education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

NOVEMBER 2007

MEMORANDUM

This memorandum consists of 10 pages.

QUESTION 1

1.1.1(a)	$(x+3)(x-1)=-x+1$ $x^2+2x-3=-x+1$ $x^2+3x-4=0$ $(x+4)(x-1)=0$ $x=-4$ or $x=1$ OR $(x+3)(x-1)+(x-1)=0$ $(x-1)(x+4)=0$ $x=1$ or $x=-4$	✓ multiplication / transposing ✓ equating to zero ✓ factors ✓ x-values	(4)
1.1.1(b)	$x^2+3x-4<0$ $(x+4)(x-1)<0$ $-4<x<1$	✓ factors ✓✓ answers	(3)
1.1.2	$x^2+3x=1$ $x^2+3x-1=0$ $x=\frac{-3\pm\sqrt{(3)^2-4(1)(-1)}}{2(1)}$ $x=\frac{-3\pm\sqrt{13}}{2}$ $x=0,3$ or $x=-3,3$ OR $x^2+3x=1$ $x^2+3x+\left(\frac{3}{2}\right)^2=1+\left(\frac{3}{2}\right)^2$ $\left(x+\frac{3}{2}\right)^2=\frac{13}{4}$ $x+\frac{3}{2}=\pm\sqrt{\frac{13}{4}}$ $x=-\frac{3}{2}\pm\sqrt{\frac{13}{4}}$ $x=0,3$ or $x=-3,3$	✓ standard form ✓ formula ✓ substitution ✓✓ answers	(5)
1.2	$x=3-y$ $2x^2+2y^2=5xy$ $2(3-y)^2+2y^2=5(3-y)y$ $2(9-6y+y^2)+2y^2=15y-5y^2$ $18-12y+2y^2+2y^2=15y-5y^2$ $9y^2-27y+18=0$ $y^2-3y+2=0$ $(y-2)(y-1)=0$ $y=2$ or $y=1$ $x=1$ or $x=2$ **OR**	✓ making x the subject of the formula ✓substitution ✓multiplication ✓simplification ✓standard form ✓✓y values ✓✓ x values ✓ making y the subject of the formula ✓substitution ✓multiplication ✓simplification ✓standard form	(9)

	$y = 3 - x$ $2x^2 + 2y^2 = 5xy$ $2x^2 + 2(3-x)^2 = 5(3-x)x$ $2x^2 + 2(9 - 6x + x^2) = 15x - 5x^2$ $2x^2 + 18 - 12x + 2x^2 = 15x - 5x^2$ $9x^2 - 27x + 18 = 0$ $x^2 - 3x + 2 = 0$ $(x-2)(x-1) = 0$ $x = 1$ or $x = 2$ $y = 2$ or $y = 1$	✓✓y values ✓✓ x values	

1.3	$f(x-1)=(x-1)^2-2(x-1)$ $=x^2-2x+1-2x+2$ $=x^2-4x+3$ $=(x^2-4x+4)-1$ $=(x-2)^2-1$ OR $f(x)=x^2-2x$ $=x^2-2x+1-1$ $=(x-1)^2-1$ $f(x-1)=(x-1-1)^2-1$ $=(x-2)^2-1$	✓substitution ✓multiplication completing the square (✓+ 4; ✓ -1)	(4)

[25]

QUESTION 2

2.1	$\sqrt[3]{125x^6}-\sqrt[4]{81x^8}+\sqrt{36x^4}$ $=5x^2-3x^2+6x^2$ $=8x^2$	✓$5x^2$ ✓$3x^2$ ✓$6x^2$ ✓$8x^2$	(4)
2.2.1	$M=\sqrt{\frac{2}{2(1,5)+5}}+\frac{1}{2(1,5)}$ $M=\frac{1}{2}+\frac{1}{3}$ M = $\frac{5}{6}$ is rational	✓ substitution ✓ simplification ✓ M = $\frac{5}{6}$	(3)
2.2.1	$2x+5>0$ $x>-\frac{5}{2}$ $x\neq 0$	✓$2x+5>0$ ✓ $x>-\frac{5}{2}$ ✓$x\neq 0$	(3)
2.3	Yes $2^{2007}.5^{2000}=2^7.2^{2000}.5^{2000}$ $=128.(2.5)^{2000}$ $=128.(10)^{2000}$ the sum of the digits is 1 + 2 + 8 = 11	✓ yes ✓ $2^7.2^{2000}$ (exponential law) ✓ 128 ✓ grouping bases with same exponents ✓sum of digits	(5)

