



**GAUTENG PROVINCE**  
EDUCATION  
REPUBLIC OF SOUTH AFRICA

**GAUTENG DEPARTMENT OF EDUCATION  
PROVINCIAL EXAMINATION  
JUNE 2016  
GRADE 11**

**MATHEMATICS P1**

**MEMORANDUM**

**11 pages**

GAUTENG DEPARTMENT OF EDUCATION-  
PROVINCIAL EXAMINATIONMATHEMATICS  
(Paper 1)

## MEMORANDUM

## QUESTION 1

1.1		$(x - 2)(3x + 4) = 0$ $x = 2$ <b>OR</b> $x = -\frac{4}{3}$	✓ $x = 2$ ✓ $x = -\frac{4}{3}$	(2)
1.2	1.2.1	$\sqrt{2 - x} = x + 4$ $(\sqrt{2 - x})^2 = (x + 4)^2$ $2 - x = x^2 + 8x + 16$ $x^2 + 8x + 16 + x - 2 = 0$ $x^2 + 9x + 14 = 0$ $(x + 2)(x + 7) = 0$ $x = -2$ <b>OR</b> $x = -7$ NA	✓ Squaring both sides ✓ Standard form ✓ Factors ✓ Answers ✓ $x = -2$ only	(5)
	1.2.2	$2x(x - 3) = 1$ $2x^2 - 6x - 1 = 0$ $a = 2; b = -6; c = -1$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(2)(-1)}}{2(2)}$ $x = \frac{6 \pm \sqrt{36 + 8}}{4}$ $x = \frac{6 \pm \sqrt{44}}{4}$ $x = 3,2$ <b>OR</b> $x = -0,2$	✓ Standard form ✓ Substitution ✓ Answer ✓ answer	(4)

	<p>1.2.3</p> $\frac{x^2 + 4x + 3}{x - 1} > 0$ $\frac{x^2 + 4x + 3}{x - 1} > 0 \quad x \neq 1$ $\frac{(x+1)(x+3)}{x-1} > 0$ <p><math>-3 &lt; x &lt; -1</math> or <math>x &gt; 1</math></p> <p style="text-align: center;"><b>OR</b></p> <p><math>(-3 ; -1) \cup (1 ; \infty)</math></p>	<ul style="list-style-type: none"> <li>✓ <math>x + 1</math></li> <li>✓ <math>x + 3</math></li> <li>✓ Critical values in context of an inequality</li> <li>✓ correct notation</li> </ul> <p>Only focus on numerator</p>	(4)
1.3	$2x^2 - 3x = 8$ $x^2 - \frac{3}{2}x = 4$ $x^2 - \frac{3}{2}x + \left(\frac{1}{2} \times \frac{-3}{2}\right)^2 = 4 + \left(\frac{1}{2} \times \frac{-3}{2}\right)^2$ $\left(x - \frac{3}{4}\right)^2 = 4 + \frac{9}{16}$ $\left(x - \frac{3}{4}\right)^2 = \frac{73}{16}$ $x - \frac{3}{4} = \pm \sqrt{\frac{73}{16}}$ $x = \frac{3}{4} \pm \sqrt{\frac{73}{16}}$ $x = \frac{3 + \sqrt{73}}{4} \quad \text{OR} \quad x = \frac{3 - \sqrt{73}}{4}$ <p><math>x = 2,89</math> OR <math>x = -1,39</math></p>	<ul style="list-style-type: none"> <li>✓ Divide by 2</li> <li>✓ <math>\frac{73}{16}</math></li> <li>✓ Finding square root (<math>\pm</math>)</li> <li>✓ <math>x = 2,89</math></li> <li>✓ <math>x = -1,39</math></li> </ul> <p>Use of quadratic formula max 2/5 for the two correct answers.</p>	(5)
			<b>[20]</b>

