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 EXAMINATION

MATHEMATICS
(Paper 1)

MEMORANDUM

QUESTION 1

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

	1.2.3	$\frac{x^2+4x+3}{x-1} > 0$ $\frac{x^2+4x+3}{x-1} > 0 \qquad x \neq 1$ $\frac{(x+1)(x+3)}{x-1} > 0$ $-3 < x < -1$ or $x > 1$ **OR** $(-3\ ;\ -1) \cup (1\ ;\ \infty)$	✓ $x+1$ ✓ $x+3$ ✓ Critical values in context of an inequality ✓ correct notation Only focus on numerator	(4)
1.3	$2x^2 - 3x = 8$ $x^2 - \frac{3}{2}x = 4$ $x^2 - \frac{3}{2}x + \left(\frac{1}{2} \times \frac{-3}{2}\right)^2 = 4 + \left(\frac{1}{2} \times \frac{-3}{2}\right)^2$ $\left(x - \frac{3}{4}\right)^2 = 4 + \frac{9}{16}$ $\left(x - \frac{3}{4}\right)^2 = \frac{73}{16}$ $x - \frac{3}{4} = \pm\sqrt{\frac{73}{16}}$ $x = \frac{3}{4} \pm \sqrt{\frac{73}{16}}$ $x = \frac{3+\sqrt{73}}{4}$ **OR** $x = \frac{3-\sqrt{73}}{4}$ $x = 2{,}89$ **OR** $x = -1{,}39$		✓ Divide by 2 ✓ $\frac{73}{16}$ ✓ Finding square root ($\pm$) ✓ $x = 2{,}89$ ✓ $x = -1{,}39$ Use of quadratic formula max 2/5 for the two correct answers.	(5)
				[20]

QUESTION 2

2.1	$\frac{3.3^x - 4.3^{x+2}}{3^x - 3^{x+1}}$ $=\frac{3.3^x - 4.3^x.3^2}{3^x - 3^x.3^1}$ $=\frac{3^x(3-4.9)}{3^x(1-3)}$ $=\frac{3-36}{-2}$ $=\frac{-33}{-2}$ $= 16\frac{1}{2}$ **OR** $\frac{33}{2}$		✓ Expansion ✓ $3^3(3-4.9)$ ✓ $3^x(1-3)$ ✓ Answer If *k*-method is used exactly the same mark allocation	(4)
2.2	2.2.1	$\frac{\sqrt{5}}{\sqrt{5}+2}+\frac{10}{\sqrt{5}}$ $=\frac{5+10(\sqrt{5}+2)}{5+2\sqrt{5}}$ $=\frac{5+10\sqrt{5}+20}{5+2\sqrt{5}}$ $=\frac{25+10\sqrt{5}}{5+2\sqrt{5}}$ $=\frac{5(5+2\sqrt{5})}{5+2\sqrt{55}}$ $=5$ **OR** $\frac{\sqrt{5}}{\sqrt{5}+2}+\frac{10}{\sqrt{5}}$ $\frac{\sqrt{5}}{\sqrt{5}+2}\times\frac{\sqrt{5}-2}{\sqrt{5}-2}+\frac{10}{\sqrt{5}}$ $=\frac{5-2\sqrt{5}}{5-4}+\frac{10}{\sqrt{5}}\times\frac{\sqrt{5}}{\sqrt{5}}$ $=5-2\sqrt{5}+\frac{10\sqrt{5}}{5}$ $=5-2\sqrt{5}+2\sqrt{5}$ $=5$	✓ $\frac{5+10(\sqrt{5}+2)}{5+2\sqrt{5}}$ ✓ simplification ✓ $\frac{5(5+2\sqrt{5})}{5+2\sqrt{55}}$ ✓ answer Rationalizing the denominator ✓ Rationalizing the denominator ✓ Simplification ✓ Answer	(4)

