



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

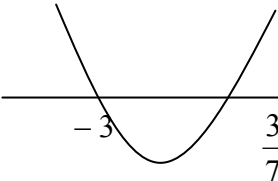
FEBRUARY/MARCH 2011

MEMORANDUM

MARKS: 150

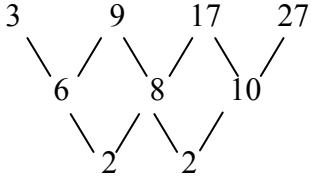
This memorandum consists of 20 pages.

QUESTION 1

<p>1.1.1</p>	$x^2 - x = 12$ $x^2 - x - 12 = 0$ $(x - 4)(x + 3) = 0$ $x = 4 \text{ or } x = -3$ <p>OR</p> $x(x - 1) = 12$ $4(3) = 12$ $(-3)(-4) = 12$ <p>By inspection</p> $x = 4 \text{ or } x = -3$	<p>✓ standard form ✓ factors ✓ answers (3)</p> <p>✓ factors</p> <p>✓✓ answers (3)</p>										
<p>1.1.2</p>	$2x^2 + 3x - 7 = 0$ $x = \frac{-3 \pm \sqrt{(3)^2 - 4(2)(-7)}}{2(2)}$ $= \frac{-3 \pm \sqrt{65}}{4}$ $x = 1,27 \text{ or } x = -2,77$	<p>✓ substitution into correct formula ✓ 65 ✓✓ answers (4)</p>										
<p>1.1.3</p>	$7x^2 + 18x - 9 > 0$ $(7x - 3)(x + 3) > 0$ <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center; border-bottom: 1px solid black;">+</td> <td style="text-align: center; border-bottom: 1px solid black;">0</td> <td style="text-align: center; border-bottom: 1px solid black;">-</td> <td style="text-align: center; border-bottom: 1px solid black;">0</td> <td style="text-align: center; border-bottom: 1px solid black;">+</td> </tr> <tr> <td style="text-align: center;">-3</td> <td></td> <td></td> <td style="text-align: center;">$\frac{3}{7}$</td> <td></td> </tr> </table>  $x < -3 \text{ or } x > \frac{3}{7}$ <p>OR</p> $x \in (-\infty; -3) \cup \left(\frac{3}{7}; \infty\right)$	+	0	-	0	+	-3			$\frac{3}{7}$		<p>✓ factors ✓ $\frac{3}{7}$ and -3 ✓ correct intervals (4)</p>
+	0	-	0	+								
-3			$\frac{3}{7}$									
<p>1.2</p>	$2x - y = 7$ $y = 2x - 7$ <p>Substitute $y = 2x - 7$ into $x^2 + xy = 21 - y^2$</p> $x^2 + x(2x - 7) = 21 - (2x - 7)^2$ $x^2 + 2x^2 - 7x = 21 - 4x^2 + 28x - 49$ $7x^2 - 35x + 28 = 0$ $x^2 - 5x + 4 = 0$ $(x - 4)(x - 1) = 0$ $x = 4 \text{ or } x = 1$ $y = 1 \text{ or } y = -5$	<p>✓ $y = 2x - 7$ ✓ substitution ✓ multiplication ✓ standard form ✓ factors ✓ x-answers ✓ y-answers (7)</p>										

