



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

MATHEMATICS P1

EXEMPLAR 2013

MEMORANDUM

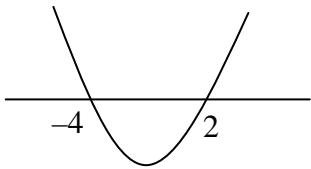
MARKS: 150

This memorandum consists of 13 pages.

QUESTION 1

1.1.1	$(2x-1)(x+5) = 0$ $x = \frac{1}{2}$ OR $x = -5$	✓✓ answers (2)
1.1.2	$2x^2 - 4x + 1 = 0$ $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(1)}}{2(2)}$ $x = \frac{4 \pm \sqrt{8}}{4}$ $x = \frac{4 \pm \sqrt{4 \cdot 2}}{4}$ $x = \frac{4 \pm 2\sqrt{2}}{4}$ $x = \frac{2(2 \pm \sqrt{2})}{4}$ $x = \frac{2 \pm \sqrt{2}}{2}$	✓ substitution into correct formula ✓✓ answers (3)
1.2.1	$125^{\frac{2}{3}}$ $= (5^3)^{\frac{2}{3}}$ $= 5^2$ $= 25$	✓ 5^3 ✓ answer (accept 25 or 5^2) (2)
1.2.2	$(3\sqrt{2} - 12)(2\sqrt{2} + 1)$ $= 6 \cdot 2 + 3\sqrt{2} - 24\sqrt{2} - 12$ $= -21\sqrt{2}$	✓ $6 \cdot 2 + 3\sqrt{2}$ ✓ $-24\sqrt{2} - 12$ ✓ answer (3)
1.3.1	$3x - 9 = 0$ $3x = 9$ $x = 3$	✓ $3x - 9 = 0$ ✓ answer (2)
1.3.2	$\frac{x^2 - x - 6}{3x - 9} = \frac{(x-3)(x-2)}{3(x-3)}$ $= \frac{x-2}{3}$	✓ $(x-3)(x-2)$ ✓ $3(x-3)$ ✓ answer (3) [15]

QUESTION 2

2.1.1	$(x+2)(x-3) < -3x+2$ $x^2 - x - 6 + 3x - 2 < 0$ $x^2 + 2x - 8 < 0$ $(x+4)(x-2) < 0$ $\begin{array}{ccccccc} + & 0 & - & 0 & + & & \\ & -4 & & 2 & & & \end{array}$ or  $-4 < x < 2$	✓ standard form ✓ factors ✓ $-4 < x$ ✓ $x < 2$ (4)
2.1.2	$x^2 + 2x - 8 < 0$ $-4 < x < 2$ $\text{Sum of integers} = (-3) + (-2) + (-1) + (0) + (1)$ $= -5$	✓ $-4 < x < 2$ ✓ $-3, -2, -1, 0, 1$ ✓ answer (3)
2.2.1	$\frac{4^{x-1} + 4^{x+1}}{17 \cdot 12^x} = \frac{4^x \cdot 4^{-1} + 4^x \cdot 4^1}{17 \cdot 3^x \cdot 4^x}$ $= \frac{4^x(4^{-1} + 4)}{17 \cdot 3^x \cdot 4^x}$ $= \frac{4^x\left(\frac{1}{4} + 4\right)}{17 \cdot 3^x \cdot 4^x}$ $= \frac{\left(\frac{17}{4}\right)}{17 \cdot 3^x}$ $= \frac{1}{4} \cdot 3^{-x} \text{ or } \frac{1}{4 \cdot 3^x}$	✓ factorise numerator ✓ $3^x \cdot 4^x$ ✓ simplification of numerator to $\frac{17}{4}$ ✓ answer (4)
2.2.2	$\frac{4^{x-1} + 4^{x+1}}{17 \cdot 12^x} = \frac{1}{4} \cdot 3^{-x}$ $= \frac{1}{4} \cdot 4t$ $= t$	✓ answer (1)

