepts	3		3		
7.2.3	Interpretation	2			2	
7.2.4	Concave up	3			3	

7.2.5	Tangent	5				5
8.1	Substitution of 0	1	1			
8.2	Rate of change	3		3		
8.3	Boiling point	2			2	
9.1.1	Venn diagram	4	4			
9.1.2	Probability	2	2			
9.1.3	Independent events	4		4		
9.2.1	Counting principle	2	2			
9.2.2	Counting principle	3			3	
	TOTAL	150	21	66	43	18