



# education

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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"> <li>✓ multiply out</li> <li>✓ factors</li> <li>✓ answers</li> </ul> <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"> <li>✓ standard form</li> <li>✓ substitution</li>   <li>✓ simplification</li> <li>✓✓ answers</li> </ul> <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"> <li>✓ multiplying LHS with LCM</li> <li>✓ multiplying RHS with LCM</li> <li>✓ simplification</li> <li>✓ standard form</li> <li>✓ factorisation</li> <li>✓ answers</li> </ul> <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 style="text-align: center;">OR</p>	<ul style="list-style-type: none"> <li>✓ making <math>y</math> the subject of the formula</li> <li>✓ substitution</li> <li>✓ multiplication</li>   <li>✓ factors</li> <li>✓ <math>x</math> answers</li> <li>✓✓ <math>y</math> answers</li> </ul> <p style="text-align: right;">(7)</p>

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

**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"> <li>✓✓ exponential laws</li>   <li>✓ answer</li> </ul> <p style="text-align: right;">(3)</p>
2.2	$\sqrt{128x^6} + \sqrt{98x^6}$ $= \sqrt{64 \times 2x^6} + \sqrt{49 \times 2x^6}$ $= 8\sqrt{2}x^3 + 7\sqrt{2}x^3$ $= (15\sqrt{2})x^3$	<ul style="list-style-type: none"> <li>✓ <math>8\sqrt{2}x^3</math></li> <li>✓ <math>7\sqrt{2}x^3</math></li> <li>✓ answer</li> </ul> <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)  <b>[10]</b>
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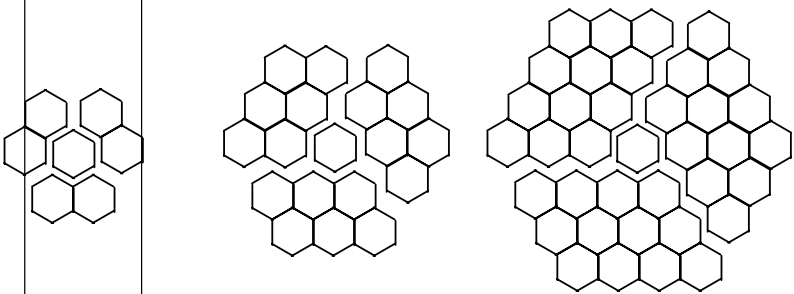
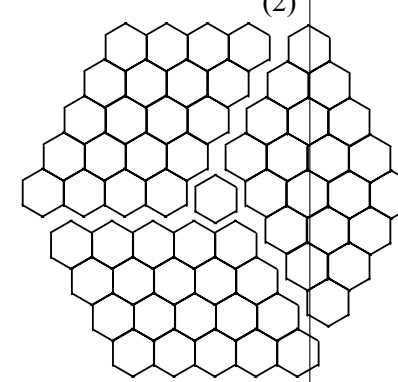
**QUESTION 3**

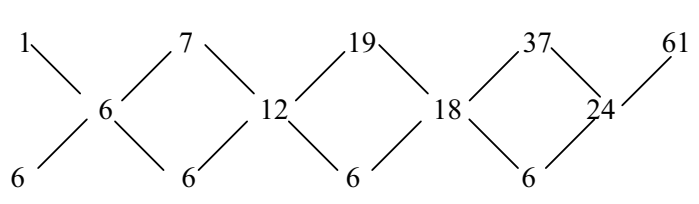
3.1	year 6 = $3^5$ hundreds = 243 hundreds = 24 300	✓✓ answer  (2)
3.2	. number of trees = $3^{n-1}$ hundreds	✓ base 3 ✓ power $n - 1$  (2)
3.3	No The number of trees will increase without bound to very large numbers, thus the forestry authorities will if necessary cut down some of the trees from time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

