education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

EXEMPLAR 2007

MEMORANDUM

This memorandum consists of 12 pages.

QUESTION 1

1.1.1	$x(x-9)+14=0$ $x^2-9x+14=0$ $(x-7)(x-2)=0$ $x=7$ or $x=2$	✓ multiply out ✓ factors ✓ answers (3)
1.1.2	$x^2-x=3$ $x^2-x-3=0$ $x=\frac{-(-1)\pm\sqrt{(-1)^2-4(1)(-3)}}{2(1)}$ $x=\frac{1\pm\sqrt{13}}{2}$ $x=-1,3$ or $x=2,3$	✓standard form ✓substitution ✓simplification ✓✓answers (5)
1.1.3	$\frac{1}{x+1}+\frac{2x}{x-1}=1$ $x-1+2x(x+1)=x^2-1$ $x-1+2x^2+2x=x^2-1$ $x^2+3x=0$ $x(x+3)=0$ $x=0$ or $x=-3$	✓multiplying LHS with LCM ✓multiplying RHS with LCM ✓ simplification ✓ standard form ✓ factorisation ✓answers (6)
1.2	$y=2-x$ $x^2+(2-x)^2-52=0$ $x^2+4-4x+x^2-52=0$ $2x^2-4x-48=0$ $x^2-2x-24=0$ $(x-6)(x+4)=0$ $x=6$ or $x=-4$ $y=-4$ or $y=6$ OR	✓ making y the subject of the formula ✓substitution ✓multiplication ✓ factors ✓ x answers ✓✓ y answers (7)

		OR
	$x = 2 - y$	✓ making x the subject of the formula
	$(2-y)^2 + y^2 - 52 = 0$	✓substitution
	$4 - 4y + y^2 + y^2 - 52 = 0$	✓multiplication
	$2y^2 - 4y - 48 = 0$	
	$y^2 - 2y - 24 = 0$	✓ factors
	$(y-6)(y+4) = 0$	
	$y = -4$ or $y = 6$	✓x answers
	$x = 6$ or $x = -4$	✓✓ y answers
		(7)
1.3.1	$x - 2 = 0$	
	$x = 2$	✓ denominator = 0
		✓answer
		(2)
1.3.2	$x + 4 < 0$	
	$x < -4$	✓ discriminant < 0
		✓answer
		(2)
		[25]

QUESTION 2

2.1	$\dfrac{x^{\frac{1}{3}} x^{\frac{1}{4}}}{x^{\frac{1}{6}}}$	✓✓exponential laws
	$= \dfrac{x^{\frac{7}{12}}}{x^{\frac{2}{12}}}$	
	$= x^{\frac{5}{12}}$	✓ answer
		(3)
2.2	$\sqrt{128x^6} + \sqrt{98x^6}$	
	$= \sqrt{64 \times 2x^6} + \sqrt{49 \times 2x^6}$	✓ $8\sqrt{2}x^3$
	$= 8\sqrt{2}x^3 + 7\sqrt{2}x^3$	✓ $7\sqrt{2}x^3$
	$= (15\sqrt{2})\,x^3$	✓ answer
		(3)

2.3	$\frac{\sqrt{x}}{x}+\frac{y}{\sqrt{x}}$ $=\frac{x+xy}{x\sqrt{x}}$ $=\frac{x(1+y)}{x\sqrt{x}}$ $=\frac{\sqrt{x}.\sqrt{x}(1+y)}{x\sqrt{x}}$ OR $=\frac{x.(1+y)}{x\sqrt{x}}\times\frac{\sqrt{x}}{\sqrt{x}}$ $=\frac{\sqrt{x}(1+y)}{x}$	✓ LCM ✓ numerator ✓factors ✓ answer (4) **[10]**

