basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

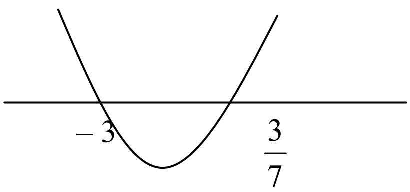
FEBRUARY/MARCH 2011

MEMORANDUM

MARKS: 150

This memorandum consists of 20 pages.

QUESTION 1

1.1.1	$x^2 - x = 12$ $x^2 - x - 12 = 0$ $(x-4)(x+3) = 0$ $x = 4$ or $x = -3$ **OR** $x(x-1) = 12$ $4(3) = 12$ $(-3)(-4) = 12$ By inspection $x = 4$ or $x = -3$	✓ standard form ✓ factors ✓ answers (3) ✓ factors ✓✓ answers (3)
1.1.2	$2x^2 + 3x - 7 = 0$ $x = \dfrac{-3 \pm \sqrt{(3)^2 - 4(2)(-7)}}{2(2)}$ $= \dfrac{-3 \pm \sqrt{65}}{4}$ $x = 1{,}27$ or $x = -2{,}77$	✓ substitution into correct formula ✓ 65 ✓✓ answers (4)
1.1.3	$7x^2 + 18x - 9 > 0$ $(7x-3)(x+3) > 0$ $+ \quad 0 \quad - \quad 0 \quad +$ $-3 \qquad \frac{3}{7}$  $x < -3$ or $x > \dfrac{3}{7}$ **OR** $x \in (-\infty\,;-3) \cup \left(\dfrac{3}{7}\,;\infty\right)$	✓ factors ✓ $\frac{3}{7}$ *and* -3 ✓ correct intervals (4)
1.2	$2x - y = 7$ $y = 2x - 7$ Substitute $y = 2x - 7$ into $x^2 + xy = 21 - y^2$ $x^2 + x(2x-7) = 21 - (2x-7)^2$ $x^2 + 2x^2 - 7x = 21 - 4x^2 + 28x - 49$ $7x^2 - 35x + 28 = 0$ $x^2 - 5x + 4 = 0$ $(x-4)(x-1) = 0$ $x = 4$ or $x = 1$ $y = 1$ or $y = -5$	✓ $y = 2x - 7$ ✓ substitution ✓ multiplication ✓standard form ✓ factors ✓ x-answers ✓ y-answers (7)

	OR $2x - y = 7$ $x = \dfrac{7+y}{2}$ Substitute $x = \dfrac{7+y}{2}$ into $x^2 + xy = 21 - y^2$ $\left(\dfrac{7+y}{2}\right)^2 + \left(\dfrac{7+y}{2}\right)y = 21 - y^2$ $\dfrac{49+14y+y^2}{4} + \dfrac{7y+y^2}{2} = 21 - y^2$ $49 + 14y + y^2 + 2(7y + y^2) = 84 - 4y^2$ $49 + 14y + y^2 + 14y + 2y^2 = 84 - 4y^2$ $7y^2 + 28y - 35 = 0$ $y^2 + 4y - 5 = 0$ $(y+5)(y-1) = 0$ $y = -5$ or $y = 1$ $x = 1$ $x = 4$	✓ $x = \dfrac{7+y}{2}$ ✓ substitution ✓ multiplication ✓standard form ✓ factors ✓ x-answers ✓ y-answers (7)
1.3	$\left(\sqrt[5]{\sqrt{35}+\sqrt{3}}\right)\left(\sqrt[5]{\sqrt{35}-\sqrt{3}}\right)$ $= \sqrt[5]{(\sqrt{35}+\sqrt{3})(\sqrt{35}-\sqrt{3})}$ $= \sqrt[5]{35-3}$ $= \sqrt[5]{32}$ $= 2$	✓ $\sqrt[5]{(\sqrt{35}+\sqrt{3})(\sqrt{35}-\sqrt{3})}$ ✓ $\sqrt[5]{35-3}$ ✓ answer (3) **[21]**

