



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	$x(x-9)+14=0$ $x^2-9x+14=0$ $(x-7)(x-2)=0$ $x=7 \text{ or } x=2$	<ul style="list-style-type: none"> ✓ multiply out ✓ factors ✓ answers <p style="text-align: right;">(3)</p>
1.1.2	$x^2-x=3$ $x^2-x-3=0$ $x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(-3)}}{2(1)}$ $x = \frac{1 \pm \sqrt{13}}{2}$ $x = -1,3 \text{ or } x = 2,3$	<ul style="list-style-type: none"> ✓ standard form ✓ substitution ✓ simplification ✓✓ answers <p style="text-align: right;">(5)</p>
1.1.3	$\frac{1}{x+1} + \frac{2x}{x-1} = 1$ $x-1+2x(x+1)=x^2-1$ $x-1+2x^2+2x=x^2-1$ $x^2+3x=0$ $x(x+3)=0$ $x=0 \text{ or } x=-3$	<ul style="list-style-type: none"> ✓ multiplying LHS with LCM ✓ multiplying RHS with LCM ✓ simplification ✓ standard form ✓ factorisation ✓ answers <p style="text-align: right;">(6)</p>
1.2	$y=2-x$ $x^2+(2-x)^2-52=0$ $x^2+4-4x+x^2-52=0$ $2x^2-4x-48=0$ $x^2-2x-24=0$ $(x-6)(x+4)=0$ $x=6 \text{ or } x=-4$ $y=-4 \text{ or } y=6$ <p>OR</p>	<ul style="list-style-type: none"> ✓ making y the subject of the formula ✓ substitution ✓ multiplication ✓ factors ✓ x answers ✓✓ y answers <p style="text-align: right;">(7)</p>

		OR
	$x = 2 - y$ $(2 - y)^2 + y^2 - 52 = 0$ $4 - 4y + y^2 + y^2 - 52 = 0$ $2y^2 - 4y - 48 = 0$ $y^2 - 2y - 24 = 0$ $(y - 6)(y + 4) = 0$ $y = -4$ or $y = 6$ $x = 6$ or $x = -4$	<ul style="list-style-type: none"> ✓ making x the subject of the formula ✓ substitution ✓ multiplication ✓ factors ✓ x answers ✓✓ y answers <p style="text-align: right;">(7)</p>
1.3.1	$x - 2 = 0$ $x = 2$	<ul style="list-style-type: none"> ✓ denominator = 0 ✓ answer <p style="text-align: right;">(2)</p>
1.3.2	$x + 4 < 0$ $x < -4$	<ul style="list-style-type: none"> ✓ discriminant < 0 ✓ answer <p style="text-align: right;">(2)</p>
		[25]

QUESTION 2

2.1	$\frac{\frac{1}{x^3} \frac{1}{x^4}}{\frac{1}{x^6}}$ $= \frac{x^{\frac{7}{12}}}{x^{\frac{2}{12}}}$ $= x^{\frac{5}{12}}$	<ul style="list-style-type: none"> ✓✓ exponential laws ✓ answer <p style="text-align: right;">(3)</p>
2.2	$\sqrt{128x^6} + \sqrt{98x^6}$ $= \sqrt{64 \times 2x^6} + \sqrt{49 \times 2x^6}$ $= 8\sqrt{2x^3} + 7\sqrt{2x^3}$ $= (15\sqrt{2})x^3$	<ul style="list-style-type: none"> ✓ $8\sqrt{2x^3}$ ✓ $7\sqrt{2x^3}$ ✓ answer <p style="text-align: right;">(3)</p>

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

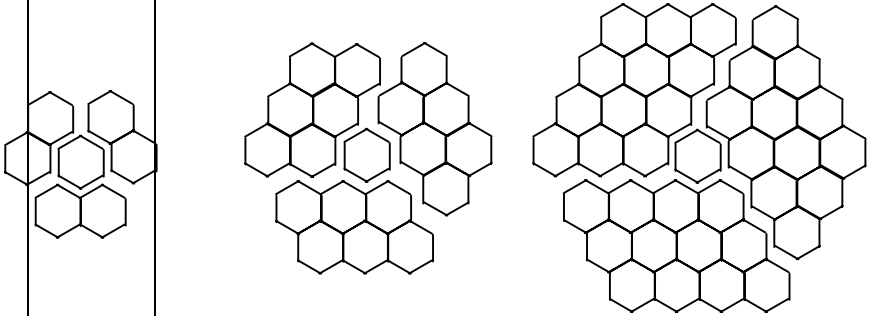
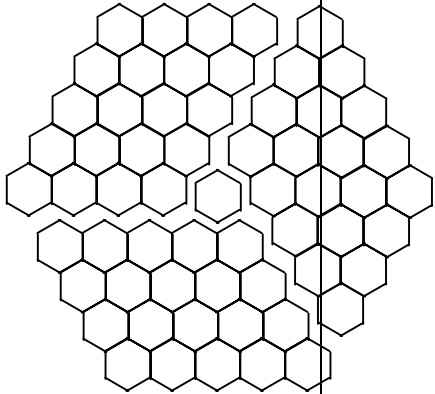
QUESTION 3

