basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 12

MATHEMATICS P1

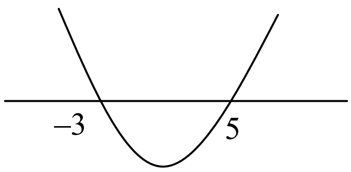
FEBRUARY/MARCH 2012

MEMORANDUM

MARKS: 150

This memorandum consists of 20 pages.

QUESTION 1

1.1.1	$3x^2 - 5x = 2$ $3x^2 - 5x - 2 = 0$ $(3x+1)(x-2) = 0$ $x = -\frac{1}{3}$ or $x = 2$	✓ standard form ✓ factors ✓ both answers (3)
1.1.2	$x - \frac{2}{x} = 5$ $x^2 - 2 = 5x$ $x^2 - 5x - 2 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $x = \frac{-(-5) \pm \sqrt{25 - 4(1)(-2)}}{2(1)}$ $x = \frac{5 \pm \sqrt{33}}{2}$ $x = 5{,}37$ or $x = -0{,}37$	✓ standard form ✓ subs in correct formula ✓✓ answers (one for each answer) (4)
1.1.3	$(x+1)(x-3) > 12$ $x^2 - 2x - 3 > 12$ $x^2 - 2x - 15 > 0$ $(x-5)(x+3) > 0$ $+ \quad 0 \quad - \quad 0 \quad +$ $-3 \qquad\qquad 5$ OR  $x < -3$ or $x > 5$	✓ multiplication ✓ factors ✓✓ answer (4)

1.2	$r + p = 2$ $r = 2 - p$ $6r + 5rp - 5p = 8$ $6(2-p) + 5(2-p)p - 5p = 8$ $12 - 6p + 10p - 5p^2 - 5p = 8$ $5p^2 + p - 4 = 0$ $(5p-4)(p+1) = 0$ $p = \frac{4}{5}$ *or* $p = -1$ $r = 2 - \left(\frac{4}{5}\right)$ *or* $r = 2 - (-1)$ $r = \frac{6}{5}$ $r = 3$ **OR** $r + p = 2$ $p = 2 - r$ $6r + 5rp - 5p = 8$ $6r + 5r(2-r) - 5(2-r) = 8$ $6r + 10r - 5r^2 - 10 + 5r = 8$ $5r^2 - 21r + 18 = 0$ $(5r-6)(r-3) = 0$ $r = \frac{6}{5}$ *or* $r = 3$ $p = 2 - \left(\frac{6}{5}\right)$ *or* $p = 2 - (3)$ $p = \frac{4}{5}$ $p = -1$	✓ $r = 2 - p$ ✓ substitution ✓ simplification ✓ factors ✓ p-answers ✓✓ r-answers (7) ✓ $p = 2 - r$ ✓ substitution ✓ standard form ✓ factors ✓ r-answers ✓✓ p-answers (7)
1.3	Let the shortest side be x Sides of the prism: x ; $2x$; $3x$ Volume = lbh $(x)(2x)(3x) = 3\ 072$ $6x^3 = 3\ 072$ $x^3 = 512$ $x = \sqrt[3]{512}$ $x = 8$	✓ let the shortest side be x ✓ x ; $2x$; $3x$ ✓ $(x)(2x)(3x) = 3\ 072$ ✓ answer (4) **[22]**

QUESTION 2

2.1	$T_n = a + (n-1)d$ $173 = -7 + (n-1)(4)$ $173 = -7 + 4n - 4$ $4n = 184$ $n = 46$ **OR** $T_n = 4n - 11$ $173 = 4n - 11$ $4n = 184$ $n = 46$	✓ $d = 4$ ✓ $T_n = -7 + 4(n-1)$ ✓ answer (3) ✓✓ $T_n = 4n - 11$ ✓ answer (3)
2.2	$S_n = \frac{n}{2}[a + l]$ $= \frac{46}{2}[-7 + 173]$ $= 23[166]$ $= 3\,818$ **OR** $S_n = \frac{n}{2}[2a + (n-1)d]$ $= \frac{46}{2}[2(-7) + (45)(4)]$ $= 23[-14 + 180]$ $= 3\,818$	✓ subs of $n = 46$ ✓ subs of a and l into the correct formula ✓ answer (3) ✓ subs of $n = 46$ ✓ subs of a and d into the correct formula ✓ answer (3)
2.3	$\sum_{n=1}^{46}(4n-11)$	✓ $n = 1$ ✓ top value = 46 ✓ $4n - 11$ (3) **[9]**