## QUESTION 2

2.1	$\frac{3 \cdot 3^x - 4 \cdot 3^{x+2}}{3^x - 3^{x+1}}$ $= \frac{3 \cdot 3^x - 4 \cdot 3^x \cdot 3^2}{3^x - 3^x \cdot 3^1}$ $= \frac{3^x(3-4 \cdot 9)}{3^x(1-3)}$ $= \frac{3-36}{-2}$ $= \frac{-33}{-2}$ $= 16\frac{1}{2} \text{ OR } \frac{33}{2}$	<ul style="list-style-type: none"> <li>✓ Expansion</li> <li>✓ <math>3^3(3-4 \cdot 9)</math></li> <li>✓ <math>3^x(1-3)</math></li> <li>✓ Answer</li> </ul> <p>If <i>k</i>-method is used exactly the same mark allocation</p>	(4)
2.2	<p>2.2.1</p> $\frac{\sqrt{5}}{\sqrt{5}+2} + \frac{10}{\sqrt{5}}$ $= \frac{5+10(\sqrt{5}+2)}{5+2\sqrt{5}}$ $= \frac{5+10\sqrt{5}+20}{5+2\sqrt{5}}$ $= \frac{25+10\sqrt{5}}{5+2\sqrt{5}}$ $= \frac{5(5+2\sqrt{5})}{5+2\sqrt{5}}$ $= 5$ <p><b>OR</b></p> $\frac{\sqrt{5}}{\sqrt{5}+2} + \frac{10}{\sqrt{5}}$ $= \frac{\sqrt{5}}{\sqrt{5}+2} \times \frac{\sqrt{5}-2}{\sqrt{5}-2} + \frac{10}{\sqrt{5}}$ $= \frac{5-2\sqrt{5}}{5-4} + \frac{10}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ $= 5 - 2\sqrt{5} + \frac{10\sqrt{5}}{5}$ $= 5 - 2\sqrt{5} + 2\sqrt{5}$ $= 5$	<ul style="list-style-type: none"> <li>✓ <math>\frac{5+10(\sqrt{5}+2)}{5+2\sqrt{5}}</math></li> <li>✓ simplification</li> <li>✓ <math>\frac{5(5+2\sqrt{5})}{5+2\sqrt{5}}</math></li> <li>✓ answer</li> </ul> <p>Rationalizing the denominator</p> <ul style="list-style-type: none"> <li>✓ Rationalizing the denominator</li> <li>✓ Simplification</li> <li>✓ Answer</li> </ul>	(4)

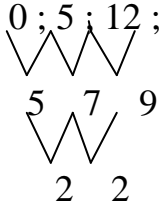
2.2.2	$\left(\frac{\sqrt{7^{2011}} - \sqrt{7^{2009}}}{\sqrt{7^{2008}}} + \sqrt{7}\right)^2$ $= \left(\frac{\sqrt{7^{2008}}(\sqrt{7^3} - \sqrt{7^1})}{\sqrt{7^{2008}}} + \sqrt{7}\right)^2$ $= (\sqrt{7^3} - \sqrt{7^1} + \sqrt{7})^2$ $= (7\sqrt{7} - \sqrt{7} + \sqrt{7})^2$ $= (7\sqrt{7})^2$ $= 343$ <p style="text-align: center;"><b>OR</b></p>	<ul style="list-style-type: none"> <li>✓ <math>\sqrt{7^{2008}}</math></li> <li>✓ <math>\sqrt{7^3} - \sqrt{7^1}</math></li> <li>✓ <math>(7\sqrt{7})^2</math></li> <li>✓ Answer</li> </ul>	
2.2.2 cont.	$\left(\frac{\sqrt{7^{2011}} - \sqrt{7^{2009}}}{\sqrt{7^{2008}}} + \sqrt{7}\right)^2$ $= \left(\frac{7^{\frac{2011}{2}} - 7^{\frac{2009}{2}}}{7^{\frac{2008}{2}}} + \sqrt{7}\right)^2$ $= \left(\frac{7^{\frac{2009}{2}}(7-1)}{7^{1004}} + \sqrt{7}\right)^2$ $= (7\sqrt{7})^2$ $= (49)(7)$ $= 343$	<ul style="list-style-type: none"> <li>✓ <math>7^{\frac{2009}{2}}</math></li> <li>✓ <math>(7-1)</math></li> <li>✓ <math>(7\sqrt{7})^2</math></li> <li>✓ Answer</li> </ul>	(4)
2.3	<p>from: <math>2^x \cdot 4^y = 1</math>  <math>2^x \cdot 2^{2y} = 2^0</math>  <math>x + 2y = 0</math>  <math>x = -2y \dots \dots \dots \textcircled{1}</math></p> <p>subst <math>\textcircled{1}</math> into <math>(4^y)^x = \frac{1}{16}</math>  <math>(4^y)^{-2y} = \frac{1}{16}</math>  <math>2^{-4y^2} = 2^{-4}</math>  <math>-4y^2 = -4</math>  <math>y = \pm 1</math></p> <p>subst <math>y = \pm 1</math> into <math>\textcircled{1}</math>  <math>y = 1 \quad x = -2</math>  <math>y = -1 \quad x = 2</math></p> <p><b>OR</b></p>	<ul style="list-style-type: none"> <li>✓ <math>2^{2y}</math></li> <li>✓ <math>x + 2y = 0</math></li> <li><b>OR</b></li> <li><math>x = -2y</math></li> <li>✓ substitution</li> <li>✓ same bases on either side</li> <li>✓ <math>y = \pm 1</math></li> <li>✓ <math>x = \pm 2</math></li> </ul>	(6)