2.3	$3^y = 81^x$ and $y = x^2 - 6x + 9$ $3^y = 3^{4x}$ $y = 4x$ $4x = x^2 - 6x + 9$ $0 = x^2 - 10x + 9$ $0 = (x-9)(x-1)$ $x = 9$ or 1 $y = 4(9)$ or $4(1)$ $= 36$ or 4 $(x; y) = (9 ; 36)$ or $(1 ; 4)$	$\checkmark 3^y = 3^{4x}$ $\checkmark y = 4x$ $\checkmark 4x = x^2 - 6x + 9$ \checkmark standard form \checkmark factors \checkmark x-values \checkmark y-values <p style="text-align: right;">(7) [19]</p>
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QUESTION 3

3.1.1	$4 - 8p = 0$ $-8p = -4$ $p = \frac{1}{2}$	$\checkmark 4 - 8p = 0$ \checkmark answer <p style="text-align: right;">(2)</p>
3.1.2	$4 - 8p < 0$ $p > \frac{1}{2}$	$\checkmark 4 - 8p < 0$ \checkmark answer <p style="text-align: right;">(2)</p>
3.2.1	$\sqrt{5-x} = x+1$ $5-x \geq 0$ and $x+1 \geq 0$ $x \leq 5$ and $x \geq -1$ Hence $-1 \leq x \leq 5$	$\checkmark 5-x \geq 0$ $\checkmark x+1 \geq 0$ \checkmark and <p style="text-align: right;">(3)</p>
3.2.2	$5-x = x^2 + 2x + 1$ $x^2 + 3x - 4 = 0$ $(x+4)(x-1) = 0$ $x = -4$ or $x = 1$ Since $-1 \leq x \leq 5$, $x = 1$ only	\checkmark square both sides \checkmark standard form \checkmark factors \checkmark answers \checkmark selection of 1 <p style="text-align: right;">(5)</p>
3.2.3	$x = -4$	\checkmark answer <p style="text-align: right;">(1) [13]</p>

QUESTION 4

4.1	$A = P(1 - in)$ $= 145000[1 - (0,17)(5)]$ $= R 21 750$	✓ substitution ✓ answer (2)
4.2.1	$\frac{8\%}{4} = 2\% \text{ per quarter}$	✓ answer (1)
4.2.2	$A = P(1 + i)^n$ <p>After 1 year, $A = P(1 + i_{eff})^4$ and $A = P(1 + 0,02)^4$</p> <p>Hence</p> $1 + i_{eff} = (1 + 0,02)^4$ $i_{eff} = (1 + 0,02)^4 - 1$ $= 0,0824$ <p>The effective interest rate is 8,24% p.a.</p>	$\checkmark 1 + i_{eff} = (1 + 0,02)^4$ ✓ answer (2)
4.3	$A = 14000 \left(1 + \frac{0,09}{2}\right)^3 \left(1 + \frac{0,075}{12}\right)^{42}$ $= R 20 755,08$	$\checkmark \frac{0,09}{2}$ $\checkmark 14000 \left(1 + \frac{0,09}{2}\right)^3$ $\checkmark \frac{0,07}{12}$ $\checkmark 42$ ✓ answer (5) [10]

QUESTION 5

5.1	R 15 000	✓ answer (1)
5.2	Simple interest	✓ answer (1)
5.3	$A = P(1 + in)$ $31 = 15(1 + 6i)$ $\frac{31}{15} = 1 + 6i$ $i = \left(\frac{31}{15} - 1\right) \div 6$ $= \frac{8}{45}$ $= 0,1778$ $= 17,78\%$	✓ substitution of (6 ; 31) into correct formula ✓ answer (2)
5.4	$A = P(1 + in)$ $w = 15(1 + 0,1778 \times 12)$ $= 47$ $A = P(1 + i)^n$ $47 = 15(1 + i)^{12}$ $\sqrt[12]{\frac{47}{15}} = 1 + i$ $i = \sqrt[12]{\frac{47}{15}} - 1 = 0,09985 = 9,99\%$	✓ $w = 47$ ✓ substitutes (12 ; w) ✓ $\sqrt[12]{\frac{47}{15}}$ ✓ answer (4) [8]