QUESTION 3

3.1.1	$r = -\frac{1}{2}$ $T_4 = 1\left(-\frac{1}{2}\right)$ $= -\frac{1}{2}$	✓ $r = -\frac{1}{2}$ ✓ answer (2)
3.1.2	$T_n = 4\left(-\frac{1}{2}\right)^{n-1}$ $\frac{1}{64} = 4\left(-\frac{1}{2}\right)^{n-1}$ $\frac{1}{256} = \left(-\frac{1}{2}\right)^{n-1}$ $\left(-\frac{1}{2}\right)^8 = \left(-\frac{1}{2}\right)^{n-1}$ $8 = n-1$ $n = 9$ **OR** $T_n = -8\left(-\frac{1}{2}\right)^{n}$ $\frac{1}{64} = -8\left(-\frac{1}{2}\right)^{n}$ $\frac{1}{256} = \left(-\frac{1}{2}\right)^{n}$ $\left(-\frac{1}{2}\right)^8 = \left(-\frac{1}{2}\right)^{n-1}$ $8 = n-1$ $n = 9$	✓ $4\left(-\frac{1}{2}\right)^{n-1}$ ✓ substitution ✓ $\frac{1}{256} = \left(-\frac{1}{2}\right)^{n-1}$ ✓ answer (4)
	OR $T_4 = -\frac{1}{2}$ $T_5 = \frac{1}{4}$ $T_6 = -\frac{1}{8}$ $T_7 = \frac{1}{16}$ $T_8 = -\frac{1}{32}$ $T_9 = \frac{1}{64}$ $n = 9$	✓ T_5 and T_6 ✓ T_7 ✓ T_8 ✓ answer (4)
3.1.3	$S_\infty = \frac{a}{1-r}$ $= \frac{4}{1-\left(-\frac{1}{2}\right)}$ $= \frac{8}{3}$	✓ substitution into correct formula ✓ answer (2)

3.2	For a geometric sequence: $\frac{x+1}{1}=\frac{x-3}{x+1}$ $x^2+2x+1=x-3$ $x^2+x+4=0$ $x=\frac{-1\pm\sqrt{1-4(1)(4)}}{2(1)}$ $x=\frac{-1\pm\sqrt{-15}}{2}$ **OR** $x^2+2x+1=x-3$ $x^2+x+4=0$ $\left(x+\frac{1}{2}\right)^2+\frac{15}{4}=0$ $\left(x+\frac{1}{2}\right)^2+\frac{15}{4}\geq\frac{15}{4}>0$ Solution is non-real. There is no x-value that makes the sequence geometric.	✓ $\frac{T_2}{T_1}=\frac{T_3}{T_2}$ ✓ standard form ✓ subs in quadratic formula ✓ non-real/no x-values (4)
	OR	
	For a geometric sequence: $\frac{x+1}{1}=\frac{x-3}{x+1}$ $x^2+2x+1=x-3$ $x^2+x+4=0$ $b^2-4ac=1-4(1)(4)$ $=-15$ Solution is non-real There is no x-value that makes the sequence geometric.	✓ $\frac{T_2}{T_1}=\frac{T_3}{T_2}$ ✓ standard form ✓ subs in discriminant ✓ non-real/no x-values (4) **[12]**