	<p>OR</p> $2x - y = 7$ $x = \frac{7+y}{2}$ <p>Substitute $x = \frac{7+y}{2}$ into $x^2 + xy = 21 - y^2$</p> $\left(\frac{7+y}{2}\right)^2 + \left(\frac{7+y}{2}\right)y = 21 - y^2$ $\frac{49 + 14y + y^2}{4} + \frac{7y + y^2}{2} = 21 - y^2$ $49 + 14y + y^2 + 2(7y + y^2) = 84 - 4y^2$ $49 + 14y + y^2 + 14y + 2y^2 = 84 - 4y^2$ $7y^2 + 28y - 35 = 0$ $y^2 + 4y - 5 = 0$ $(y+5)(y-1) = 0$ $y = -5 \quad \text{or} \quad y = 1$ $x = 1 \quad \quad \quad x = 4$	<p>✓ $x = \frac{7+y}{2}$</p> <p>✓ substitution</p> <p>✓ multiplication</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ x-answers</p> <p>✓ y-answers</p> <p style="text-align: right;">(7)</p>
1.3	$\left(\sqrt[5]{\sqrt{35} + \sqrt{3}}\right)\left(\sqrt[5]{\sqrt{35} - \sqrt{3}}\right)$ $= \sqrt[5]{(\sqrt{35} + \sqrt{3})(\sqrt{35} - \sqrt{3})}$ $= \sqrt[5]{35 - 3}$ $= \sqrt[5]{32}$ $= 2$	<p>✓</p> $\sqrt[5]{(\sqrt{35} + \sqrt{3})(\sqrt{35} - \sqrt{3})}$ <p>✓ $\sqrt[5]{35 - 3}$</p> <p>✓ answer</p> <p style="text-align: right;">(3)</p> <p style="text-align: right;">[21]</p>

QUESTION 2

2.1	39	✓ answer (1)
2.2	 <p>Let $T_n = an^2 + bn + c$ Then $2a = 2$ $a = 1$ $3a + b = 6$ $3(1) + b = 6$ $b = 3$ $a + b + c = 3$ $1 + 3 + c = 3$ $c = -1$ $T_n = n^2 + 3n - 1$</p> <p>OR</p> $2a = 2$ $a = 1$ $c = 3 - 4 = -1$ $T_n = n^2 + bn - 1$ $3 = (1)^2 + b(1) - 1$ (using $T_1 = 3$) $b = 3$ $T_n = n^2 + 3n - 1$	<p>✓ formula ✓ $a = 1$ ✓ $b = 3$ ✓ $c = -1$ (4)</p> <p>✓ $a = 1$ ✓ $c = -1$ ✓ formula ✓ $b = 3$ (4)</p>
2.3	$n^2 + 3n - 1 > 269$ $n^2 + 3n - 270 > 0$ $(n + 18)(n - 15) > 0$ The first value of n is 16 The term is $16^2 + 3(16) - 1 = 303$	<p>✓ $n^2 + 3n - 1 > 269$ ✓ factors ✓ $n = 16$ ✓ answer (4)</p> <p>[9]</p>

QUESTION 3

3.1	$S_{\infty} = 8 + \frac{8}{\sqrt{2}} + \dots$ $r = \frac{1}{\sqrt{2}} \quad \text{and}$ $s_{\infty} = \frac{a}{1-r}$ $= \frac{8}{1 - \frac{1}{\sqrt{2}}}$ $= \frac{8\sqrt{2}}{\sqrt{2}-1}$ $= \frac{8\sqrt{2}(\sqrt{2}+1)}{(\sqrt{2}-1)(\sqrt{2}+1)}$ $= 8\sqrt{2}\sqrt{2} + 8\sqrt{2}$ $= 16 + 8\sqrt{2}$ <p>OR</p> $S_{\infty} = 8 + \frac{8}{\sqrt{2}} + \dots$ $r = \frac{1}{\sqrt{2}} \quad \text{and}$ $s_{\infty} = \frac{a}{1-r}$ $= \frac{8}{1 - \frac{1}{\sqrt{2}}}$ $= \frac{8\left(1 + \frac{1}{\sqrt{2}}\right)}{\left(1 - \frac{1}{\sqrt{2}}\right)\left(1 + \frac{1}{\sqrt{2}}\right)}$ $= \frac{8\left(1 + \frac{1}{\sqrt{2}}\right)}{\frac{1}{2}}$ $= 16\left(1 + \frac{1}{\sqrt{2}}\right)$ $= 16 + \frac{16\sqrt{2}}{2}$ $= 16 + 8\sqrt{2}$	$\checkmark r = \frac{1}{\sqrt{2}}$ $\checkmark \text{ substitution}$ $\checkmark \text{ rationalisation}$ $\checkmark \text{ simplification} \quad (4)$ $\checkmark r = \frac{1}{\sqrt{2}}$ $\checkmark \text{ substitution}$ $\checkmark \text{ rationalisation}$ $\checkmark \text{ simplification} \quad (4)$
-----	---	---