	$2^x \cdot 4^y = 1$ $2^x \cdot 2^{2y} = 2^0$ $x + 2y = 0 \dots\dots\dots 1$ $(4^y)^x = \frac{1}{16}$ $2^{2xy} = 2^{-4}$ $2xy = -4$ $y = -\frac{2}{x} \dots\dots\dots 2$ $x + 2\left(-\frac{2}{x}\right) = 0$ $x^2 - 4 = 0$ $(x - 2)(x + 2) = 0$ $x = -2 \text{ or } x = 2$ $y = -\frac{2}{x}$ $= -\frac{2}{2} \text{ or } -\frac{2}{-2}$ $y = -1 \quad y = 1$	$\checkmark 2^{2y}$ $\checkmark x + 2y = 0$ <p><b>OR</b></p> $x = -2y$ $\checkmark 2^{2xy} = 2^{-4}$ $\checkmark 2xy = -4$ $\checkmark y = \pm 1$ $\checkmark x = \pm 2$	
			<b>[18]</b>

## QUESTION 3

3.1	3.1.1	Roots are non-real (imaginary) therefore $\Delta < 0$ .	<ul style="list-style-type: none"> <li>✓✓ Non-real roots</li> <li><b>OR</b></li> <li>✓✓ <math>\Delta &lt; 0</math></li> </ul>	(2)
	3.1.2	Roots are real and equal, $\Delta = 0$	<ul style="list-style-type: none"> <li>✓ Roots are real</li> <li>✓ Roots equal</li> </ul>	(2)
3.2		$\Delta = (2k - 1)^2 - 4(k)(k-1)$ $= 4k^2 - 4k + 1 - 4k^2 + 4k$ $= 1$ <p>1 is a perfect square, the coefficients are rational, so the roots are rational.</p>	<ul style="list-style-type: none"> <li>✓ Substitution</li> <li>✓ Simplification</li> <li>✓ Value of 1</li> <li>✓ Perfect square</li> </ul>	(4)
				<b>[8]</b>