[15]

QUESTION 3

3.1	29	✓ answer	(1)
3.2	$T_n = an^2 + bn + c$ From (1 ; 1) $1 = a + b + c$ $c = 1 - a - b$ From (2 ; 5) $5 = 4a + 2b + c$ $5 = 4a + 2b + 1 - a - b$ $4 = 3a + b$ (i) From (3; 11) $11 = 9a + 3b + c$ $11 = 9a + 3b + 1 - a - b$ $10 = 8a + 2b$ (ii) Solving (i) and (ii) simultaneously: $8 = 6a + 2b$ $10 = 8a + 2b$ $2 = 2a$ $a = 1$ $b = 1$ $c = -1$ $T_n = n^2 + n - 1$ OR $T_n = an^2 + bn + c$ From (1 ; 1) $1 = a + b + c$ (i) From (2 ; 5) $5 = 4a + 2b + c$ (ii) From (3; 11) $11 = 9a + 3b + c$ (iii) (ii) – (i) $3a + b = 4$ (iv) (iii) – (ii) $5a + b = 6$ (v) (v) – (iv) $2a = 2$ $a = 1$ $b = 1$ $c = -1$ $T_n = n^2 + n - 1$	✓ c = ✓ (i) ✓ (ii) ✓ ✓ a ✓ b ✓ c ✓✓ eqn^s (i),(ii),(iii) ✓ eqn (iv) ✓ eqn (v) ✓ a = 1 ✓ b = 1 ✓ c = – 1	(7)
3.3	$P_n = n^2 + n - 1$ $P_{100} = 100^2 + 100 - 1 = 10\,099$ OR $P_n = 100(101) - 1$ $P_n = 10\,099$	✓ substitution ✓ answer ✓ substitution ✓ answer	(2)

[10]