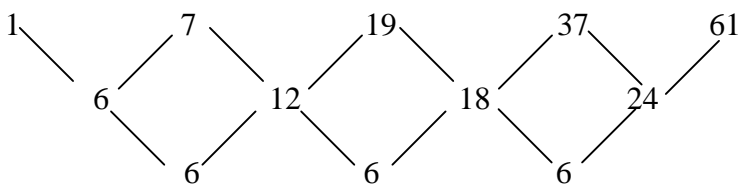
3.1	year 6 = 3^5 hundreds = 243 hundreds = 24 300	✓✓ answer (2)
3.2	number of trees = 3^{n-1} hundreds	✓ base 3 ✓ power n – 1 (2)
3.3	No The number of trees will increase without bound to very large numbers, thus the forestry authorities will if necessary cut down some of the trees from time to time.	✓ 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	✓ adding 6 ✓ second difference (2)
	 <p>From the structure of the picture: pattern 2: $3(2 \times 1) + 1$ pattern 3: $3(3 \times 2) + 1$ pattern 4: $3(4 \times 3) + 1$ pattern n: $3[n(n-1)] + 1$ $= 3n^2 - 3n + 1$</p>	

<p>5.3</p>	<p>Example:</p>  <p>Pattern will yield a quadratic equation since second difference is constant</p> $an^2 + bn + c = y$ <p>Pattern 2: $4a + 2b + c = 7$ (i) Pattern 3: $9a + 3b + c = 19$ (ii) (i) – (ii) $5a + b = 12$ (iii) $\therefore b = 12 - 5a$</p> <p>Pattern 4: $16a + 4b + c = 37$ (iv) (iv) – (ii) $7a + b = 18$ (v) (v) – (iii) $2a = 6$ $a = 3$ $\therefore b = -3$ $4(3) + 2(-3) + c = 7$ $12 - 6 + c = 7$ $c = 1$</p> <p>$P_n = 3n^2 - 3n + 1$</p>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> Learners may use other strategies to generate the relationship </div> <p>✓ a ✓ b ✓ c ✓ answer</p> <p style="text-align: right;">(4) [8]</p>
------------	---	--

QUESTION 6

<p>6.1.1</p>	$F_v = P_v(1 - in)$ $F_v = 16000(1 - 0,15 \times 3)$ $F_v = R 8800$	<p>✓ formula ✓ substitution ✓ answer</p> <p style="text-align: right;">(3)</p>
<p>6.1.2</p>	$F_v = P_v(1 - i)^n$ $8800 = 16000(1 - i)^3$ $0,55 = (1 - i)^3$ $0,82 = 1 - i$ $i = 1 - 0,82$ $i = 0,18$ <p>rate is 18%</p>	<p>✓ formula ✓ substitution</p> <p>✓ 0,55</p> <p>✓ 0,18 ✓ answer</p> <p style="text-align: right;">(5)</p>

6.2	$F_v = 12500(1,01)^{24} (1,07)^6$ $F_v = R\ 23819,12$	✓ 1,01 ✓ 1,07 ✓ substitution ✓ answer (4)
6.3.1	$i^{(12)} = 7.2\% = \frac{7.2}{100} = 0.072$ $1+i = \left(1 + \frac{i^{(12)}}{12}\right)^{12}$ $1+i = \left(1 + \frac{0.072}{12}\right)^{12}$ $1+i = 1,074424$ $i = 0,074424$ <p>∴ Effective rate is 7,442 % p.a.</p>	✓ $i^{(12)} = 0,72$ ✓ 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	$F_v = [120000(1,006)^{18} - 20000][1,006]^{30}$ $F_v = R\ 135,981,73$	✓ 1,006 ✓ power 18 ✓ $(1,006)^{30}$ ✓ ✓ answer (5)
		[24]

QUESTION 7

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

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

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

QUESTION 8

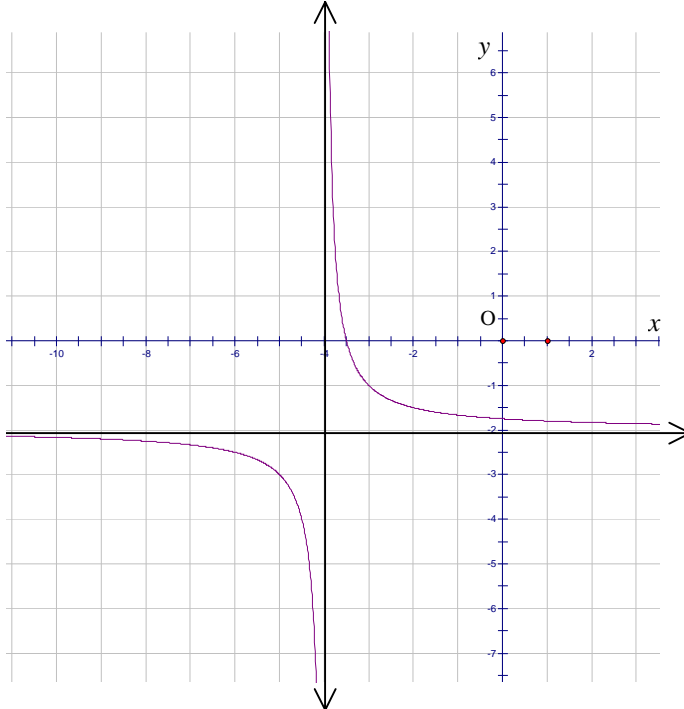
8.1.1	$y = a \cdot b^x$ $144 = a \cdot \left(\frac{3}{4}\right)^2$ $a = 256$	<p>✓ substitution</p> <p>✓✓ answer</p> <p>(3)</p>
8.1.2	$y = 256 \left(\frac{3}{4}\right)^x$	<p>✓ answer</p> <p>(1)</p>

