education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

NATIONAL SENIOR CERTIFICATE EXAMINATION

MATHEMATICS P1

SEPTEMBER 2019

GRADE 12

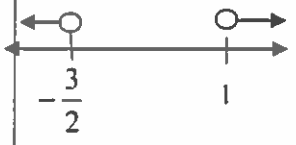
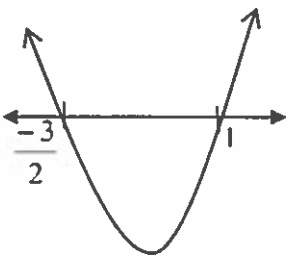
MEMORANDUM

MARKS: 150

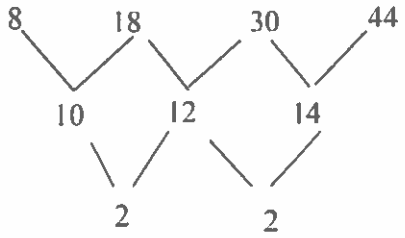
TIME: 3 HOURS

This MEMORANDUM consists of 12 pages

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

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

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	$T_n = n^2 + 7n$ $368 = n^2 + 7n$ $n^2 + 7n - 368 = 0$ $(n+23)(n-16) = 0$ $n = -23 \quad or \quad n = 16$ $\therefore T_{31} = 368$	✓ Substitution ✓ Factors ✓ n values ✓Answer (4)
2.2	$T_2 + T_3 = 280$ $\quad T_5 + T_6 = 4375$ $ar + ar^2 = 280$ $\quad ar^4 + ar^5 = 4375$ $a = \frac{280}{r + r^2}$ $\quad a = \frac{4375}{r^4 + r^5}$ $\frac{280}{r + r^2} = \frac{4375}{r^4 + r^5}$ $4375(r + r^2) = 280(r^4 + r^5)$ $4375r(1 + r) = 280r^4(1 + r)$ $4375r = 280r^4$ $r^3 = \frac{125}{8}$ $= \left(\frac{5}{2}\right)^3$ $r = \frac{5}{2}$	✓ Equation 1 ✓ Equation 2 ✓ Equating ✓ $r^3 = \frac{125}{8}$ ✓ Answer (5)

	OR $T_2+T_3=280=ar+ar^2$ $T_5+T_6=4375=ar^4+ar^5$ $ar^4+ar^5=4375$ $ar^4(1+r)=4375$ $ar(1+r)=280$ $1+r=\frac{280}{ar}$ Substitute $1+r=\frac{280}{ar}$ into $ar^4(1+r)=4375$ $ar^4\left(\frac{280}{ar}\right)=4375$ $r^3=\frac{4375}{280}$ $r^3=\frac{125}{8}$	✓ Equation 1 ✓ Equation 2 ✓ Substitution ✓ $r^3=\frac{125}{8}$ ✓ Answer (5)
2.3	$a+(a+d)+(a+2d)+\ldots$ $S_{12}=\frac{12}{2}[2a+(n-1)d]$ $S_{12}=\frac{12}{2}[2a+11d]$ $S_{12}=12a+66d$ $a+3+(a+3+d)+(a+3+2d)+\ldots$ $S_{12}=\frac{12}{2}[2(a+3)+(n-1)d]$ $S_{12}=6[2a+6+11d]$ $S_{12}=12a+36+66d$ ∴ The sum will increaseby 36	✓ Equation 1 ✓ Sequence ✓ Equation 2 ✓ Answer (4)
2.4.1	$r=\frac{4m}{1}$ $-1<r<1$ $-1<4m<1$ $-\frac{1}{4}<m<\frac{1}{4}$	✓ Value of r ✓ $-1<r<1$ ✓ Answer (3)
2.4.2	$S_\infty=\frac{a}{1-r}$ $\frac{2}{3}=\frac{1}{1-4m}$	✓ Substitution in correct formula

	$2-8m=3$ $m=\frac{-1}{8}$	✓ 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 $y=\frac{-2}{5}(x^2-4x-5)$ $y=\frac{-2}{5}\left[(x-2)^2-4-5\right]$	✓ Substitution of 2 ✓ $y=\frac{18}{5}$ ✓ Factorization ✓ Completing the square

	$y=\frac{-2}{5}(x-2)^2+\frac{18}{5}$ $\left(-1\ ;\ \frac{18}{5}\right)$	✓✓ Answers (4)
3.6.1	$1 \le x \le 2$ 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	$\frac{-4}{x+2}-1=-x-3$ $(-x-2)(x+2)=-4$ $-x^2-4x-4=-4$ $-x(x+4)=0$ $x=0$ or $x=-4$ $-4 \le x < -2$ $x \ge 0$	✓ Equating ✓ Factors ✓ x values ✓✓ Answer (5)