QUESTION 2

2.1	39	✓ answer (1)
2.2	$\begin{array}{ccccccc} 3 & & 9 & & 17 & & 27 \\ & 6 & & 8 & & 10 & \\ & & 2 & & 2 & & \end{array}$ Let $T_n = an^2 + bn + c$ Then $2a = 2$ $a = 1$ $3a + b = 6$ $3(1) + b = 6$ $b = 3$ $a + b + c = 3$ $1 + 3 + c = 3$ $c = -1$ $T_n = n^2 + 3n - 1$	✓ formula ✓ $a = 1$ ✓ $b = 3$ ✓ $c = -1$ (4)
	OR $2a = 2$ $a = 1$ $c = 3 - 4 = -1$ $T_n = n^2 + bn - 1$ $3 = (1)^2 + b(1) - 1$ (using $T_1 = 3$) $b = 3$ $T_n = n^2 + 3n - 1$	✓ $a = 1$ ✓ $c = -1$ ✓ formula ✓ $b = 3$ (4)
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 $16^2 + 3(16) - 1 = 303$	✓ $n^2 + 3n - 1 > 269$ ✓ factors ✓ $n = 16$ ✓ answer (4) **[9]**

QUESTION 3

3.1	$S_\infty = 8 + \frac{8}{\sqrt{2}} + ...$ $r = \frac{1}{\sqrt{2}}$ and $s_\infty = \frac{a}{1-r}$ $= \frac{8}{1-\frac{1}{\sqrt{2}}}$ $= \frac{8\sqrt{2}}{\sqrt{2}-1}$ $= \frac{8\sqrt{2}(\sqrt{2}+1)}{(\sqrt{2}-1)(\sqrt{2}+1)}$ $= 8\sqrt{2}\sqrt{2} + 8\sqrt{2}$ $= 16 + 8\sqrt{2}$	✓ $r = \frac{1}{\sqrt{2}}$ ✓ substitution ✓ rationalisation ✓ simplification (4)
	OR	
	$S_\infty = 8 + \frac{8}{\sqrt{2}} + ...$ $r = \frac{1}{\sqrt{2}}$ and $s_\infty = \frac{a}{1-r}$ $= \frac{8}{1-\frac{1}{\sqrt{2}}}$ $= \frac{8\left(1+\frac{1}{\sqrt{2}}\right)}{\left(1-\frac{1}{\sqrt{2}}\right)\left(1+\frac{1}{\sqrt{2}}\right)}$ $= \frac{8\left(1+\frac{1}{\sqrt{2}}\right)}{\frac{1}{2}}$ $= 16\left(1+\frac{1}{\sqrt{2}}\right)$ $= 16 + \frac{16\sqrt{2}}{2}$ $= 16 + 8\sqrt{2}$	✓ $r = \frac{1}{\sqrt{2}}$ ✓ substitution ✓ rationalisation ✓ simplification (4)

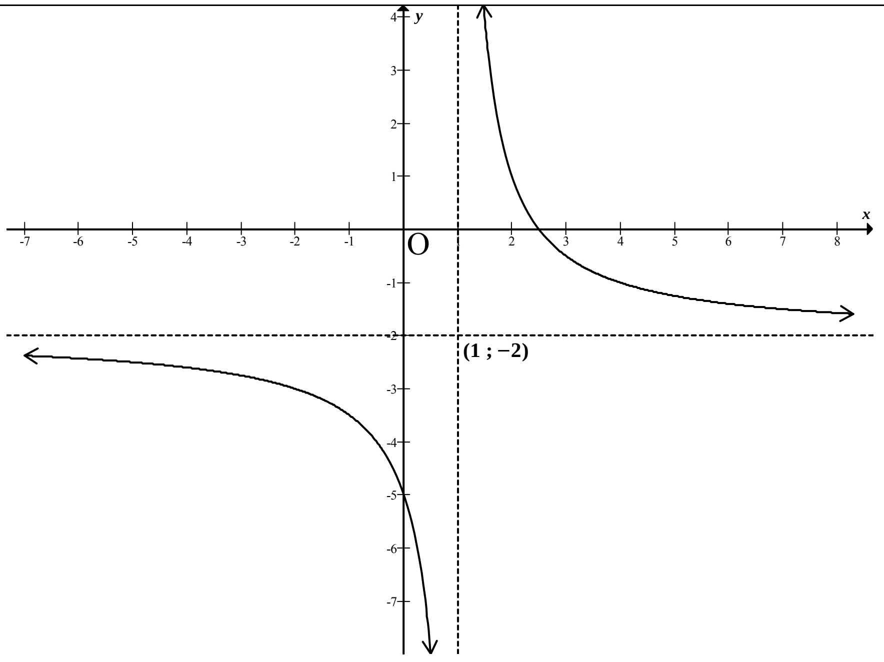
3.2.1	5 + 15 + 45 + … + T_{20} $= \sum_{n=1}^{20} 5(3)^{n-1}$ **OR** 5 + 15 + 45 + … + T_{20} $= 5\sum_{n=0}^{19} (3)^{n}$ **OR** 5 + 15 + 45 + … + T_{20} $= 5\sum_{i=l}^{l+19} (3)^{i-l}$ for any $l \in Z$	✓ ✓answer (2) ✓ ✓answer (2) ✓ ✓answer (2)
3.2.2	$5+15+45+...+T_{20}$ $= \frac{5(3^{20}-1)}{3-1}$ = 8 716 961 000	✓ formula ✓ substitution ✓ answer (3) **[9]**