	2.2.2	$(\frac{\sqrt{7^{2011}}-\sqrt{7^{2009}}}{\sqrt{7^{2008}}}+\sqrt{7})^2$ $=(\frac{\sqrt{7^{2008}}(\sqrt{7^3}-\sqrt{7^1})}{\sqrt{7^{2008}}}+\sqrt{7})^2$ $=(\sqrt{7^3}-\sqrt{7^1}+\sqrt{7})^2$ $=(7\sqrt{7}-\sqrt{7}+\sqrt{7})^2$ $=(7\sqrt{7})^2$ $=343$ **OR**	✓ $\sqrt{7^{2008}}$ ✓ $\sqrt{7^3}-\sqrt{7^1}$ ✓ $(7\sqrt{7})^2$ ✓ Answer	
	2.2.2 cont.	$(\frac{\sqrt{7^{2011}}-\sqrt{7^{2009}}}{\sqrt{7^{2008}}}+\sqrt{7})^2$ $=(\frac{7^{\frac{2011}{2}}-7^{\frac{2009}{2}}}{7^{\frac{2008}{2}}}+\sqrt{7})^2$ $=(\frac{7^{\frac{2009}{2}}(7-1)}{7^{1004}}+\sqrt{7})^2$ $=(7\sqrt{7})^2$ $=(49)(7)$ $=343$	✓ $7^{\frac{2009}{2}}$ ✓ $(7-1)$ ✓ $(7\sqrt{7})^2$ ✓ Answer	(4)
2.3	from: $2^x \cdot 4^y = 1$ $2^x \cdot 2^{2y} = 2^0$ $x+2y = 0$ $x=-2y$.................① subst ① into $(4^y)^x = \frac{1}{16}$ $(4^y)^{-2x} = \frac{1}{16}$ $2^{-4y^2} = 2^{-4}$ $-4y^2 = -4$ $y = \pm 1$ subst $y = \pm 1$ into ① $y = 1$ $x = -2$ $y = -1$ $x = 2$ **OR**	✓ 2^{2y} ✓ $x+2y = 0$ **OR** $x=-2y$ ✓ substitution ✓ same bases on either side ✓ $y = \pm 1$ ✓ $x = \pm 2$		(6)

	$2^x.4^y = 1$ $2^x.2^{2y} = 2^0$ $x + 2y = 0..........1$ $(4^y)^x = \frac{1}{16}$ $2^{2xy} = 2^{-4}$ $2xy = -4$ $y = -\frac{2}{x}................2$ $x + 2\left(-\frac{2}{x}\right) = 0$ $x^2 - 4 = 0$ $(x-2)(x+2) = 0$ $x = -2$ or $x = 2$ $y = -\frac{2}{x}$ $= -\frac{2}{2}$ or $-\frac{2}{-2}$ $y = -1$ $y = 1$	✓ 2^{2y} ✓ $x + 2y = 0$ **OR** $x = -2y$ ✓ $2^{2xy} = 2^{-4}$ ✓ $2xy = -4$ ✓ $y = \pm 1$ ✓ $x = \pm 2$	
			[18]

QUESTION 3

3.1	3.1.1	Roots are non-real (imaginary) therefore $\Delta < 0$.	✓✓Non-real roots **OR** ✓✓ $\Delta < 0$	(2)
	3.1.2	Roots are real and equal, $\Delta = 0$	✓ Roots are real ✓ Roots equal	(2)
3.2		$\Delta = (2k-1)^2 - 4(k)(k-1)$ $= 4k^2 - 4k + 1 - 4k^2 + 4k$ $= 1$ 1 is a perfect square, the coefficients are rational, so the roots are rational.	✓ Substitution ✓ Simplification ✓ Value of **1** ✓ Perfect square	(4)
				[8]