QUESTION 6

6.1.1	Multiply $\frac{1}{8}$ by $\frac{1}{2}$	✓ multiply $\frac{1}{8}$ ✓ $\frac{1}{2}$ (2)
6.1.2	$T_n = \frac{1}{2} \left(\frac{1}{2} \right)^{n-1}$ OR $T_n = \left(\frac{1}{2} \right)^n$ OR $T_n = 2^{-n}$	✓ $a = \frac{1}{2}$ ✓ $\left(\frac{1}{2} \right)^{n-1}$ (2) ✓✓ answer (2) ✓✓ answer (2)
6.1.3	Continuing the pattern: $\frac{1}{2}; \frac{1}{4}; \frac{1}{8}; \frac{1}{16}; \frac{1}{32}; \frac{1}{64}; \frac{1}{128}; \frac{1}{256}; \frac{1}{512}; \frac{1}{1024}$ Hence $n = 10$ OR $\frac{1}{2^n} = \frac{1}{1024}$ $2^{-n} = 2^{-10}$ $n = 10$	✓ expand sequence ✓ $n = 10$ (2) ✓ $\frac{1}{2^n} = \frac{1}{1024}$ ✓ $n = 10$ (2)
6.2.1	124	✓ answer (1)
6.2.2	$T_n = -8n + 164$	✓ $-8n$ ✓ $+164$ (2)
6.2.3	$-8n + 164 < 0$ $164 < 8n$ $20,5 < n$ Hence T_{21} is the first term to be negative.	✓ $-8n + 164 < 0$ ✓ $20,5 < n$ ✓ answer (3)

6.2.4	$2a = -8$ $a = -4$ $3a + b = 156$ $3(-4) + b = 156$ $b = 168$ $T_5 = -24$ $-4(5)^2 + 168(5) + c = -24$ $c = -764$ $T_n = -4n^2 + 168n - 764$ <p>OR</p> $T_5 = -24 \text{ (given)}$ $T_6 = -24 + 124$ $= 100$ $T_n = -4n^2 + bn + c$ $-24 = -4(5)^2 + b(5) + c$ $76 = 5b + c \quad \dots \text{ (1)}$ $100 = -4(6)^2 + b(6) + c$ $244 = 6b + c \quad \dots \text{ (2)}$ $168 = b \quad \dots \text{ (2) - (1)}$ $c = -764$ <p>OR</p> $T_5 = -24 \text{ (given)}$ $T_4 = -24 - 132$ $= -156$ $T_n = -4n^2 + bn + c$ $-24 = -4(5)^2 + b(5) + c$ $76 = 5b + c \quad \dots \text{ (1)}$ $-156 = -4(4)^2 + b(4) + c$ $-92 = 4b + c \quad \dots \text{ (2)}$ $168 = b \quad \dots \text{ (1) - (2)}$ $c = -764$	$\checkmark a = -4$ \checkmark substitutions $\checkmark b = 168$ \checkmark substitution $\checkmark c = -764$ (5) $\checkmark T_6 = 100$ $\checkmark a = -4$ \checkmark substitutions $\checkmark b = 168$ $\checkmark c = -764$ (5) $\checkmark T_4 = -156$ $\checkmark a = -4$ \checkmark substitutions $\checkmark b = 168$ $\checkmark c = -764$ (5) [17]
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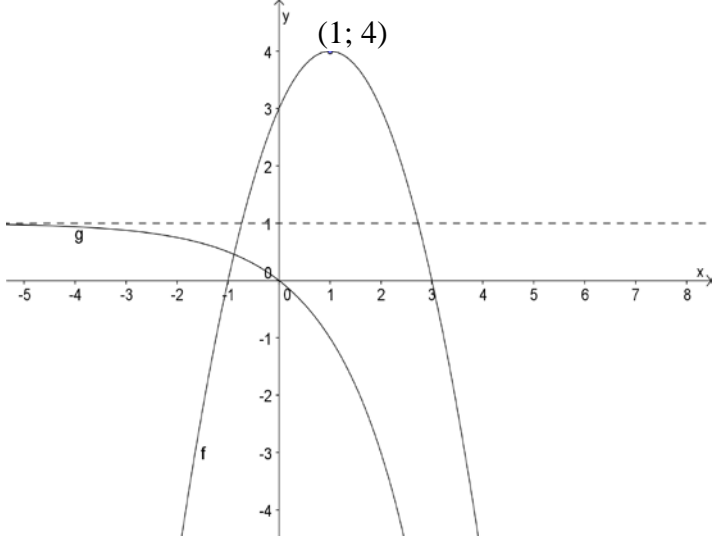
QUESTION 7