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

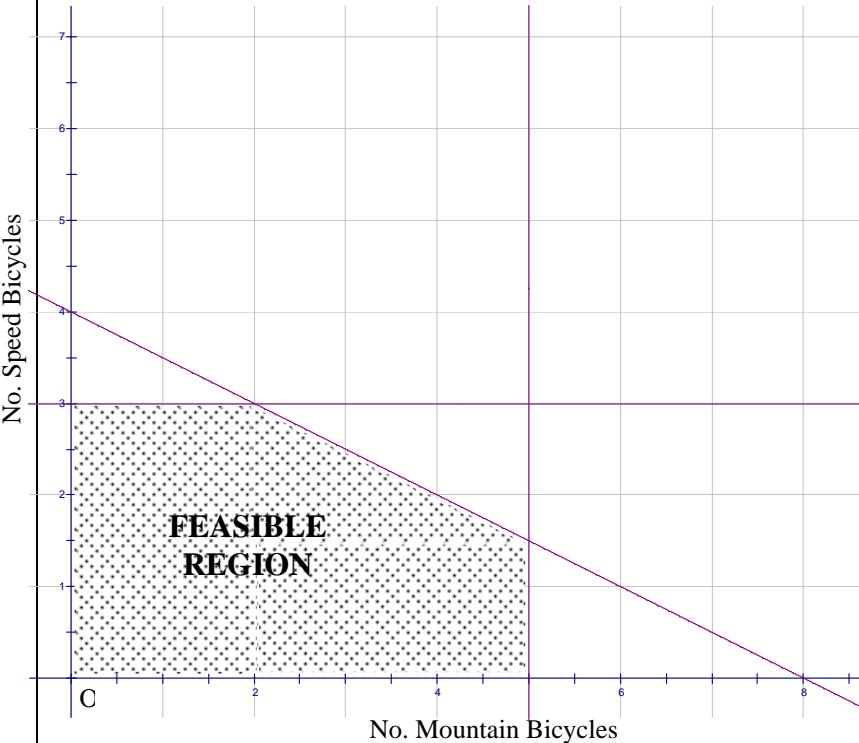
MEMORANDUM

<p>9.3</p>		<ul style="list-style-type: none"> ✓ intercepts ✓ y-asymptote ✓ x-asymptote ✓ shape <p style="text-align: right;">(4)</p> <p style="text-align: right;">[12]</p>
------------	--	---

QUESTION 10

<p>10.1</p>	<p>period = 720°</p>	<ul style="list-style-type: none"> ✓ answer <p style="text-align: right;">(1)</p>
<p>10.2</p>	<p>$a = \frac{1}{2}$ $b = 45^\circ$</p>	<ul style="list-style-type: none"> ✓ answer ✓ answer <p style="text-align: right;">(2)</p>
<p>10.3</p>	<p>$y \in [-2; 0]$</p>	<ul style="list-style-type: none"> ✓ end values ✓ brackets <p style="text-align: right;">(2)</p> <p style="text-align: right;">[5]</p>

QUESTION 11

<p>11.1</p>	<p>$0 \leq x \leq 5$ $0 \leq y \leq 3$ $x + 2y \leq 8$ $x, y \in \mathbb{N}$</p>	<p>✓✓ first constraint ✓✓ second constraint ✓✓ third constraint (6)</p>
<p>11.2 & 11.3</p>		<p>✓ $y = 3$ line ✓ $x = 5$ line ✓ gradient third line ✓ intercepts of third line (4)</p> <p>✓✓ Feasible Region (2)</p>
<p>11.4</p>	<p>$P = 200x + 600y$</p>	<p>✓ coefficient of x ✓ coefficient of y ✓ addition (3)</p>
<p>11.5</p>	<p>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): $P = 200(0) + 600(0) = 0$</p> <p>\therefore maximum at (2; 3) 2 mountain bicycles and 3 speed bicycles manufactured daily would maximise the profit</p>	<p>✓✓✓ substitution of end points</p> <p>✓ answer (4)</p> <p>[19]</p>