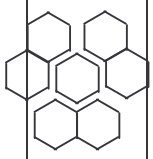
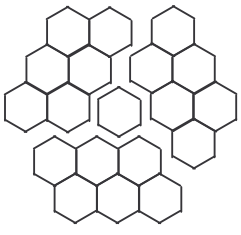
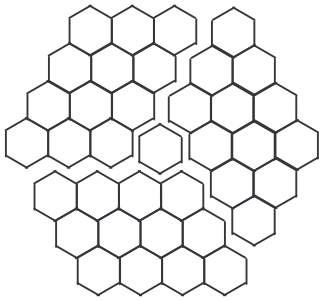
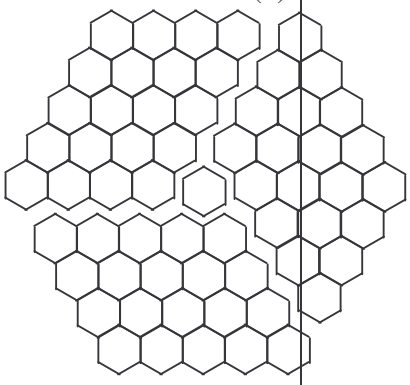
QUESTION 3

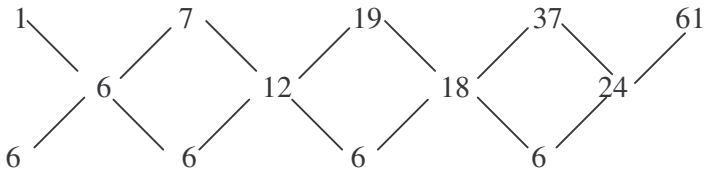
3.1	year 6 = 3^5 hundreds = 243 hundreds = 24 300	✓✓ answer (2)
3.2	. number of trees = 3^{n-1} hundreds	✓ base 3 ✓ power n – 1 (2)
3.3	No The number of trees will increase without bound to very large numbers, thus the forestry authorities will if necessary cut down some of the trees from time to time.	✓ No ✓ reason (2) **[6]**

QUESTION 4

4.1	$t = n(n+2)$	✓✓ answer (2)
4.2	Yes. The one formula is the factorised format of the other formula $n(n+2) = n^2 + 2n$	✓ Yes ✓ explanation (2)
4.3	$n^2 + 2n = 143$ $n^2 + 2n - 143 = 0$ $(n+13)(n-11) = 0$ $n = -13$ or $n = 11$ $\therefore n = 11$	✓ setting up of equation ✓ standard form ✓ factors ✓ answer $\neq -13$ ✓ answer = 11 (5) **[9]**

QUESTION 5

5.1	pattern 6: 91	✓✓ answer (2)
5.2	The difference between consecutive patterns increases by six every time    From the structure of the picture: pattern 2: 3(2 x 1) + 1 pattern 3: 3(3 x 2) + 1 pattern 4: 3(4 x 3) + 1 pattern n: 3[n(n-1)] + 1 $= 3n^2 - 3n + 1$	✓adding 6 ✓second difference (2) 

	Example:  	Learners may use other strategies to generate the relationship
5.3	Pattern will yield a quadratic equation since second difference is constant $an^2 + bn + c = y$ Pattern 2: $4a + 2b + c = 7$ ……. (i) Pattern 3: $9a + 3b + c = 19$ ……..... (ii) (i) – (ii) $5a + b = 12$ ……. (iii) $\therefore \quad b = 12 - 5a$ Pattern 4: $16a + 4b + c = 37$ ……. (iv) (iv) – (ii) $7a + b = 18$ ……. (v) (v) – (iii) $2a = 6$ $a = 3$ $\therefore \quad b = -3$ $4(3) + 2(-3) + c = 7$ $12 - 6 + c = 7$ $c = 1$ $P_n = 3n^2 - 3n + 1$	✓ a ✓ b ✓ c ✓answer (4) **[8]**