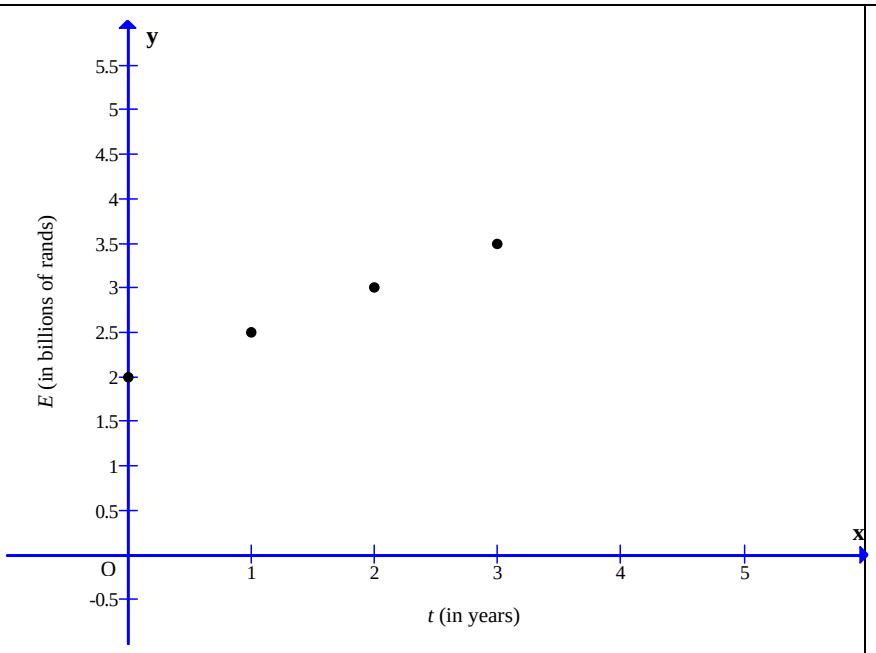
QUESTION 4

4.1	$2; 1; \frac{1}{2}; \frac{1}{4}; \frac{1}{8}; \frac{1}{16}$ $\therefore$ Height reached during the 6^{th} bounce = $\frac{1}{16}$	✓✓ Answer	(2)
4.2	1^{st} bounce : $4\left(\frac{1}{2}\right) = 2^2.2^{-1} = 2^{2-1} = 2^1$ 2^{nd} bounce : $4\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = 2^2.2^{-1}.2^{-1} = 2^{2-2} = 2^0$ 3^{rd} bounce: $4\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right) = 2^2.2^{-1}.2^{-1}.2^{-1} = 2^{2-3} = 2^{-1}$ n^{th} bounce : $4\left(\frac{1}{2}\right)^n = 2^{(2-n)}$ OR 1^{ste} bounce: $2 = 2^1$ 2^{de} bounce: $1 = 2^0$ 3^{de} bounce: $\frac{1}{2} = 2^{-1}$ 4^{de} bounce: $\frac{1}{4} = 2^{-2}$ . . n^{de} bounce : 2^{2-n}	✓✓ (for 1^{st} bounce 2^{nd} bounce and 3^{rd} bounce) ✓✓nth bounce	(4)
4.3	$2^{2-n} = \frac{1}{512}$ $2^{2-n} = 2^{-9}$ $2 - n = -9$ $n = 11$ during the 11^{th} bounce	✓ substitution ✓ 2^{-9} ✓ equating exponents ✓ answer	(4)

[10]

QUESTION 5

5.1	$A = P(1-i)^n$ $21500 = 86000(1-i)^4$ $0.25 = (1-i)^4$ $\sqrt[4]{0.25} = 1-i$ $i = 1 - 0.707$ $i = 0.2928932188$ percentage rate = 29,29%	✓formula ✓21500 ✓substitution ✓answer ✓answer as percentage	(5)
5.2.1	$1+i = \left(1+\frac{i^{(m)}}{m}\right)^m$ $1+i = \left(1+\frac{0,12}{12}\right)^{12}$ $1+i = 1,126825$ $i = 12,68\%$	✓ Formula ✓ Substitution ✓Simplification ✓ answer 12,68%	(4)
5.2.2	$T_0 \quad T_1 \quad T_2 \quad T_3 \quad T_4 \quad T_5$ $i^{(12)} = \frac{0.12}{12} = 0.01$ $\quad i^{(2)} = \frac{0.14}{2} = 0.07$ Original investment $75000 = P\left(1+\frac{0,12}{12}\right)^{2\times12}\left(1+\frac{0,14}{2}\right)^{3\times2}$ 75 000 = 1,905529326 P P = R 39 359,14	✓ i ✓ next i. ✓formula ✓✓substitution ✓answer	(6)