<p style="text-align: center;"> T_1 0 T_3 0 </p> <p> $y = x + 12$ $T_3 = 0 + x = x$ AND $T_3 + y = 0$ $y = -x$ </p> <p>AND $y = x + 12$</p> <p>Hence $-x = x + 12$ $-2x = 12$ $x = -6$</p> <p>OR</p> <p>2a = 12 a = 6 $T_n = 6n^2 + bn + c$</p> <p>$n = 2$ and $n = 4$:</p> <p>$24 + 2b + c = 0$ $96 + 4b + c = 0$ $72 + 2b = 0$ $2b = -72$ $b = -36$</p> <p>$24 - 72 + c = 0$ $c = 48$</p> <p>$T_n = 6n^2 - 36n + 48$ $T_3 = 6(3)^2 - 36(3) + 48$ $= 102 - 108$ $= -6$</p>	<p>✓ introduce variables</p> <p>✓ $T_3 = x$ ✓ $y = -x$</p> <p>✓ $y = x + 12$</p> <p>✓ $-x = x + 12$</p> <p>✓ answer</p> <p style="text-align: right;">[6]</p> <p>✓ $a = 6$</p> <p>✓ $24 + 2b + c = 0$ ✓ $96 + 4b + c = 0$</p> <p>✓ $b = -36$</p> <p>✓ $c = 48$</p> <p>✓ answer</p> <p style="text-align: right;">[6]</p>
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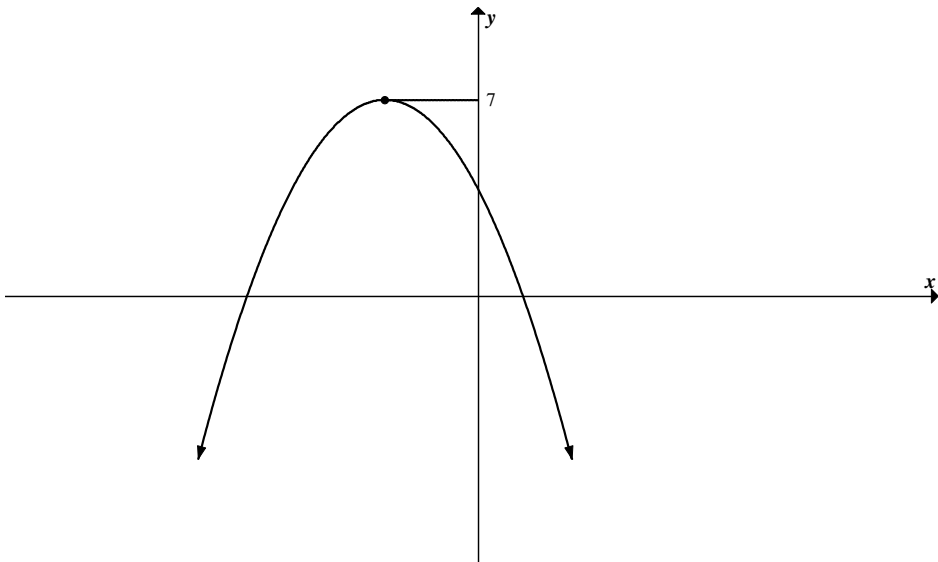
QUESTION 8