QUESTION 6

6.1.1	$F_v = P_v(1 - in)$ $F_v = 16000(1 - 0{,}15 \times 3)$ $F_v = \text{R } 8800$	✓ formula ✓ substitution ✓answer (3)
6.1.2	$F_v = P_v(1 - i)^n$ $8800 = 16000(1 - i)^3$ $0{,}55 = (1 - i)^3$ $0{,}82 = 1 - i$ $i = 1 - 0{,}82$ $i = 0{,}18$ rate is 18%	✓formula ✓substitution ✓ 0,55 ✓0,18 ✓answer (5)

6.2	$F_v = 12500(1,01)^{24}(1,07)^6$ $F_v = \text{R } 23819,12$	✓1,01 ✓1,07 ✓substitution ✓answer (4)
6.3.1	$i^{(12)} = 7.2\% = \frac{7.2}{100} = 0.072$ $1+i = \left(1+\frac{i^{(12)}}{12}\right)^{12}$ $1+i = \left(1+\frac{0.072}{12}\right)^{12}$ $1+i = 1,074424$ $i = 0,074424$ $\therefore$ Effective rate is 7,442 % p.a.	✓ $i^{(12)} = 0,72$ ✓ formula ✓ answer for i ✓ answer (4)
6.3.2	$A = P(1+i)^n$ $= 120000(1+0,07442)^3$ $= R148834,46$	✓ formula ✓ substitution ✓ answer (3)
6.3.3	$F_V = \left[120000(1,006)^{18} - 20000\right][1,006]^{30}$ $F_V = \text{R } 135,981,73$	✓1,006 ✓ power 18 ✓ $(1,006)^{30}$ ✓✓answer (5) **[24]**

QUESTION 7

7.1	$x(x+3) = 0$ $x = 0$ or $x = -3$	✓$x = 0$ ✓$x = -3$ (2)
7.2	Axis of symmetry $= \frac{0-3}{2} = -\frac{3}{2}$ $y = -\frac{3}{2}\left(-\frac{3}{2}+3\right) = -\frac{9}{4}$ $P\left(-\frac{3}{2};-\frac{9}{4}\right)$ OR	✓method adding x-int ✓AOS = $-\frac{3}{2}$ ✓substitution ✓ $y = -\frac{9}{4}$ ✓ coordinate (5)

	$= -\frac{b}{2a}$ Axis of symmetry $= -\frac{3}{2(1)}$ $= -\frac{3}{2}$ $y = -\frac{3}{2}\left(-\frac{3}{2}+3\right) = -\frac{9}{4}$ $P\left(-\frac{3}{2};-\frac{9}{4}\right)$	✓substitution into $x = -\frac{b}{2a}$ ✓AOS $= -\frac{3}{2}$ ✓substitution ✓ $y = -\frac{9}{4}$ ✓ x– coordinate (5)
7.3	average gradient $= \frac{f(-5)-f(-3)}{-5-(-3)}$ $= \frac{-5(-5+3)-[-3(-3+3)]}{-2}$ $= \frac{10-0}{-2}$ $= -5$ OR average gradient $= \frac{f(-3)-f(-5)}{-3-(-5)}$ $= \frac{-3(-3+3)-[-5(-5+3)]}{2}$ $= \frac{0-10}{2}$ $= -5$	✓substitution into formula ✓values ✓answer (3) OR ✓substitution into formula ✓values ✓answer (3)
7.4	The function is decreasing at an average rate of 5 y units to 1 x unit.	✓decreasing ✓average rate (2)
7.5	$x < -3$ or $x > 0$	✓ or ✓ $x < -3$ ✓ $x > 0$ (3)
7.6	Turning point of f(x-2) $= \left(-\frac{3}{2}+2;-\frac{9}{4}\right)$ $= \left(\frac{1}{2};-\frac{9}{4}\right)$	✓ x coordinate ✓ y coordinate (2)