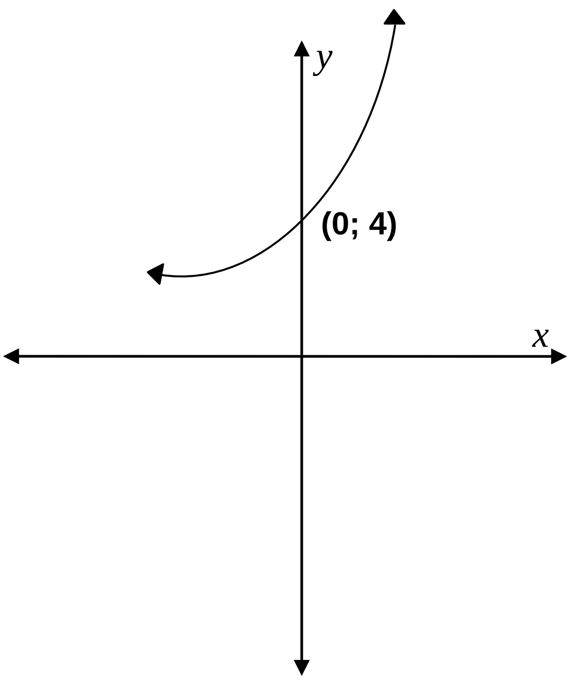
QUESTION 4

4.1	4.1.1	-1; 8; 23;	✓ –1 ✓8 ✓23	(3)
	4.1.2	$3k^2 - 4 = 71$ $k^2 = 25$ $k = \pm 5$ $\therefore k = 5$	✓$3k^2 - 4 = 71$ ✓ $k^2 = 25$ or $(k-5)(k+5)$ ✓ $k = 5$ No marks for $k = \pm 5$	(3)
4.2	4.2.1	Quadratic number pattern 0 ; 5 ; 12 ; 21; .... 5 7 9 2 2 Quadratic number pattern **OR/OF** Quadratic number pattern The first difference is not constant but the second difference is constant.	✓ Quadratic ✓ second difference is constant or illustration If the learner only show the pattern without justification only 1 mark	(2)

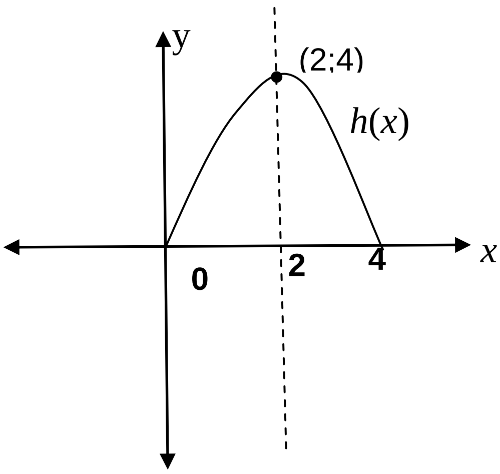
	4.2.2	$2a = 2$ $\therefore a = 1$ $3a + b = 5$ $3(1) + b = 5$ $\therefore b = 2$ $T_1 = a + b + c$ $0 = 1 + 2 + c$ $\therefore c = -3$ $\therefore Tn = an^2 + bn + c$ $Tn = n^2 + 2n - 3$	✓$a = 1$ ✓$b = 2$ ✓$c = -3$ ✓$Tn = n^2 + 2n - 3$	(4)
4.3	4.3.1	<u>Row 4</u> $7^2 - 6^2 + 5^2 - 4^2 = 22$ <u>Row 20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

QUESTION 5

5.1	$x = -2$ and $y = 1$	✓ $x = -2$ ✓ $y = 1$ 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 $k = -6$ $\therefore y = \frac{-6}{x+2} + 1$	✓ Substitution of $(0\ ; -2)$ and $q = 1$ ✓ k value ✓ Answer	(3)

5.3	$0 = \frac{-6}{x+2} + 1$ $-1 = \frac{-6}{x+2}$ $(x+2) = 6$ $x = 4$ $\therefore D(4\ ;\ 0)$	✓ $y = 0$ ✓ $x+2=6$ ✓ $x = 4$ ✓ Writing Point D in coordinate form.	(4)
5.4	C(–2 ; 0) 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 ✓ $x+2$ ✓ $(x-4)$ ✓ Sub. B (0; –2) ✓ $a = \frac{1}{4}$ ✓ answer in any form	(5)
5.5	$g(x) = 2^{x+2}$ 	✓ Shape ✓ Coordinates of (0 ; 4) ✓ Graph not crossing the x- axis	(3)
5.6	$y = 2^{x-1}$	✓✓ $y = 2^{x-1}$	(2)
5.7	y is real , $y \neq 1$ ($y \in \mathbb{R}$)	✓ y is real, $y \neq 1$ both condition	(1)
			[20]

QUESTION 6

6.1	$x \in [0 ; 4]$ **OR** $0 \leq x \leq 4$	✓ 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	$h(x) = - x^2 + 4x$ $= -(x - 5)^2 + 4(x - 5)$ $= - (x^2 - 10x +25) + 4x -20$ $= - x^2 +10x -25 + 4x -20$ $\therefore h(x - 5) = - x^2 + 14x -45$ **OR** $y = - (x - 2)^2 + 4$ $= - (x - 2 - 5)^2 + 4$ $= - (x - 7)^2 + 4$ $= - (x^2 - 14x + 49) + 4$ $= - x^2 + 14x - 49 + 4$ $= - x^2 + 14x - 45$	✓ Sub x with $(x-5)$ ✓ Simplification ✓ Answer **OR** ✓ $(x - 2 - 5)^2$ ✓ 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]