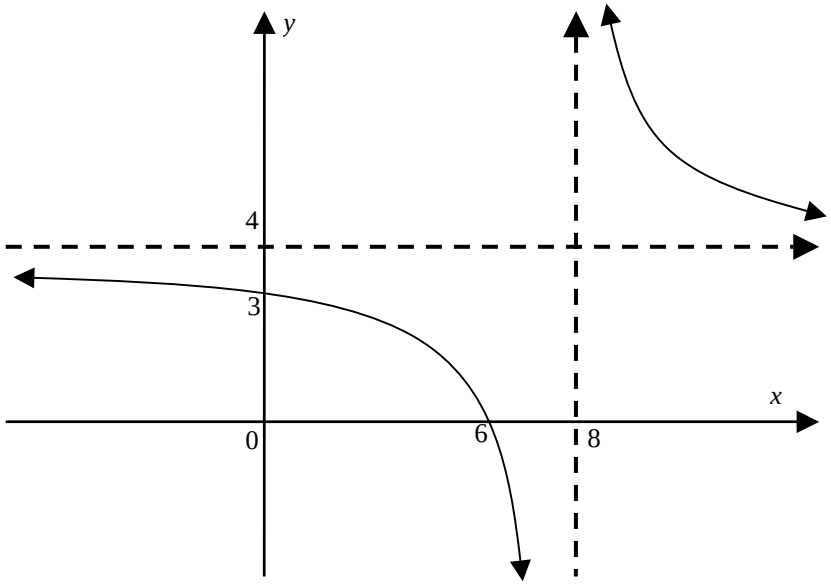
5.3.1		✓✓ plotting of points (one mark for plotting one or two correct points; two marks for plotting three or four correct points)	(2)
5.3.2	The expenditure is increasing by 0,5 billion rand each year. OR The graph is a straight line OR Linear appreciation	✓ 0,5 per year OR ✓ straight line	(1)
5.3.3	$E = 0{,}5t + 2$	✓2 ✓$0{,}5t$	(2)
5.3.4	$E = 0{,}5(8) + 2$ E = R 6 billion	✓ answer	(1) **[21]**

QUESTION 6

6.1	P(1 ; 8) is the turning point $f(x) = a(x-1)^2 + 8$ $f(0) = 6$ $a + 8 = 6$ $a = -2$ $f(x) = -2(x-1)^2 + 8$ $f(x) = -2(x^2 - 2x + 1) + 8$ $f(x) = -2x^2 + 4x + 6$ OR Shift the parabola one unit to the left Then $f(x+1) = ax^2 + 8$ $f(0) = 6$ for $x = -1$ $6 = a(-1)^2 + 8$ $a = -2$ $f(x+1) = -2x^2 + 8$ $f(x) = f((x-1)+1)$ $f(x) = -2(x-1)^2 + 8$ $f(x) = -2x^2 + 4x + 6$	✓✓ substitute Turning point ✓ substitute (0; 6) ✓ $a + 8 = 6$ ✓ $a = -2$ ✓ multiplication	(6)
6.2	Ave gradient $= \frac{f(1) - f(3)}{1-3}$ or $\frac{f(3) - f(1)}{3-1}$ $= \frac{8-0}{-2}$ $= \frac{0-8}{2}$ $= -4$ $= -4$	✓ $\frac{f(1) - f(3)}{1-3}$ ✓ substitution ✓ answer	(3)
6.3	$y = mx - 1$ $0 = 3m - 1$ $3m = 1$ $m = \frac{1}{3}$ $y = \frac{1}{3}x - 1$	✓ -1 ✓ substitution (3; 0) ✓ m	(3)
6.4	$-2x^2 + 4x + 6 = \frac{1}{3}x - 1$ $-6x^2 + 12x + 18 = x - 3$ $6x^2 - 11x - 21 = 0$ $(6x + 7)(x - 3) = 0$ $x = -\frac{7}{6}$ or $x = 3$	✓ equating ✓ standard form ✓ factors	(6)

	$C\left(-\frac{7}{6}\ ;\ -\frac{25}{18}\right)$	✓ x-values ✓✓ coordinate	
6.5	The parabola is reflected about the y-axis	✓ reflected ✓ y-axis	(2)
6.6	$h(x) = -2x^2 - 4x + 6$	✓✓ answer	(2) [22]

QUESTION 7

7.1	$x \in R;\ x \neq 8$	✓answer	(1)
7.2	$f(x) = \frac{8}{x-8} + 4$ $0 = \frac{8}{x-8} + 4$ $0 = 8 + 4(x-8)$ $4x = 24$ $x = 6$	✓$y = 0$ ✓answer	(2)
7.3	$f(0) = \frac{8}{0-8} + 4$ $p = \frac{8}{-8} + 4$ $p = -1 + 4$ $p = 3$	✓substitute $x = 0$ ✓answer	(2)
7.4	$x = 8$ and $y = 4$	✓✓answers	(2)
7.5		✓shape ✓y-intercept ✓x-intercept ✓ asymptotes	(4)

