



# WESTERN CAPE Education Department

Provincial Government of the Western Cape

**MEMORANDUM**

**GRADE 12**

**MATHEMATICS PAPER 1  
SEPTEMBER 2011**

**This memo paper consists of 11 pages.**

**Question 1**

1.1.1	$f(-2) = (-2)^2 - 4(-2) - 12 = 0$	✓ answer	(1)
1.1.2	$f(6) = (6)^2 - 4(6) - 12 = 0$	✓ answer	(1)
1.1.3	$x + 2$ and $x - 6$ are factors of $f(x)$	✓ answer	(1)
1.1.4	$x = -2$ or $x = 6$	✓ answers	(2)
1.2	$9^{x^2+x} = 27^{x+1}$ $3^{2x^2+2x} = 3^{3x+3}$ $\therefore 32 + 2x = 3x + 3$ $2x^2 - x - 3 = 0$ $(2x - 3)(x + 1) = 0$ $x = \frac{3}{2} \text{ or } x = 1$	✓ exponential law ✓ equate exponents ✓ standard form ✓ factors  ✓ answer	(5)
1.3	$\frac{2x^2 - x}{5} \geq 0$ $\therefore 2x^2 - x \geq 0$ $x(2x - 1) \geq 0$ $x \leq 0 \text{ or } x \geq \frac{1}{2}$	✓ ✓ ✓✓	(4)
1.4	$y = 2x - 2$ $2x - 2 = (x - 2)(x - 1)$ $\therefore x^2 - 5x + 4 = 0$ $(x - 4)(x - 1) = 0$ $\therefore x = 4 \text{ or } x = 1$ and $y = 6$ or $y = 0$	✓ making y the subject ✓ equating ✓ standard form ✓ factors ✓ values of x ✓ values of y	(6)
			[20]