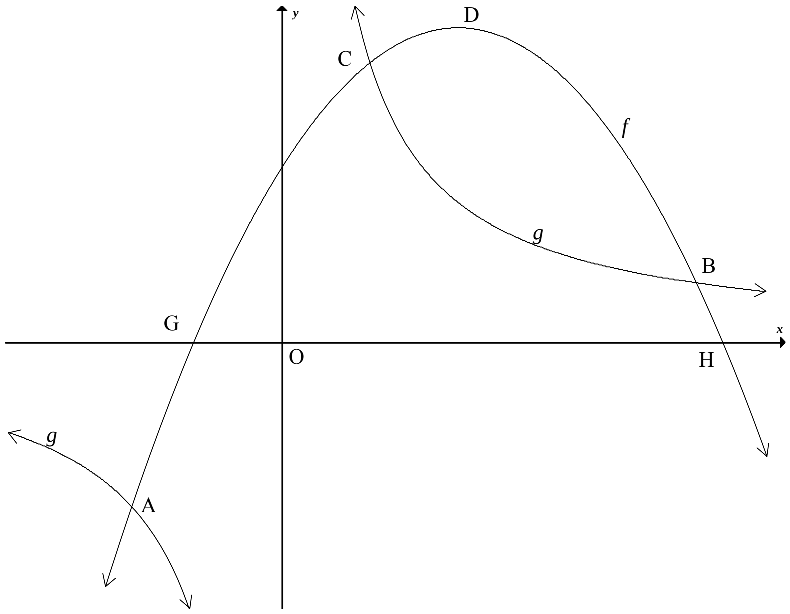
QUESTION 4

4.1	17 10 5 2 -7 -5 -3 2 2 $r = 1$ $s = 2$	✓ complete pattern ✓ $r = 1$ ✓ $s = 2$ (3)
	OR **NOTE:** Candidates may do 4.2 first. $d(n) = n^2 - 10n + 26$ $r = d(5)$ $= (5)^2 - 10(5) + 26$ $= 1$ $s = d(6)$ $= (6)^2 - 10(6) + 26$ $= 12$	✓ $d(n) = n^2 - 10n + 26$ ✓ $r = 1$ ✓ $s = 2$ (3)
	OR $d(n) = (n-5)^2 + 1$ $r = d(5)$ $= (5-5)^2 + 1$ $= 1$ $s = d(6)$ $= (6-5)^2 + 1$ $= 2$	✓ $d(n) = (n-5)^2 + 1$ ✓ $r = 1$ ✓ $s = 2$ (3)
4.2	$2a = 2$ $a = 1$ $3a + b = -7$ $\therefore 3(1) + b = -7$ $b = -10$ $\therefore a + b + c = 17$ $1 - 10 + c = 17$ $c = 26$ $\therefore d(n) = n^2 - 10n + 26$ **OR**	✓ $a = 1$ ✓ method ✓ $b = -10$ ✓ $c = 26$ (4)

	$a+b+c=17$ $4a+2b+c=10$ $3a+b=-7$ $9a+3b=-21$ $9a+3b+c=5$ $-21+c=5$ $c=26$ $a+b=-9$ $4a+2b=-16$ $2a+2b=-18$ $2a=2$ $a=1$ $b=-10$ $d(n)=n^2-10n+26$ **OR** $a+b+c=17$ $4a+2b+c=10$ $9a+3b+c=5$ $3a+b=-7$ $5a+b=-5$ $2a=2$ $a=1$ $3(1)+b=-7$ $b=-10$ $(1)-10+c=17$ $c=26$ $d(n)=n^2-10n+26$	✓ method ✓ $a=1$ ✓ $c=26$ ✓ $b=-10$ (4)
	OR $2a=2$ $a=1$ $c=26$ $d(n)=n^2+bn+26$ $17=(1)^2+b+26$ $b=-10$ $d(n)=n^2-10n+26$	✓ method ✓ $a=1$ ✓ $c=26$ ✓ $b=-10$ (4)
	OR $\mathrm{d(n)}=\frac{\mathrm{n}-1}{2}\left[2(\text{first difference})+(\mathrm{n}-2)(\text{second difference})\right]+\mathrm{d}(1)$ $d(n)=\frac{n-1}{2}\left[2(-7)+(n-2)(2)\right]+17$ $d(n)=\frac{n-1}{2}\left[-18-2n\right]+17$ $d(n)=(n-1)(-9-n)+17$ $d(n)=n^2-10n+26$ **OR**	✓ method ✓ $a=1$ ✓ $c=26$ ✓ $b=-10$ (4)