[11]

QUESTION 8

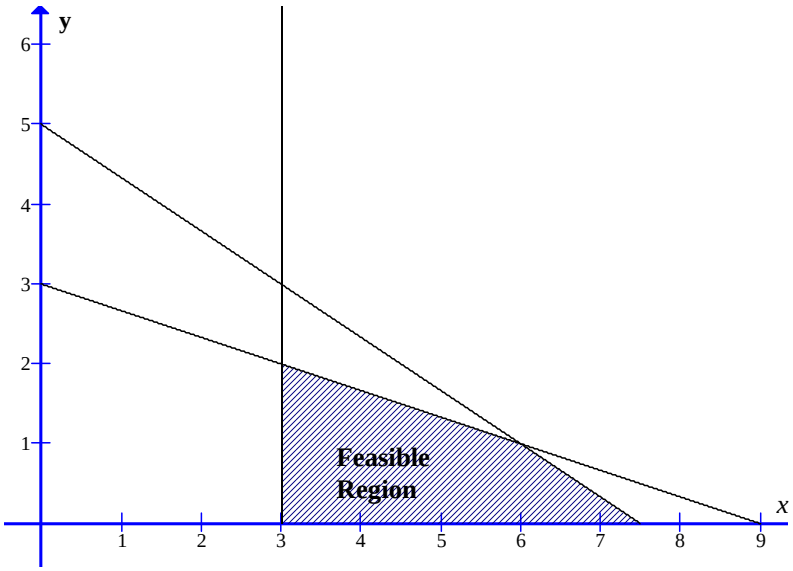
8.1	$f(x) = 1 + a.2^x$ $f(0) = 0$ $1 + a(2)^0 = 0$ $a = -1$	✓ $f(0) = 0$ ✓ substitution	(2)
8.2	$f(-15) = 1 + (-1)(2)^{-15}$ $= 1 - (2)^{-15}$ $= 0{,}99997$	✓ substitution ✓ answer	(2)
8.3	$\frac{1}{2} = -2^x + 1$ $\frac{1}{2} - 1 = -2^x$ $-\frac{1}{2} = -2^x$ $2^{-1} = 2^x$ $x = -1$	✓ substitution ✓ $2^{-1} = 2^x$ ✓ answer	(3)
8.4	$h(x) = f(x-2) = 1 - 2^{x-2}$	✓✓ answer	(2)
			[9]

QUESTION 9

9.1	Period = $\frac{360°}{2} = 180°$	✓ formula ✓ answer	(2)
9.2	$y \in [-2; 0]$	✓✓ answer	(2)
9.3	Amplitude = $\frac{1}{2}$	✓✓ answer	(2)

[6]

QUESTION 10

10.1	$3x + 9y \leq 27$ $4x + 6y \leq 30$ $x \geq 3$	✓✓ constraint ✓✓ constraint ✓ constraint	(5)
10.2		Sketching ✓✓ $3x + 9y \leq 27$ ✓✓ $4x + 6y \leq 30$ ✓ $x \geq 3$ ✓✓feasible region	(8)
10.3	$P = 30x + 50y$	✓ coefficient of x ✓ coefficient of y	(2)
10.4	At point A (3; 2): P = 30(3) + 50(2) = 190 At point B (3; 0): P = 30(3) + 50(0) = 90 At point C (7,5; 0): P = 30(7,5) + 50(0) = 225 At point D (6; 1) : P = 30(6) + 50(1) = 230 Maximum value of P is at D (6;1) ∴ $x = 6$ i.e. 6 liters of Laughter ∴ $y = 1$ i.e. 1 liter of Joy	✓✓ substitution of points A, B, C and D ✓ x- answer ✓ y-answer	(4)
10.5	Max profit = 30(6) + 1(50) = R 230	✓✓ answer	(2)

[21]