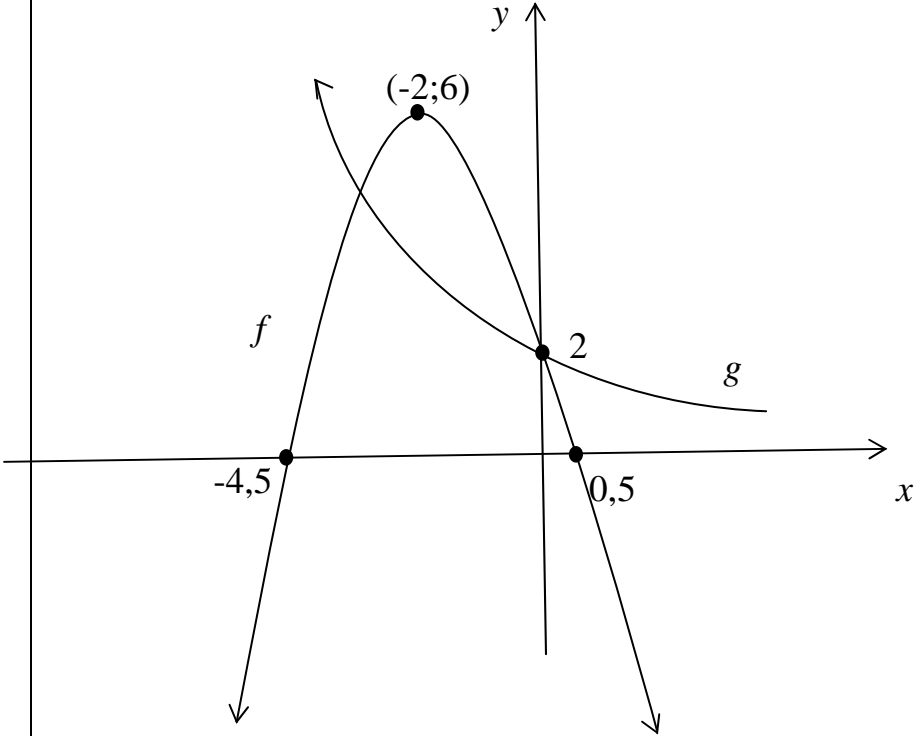
## Question 2

2.1	The general term is $T_n = an^2 + bn + c$ $T_n = 2n^2 + n$	✓ for the quadratic pattern ✓✓ for $a$ ✓✓ for $b$	(5)
2.2.1	18	✓✓ answer	(2)
2.2.2	9	✓✓ answer	(2)
2.2.3	28	✓✓ answer Note that 27 is not an acceptable answer as you may not leave one person standing	(2)
2.2.4	$S = 2n + 2$	✓✓ answer	(2)
2.2.5	$S = n + 4$ , where $n$ is an even number	✓✓ answer ✓ condition on $n$	(3)
2.3	$T_{50} = 201 + (50 - 1)(-4) = 5$	✓ value of $d$ ✓ value of $a$ ✓ sub in formula ✓ answer	(4)
2.4	$\frac{3}{4} = \left(\frac{3}{128}\right)r^5$ $r^5 = 32$ $r = 2$	✓✓ sub in formula and equating ✓ simplification ✓ answer	(4)
2.5	$S_{20} = \frac{3}{128} \frac{[2^{20} - 1]}{2 - 1} = 24576$	✓✓✓ sub in formula and value of $a$ and value of $r$ ✓ answer	(4)
			[28]

## Question 3

3.1.1	$A = 175\,000(1 - 0,075)^5 = R118\,507,74$	✓✓ substitution and answer	(2)
3.1.2	$A = 175\,000(1 + 0,085) = R245\,500$	✓✓ substitution and answer	
3.1.3	Value of her investment after 5 years: $A = 50\,000 \left(1 + \frac{0,11}{12}\right)^{60} = R86\,445,78$ After discount the price is R 208 250  So she will have to pay an extra R 3 296,48	✓✓ substitution and answer  ✓ amount after discount  ✓ for answer	(4)
3.2.1	$250000 = \frac{x \left[ 1 - \left(1 + \frac{0,115}{12}\right)^{-240} \right]}{\frac{0,115}{12}}$ $\therefore x = R\,2\,666,07$	✓✓ substitution in the present value formula  ✓✓ for answer	(4)
3.2.2	Balance = $\frac{2666,07 \left[ 1 - \left(1 + \frac{0,115}{12}\right)^{-96} \right]}{\frac{0,115}{12}}$ $= R\,166\,844,46$	✓✓ substitution in the present value formula  ✓✓ for answer	(4)
	OR		
	Bal. = $250000 \left(1 + \frac{0,115}{12}\right)^{144} - \frac{2667,07 \left[ \left(1 + \frac{0,115}{12}\right)^{144} - 1 \right]}{\frac{0,115}{12}}$ ✓✓ $= R\,166\,845,97$ ✓✓		
			[16]