	$d(n)=(n-1)d(2)-(n-2)d(1)+\text{second difference}\times\dfrac{(n-1)(n-2)}{2}$ $d(n)=(n-1)(10)-(n-2)(17)+\dfrac{2(n-1)(n-2)}{2}$ $d(n)=10n-10-17n+34+(n-1)(n-2)$ $d(n)=n^2-10n+26$	✓ method ✓ $a = 1$ ✓ $c = 26$ ✓ $b = -10$ (4)
	OR $d(n)=(n-5)^2+1$ $=n^2-10n+26$ $a=1$ $b=-10$ $c=26$	✓ method ✓ $a = 1$ ✓ $c = 26$ ✓ $b = -10$ (4)
4.3	$d(8)=(8)^2-10(8)+26$ $=10$ m	✓ subs $t = 8$ ✓ answer (2)
	OR By symmetry $d(8)$ $=d(5+3)$ $=d(5-3)$ $=d(2)$ $=10$	✓ method ✓ answer (2)
	OR 17, 10, 5, 2, 1, 2, 5, 10 so $d(8) = 10$	✓ method ✓ answer (2)
4.4	Since the distance from P is decreasing for $n < 5$ the athlete is moving towards P. Since the distance from P is increasing for $n > 5$, the athlete is moving away from P.	✓✓ decreasing Moving towards ✓✓ increasing Moving away
	OR It is sufficient to show that d is decreasing when $n < 5$ and increasing when $n > 5$ $d(n)=n^2-10n+26$ $d'(n)=2n-10$ $d'(n)=2(n-5)$ For $n < 5$, $2(n-5)<0$ $d'(n)<0$ ∴ decreasing For $n > 5$, $2(n-5)>0$ $d'(n)>0$ ∴ increasing	✓ $d'(n)=2n-10$ ✓ $2(n-5)<0$ ✓ decreasing ✓ increasing (4) **[13]**

QUESTION 5



5.1	$x = 0$ $y = 0$	✓ answer ✓ answer (2)
5.2	$f(x) = -2x^2 + 8x + 10$ $x^2 - 4x - 5 = 0$ $(x-5)(x+1) = 0$ $x = 5$ or $x = -1$ H(5 ; 0)	✓ equate to 0 ✓ factors ✓ x-values ✓ answer (4)
5.3	$f(x) = -2x^2 + 8x + 10$ $f(x) = -2(x-2)^2 + 18$ Range of f is $y \leq 18$ **OR** $y \in (-\infty ; 18]$ **OR** $f(x) = -2x^2 + 8x + 10$ $x = -\frac{8}{2(-2)}$ $x = 2$ $y = -2(2)^2 + 8(2) + 10$ $y = 18$ Range of f is $y \leq 18$ **OR** $y \in (-\infty ; 18]$ **OR**	✓ method ✓ $(x-2)^2$ ✓ 18 ✓ answer (4) ✓ method ✓ $x = 2$ ✓ $y = 18$ ✓ answer (4) ✓ method

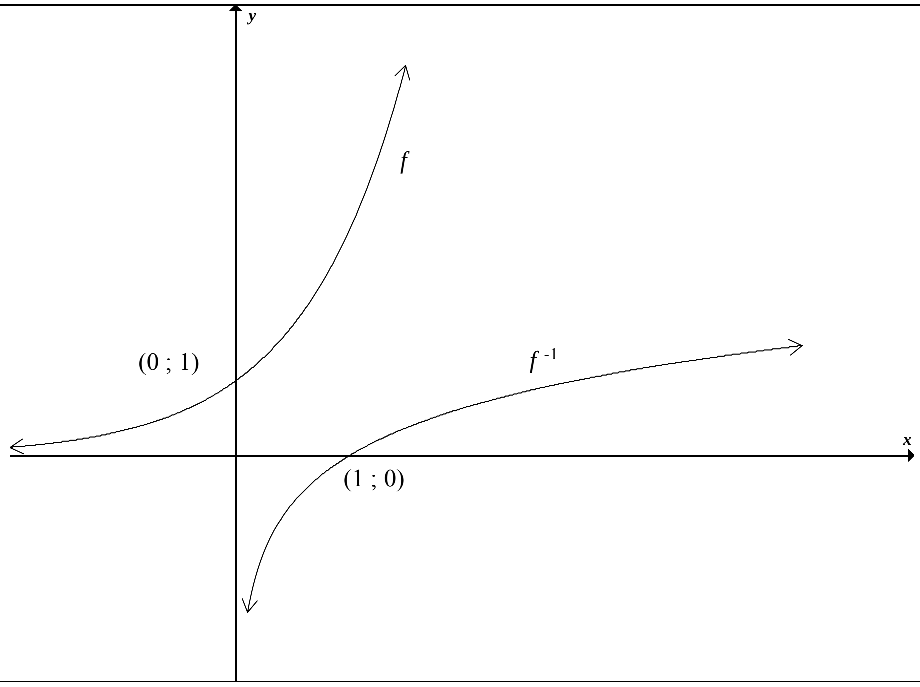
	$x=\frac{5-1}{2}$ $x=2$ $y=-2(2)^2+8(2)+10$ $y=18$ Range of f is $y\leq 18$ **OR** $y\in(-\infty\,;18]$	✓ $x=2$ ✓ $y=18$ ✓ answer (4)