QUESTION 4

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

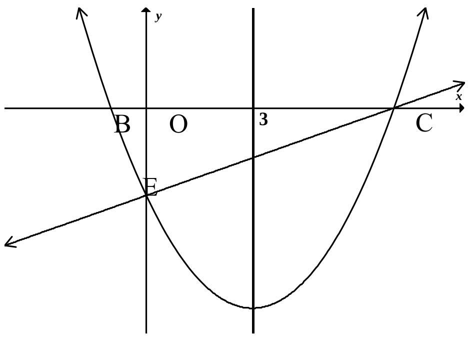
	OR The 3^{rd} term of GP = 3 + 3^{rd} term of AP $12r^2 = 3 + 12 + 2d$ $12r^2 = 15 + 24r - 24$ $12r^2 - 24r + 9 = 0$ $4r^2 - 8r + 3 = 0$ $(2r - 3)(2r - 1) = 0$ $r = \frac{3}{2} \quad or \quad r = \frac{1}{2}$	✓ equation ✓ equation ✓ standard form ✓ factors ✓ answers **[11]**

QUESTION 5

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

5.4	$-f(x)=\dfrac{-3}{x-1}+2$ $y \in R-\{2\}$ OR $y \in (-\infty\,;2)\cup(2\,;\infty)$ OR $y \in R; y \neq 2$	✓ answer (1)
5.5	$g(x)=\dfrac{-3}{x+1}-2$ $=\dfrac{3}{-x-1}-2$ 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



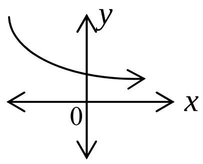
6.1	$\dfrac{x}{2}-\dfrac{7}{2}=0$ $x=7$ C(7 ; 0) OR $y=\dfrac{7}{2}-\dfrac{7}{2}$ $y=0$ C(7 ; 0)	$\dfrac{x}{2}-\dfrac{7}{2}=0$ (1) ✓ substitution ✓ answer (2)
6.2	x- coordinate of B is $3-4=-1$	✓ answer (1)

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

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

	$\frac{1}{2}\left(x^2-2-3\right)^2-8=0$ $\frac{1}{2}\left(x^2-5\right)^2=8$ $\left(x^2-5\right)^2=16$ $x^2-5=4$ or $x^2-5=-4$ $x^2=9$ or $x^2=1$ $x=3$ or $x=-3$ or $x=1$ or $x=-1$ **OR** $f(x^2-2)=0$ $\frac{1}{2}\left(x^2-2-3\right)^2-8=0$ $\frac{1}{2}\left(x^2-5\right)^2=8$ $\left(x^2-5\right)^2-16=0$ $\left(x^2-5-4\right)\left(x^2-5+4\right)=0$ $\left(x^2-9\right)\left(x^2-1\right)=0$ $(x-3)(x+3)(x-1)(x+1)=0$ $x=3$ or $x=-3$ or $x=1$ or $x=-1$	✓ substitution ✓ simplification ✓ factors ✓ answer (4) ✓ substitution ✓ simplification ✓ factors ✓ answer (4) **[15]**