<p>3.2.1</p>	$5 + 15 + 45 + \dots + T_{20}$ $= \sum_{n=1}^{20} 5(3)^{n-1}$ <p>OR</p> $5 + 15 + 45 + \dots + T_{20}$ $= 5 \sum_{n=0}^{19} (3)^n$ <p>OR</p> $5 + 15 + 45 + \dots + T_{20}$ $= 5 \sum_{i=l}^{l+19} (3)^{i-l} \quad \text{for any } l \in \mathbb{Z}$	<p>✓ ✓ answer (2)</p> <p>✓ ✓ answer (2)</p> <p>✓ ✓ answer (2)</p>
<p>3.2.2</p>	$5 + 15 + 45 + \dots + T_{20}$ $= \frac{5(3^{20} - 1)}{3 - 1}$ $= 8\,716\,961\,000$	<p>✓ formula ✓ substitution</p> <p>✓ answer (3) [9]</p>

QUESTION 4

<p>4.1.1</p>	$S_{23} = \frac{23}{2}(5(23) + 9)$ $= 1426$	<p>✓ substitution</p> <p>✓ answer (2)</p>
<p>4.1.2</p>	$T_{23} = S_{23} - S_{22}$ $= 1426 - \frac{22}{2}(5(22) + 9)$ $= 1426 - 1309$ $= 117$	<p>✓ statement</p> <p>✓ $S_{22} = 1309$</p> <p>✓ answer (3)</p>
<p>4.2</p>	<p>Arithmetic Sequence: $12 ; 12 + d ; 12 + 2d$ Geometric Sequence: $12 ; 12r ; 12r^2$ $12 + d = 12r$ $d = 12r - 12$ $12 + 12r + 12r^2 = 12 + 12 + d + 12 + 2d + 3$ $12r^2 = 12 + 2(12r - 12) + 3$ $12r^2 = 12 + 24r - 24 + 3$ $12r^2 - 24r + 9 = 0$ $4r^2 - 8r + 3 = 0$ $(2r - 3)(2r - 1) = 0$ $r = \frac{3}{2} \quad \text{or} \quad r = \frac{1}{2}$</p>	<p>✓ equation</p> <p>✓ equation</p> <p>✓ standard form</p> <p>✓ factors</p> <p>✓ answers (6)</p>

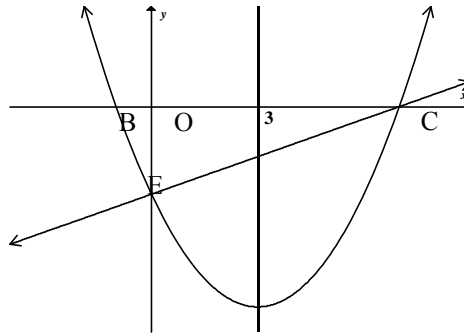
	<p>OR The 3rd term of GP = 3 + 3rd term of AP $12r^2 = 3 + 12 + 2d$ $12r^2 = 15 + 24r - 24$ $12r^2 - 24r + 9 = 0$ $4r^2 - 8r + 3 = 0$ $(2r - 3)(2r - 1) = 0$ $r = \frac{3}{2}$ or $r = \frac{1}{2}$</p>	<p>✓ equation ✓ equation ✓ standard form ✓ factors ✓ answers</p> <p style="text-align: right;">[11]</p>
--	--	--

QUESTION 5

5.1	$x = 1$ $y = -2$	<p>✓✓ answers (2)</p>
5.2	<p>y-intercept: $y = \frac{3}{0-1} - 2 = -5$ x-intercept: $(\frac{5}{2}; 0)$ $0 = \frac{3}{x-1} - 2$ $2 = \frac{3}{x-1}$ $2x - 2 = 3$ $2x = 5$ $x = \frac{5}{2}$</p>	<p>✓ $y = -5$ ✓ substitute $y = 0$ ✓ answer (3)</p>
5.3		<p>✓ asymptotes ✓ y-intercept ✓ shape (3)</p>