## QUESTION 4

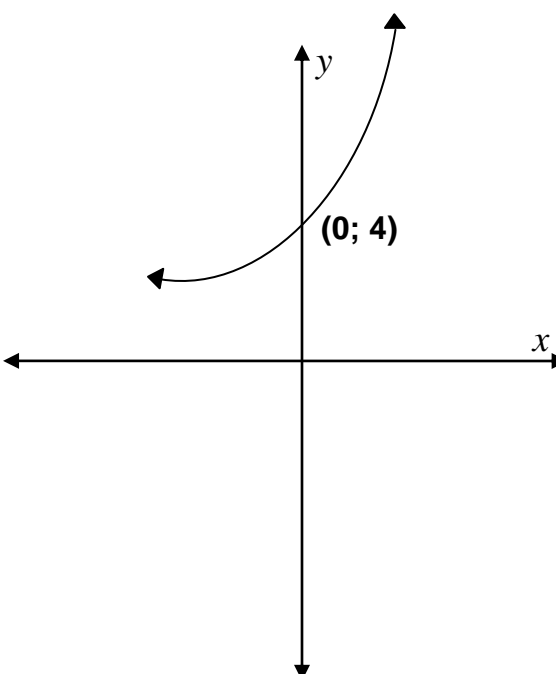
4.1	4.1.1	-1; 8; 23; .....	<ul style="list-style-type: none"> <li>✓ -1</li> <li>✓ 8</li> <li>✓ 23</li> </ul>	(3)
	4.1.2	$3k^2 - 4 = 71$ $k^2 = 25$ $k = \pm 5$ $\therefore k = 5$	<ul style="list-style-type: none"> <li>✓ <math>3k^2 - 4 = 71</math></li> <li>✓ <math>k^2 = 25</math> or <math>(k-5)(k+5)</math></li> <li>✓ <math>k = 5</math></li> </ul> <p>No marks for <math>k = \pm 5</math></p>	(3)
4.2	4.2.1	<p>Quadratic number pattern</p> <p>0 ; 5 ; 12 ; 21 ; ....</p>  <p>Quadratic number pattern</p> <p><b>OR/OF</b>          Quadratic number pattern          The first difference is not constant but the second difference is constant.</p>	<ul style="list-style-type: none"> <li>✓ Quadratic</li> <li>✓ second difference is constant or illustration</li> </ul> <p>If the learner only show the pattern without justification only 1 mark</p>	(2)

	4.2.2	$2a = 2$ $\therefore a = 1$ $3a + b = 5$ $3(1) + b = 5$ $\therefore b = 2$  $T_1 = a + b + c$ $0 = 1 + 2 + c$ $\therefore c = -3$ $\therefore T_n = an^2 + bn + c$ $T_n = n^2 + 2n - 3$	$\checkmark a = 1$  $\checkmark b = 2$  $\checkmark c = -3$  $\checkmark T_n = n^2 + 2n - 3$	(4)
4.3	4.3.1	<u>Row 4</u> $7^2 - 6^2 + 5^2 - 4^2 = 22$  <u>Row 20</u> $23^2 - 22^2 + 21^2 - 20^2 = 86$	$\checkmark \text{Row } 4 = 22$  $\checkmark \text{Row } 20 = 86$	(2)
	4.3.2	$(n+3)^2 - (n+2)^2 + (n+1)^2 - n^2 = 4n+6$	$\checkmark a = n+3$  $\checkmark b = n+2; c = n+1; d = n$ $\checkmark T_n = 4n+6$ If only the general term was given 1/3	(3)
				<b>[17]</b>

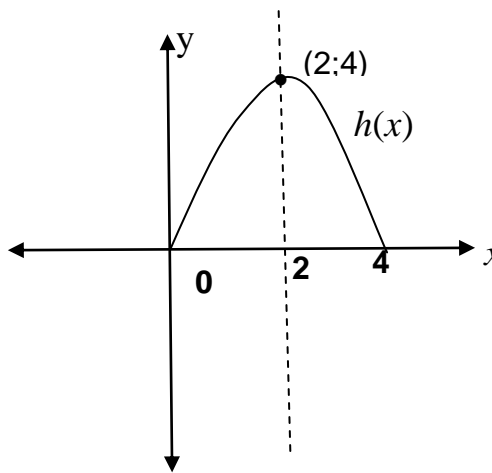
## QUESTION 5

5.1	$x = -2$ and $y = 1$	$\checkmark x = -2$ $\checkmark y = 1$ Both has to be in equation form. If not 0/2 If $p = -2$ and $q = 10/2$	(2)
5.2	Sub B = (0; -2) in $y = \frac{k}{x+2} + 1$ $-2 = \frac{k}{0+2} + 1$ $-2 = \frac{k}{2} + 1$  $-3 = \frac{k}{2}$ then $k = -6$ $\therefore y = \frac{-6}{x+2} + 1$	$\checkmark$ Substitution of (0 ; -2) and $q = 1$  $\checkmark k$ value $\checkmark$ Answer	(3)