7.7	$\text{LM} = -\frac{1}{2}x + 2 - \left(x^2 + 3x\right)$	✓top graph – bottom graph
	$\text{LM} = -x^2 - \frac{7}{2}x + 2$	
	$= -\left(x^2 + \frac{7}{2}x - 2\right)$	✓ $+\left(\frac{7}{4}\right)^2$
	$= -\left[x + \frac{7}{2}x + \left(\frac{7}{4}\right)^2 - 2 - \frac{49}{16}\right]$	✓ $-\left(\frac{7}{4}\right)^2$
	$= -\left[\left(x + \frac{7}{4}\right)^2 - \frac{81}{16}\right]$	✓ $\left(x + \frac{7}{4}\right)^2$ - $\frac{81}{16}$
	$= -\left(x + \frac{7}{4}\right)^2 + \frac{81}{16}$	✓answer (5)
	OR	OR
	$\text{LM} = -\frac{1}{2}x + 2 - \left(x^2 + 3x\right)$	✓top graph – bottom graph
	$\text{LM} = -x^2 - \frac{7}{2}x + 2$	✓substitution
	AOS : $x = -\frac{-\frac{7}{2}}{2(-1)} = -\frac{7}{4}$	✓substitution into AOS ✓x-value
	$y = -\left(-\frac{7}{4}\right)^2 - \frac{7}{2}\left(-\frac{7}{4}\right) + 2$	✓y-value (5)
	$= \frac{81}{16}$	
	$= 5{,}0625$	
	LM = $= -\left(x + \frac{7}{4}\right)^2 + \frac{81}{16}$	
7.8	Maximum length = $\frac{81}{16}$	✓maximum length
	Occurs at $x = -\frac{7}{4}$	✓ $x = -\frac{7}{4}$ (2)
		[24]

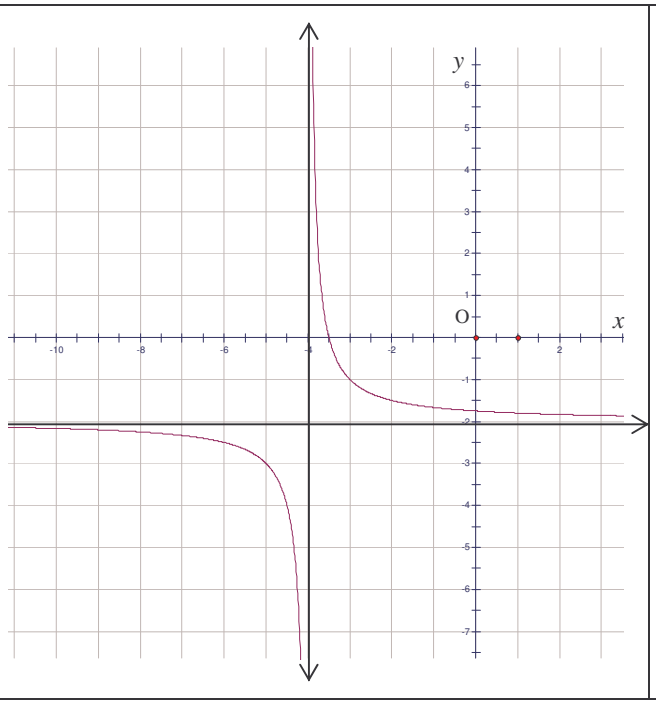
QUESTION 8

8.1.1	$y = a.b^x$	✓substitution
	$144 = a.\left(\frac{3}{4}\right)^2$	✓✓answer (3)
	$a = 256$	
8.1.2	$y = 256\left(\frac{3}{4}\right)^x$	✓answer (1)

8.2	$y = 256\left(\frac{3}{4}\right)^{13}$ $= 6{,}08$	✓substitution ✓answer (2)
8.3	The graph will transform to an increasing function as it will reflect about the *y*-axis but the *y*-intercept will remain the same.	✓reflect about *y*-axis ✓same *y*-intercept (2) **[8]**