5.4	$-f(x) = \frac{-3}{x-1} + 2$ $y \in \mathbb{R} - \{2\} \quad \text{OR} \quad y \in (-\infty; 2) \cup (2; \infty) \quad \text{OR} \quad y \in \mathbb{R}; y \neq 2$	✓ answer (1)
5.5	$g(x) = \frac{-3}{x+1} - 2$ $= \frac{3}{-x-1} - 2$ Reflection of f about the y -axis. OR (i) horizontal shift 2 units to the left followed by (ii) reflection in x -axis, followed by (iii) vertical downward shift of 4 units	✓ manipulation ✓ answer (2) [11]

QUESTION 6



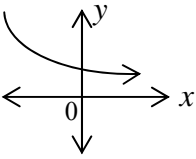
6.1	$\frac{x}{2} - \frac{7}{2} = 0$ $x = 7$ $C(7; 0)$ OR $y = \frac{7}{2} - \frac{7}{2}$ $y = 0$ $C(7; 0)$	$\frac{x}{2} - \frac{7}{2} = 0$ (1) ✓ substitution ✓ answer (2)
6.2	$x\text{-coordinate of B is}$ $3 - 4 = -1$	✓ answer (1)

<p>6.3</p>	<p>OPTION 1</p> $f(x) = a(x - 3)^2 + q$ <p>At B and C: $0 = 16a + q$</p> <p>At E: $-\frac{7}{2} = 9a + q$</p> <p>Solving simultaneously gives</p> $a = \frac{1}{2} \text{ and } q = -8$ <p>OPTION 2</p> $f(x) = a(x + 1)(x - 7)$ $y = a(x + 1)(x - 7)$ $-3,5 = a(0 + 1)(0 - 7)$ $-3,5 = -7a$ $a = \frac{1}{2}$ $f(x) = \frac{1}{2}(x + 1)(x - 7)$ $= \frac{1}{2}(x^2 - 6x - 7)$ $= \frac{1}{2}[(x - 3)^2 - 16]$ $= \frac{1}{2}(x - 3)^2 - 8$ <p>OPTION 3</p> $a = \frac{1}{2}$ <p>Axis of symmetry: $x = 3$ or $x = \frac{-1 + 7}{2} = 3$</p> $f(x) = \frac{1}{2}(x - 3)^2 + q$ $0 = \frac{1}{2}(7 - 3)^2 + q$ $q = -8$ $y = \frac{1}{2}(x - 3)^2 - 8$	<p>✓ substitution ✓ substitution</p> <p>✓ substitution</p> <p>✓✓ $a = \frac{1}{2}$ ✓ $q = -8$</p> <p>(6)</p> <p>✓ substitution</p> <p>✓ substitution</p> <p>✓ $a = \frac{1}{2}$ ✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p>(6)</p> <p>✓✓✓ $a = \frac{1}{2}$</p> <p>✓ substitution</p> <p>✓ substitution</p> <p>✓ answer</p> <p>(6)</p>
------------	--	---