	OR $f(x)=-2x^2+8x+10$ $f'(x)=-4x+8$ $0=-4x+8$ $x=2$ $y=-2(2)^2+8(2)+10$ $y=18$ Range of f is $y\leq 18$ **OR** $y\in(-\infty\,;18]$	✓ method ✓ $x=2$ ✓ $y=18$ ✓ answer (4)
5.4	$f(1)=-2(1)^2+8(1)+10$ $f(1)=16$ $g(1)=\frac{16}{1}$ $g(1)=16$ C(1 ; 16) lies on both the graphs of f and g **OR** $-2x^2+8x+10=\frac{16}{x}$ $-2x^3+8x^2+10x-16=0$ $x^3-4x^2-5x+8=0$ $(x-1)(x^2-3x-8)=0$ $x=1$ *or* $x^2-3x-8=0$ C(1 ; 16)	✓ substitution $f(1)$ ✓ substitution $g(1)$ (2) ✓ equating ✓ answer (2)
5.5	$p(x)=f(3x)$ $3x=2$ $x=\frac{2}{3}$ TP $(\frac{2}{3}\ ;18)$ **NOTE:** Answer Only: Full Marks **OR** $p(x)=-2(3x)^2+8(3x)+10$ $=-18x^2+24x+10$	✓ $3x=2$ ✓ $x=\frac{2}{3}$ ✓ $y=18$ (3) ✓ $x=-\frac{24}{2(-18)}$ ✓ $x=\frac{2}{3}$

	$x = -\dfrac{24}{2(-18)}$ $x = \dfrac{2}{3}$ TP $(\dfrac{2}{3}\ ;\ 18)$ **OR**	✓ $y = 18$ (3)

	$p(x) = -2(3x)^2 + 8(3x) + 10$ $= -18x^2 + 24x + 10$ $p'(x) = -36x + 24$ $0 = -36x + 24$ $x = \dfrac{2}{3}$ TP $(\dfrac{2}{3}\ ;\ 18)$ **OR** $p(x) = -2(3x)^2 + 8(3x) + 10$ $= -18x^2 + 24x + 10$ $= -18\left(x - \dfrac{2}{3}\right)^2 + 18$ TP $(\dfrac{2}{3}\ ;\ 18)$	✓ $0 = -36x + 24$ ✓ $x = \dfrac{2}{3}$ ✓ $y = 18$ (3) ✓ $p(x) = -18\left(x - \dfrac{2}{3}\right)^2 + 18$ ✓ $x = \dfrac{2}{3}$ ✓ $y = 18$ (3) **[15]**

QUESTION 6

6.1	$f(x) = 3^x$ $f^{-1}(x) = \log_3 x$	✓ answer (1)
6.2		$f^{-1}(x) = \log_3 x$ (Log Graph) ✓shape ✓x-intercept $f(x) = 3^x$ (Exponential Graph) ✓shape ✓y-intercept (4)
6.3	$x > 0$ **OR** $x \in (0 ; \infty)$	✓✓ answer (2)
6.4	$0 < x \leq 1$	✓ critical values ✓ notation (2)
6.5	$y > -4$ **OR** $y \in (-4 ; \infty)$	✓✓ answer (2)
6.6	$g(x) = -3^{x-2}$ **OR** $g(x) = -f(x-2)$ **OR** $g(x) = -\frac{1}{9}\left(3^x\right)$ **OR** $g(x) = -\frac{1}{9} f(x)$	✓ – (sign) ✓ $x - 2$ (2) ✓ – (sign) ✓ $\frac{1}{9}$ (2) **[13]**