**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) <b>[9]</b>

**QUESTION 5**

5.1	pattern 6: 91	✓✓ answer (2)
5.2	<p>The difference between consecutive patterns increases by six every time</p>  <p>From the structure of the picture:          pattern 2: <math>3(2 \times 1) + 1</math>          pattern 3: <math>3(3 \times 2) + 1</math>          pattern 4: <math>3(4 \times 3) + 1</math>          pattern n: <math>3[n(n-1)] + 1</math>  <math>= 3n^2 - 3n + 1</math></p>	<p>✓ adding 6          ✓ second difference          (2)</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: <math>4a + 2b + c = 7</math> ..... (i)          Pattern 3: <math>9a + 3b + c = 19</math> ..... (ii)          (i) – (ii) <math>5a + b = 12</math> ..... (iii)  <math>\therefore b = 12 - 5a</math></p> <p>Pattern 4: <math>16a + 4b + c = 37</math> ..... (iv)          (iv) – (ii) <math>7a + b = 18</math> ..... (v)          (v) – (iii) <math>2a = 6</math>  <math>a = 3</math>  <math>\therefore b = -3</math>  <math>4(3) + 2(-3) + c = 7</math>  <math>12 - 6 + c = 7</math>  <math>c = 1</math></p> $P_n = 3n^2 - 3n + 1$	<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) <b>[8]</b></p>
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**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  ✓ 0,55  ✓ 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)
			<b>[24]</b>

**QUESTION 7**

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

	$= -\frac{b}{2a}$ $\text{Axis of symmetry} = -\frac{3}{2(1)}$ $= -\frac{3}{2}$ $y = -\frac{3}{2}\left(-\frac{3}{2} + 3\right) = -\frac{9}{4}$ $P\left(-\frac{3}{2}; -\frac{9}{4}\right)$	<p>✓ substitution into</p> $x = -\frac{b}{2a}$ <p>✓ AOS = <math>-\frac{3}{2}</math></p> <p>✓ substitution</p> $y = -\frac{9}{4}$ <p>✓ x- coordinate</p> <p>(5)</p>
7.3	<p>average gradient = <math>\frac{f(-5) - f(-3)}{-5 - (-3)}</math></p> $= \frac{-5(-5 + 3) - [-3(-3 + 3)]}{-2}$ $= \frac{10 - 0}{-2}$ $= -5$ <p>OR</p> <p>average gradient = <math>\frac{f(-3) - f(-5)}{-3 - (-5)}</math></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> <p>OR</p> <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>	
7.5	<p><math>x &lt; -3</math> or <math>x &gt; 0</math></p>	<p>✓ decreasing</p> <p>✓ average rate</p> <p>(2)</p>
7.6	<p>Turning point of <math>f(x-2) = \left(-\frac{3}{2} + 2; -\frac{9}{4}\right)</math></p> $= \left(\frac{1}{2}; -\frac{9}{4}\right)$	<p>✓ or</p> <p>✓ <math>x &lt; -3</math></p> <p>✓ <math>x &gt; 0</math></p> <p>(3)</p> <p>✓ x coordinate</p> <p>✓ y coordinate</p> <p>(2)</p>



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

**QUESTION 8**

<p>8.1.1</p>	$y = a.b^x$ $144 = a.\left(\frac{3}{4}\right)^2$ $a = 256$	<p>✓ substitution</p> <p>✓ answer</p> <p>(3)</p>
<p>8.1.2</p>	$y = 256\left(\frac{3}{4}\right)^x$	<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) <b>[8]</b>

**QUESTION 9**

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

<p>9.3</p>		<ul style="list-style-type: none"> <li>✓ intercepts</li> <li>✓ y-asymptote</li> <li>✓ x-asymptote</li> <li>✓ shape</li> </ul> <p style="text-align: right;">(4)</p> <p style="text-align: right;"><b>[12]</b></p>
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**QUESTION 10**

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

**QUESTION 11**

11.1	$0 \leq x \leq 5$ $0 \leq y \leq 3$ $x + 2y \leq 8$ $x, y \in \mathbb{N}$	✓✓ 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): $P = 200(0) + 600(0) = 0$  $\therefore$ maximum at (2; 3) 2 mountain bicycles and 3 speed bicycles manufactured daily would maximise the profit	✓✓✓ substitution of end points  ✓ answer (4) <b>[19]</b>