	<p>OPTION 4</p> $a = \frac{1}{2}$ <p>Axis of symmetry: $x = 3$</p> $f(x) = \frac{1}{2}(x-3)^2 + q$ $q = f(3)$ $q = \frac{1}{2}(3+1)(3-7)$ $q = -8$ $y = \frac{1}{2}(x-3)^2 - 8$	<p>✓✓✓ $a = \frac{1}{2}$</p> <p>✓ substitution</p> <p>✓ substitution</p> <p>✓ answer</p> <p>(6)</p>
<p>6.4</p>	$h(x) = -f(x) = -\frac{1}{2}(x-3)^2 + 8$	<p>✓ answer</p> <p>(1)</p>
<p>6.5</p>	$1 - f(x) = -\frac{1}{2}(x-3)^2 + 9$ <p>∴ Maximum value is 9.</p> <p>OR</p> <p>Maximum value = $1 - (-8)$ = 9</p> <p>OR</p> $t(x) = -\frac{1}{2}x^2 + 3x + \frac{9}{2}$ $t'(x) = -x + 3 = 0$ $\text{Max } V_{at\ x=3} = -\frac{1}{2}(3)^2 + 3(3) + \frac{9}{2} = 9$	<p>✓ method</p> <p>✓ answer</p> <p>(2)</p>
<p>6.6</p>	$f(x^2 - 2) = 0$ $f(x) = 0 \text{ if } x = -1 \text{ or } x = 7$ $\therefore f(x^2 - 2) = 0 \text{ if } x^2 - 2 = -1 \text{ or } x^2 - 2 = 7$ $\therefore x^2 = 1 \quad \text{or} \quad x^2 = 9$ $\therefore x = 1 \text{ or } x = -1 \quad \text{or} \quad x = 3 \text{ or } x = -3$	<p>✓ substitution</p> <p>✓ simplification</p> <p>✓ answer</p> <p>✓ answer</p> <p>(4)</p>

	$\frac{1}{2}(x^2 - 2 - 3)^2 - 8 = 0$ $\frac{1}{2}(x^2 - 5)^2 = 8$ $(x^2 - 5)^2 = 16$ $x^2 - 5 = 4 \quad \text{or} \quad x^2 - 5 = -4$ $x^2 = 9 \quad \text{or} \quad x^2 = 1$ $x = 3 \quad \text{or} \quad x = -3 \quad \text{or} \quad x = 1 \quad \text{or} \quad x = -1$ <p>OR</p> $f(x^2 - 2) = 0$ $\frac{1}{2}(x^2 - 2 - 3)^2 - 8 = 0$ $\frac{1}{2}(x^2 - 5)^2 = 8$ $(x^2 - 5)^2 - 16 = 0$ $(x^2 - 5 - 4)(x^2 - 5 + 4) = 0$ $(x^2 - 9)(x^2 - 1) = 0$ $(x - 3)(x + 3)(x - 1)(x + 1) = 0$ $x = 3 \quad \text{or} \quad x = -3 \quad \text{or} \quad x = 1 \quad \text{or} \quad x = -1$	<p>✓ substitution</p> <p>✓ simplification</p> <p>✓ factors</p> <p>✓ answer</p> <p>(4)</p> <p>✓ substitution</p> <p>✓ simplification</p> <p>✓ factors</p> <p>✓ answer</p> <p>(4)</p> <p>[15]</p>
--	---	---

QUESTION 7

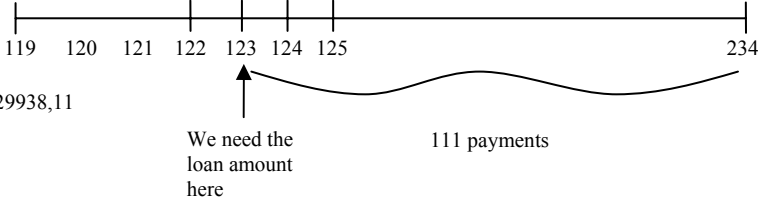
7.1	<p>Decreasing function Since $0 < a < 1$ OR As x increases, $f(x)$ decreases</p>	<p>✓ decreasing</p> <p>✓ $a < 1$</p> <p>(2)</p>
7.2	<p>$f^{-1} : x = \left(\frac{1}{3}\right)^y$ OR </p> <p>$y = \log_{\frac{1}{3}} x$</p> <p>OR</p> <p>$f^{-1} : x = \left(\frac{1}{3}\right)^y$</p> <p>$y = -\log_3 x$</p>	<p>✓ $x = \left(\frac{1}{3}\right)^y$</p> <p>✓ $y = \log_{\frac{1}{3}} x$ or</p> <p>$y = -\log_3 x$</p> <p>(2)</p>
7.3	<p>$y = -5$</p>	<p>✓ answer</p> <p>(1)</p>