QUESTION 7

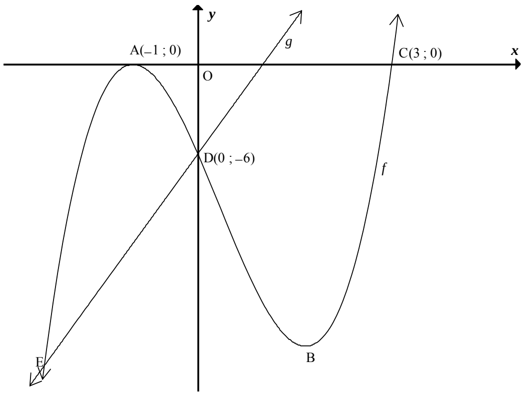
7.1	$\frac{88}{100} \times 850\ 000$ $= R748\ 000$ **OR** $\frac{12}{100} \times 850\ 000$ $= R102\ 000$ Loan amount = R850 000 – R102 000 = R748 000	✓ $\frac{88}{100} \times 850\ 000$ ✓ answer (2) ✓ $\frac{12}{100} \times 850\ 000$ ✓ answer (2)
7.2	$1 + i_e = \left(1 + \frac{0,09}{12}\right)^{12}$ $i_e = 0,09380689$ $r = 9,38\%\ \ p.a$ $\neq 9,6\%$ Not correct **OR** $1 + 0,096 = \left(1 + \frac{i}{12}\right)^{12}$ $\sqrt[12]{1,096} = 1 + \frac{i}{12}$ $1,007668183 = 1 + \frac{i}{12}$ $i = 0,092018201$ $r = 9,2\%\ \ p.a$ $\neq 9\%$ Not correct	✓ $\frac{0,09}{12}$ ✓ substitution ✓ answer ✓ decision (4) ✓ $\frac{i}{12}$ ✓ substitution ✓ answer ✓ decision (4)
7.3	$P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $748\ 000 = \frac{x\left[1-\left(1+\frac{0,09}{12}\right)^{-240}\right]}{\frac{0,09}{12}}$ $x = R6\ 729,95$	✓ subs into correct formula ✓ $i = \frac{0,09}{12}$ ✓ n = – 240 ✓ answer (4)

7.4	$P_v = \frac{x[1-(1+i)^{-n}]}{i}$ $748\ 000 = \frac{7\ 000\left[1-\left(1+\frac{0,09}{12}\right)^{-n}\right]}{\frac{0,09}{12}}$ $\frac{561}{700} = 1-\left(1+\frac{0,09}{12}\right)^{-n}$ $\left(1+\frac{0,09}{12}\right)^{-n} = \frac{139}{700}$ $-n\log\left(1+\frac{0,09}{12}\right) = \log\frac{139}{700}$ $n = 216,35 \text{ months}$ $= 18,03 \text{ years}$	✓ subs into correct formula ✓ simplification ✓ use of logs ✓ answer (4)
	OR	
	$P_v = \frac{x[1-(1+i)^{-12n}]}{i}$ $748\ 000 = \frac{7\ 000\left[1-\left(1+\frac{0,09}{12}\right)^{-12n}\right]}{\frac{0,09}{12}}$ $\frac{561}{700} = 1-\left(1+\frac{0,09}{12}\right)^{-12n}$ $\left(1+\frac{0,09}{12}\right)^{-12n} = \frac{139}{700}$ $-12n\log\left(1+\frac{0,09}{12}\right) = \log\frac{139}{700}$ $n = 18,03 \text{ years}$	✓ subs into correct formula ✓ simplification ✓ use of logs ✓ answer (4) **[14]**