5.3	$0 = \frac{-6}{x+2} + 1$ $-1 = \frac{-6}{x+2}$ $(x+2) = 6$ $x = 4$ $\therefore D(4; 0)$	<ul style="list-style-type: none"> <li>✓ <math>y = 0</math></li> <li>✓ <math>x + 2 = 6</math></li> <li>✓ <math>x = 4</math></li> <li>✓ Writing Point D in coordinate form.</li> </ul>	(4)
5.4	$C(-2; 0) \text{ and } B(4; 0)$ $y = a(x+2)(x-4)$ $-2 = a(0+2)(0-4)$ $-2 = a(-8)$ $\frac{1}{4} = a$ $y = \frac{1}{4}(x+2)(x-4)$ $y = \frac{1}{4}(x^2 - 2x - 8)$ $= \frac{1}{4}x^2 - \frac{1}{2}x - 2$	CA from 5.3 <ul style="list-style-type: none"> <li>✓ <math>x+2</math></li> <li>✓ <math>(x-4)</math></li> <li>✓ Sub. B (0; -2)</li> <li>✓ <math>a = \frac{1}{4}</math></li> <li>✓ answer in any form</li> </ul>	(5)
5.5	$g(x) = 2^{x+2}$ 	<ul style="list-style-type: none"> <li>✓ Shape</li> <li>✓ Coordinates of (0; 4)</li> <li>✓ Graph not crossing the <math>x</math>-axis</li> </ul>	(3)
5.6	$y = 2^{x-1}$	✓✓ $y = 2^{x-1}$	(2)
5.7	$y$ is real, $y \neq 1$ $(y \in \mathbb{R})$	<ul style="list-style-type: none"> <li>✓ <math>y</math> is real, <math>y \neq 1</math></li> </ul> both condition	(1)
			<b>[20]</b>

## QUESTION 6

6.1	$x \in [0 ; 4]$ <b>OR</b> $0 \leq x \leq 4$	✓ 0 ✓ 4	(2)
6.2	$h(x) = -(x^2 - 4x + 4 - 4)$ $= -(x - 2)^2 - 4$	✓ $a = -1.$ ✓ $p = -2.$ ✓ $q = -4.$	(3)
6.3		CA from 6.1  ✓ Shape (neg graph) ✓ Turning point ✓ y-intercept. ✓ positive y-values only.	(4)
6.4	$h(x) = -x^2 + 4x$ $= -(x - 5)^2 + 4(x - 5)$ $= -(x^2 - 10x + 25) + 4x - 20$ $= -x^2 + 10x - 25 + 4x - 20$ $\therefore h(x - 5) = -x^2 + 14x - 45$  <b>OR</b>  $y = -(x - 2)^2 + 4$ $= -(x - 2 - 5)^2 + 4$ $= -(x - 7)^2 + 4$ $= -(x^2 - 14x + 49) + 4$ $= -x^2 + 14x - 49 + 4$ $= -x^2 + 14x - 45$	✓ Sub $x$ with $(x - 5)$ ✓ Simplification ✓ Answer  <b>OR</b>  ✓ $(x - 2 - 5)^2$  ✓ Simplification  ✓ Answer	(3)

6.5	$k(x) = x^2 - 4x$	✓ $x^2$ ✓ $-4x$	(2)
6.6	$p(-3) = \frac{9}{2}$ $p(-1) = \frac{1}{2}$ Average gradient $= \frac{y_2 - y_1}{x_2 - x_1}$ $= \frac{\frac{9}{2} - \frac{1}{2}}{-3 - (-1)}$ $\therefore$ Average gradient of $p = -2$	✓ $p(-3) = \frac{9}{2}$ ✓ $p(-1) = \frac{1}{2}$ ✓ Answer	(3)
			[17]