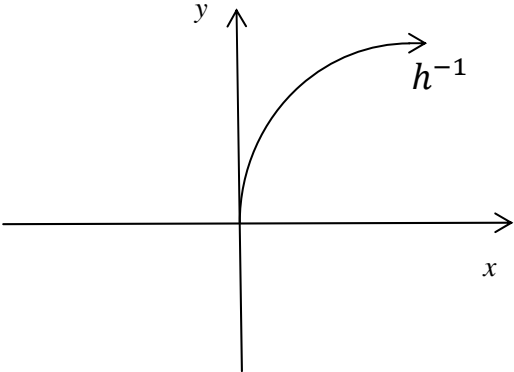
**Question 4**

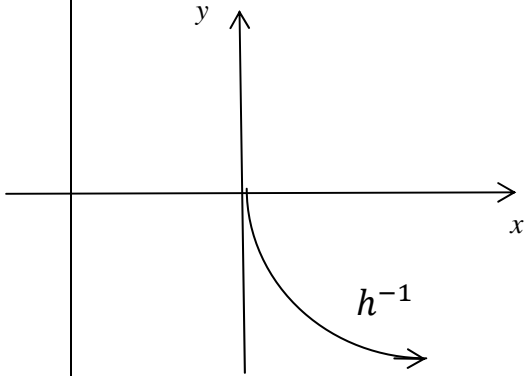
<p>4.1</p>	 <p style="text-align: center;"> <math>f(x)</math>                      <math>g(x)</math>              x-intercepts    ✓✓                      asymptote    ✓              y-intercepts    ✓                                      ✓              turning point    ✓✓                                      ✓         </p> <p><b>Note that the roots of the quadratic are irrational. Do not penalize for rounding off.</b></p>	<p>(8)</p>	
<p>4.2</p>	<p><math>k(x) = -(-x + 2)^2 + 6</math> or <math>k(x) = -(x - 2)^2 + 6</math></p>	<p>✓✓</p>	<p>(2)</p>
<p>4.3</p>	<p><math>l(x) = -(2^{-x}) - 1</math></p>	<p>✓✓</p>	<p>(2)</p>
<p>4.4</p>	<p><math>y = 2</math></p>	<p>✓✓</p>	<p>2</p>
<p>4.5</p>	<p><math>(-3 ; 6)</math></p>	<p>✓✓</p>	<p>(2)</p>
			<p>[16]</p>

**Question 5**

5.1	$a = 2, \quad p = 3 \text{ and } q = 4$	✓✓ for $a$ ✓ for $p$ ✓ for $q$	(4)
5.2	$y \in \mathbb{R}, \quad y \neq 2$	✓✓	(2)
5.3	The point (3 ; 4) will lie on the line $y = x + c$ Sub the point: $4 = 3 + c$ So $c = 1$	✓ for realizing that (3;4) will be on the axis of symmetry ✓ for substitution ✓ answer	(3)
			[9]

**Question 6**

6.1	$f^{-1}(x) = 5^x$	✓✓ answer	2
6.2.1	$y = \pm\sqrt{x}$	✓✓ answer	(2)
6.2.2	Because one $x$ value is associated with two $y$ values. ( the function is one-to many)	✓✓ answer	(2)
6.2.3	$x \geq 0$ or $x \leq 0$	✓ answer ✓ answer	(2)
6.2.4	For $x \geq 0$ 	✓✓ answer	

	<p>for <math>x \leq 0</math></p> 	<p>✓✓ answer</p>	<p>(4)</p>
			<p>[12]</p>

## Question 7

7.1.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $f'(x) = \lim_{h \rightarrow 0} \frac{(x+h)^2 - 3 - (x^2 - 3)}{h}$ $= \lim_{h \rightarrow 0} \frac{2xh + h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(2x+h)}{h}$ $= \lim_{h \rightarrow 0} 2x + h$ $= 2x$	✓ substitution ✓ simplification  ✓ simplification  ✓ simplification ✓ answer	(5)
7.2.1	$y = x^{\frac{3}{2}}$ $\therefore \frac{dy}{dx} = \frac{3}{2} x^{\frac{1}{2}}$	✓ rewrite in exponent form  ✓ answer	(2)
7.2.2	$y = x^2 + 4x^{-1} - 4x^{-2}$ $\frac{dy}{dx} = 2x - 4x^{-2} + 8x^{-3}$ $\therefore \frac{dy}{dx} = 2x - \frac{4}{x^2} + \frac{8}{x^3}$	✓ writing in exponent form  ✓✓✓ one mark per term ✓ answer with positive exponents	(5)
7.3	$h(x) = x^2 + 2x - 2$ $\therefore h'(x) = 2x + 4$ $\therefore 2x + 4 = -6$ $x = -5$ $y = f(-5) = 3$	✓ derivative ✓ equate to gradient ✓ x co-ordinate ✓ ✓ y co-ordinate	(5)
			[17]