QUESTION 5 [16]

5.1

$$F = \frac{x\left[(1+i)^n - 1\right]}{i}$$

$$F = \frac{500\left[\left(1+\frac{0,09}{12}\right)^{217} - 1\right]}{\frac{0,09}{12}}$$

F = R270687,16

✓ Substitution in correct formula
✓ Value of n
✓✓ Answer (4)

5.2

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

$$A = 600\left(1+\frac{0,08}{4}\right)^4 \qquad A = 600\left(1+\frac{i}{2}\right)^2$$

$$600\left(1+\frac{0,08}{4}\right)^4 = 600\left(1+\frac{i}{2}\right)^2$$

$$1,08243216 = \left(1+\frac{i}{2}\right)^2$$

$$i = 2\left(\sqrt{1,08243216} - 1\right)$$

$$= 0,0808$$

Rate = 8,08%

✓ Substitution in correct formula both
✓ Equating
✓Value of i
✓ Answer (4)

OR

$$\left(1+\frac{0,08}{4}\right)^4 = \left(1+\frac{i}{2}\right)^2$$

$$1+\frac{i}{2} = 1,0404$$

$$i = 0,0808$$

$r = 8,08\%$

✓✓ Substitution and Equating
✓Value of i
✓ Answer (4)

5.3

$$P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$$

$$650000 = \frac{x\left[1-\left(1+\frac{0,143}{12}\right)^{-240}\right]}{\frac{0,143}{12}}$$

x = R8224,89

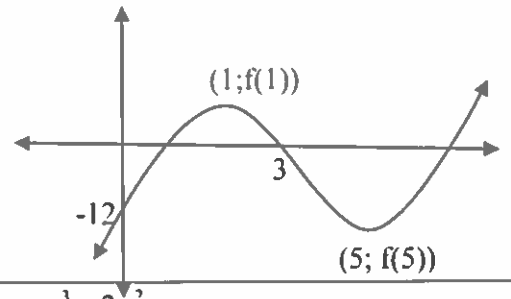
No, they can not

✓ Substitution in correct formula
✓Simplification
✓ Value of x
✓ Answer (4)

	OR $650000\left(1+\frac{0,143}{12}\right)^{240}=\frac{x\left[\left(1+\frac{0,143}{12}\right)^{240}-1\right]}{\frac{0,143}{12}}$ $x = \text{R}8224,89$ No, they can not	✓ Substitution in correct formula ✓Simplification ✓ Value of x ✓ Answer (4)
5.4	$P=\frac{x\left[1-(1+i)^{-n}\right]}{i}$ $1000000=\frac{25000\left[1-\left(1+\frac{0,095}{12}\right)^{-n}\right]}{\frac{0,095}{12}}$ $0,683333333=1,007916667^{n}$ $-n=\frac{\log 0,683333333}{\log 1,007916667}$ $= -48,287712$ 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	$f(x)=-2x^2+2$ $f(x+h)=-2(x+h)^2+2$ $f(x+h)=-2(x^2+2xh+h^2)+2$ $=-2x^2-4xh-2h^2+2$ $f'(x)=\lim_{h\to 0}\frac{f(x+h)^2-f(x)}{h}$ $f'(x)=\lim_{h\to 0}\frac{-2x^2-4xh-2h^2+2-\left(-2x^2+2\right)}{h}$ $f'(x)=\lim_{h\to 0}\frac{-2x^2-4xh-2h^2+2+2x^2-2}{h}$ $f'(x)=\lim_{h\to 0}\frac{-4xh-2h^2}{h}$	✓ Finding $f(x+h)$ ✓ Correct substitution into formula and notation ✓ Simplification ✓ Common factor

	$f'(x)=\lim_{h\to 0}\frac{h(-4x-2h)}{h}$ $= -4x$	✓ 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	$-x^3-2x^2+15x=0$ $-x(x^2+2x-15)=0$ $-x(x+5)(x-3)=0$ $x=0$ or $x=-5$ or $x=3$ AB = 8 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 $x \in \left(-\alpha; -\frac{2}{3}\right)$	✓✓ 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	$d = 86mm$	✓ 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

	$3y+12+9+8=74$ $3y=45$ $y=15$	✓✓ 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! x 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	Knowledg	Routine Procedure	Complex Procedure	Problem Solving
			± 20%	± 35%	± 30%	± 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