QUESTION 8

8.1	$f(x) = 9 - x^2$ $f(x+h) = 9 - (x+h)^2$ $= 9 - x^2 - 2xh - h^2$ $f(x+h) - f(x) = -2xh - h^2$ $f'(x) = \lim_{h \to 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \to 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \to 0} (-2x - h)$ $= -2x$ **OR** $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$ $= \lim_{h \to 0} \frac{9 - (x+h)^2 - (9 - x^2)}{h}$ $= \lim_{h \to 0} \frac{9 - (x^2 + 2xh + h^2) - 9 + x^2}{h}$ $= \lim_{h \to 0} \frac{-2xh - h^2}{h}$ $= \lim_{h \to 0} \frac{h(-2x - h)}{h}$ $= \lim_{h \to 0} (-2x - h)$ $= -2x$	✓ substitution ✓ simplification ✓ formula ✓ common factor ✓ answer (5) ✓ formula ✓ substitution ✓ simplification ✓ common factor ✓ answer (5)
8.2.1	$D_x[1 + 6\sqrt{x}]$ $= D_x\left[1 + 6x^{\frac{1}{2}}\right]$ $= 3x^{-\frac{1}{2}}$	✓ $6x^{\frac{1}{2}}$ ✓ answer (2)
8.2.2	$y = \frac{8 - 3x^6}{8x^5}$ $= \frac{1}{x^5} - \frac{3}{8}x$ $= x^{-5} - \frac{3}{8}x$ $\frac{dy}{dx} = -5x^{-6} - \frac{3}{8}$	✓ x^{-5} ✓ $\frac{3}{8}x$ ✓ $-5x^{-6}$ ✓ $-\frac{3}{8}$ (4) **[11]**

QUESTION 9

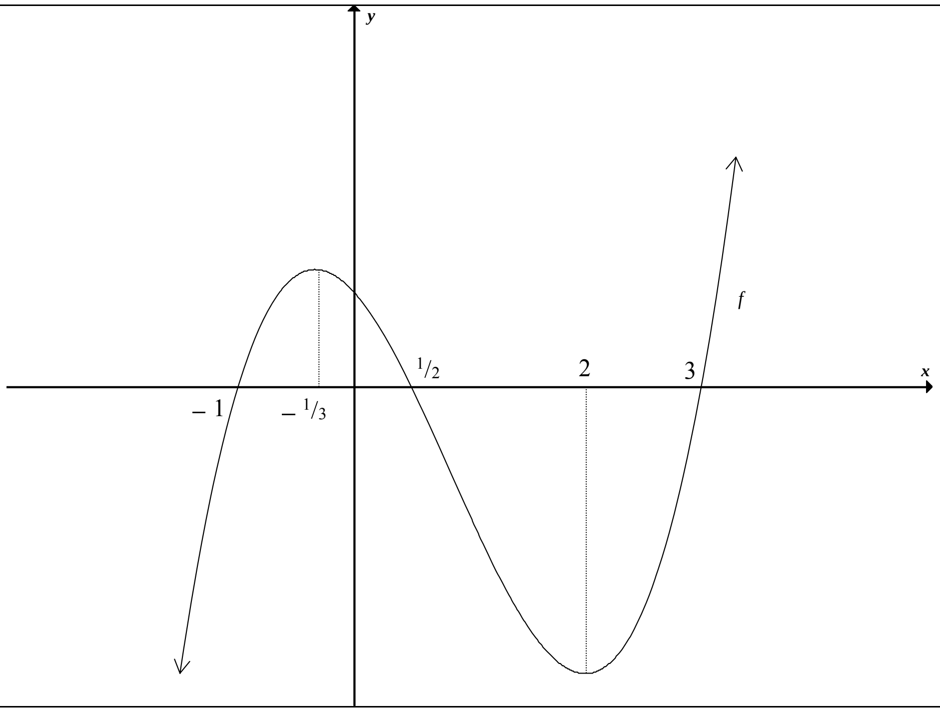


9.1	$f(x)=a(x+1)^2(x-3)$ $-6=a(0+1)^2(0-3)$ $-6=-3a$ $a=2$ $f(x)=2(x^2+2x+1)(x-3)$ $=2x^3-2x^2-10x-6$	✓✓ substitution of x-values ✓ subs (0 ; – 6) ✓ $a=2$ ✓ simplification (5)
9.2	$f'(x)=6x^2-4x-10$ $6x^2-4x-10=0$ $3x^2-2x-5=0$ $(3x-5)(x+1)=0$ $x=\frac{5}{3}$ *or* $x=-1$ $\text{B}\left(\frac{5}{3}\ ;\ -\frac{512}{27}\right)$ **OR** $\text{B}(1{,}67\ ;\ -18{,}96)$	✓ $f'(x)=6x^2-4x-6$ ✓ $f'(x)=0$ ✓ factors ✓ x-value ✓ y-value (5)
9.3	$h(x)=2x^3-2x^2-10x-6-(6x-6)$ $=2x^3-2x^2-16x$ $h'(x)=6x^2-4x-16$ $0=3x^2-2x-8$ $0=(3x+4)(x-2)$ $x=-\frac{4}{3}$ *or* $x=2$ $\therefore\ x=-\frac{4}{3}$	✓ $h(x)=2x^3-2x^2-16x$ ✓ $h'(x)=6x^2-4x-16$ ✓ $h'(x)=0$ ✓ factors ✓ correct x-value (5) **[15]**