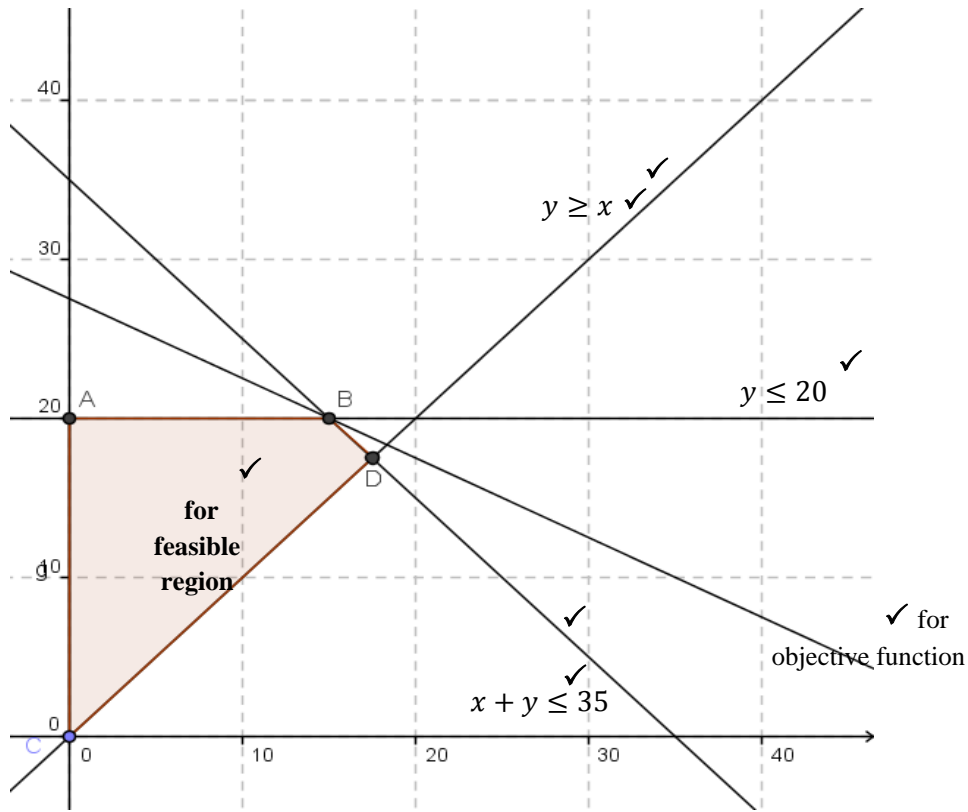
**Question 8**

<p>8.1.1</p>	$f'(x) = 3x^2 - 12x + 9 = 0$ $\therefore 3(x - 1)(x - 3) = 0$ $x = 1 \text{ or } x = 3$ $y = 0 \text{ or } y = -4$ <p>Turning points: (1 ; 0) and (3 ; -4)</p>	<p>✓ equating derivative to 0</p> <p>✓ x values</p> <p>✓ y values</p> <p>✓ ✓ answer</p> <p>One mark per point.</p>	<p>(5)</p>
<p>8.1.2</p>	$f''(x) = 6x - 12 = 0$ $x = 2$ $y = -2$ <p>Point of inflection is (2; -2)</p>	<p>..✓ equating 2<sup>nd</sup> derivative to 0</p> <p>✓ ✓ answer. If answer only then 2/3</p>	<p>(3)</p>
<p>8.1.3</p>			<p>(3)</p>
<p>8.1.4</p>	<p><math>-4 &lt; k &lt; 0</math></p>	<p>✓✓</p>	<p>(2)</p>

8.2.1	$V = \ell \cdot b \cdot h$ $\therefore 2x \times x \times h = 1$ $h = \frac{1}{2x^2}$	✓ substitute ✓ answer	(2)
8.2.2	Surface Area = $2x \times x + 2(2x + x)h$ $= 2x^2 + 6x \times \frac{1}{2x^2}$ $= 2x^2 + 3x^{-1}$ Hence the cost is given by: $c(x) = 2x^2(200) + 3x^{-1}(120)$ $= 400x^2 + 360x^{-1}$	✓ use of formula ✓ simplification ✓ substitution	(3)
8.2.3	$c'(x) = 800x - 360x^{-2} = 0$ $800x^3 = 360$ $x = 0,77$ Hence the minimum cost is: $c = 400(0,77)^2 + 360(0,77)^{-1}$ $= R 704,69$	✓ differentiate and equate to 0 ✓ value of $x$ ✓ substitute value of $x$ ✓ answer	(4)
			[22]

**Question 9**

9.1



(7)

9.2  $P = 250x + 500y$  ✓

(1)

9.3 Optimal solution: 15 male and 20 female workers

✓  
Second mark on graph

(2)

[10]

**Total Marks: 150**