QUESTION 7

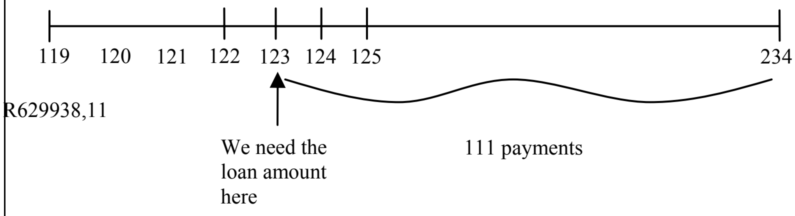
7.1	Decreasing function Since $0< a < 1$ OR As x increases, $f(x)$ decreases	✓ decreasing ✓ $a < 1$ (2)
7.2	$f^{-1}:\quad x=\left(\frac{1}{3}\right)^y$ $y=\log_{\frac{1}{3}} x$ OR  OR $f^{-1}:\quad x=\left(\frac{1}{3}\right)^y$ $y=-\log_3 x$	✓ $x=\left(\frac{1}{3}\right)^y$ ✓ $y=\log_{\frac{1}{3}} x$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

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

QUESTION 8

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

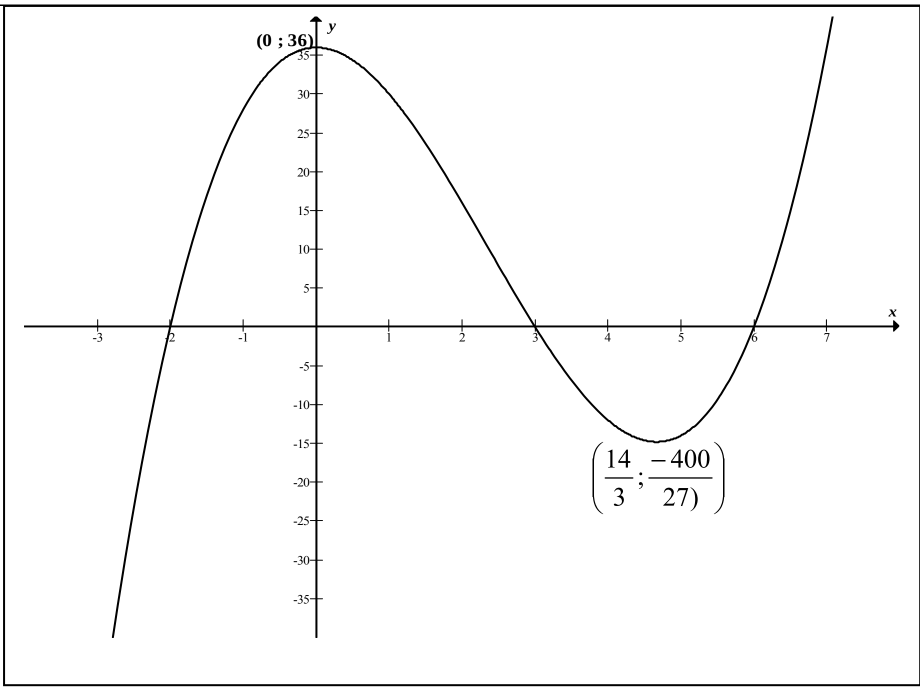
8.2.1	$P_v = \dfrac{x\left[1-(1+i)^{-n}\right]}{i}$ $800000 = \dfrac{10000\left[1-\left(1+\frac{0,14}{12}\right)^{-n}\right]}{\frac{0,14}{12}}$ $1-\left(1+\frac{0,14}{12}\right)^{-n} = \frac{14}{15} \quad (= 0,933333)$ $\left(1+\frac{0,14}{12}\right)^{-n} = \frac{1}{15} \quad (= 0,06666666)$ $\log\left(1+\frac{0,14}{12}\right)^{-n}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

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

QUESTION 9

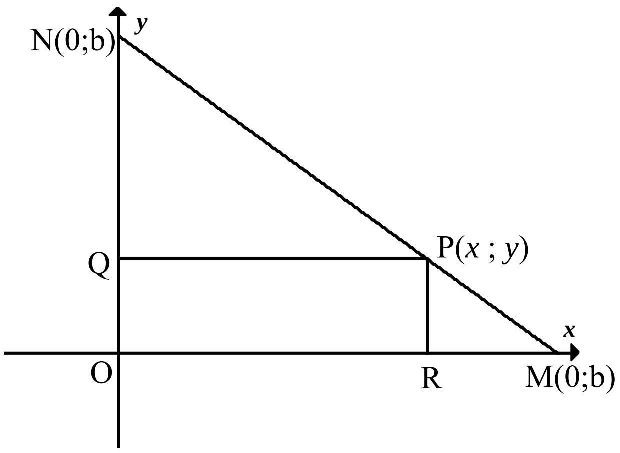
9.1	$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \to 0} \frac{1 - 3(x+h)^2 - (1 - 3x^2)}{h}$ $= \lim_{h \to 0} \frac{1 - 3x^2 - 6xh - 3h^2 - 1 + 3x^2}{h}$ $= \lim_{h \to 0} \frac{-6xh - 3h^2}{h}$ $= \lim_{h \to 0} \frac{h(-6x - 3h)}{h}$ $= \lim_{h \to 0} (-6x - 3h)$ $= -6x$	✓ substitution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