QUESTION 9

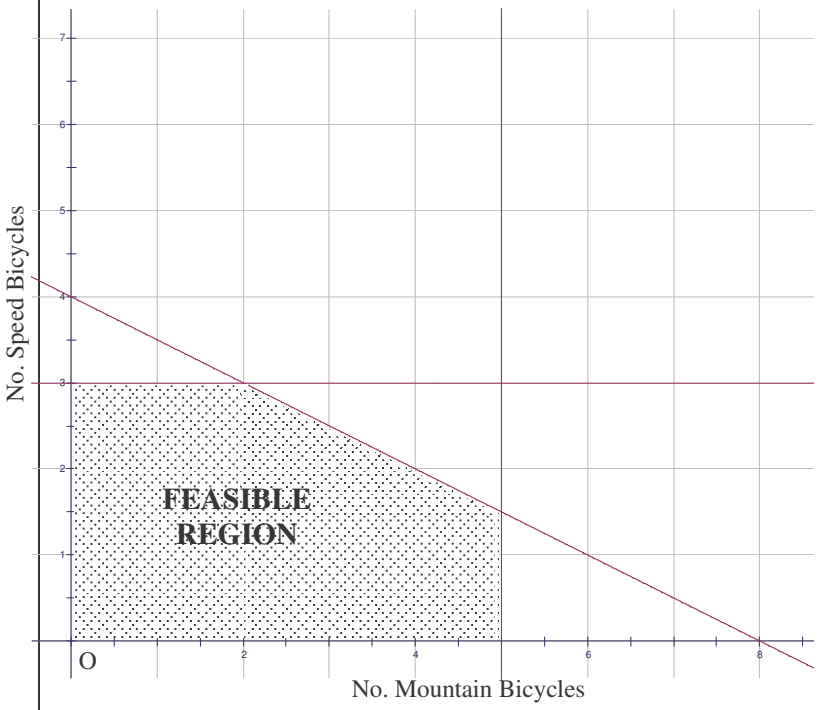
9.1	$x = -4$ $y = -2$	✓answer ✓answer (2)
9.2	*x*-int: $0 = \frac{1}{x+4} - 2 \quad x \neq -4$ $0 = 1 - 2(x+4)$ $0 = 1 - 2x - 8$ $2x = -7$ $x = -\frac{7}{2}$ $\left(-\frac{7}{2};0\right)$ *y*-int: $y = \frac{1}{0+4} - 2$ $y = -\frac{7}{4}$ *y*-int $\left(0;-\frac{7}{4}\right)$	✓ $y = 0$ ✓ $2x = -7$ ✓ $x = -\frac{7}{2}$ ✓ $\left(-\frac{7}{2};0\right)$ ✓ $x = 0$ ✓ $y = -\frac{7}{4}$ (6)

9.3		✓intercepts ✓y-asymptote ✓x-asymptote ✓shape (4) **[12]**

QUESTION 10

10.1	period = 720°	✓answer (1)
10.2	$a = \frac{1}{2}$ $b = 45°$	✓answer ✓answer (2)
10.3	$y \in [-2;0]$	✓end values ✓brackets (2) **[5]**

QUESTION 11

11.1	$0 \le x \le 5$ $0 \le y \le 3$ $x + 2y \le 8$ $x, y \in$ N	✓✓ first constraint ✓✓ second constraint ✓✓ third constraint (6)
11.2 & 11.3		✓ $y = 3$ line ✓ $x = 5$ line ✓ gradient third line ✓ intercepts of third line (4) ✓✓ Feasible Region (2)
11.4	P = 200x + 600y	✓coefficient of x ✓coefficient of y ✓addition (3)
11.5	At point (3; 0): P = 200(3) + 600(0) = 600 At point (2; 3): P = 200(2) + 600(3) = 2200 At point (5; 0): P = 200(5) + 600(0) = 1000 At point (0; 0): P = 200(0) + 600(0) = 0 ∴ maximum at (2; 3) 2 mountain bicycles and 3 speed bicycles manifactured daily would maximise the profit	✓✓✓substitution of end points ✓answer (4) **[19]**