7.4	<p>Reflection about $y = x$. Reflection about the x-axis.</p> <p>OR</p> <p>Reflection about the y-axis. Then reflection about the line $y = x$.</p> <p>OR</p> <p>Reflection about the line $y = -x$ followed by reflection about the y-axis.</p> <p>OR</p> <p>Rotation through 90° in a clockwise direction.</p> <p>OR</p> <p>Rotation through 90° in an anti-clockwise direction. Reflection through the origin.</p>	<p>✓ reflection about $y = x$ ✓ reflection about y-axis (2)</p> <p>✓ reflection about y-axis ✓ reflection about $y = x$ (2)</p> <p>✓ rotation through 90° ✓ clockwise direction (2)</p> <p>✓ answer ✓ answer (2) [7]</p>
-----	---	---

QUESTION 8

8.1	<p>$A = P(1 + i)^n$</p> <p>$1711,41 = 1430,77 \left(1 + \frac{i}{12}\right)^{18}$</p> <p>$\left(1 + \frac{i}{12}\right)^{18} = 1,196146131... \quad \mathbf{OR} \quad \left[\frac{1711,41}{1430,77}\right]^{\frac{1}{18}} = 1,00999...$</p> <p>$1 + \frac{i}{12} = 1,009999937... \quad \therefore i = 12(1,01 - 1)$</p> <p>$i = 0,1199992431... = 12\%$</p> <p>Rate = 12, 00% p.a. compounded monthly.</p>	<p>✓ substitution</p> <p>✓ $\left(1 + \frac{i}{12}\right)^{18} = 1,196146131...$</p> <p>✓ $1 + \frac{i}{12} = 1,009999937...$</p> <p>✓ answer (4)</p>
-----	--	---

<p>8.2.1</p>	$P_v = \frac{x[1 - (1 + i)^{-n}]}{i}$ $800000 = \frac{10000 \left[1 - \left(1 + \frac{0,14}{12} \right)^{-n} \right]}{\frac{0,14}{12}}$ $1 - \left(1 + \frac{0,14}{12} \right)^{-n} = \frac{14}{15} \quad (= 0,933333)$ $\left(1 + \frac{0,14}{12} \right)^{-n} = \frac{1}{15} \quad (= 0,06666666)$ $\log \left(1 + \frac{0,14}{12} \right)^{-n} = \log \frac{1}{15}$ $-n \log \left(1 + \frac{0,14}{12} \right) = \log \frac{1}{15} \quad \left(\begin{array}{l} -n = \frac{\log \frac{1}{15}}{\log \left(1 + \frac{0,14}{12} \right)} \\ = -233,47 \end{array} \right)$ $n = 233,47$ <p>∴ the loan will be paid off at the end of the 234th month</p> <p>OR</p> <p>Balance outstanding after 233rd month</p> $= 800000 \left(1 + \frac{0,14}{12} \right)^{233} - \frac{10000 \left[\left(1 + \frac{0,14}{12} \right)^{233} - 1 \right]}{\frac{0,14}{12}}$ <p>= R4 660,04 which is less than R10 000 Therefore the loan will be paid off after 234 months.</p> <p>OR</p> <p>Total value of the loan after 234 payments</p> $= \frac{10000 \left(1 - \left(1 + \frac{0,14}{12} \right)^{-234} \right)}{\frac{0,14}{12}}$ <p>= R800 350,21 > R800 000 and the differences is less than R10 000 Therefore the loan will be paid off after 234 months.</p>	<p>✓ substitute into P_v</p> <p>✓ $i = \frac{0,14}{12}$</p> <p>✓ using logs</p> <p>✓ answer (4)</p> <p>✓ substitution into P formula</p> <p>✓ 234</p> <p>✓ answer</p> <p>✓ argument (4)</p> <p>✓ substitution into F formula</p> <p>✓ 234</p> <p>✓ answer</p> <p>✓ argument (4)</p>
--------------	--	--