QUESTION 10

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

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

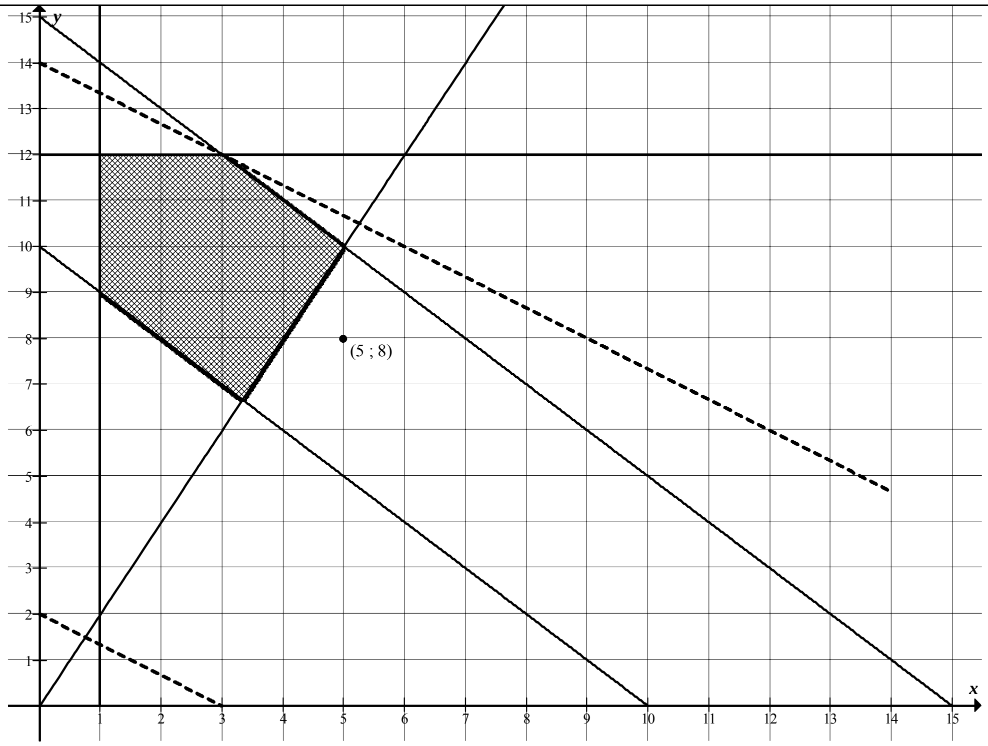
QUESTION 11



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)