8.1	$x = 3$ $y = -1$	✓ answer ✓ answer (2)
8.2	$R; x \neq 3$ OR $(-\infty; 3) \cup (3; \infty)$	✓ R ✓ $x \neq 3$ ✓ $(-\infty; 3)$ ✓ $(3; \infty)$ (2)
8.3	$d = \tan 76^\circ$ $d = 4$ $6 = 4(3) + e$ $e = -6$ $g(x) = 4x - 6$	✓ $d = \tan 76^\circ$ ✓ $d = 4$ ✓ $e = -6$ (3)
8.4	$\frac{2}{x-3} - 1 = 4x - 6$ $\frac{2}{x-3} = 4x - 5$ $2 = 4x(x-3) - 5(x-3)$ $2 = 4x^2 - 12x - 5x + 15$ $0 = 4x^2 - 17x + 13$ $0 = (4x - 13)(x - 1)$ $x = \frac{13}{4}$ or $x = 1$ $y = 4\left(\frac{13}{4}\right) - 6$ or $y = 4(1) - 6$ $y = 7$ or $y = -2$ Points of intersection are A $(1; -2)$ and C $\left(\frac{13}{4}; 7\right)$	✓ equating ✓ simplification ✓ standard form ✓ factors ✓ x-values ✓ y-values (6)
8.5	$1 \leq x < 3$ or $x \geq \frac{13}{4}$ OR $x \in [1; 3) \cup \left[\frac{13}{4}; \infty\right)$	✓ $1 \leq x$ ✓ $x < 3$ ✓ $x \geq \frac{13}{4}$ (3)
8.6	$y = (x-3) - 1$ $y = x - 4$ OR $y = x + c$ Substitute $(3; -1)$ $-1 = 3 + c$ $c = -4$ $y = x - 4$	✓ $x - 3$ ✓ -1 ✓ answer (3) ✓✓ substitute $(3; -1)$ ✓ answer (3) [19]

QUESTION 9

<p>9.1</p>	 <p> $x^2 - 2x - 3 = 0$ $(x - 3)(x + 1) = 0$ $x = 3 \text{ or } x = -1$ $x = \frac{-2}{2(-1)} = 1$ $y = -(1)^2 + 2(1) + 3 = 4$ </p> <p> $0 = 1 - 2^x$ $2^x = 2^0$ $x = 0$ </p> <p> $y = 1 - 2^0$ $y = 0$ </p>	<p>f:</p> <ul style="list-style-type: none"> ✓ shape ✓ x-int ✓ y-int ✓✓ turning point <p>g:</p> <ul style="list-style-type: none"> ✓ shape ✓ x-int ✓ y-int ✓ asymptote <p>(9)</p>
<p>9.2</p>	<p>Average gradient = $\frac{f(0) - f(-3)}{0 - (-3)}$</p> $= \frac{3 - (-12)}{3}$ $= 5$	<ul style="list-style-type: none"> ✓ correct formula ✓ $f(-3) = -12$ ✓ answer <p>(3)</p>
<p>9.3</p>	<p>$-1 \leq x \leq 0 \text{ or } x \geq 3$</p>	<ul style="list-style-type: none"> ✓ $-1 < x$ ✓ $x < 0$ ✓ $x > 3$ <p>(3)</p>
<p>9.4</p>	<p>Given: $f(x) + c = 0$ has one solution/equal roots i.e. $f(x) = -c$ has one solution $\Rightarrow -c = f(1) = 4$ $\Rightarrow c = -4$</p> <p>OR</p> <p>h is f translated 4 units down y-intercept of h will then be at -1 $\therefore 3 + c = -1$ $c = -4$</p>	<ul style="list-style-type: none"> ✓ $-c = f(1)$ ✓ answer <p>(2)</p> <ul style="list-style-type: none"> ✓ $3 + c = -1$ ✓ answer <p>(2)</p>
<p>9.5</p>	<p>$(0; 1)$</p>	<ul style="list-style-type: none"> ✓✓ $(0; 1)$ <p>(2)</p>
<p>9.6</p>	<p>$k(x) = 1 - 2^{-x}$</p>	<ul style="list-style-type: none"> ✓ answer <p>(1)</p> <p>[20]</p>