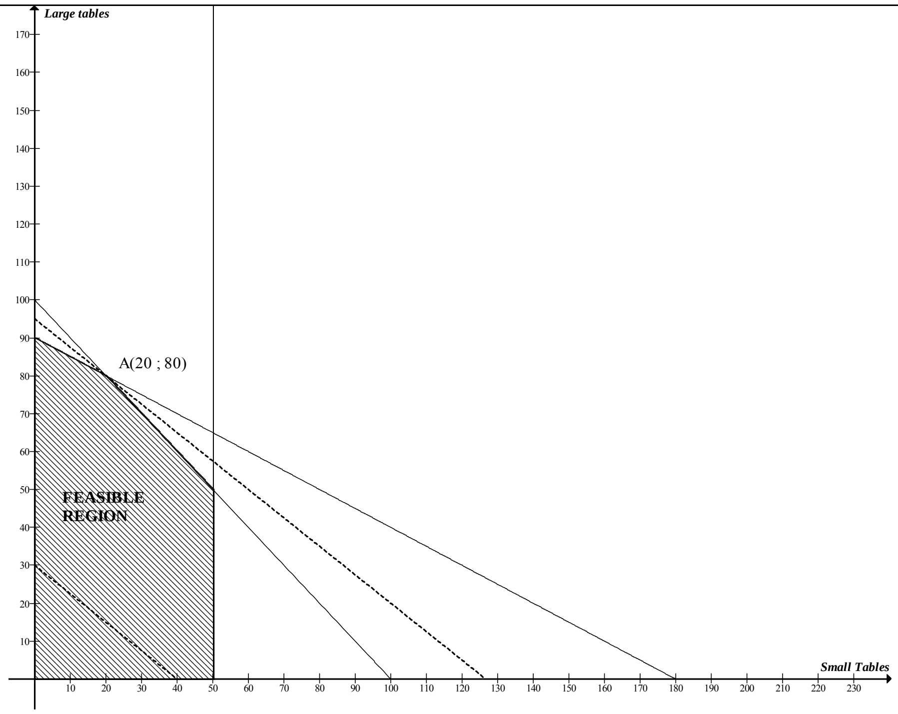
QUESTION 10

10.1	$y = 5(1) - 8$ $= -3$ Point of contact is (1 ; – 3)	✓ subs 1 (1)
10.2	$-3 = 2(1)^3 + p(1)^2 + q(1) - 7$ $2 = p + q$ $g'(x) = 6x^2 + 2px + q$ $g'(1) = 5$ $5 = 6(1)^2 + 2p(1) + q$ $-1 = 2p + q$ $p = -3$ $q = 5$	✓ subs (1 ; – 3) ✓ $g'(x) = 6x^2 + 2px + q$ ✓ subs x = 1 and y = 5 ✓ simplification ✓ p-value ✓ q-value (6) **[7]**

QUESTION 11

		✓ x-intercepts ✓ turning point ✓✓ shape **[4]**

QUESTION 12

12.1	$x, y \in N_0$ $x + y \leq 100$ $x \leq 50$ $x + 2y \leq 180$ **OR** $y \leq -x + 100$ $x \leq 50$ $y \leq -\frac{1}{2}x + 90$	✓✓ $x + y \leq 100$ ✓✓ $x + 2y \leq 180$ ✓ $x \leq 50$ (5)
12.2		✓✓✓ each constraint ✓ feasible region (4)
12.3	90 tables	✓ answer (1)
12.4	$P = 300x + 400y$	✓ answer (1)
12.5	Maximum at A (20 ; 80) 20 small tables and 80 large tables.	✓✓ answer (2)
12.6	$P = qx + 400y$ $m = -\frac{q}{400}$ $-1 \leq -\frac{q}{400} \leq -\frac{1}{2}$ $200 \leq q \leq 400$	✓ $m = -\frac{q}{400}$ ✓ $200 \leq q \leq 400$ (2) **[15]**

TOTAL: 150

QUESTION 12.2