<p>8.2.2</p> <p>Balance Outstanding after 119 months</p> $= 800000 \left(1 + \frac{0,14}{12}\right)^{119} - \frac{10000 \left[\left(1 + \frac{0,14}{12}\right)^{119} - 1 \right]}{\frac{0,14}{12}}$ <p>= R629 938,11</p>  <p>R629938,11</p> <p>Total Payable at the end of the 123rd month</p> $= 629\,938,11 \left(1 + \frac{0,14}{12}\right)^4$ <p>= R659 853,68</p> <p>New instalment:</p> $659\,853,68 = \frac{x \left[1 - \left(1 + \frac{0,14}{12}\right)^{-111} \right]}{\frac{0,14}{12}}$ <p>$x = R10\,632,39$</p>	<p>✓ $800000 \left(1 + \frac{0,14}{12}\right)^{119}$</p> <p>✓ $\frac{10000 \left[\left(1 + \frac{0,14}{12}\right)^{119} - 1 \right]}{\frac{0,14}{12}}$</p> <p>✓ R629 938,11</p> <p>✓ $629938,11 \left(1 + \frac{0,14}{12}\right)^4$</p> <p>✓ R659 853,68</p> <p>✓ substitution into P_v</p> <p>✓ answer</p> <p style="text-align: right;">(7) [15]</p>
--	--

QUESTION 9

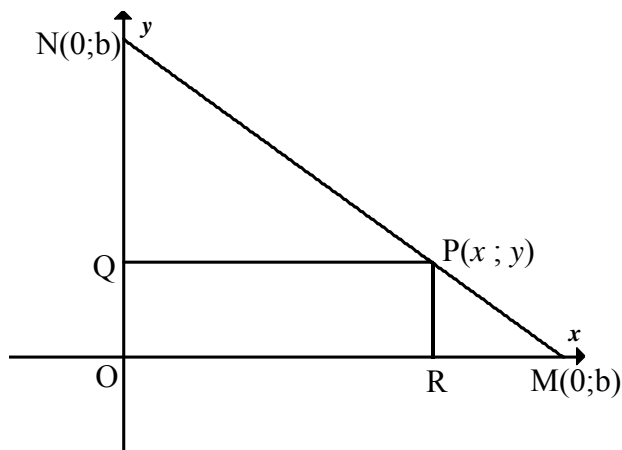
9.1	$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \rightarrow 0} \frac{1 - 3(x+h)^2 - (1 - 3x^2)}{h}$ $= \lim_{h \rightarrow 0} \frac{1 - 3x^2 - 6xh - 3h^2 - 1 + 3x^2}{h}$ $= \lim_{h \rightarrow 0} \frac{-6xh - 3h^2}{h}$ $= \lim_{h \rightarrow 0} \frac{h(-6x - 3h)}{h}$ $= \lim_{h \rightarrow 0} (-6x - 3h)$ $= -6x$	<p>✓ substitution into formula</p> <p>✓ $1 - 3x^2 - 6xh - 3h^2$</p> <p>✓ $h(-6x - 3h)$</p> <p>✓ answer</p> <p>(4)</p>
9.2	$D_x \left[4 - \frac{4}{x^3} - \frac{1}{x^4} \right]$ $= D_x \left[4 - 4x^{-3} - x^{-4} \right]$ $= 12x^{-4} + 4x^{-5}$	<p>✓ simplification</p> <p>✓✓ answer</p> <p>(3)</p>
9.3	$y = (1 + \sqrt{x})^2$ $y = 1 + 2\sqrt{x} + x$ $y = 1 + 2x^{\frac{1}{2}} + x$ $\frac{dy}{dx} = x^{-\frac{1}{2}} + 1$	<p>✓ expansion</p> <p>✓ $x^{-\frac{1}{2}}$</p> <p>✓ 1</p> <p>(3)</p> <p>[10]</p>