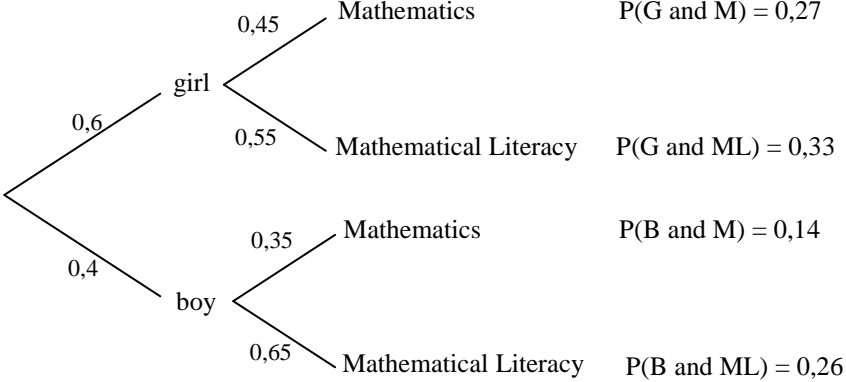
QUESTION 10

<p>Range of $f(-\infty;7] \Rightarrow$ y-part of turning point [Max value of $f(x)$] is 7 $a < 0$ and shape </p> <p>$b < 0 \Rightarrow b$ negative \Rightarrow axis of symmetry on left of y-axis</p> <p>roots real, unequal & opposite signs \Rightarrow x-ints on opposite sides of y-axis</p> 	<p>✓ shape</p> <p>✓ turning point at $y = 7$</p> <p>✓ axis of symmetry on left of y-axis</p> <p>✓ roots are on opposite sides</p> <p style="text-align: right;">[4]</p>
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QUESTION 11

11.1	<p>No, W and T are not mutually exclusive Because $P(W \text{ and } T) \neq 0$</p> <p>OR</p> <p>No, W and T are not mutually exclusive Because $P(W \text{ or } T) = 0,61 \neq 0,75 = P(W) + P(T)$</p>	<p>✓ not mutually exclusive ✓ $P(W \text{ and } T) \neq 0$</p> <p style="text-align: right;">(2)</p>
11.2	<p>$P(W \text{ and } T) = 0,14$ (given)</p> <p>and</p> <p>$P(W) \times P(T) = 0,4 \times 0,35 = 0,14$ $\Rightarrow P(W \text{ and } T) = P(W) \times P(T)$ Therefore yes, W and T are independent events</p>	<p>✓ $P(W) \times P(T) = 0,14$ ✓ $P(W \text{ and } T) = P(W) \times P(T)$ ✓ conclusion (yes)</p> <p style="text-align: right;">(3) [5]</p>

QUESTION 12

12.1.1	$a = 5$ $b = 4$ $c = 8$ $d = 1$ $e = 6$	✓ $a = 5$ ✓ $b = 4$ ✓ $c = 8$ ✓ $d = 1$ ✓ $e = 6$ (5)
12.1.2	6	✓ answer (1)
12.1.3	$\frac{4}{33}$	✓ answer (1)
12.1.4	$\frac{4 + 3 + 2 + a + b + c}{33} = \frac{26}{33}$	✓ answer (1)
12.2	 <p> $P(\text{Mathematics}) = P(\text{G and M}) + P(\text{B and M})$ $= (0,6)(0,45) + (0,4)(0,35)$ $= 0,27 + 0,14$ $= 0,41$ </p>	P(G and M) = 0,27 P(G and ML) = 0,33 P(B and M) = 0,14 P(B and ML) = 0,26 ✓ 0,4 ✓ 0,45 ✓ 0,35 ✓ P(G and M) = 0,27 ✓ P(B and M) = 0,14 ✓ answer (6) [14]

TOTAL: 150