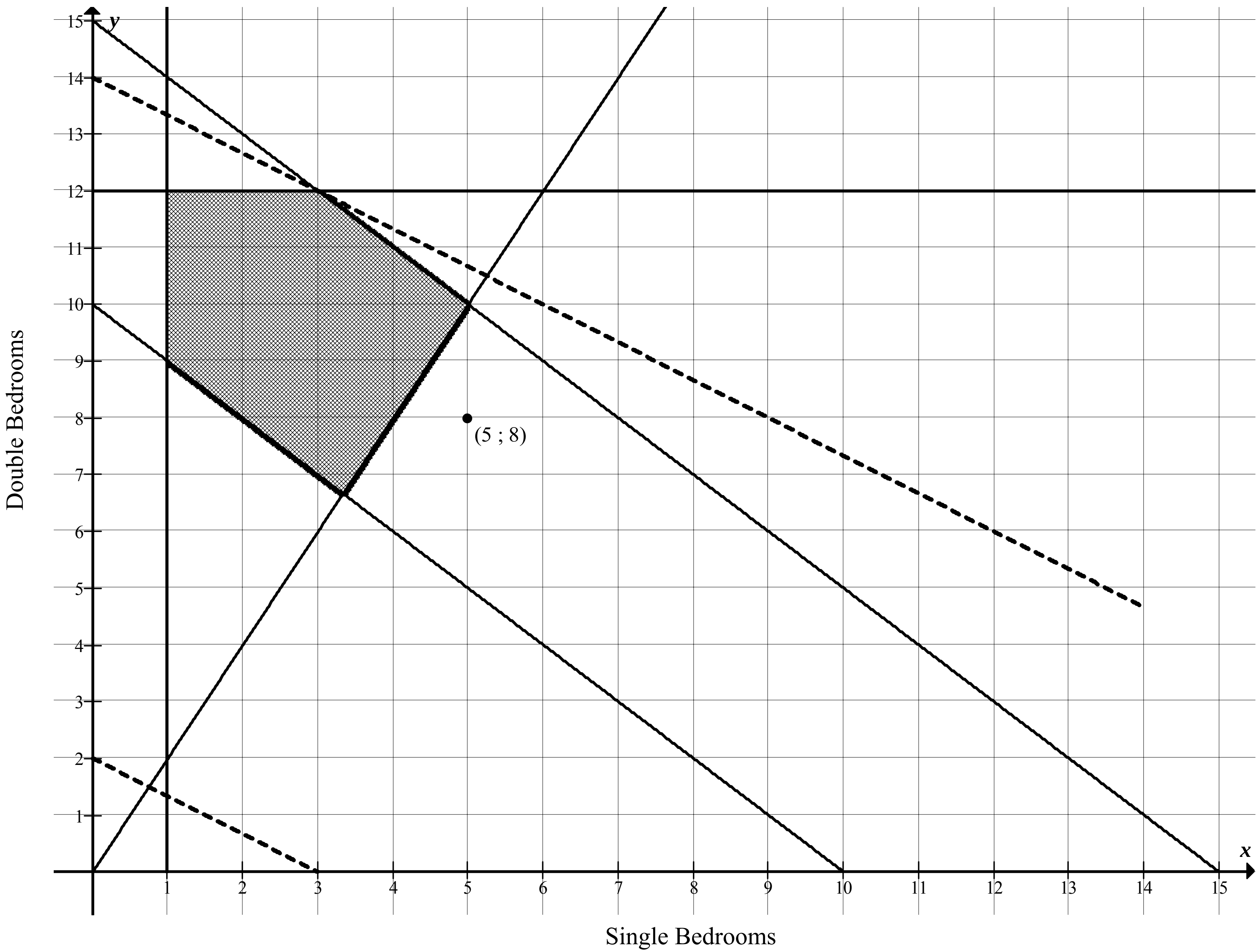
	$\frac{x}{a}+\frac{y}{b}=1$ $\frac{y}{b}=1-\frac{x}{a}$ To maximise *xy*, we maximise $\frac{xy}{ab}=\frac{x}{a}\left(\frac{y}{b}\right)=\frac{x}{a}\left(1-\frac{x}{a}\right)$ This is a maximum when $\frac{x}{a}=\frac{1}{2}$ i.e. $x=\frac{a}{2}$ By the midpoint theorem, P is then the midpoint of MN.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

QUESTION 12

12.1	$x \geq 1$ $y \leq 12$ $x+y \geq 10$ $x+y \leq 15$ $y \geq 2x$ $x, y \in N_0$	✓ $x \geq 1$ ✓ $y \leq 12$ ✓ $x+y \geq 10$ ✓ $x+y \leq 15$ ✓✓ $y \geq 2x$ (6)
12.2		✓ $x \geq 1$; ✓ $y \leq 12$ ✓ $x+y \leq 15$ ✓ $x+y \geq 10$ ✓ $y \geq 2x$ ✓ ✓feasible region (7)
12.3	No. The point (5 ; 8) lies outside the feasible region **OR** 8 is not greater than 2(5) =10	✓ No ✓ Reason (2)

12.4	I = 600x + 900y $y = -\frac{2}{3}x + \frac{I}{900}$ Maximum Income at(3 ; 12) 3 single bedrooms and 12 double bedrooms **OR** To optimise profit, the group must build as many rooms as possible and then, as many double rooms as possible. So 15 rooms, 12 double rooms, hence 3 single rooms.	✓ objective function ✓ search line ✓ answer (3) **[18]**

TOTAL: 150


y
x
Double Bedrooms
Single Bedrooms
(5 ; 8)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15