QUESTION 10

<p>10.1</p>	<p>$(-6)(-3)(+2) = 36$</p> <p>y-intercept is 36</p> <p>OR</p> <p>$g(x) = (x-6)(x^2 - x - 6)$ $g(x) = x^3 - 7x^2 + 36$ y-intercept : (0;36)</p>	<p>✓ $(-6)(-3)(+2)$</p> <p>✓ y-intercept is 36 (1)</p> <p>✓ trinomial</p> <p>✓ 36 (1)</p>
<p>10.2</p>	<p>$g(x) = 0$ $x = 6$ or $x = 3$ or $x = -2$ intercepts are (6 ; 0) and (3 ; 0) and (-2 ; 0)</p>	<p>✓ $g(x) = 0$</p> <p>✓ all x-intercepts (2)</p>
<p>10.3</p>	<p>$g(x) = (x-6)(x^2 - x - 6)$ $= x^3 - 7x^2 + 36$ $g'(x) = 3x^2 - 14x$ $0 = x(3x - 14)$ $x = 0$ or $x = \frac{14}{3}$</p> <p>Turning points are (0 ; 36) and $(\frac{14}{3} ; -\frac{400}{27})$</p>	<p>✓ $x^3 - 7x + 36$</p> <p>✓ $g'(x) = 3x^2 - 14x$</p> <p>✓ $g'(x) = 0$</p> <p>✓ answers</p> <p>✓✓ points (6)</p>
<p>10.4</p>		<p>✓ x-intercepts</p> <p>✓✓ turning points</p> <p>✓ shape (4)</p>

10.5	$g(x).g'(x < 0$ $x < -2$ or $0 < x < 3$ or $\frac{14}{3} < x < 6$	1 mark for each inequality (3) [16]
------	--	--

QUESTION 11



11.1	$m = -\frac{b}{a}$ $y - b = \frac{-b}{a}(x - 0)$ $y = \frac{-b}{a}x + b$ OR $y = mx + b$ $0 = ma + b$ $m = \frac{-b}{a}$ $y = -\frac{b}{a}x + b$ OR $\frac{x}{a} + \frac{y}{b} = 1$	✓ $m = -\frac{b}{a}$ ✓ answer (2)
11.2	$A = xy$ $A = x\left(\frac{-bx}{a} + b\right)$ $= -\frac{b}{a}x^2 + bx$ $\frac{dA}{dx} = -\frac{2b}{a}x + b$ $0 = -\frac{2b}{a}x + b$ $-ba = -2bx$ $x = \frac{a}{2}$ $y = -\frac{b}{a}\left(\frac{a}{2}\right) + b$ $= \frac{b}{2}$ $P\left(\frac{a}{2}; \frac{b}{2}\right)$ which is the midpoint of MN OR	✓ area formula ✓ substitution ✓ $\frac{dA}{dx} = -\frac{2b}{a}x + b$ ✓ $\frac{dA}{dx} = 0$ ✓ x-value ✓ y-value (6)

	$\frac{x}{a} + \frac{y}{b} = 1$ $\frac{y}{b} = 1 - \frac{x}{a}$ <p>To maximise xy, we maximise</p> $\frac{xy}{ab} = \frac{x}{a} \left(\frac{y}{b} \right) = \frac{x}{a} \left(1 - \frac{x}{a} \right)$ <p>This is a maximum when $\frac{x}{a} = \frac{1}{2}$ i.e. $x = \frac{a}{2}$</p> <p>By the midpoint theorem, P is then the midpoint of MN.</p>	<p>(6) [8]</p>
--	--	--------------------

QUESTION 12

12.1	$x \geq 1$ $y \leq 12$ $x + y \geq 10$ $x + y \leq 15$ $y \geq 2x$ $x, y \in N_0$	<ul style="list-style-type: none"> ✓ $x \geq 1$ ✓ $y \leq 12$ ✓ $x + y \geq 10$ ✓ $x + y \leq 15$ ✓✓ $y \geq 2x$ <p>(6)</p>
12.2		<ul style="list-style-type: none"> ✓ $x \geq 1$; ✓ $y \leq 12$ ✓ $x + y \leq 15$ ✓ $x + y \geq 10$ ✓ $y \geq 2x$ ✓✓ feasible region <p>(7)</p>
12.3	<p>No. The point (5 ; 8) lies outside the feasible region</p> <p style="text-align: center;">OR</p> <p>8 is not greater than $2(5) = 10$</p>	<ul style="list-style-type: none"> ✓ No ✓ Reason <p>(2)</p>

