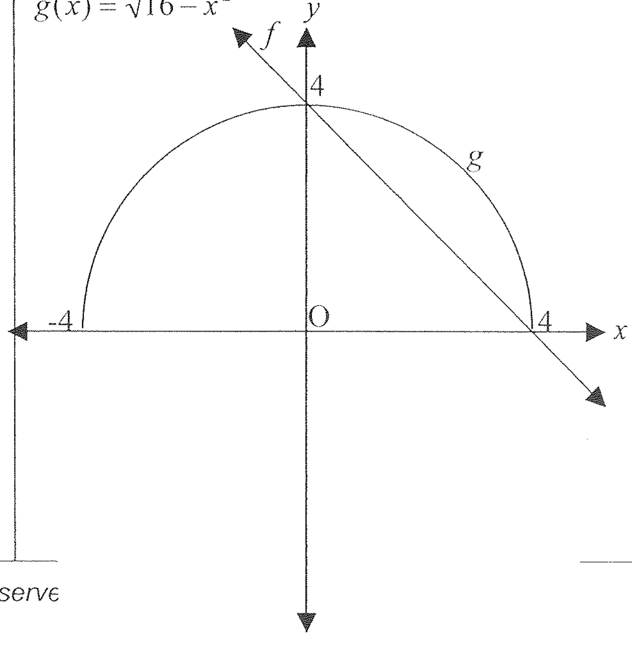
POSSIBLE ANSWERS
FEB / MARCH 2007

		MATHEMATICS P1 SG FEB/MARCH 2007		
1.1	1.1.1	$x(x-3)=4(x+2)$ $x^2-3x=4x+8$ $x^2-7x-8=0$ $(x-8)(x+1)=0$ $x=8$ or $x=-1$	(3)	✓ multiplication ✓ Factorization ✓ answer
	1.1.2.	$3x^2+5x-4=0$ $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$ $=\frac{-5\pm\sqrt{25+48}}{6}$ $=\frac{-5\pm\sqrt{73}}{6}$ $=0{,}59$ or $-2{,}26$	(4)	✓ Formula ✓ substitution ✓ ✓ each value
	1.1.3	$\sqrt{2-7x}=2-x$ $2-7x=4-4x+x^2$ $x^2+3x+2=0$ $(x+2)(x+1)=0$ $x=-2$ or $x=-1$ Check: For $x=-2$ L.H.S = $\sqrt{16}$ =2-(-2) = 4 = R.H.S For $x=-1$: L.H.S = $\sqrt{9}$ = 2-(-1) =3 = R.H.S **OR** For the 2 sides to be defined we need $2-x\geq 0$ and $2-7x\geq 0$. $\therefore x\leq 2$ and $x\leq\frac{2}{7}$ $\therefore x\leq\frac{2}{7}$ Both $x=-2$ and $x=-1$ are $\leq\frac{2}{7}$ $\therefore$ both are solutions	(5)	✓ Squaring both sides ✓ simplifying ✓ Factorization ✓ x values ✓ checking

1.2		$2x - y = 2$……………(1) $y = (x-1)(x-2)$……………(2) From equation (1): $y = 2x - 2$……………(3) Substitute equation (3) into equation (2): $2x - 2 = (x-1)(x-2$ ↘ $x^2 - 3x + 2 = 2x - 2$ **OR** $2(x-1) = (x-1)x-2)$ $x^2 - 5x + 4 = 0$ $\quad$ $x - 1 = 0$ or $x - 2 = 2$ $(x-1)(x-4) = 0$ $\quad$ $x = 1$ or $x = 4$ $x = 1$ or $x = 4$ For $x = 1; y = 0$ For $x = 4; y = 6$ Points of intersection are: (1;0) and (4;6) **OR**		✓ subject of the formula ✓ substitution ✓ Simplification ✓ standard form ✓ factorization ✓ values for x ✓ value for y ✓ value for y
		$2x - y = 2$……………(1) $y = (x-1)(x-2)$……………(2) From equation (1): $x = \frac{y+2}{2}$……………(3) Substitute equation (3) into equation (2): $y = (\frac{y+2}{2} - 1)(\frac{y+2}{2} - 2)$ $y = (\frac{y+2-2}{2})(\frac{y+2-4}{2})$ $4y = (y)(y-2)$ ↘ $y^2 - 2y = 4y$ $\quad$ or $y = 0$ or $y - 2 = 4$ $y^2 - 6y = 0$ $\quad$ $y = 0$ or $y = 6$ $y(y-6) = 0$ $y = 0$ or $y = 6$ For $y = 0; x = 1$ For $y = 6; x = 4$ Points of intersection are: (1;0) and (4;6)	(8)	✓ subject of the formula ✓ substitution ✓ simplification ✓ standard form ✓ factorization ✓ values for y ✓ value for x ✓ value for x
1.3.		$6x^2 - 7mx - 5m^2 = 0$ $\Delta = b^2 - 4ac$ $= (-7m)^2 - 4(6)(-5m^2)$ $= 49m^2 + 120m^2$ $= 169m^2$ $= (13m)^2$ is a perfect square $\therefore$ The roots are rational **OR**		✓ formula $b^2 - 4ac$ ✓ substitution ✓simplification ✓ perfect square ✓ rational

1.3		$6x^2 - 7mx - 5m^2 = 0$ $(2x+m)(3x-5m) = 0$ $x = \frac{-m}{2}$ or $x = \frac{5m}{3}$ $\therefore$ Roots are rational since m is rational	(5)	✓✓ factorization ✓✓ values of x ✓ rational
1.4		$3x^2 - x + k = 0$ $x = \frac{4}{3}$: $3\left(\frac{4}{3}\right)^2 - \frac{4}{3} + k = 0$ $\frac{16}{3} - \frac{4}{3} + k = 0$ $\frac{12}{3} + k = 0$ $k = -4$ **OR** For $x = \frac{4}{3}$ $\therefore 3x - 4$ is a factor Then $3x^2 - x + k = (3x-4)(x+1) + (k+4)$. But $(3x-4)(x+1) = 0$ for $x = \frac{4}{3}$ $\therefore 0 = 0 + (k+4)$ $\therefore k = -4$	(3)	✓ substitution ✓ simplification ✓ value of k ✓ factor ✓ simplifying ✓value of k
1.5		Let the original number be x and the new number be y $\therefore x = 10a + b$ ....(1) and $y = 10b + a$ ....(2) Difference $= x - y = 10a + b - (10b + a)$ $= 10a + b - 10b - a$ $= 9a - 9b$ $= 9(a - b)$	(4) **[32]**	✓ equation ✓ equation ✓ difference ✓ answer
2.1		Let $f(x) = x^3 + px^2 + 2x + 3$ $f(3) = 0$ $3^3 + p(3)^2 + 2(3) + 3 = 0$ $27 + 9p + 6 + 3 = 0$ $9p = -36$ $p = -4$	(4)	✓ factor theorem ✓ substitution ✓ simplification ✓ answer
2.2		$f(x) = 2x^3 - 5x^2 + 2ax + 48$ $g(x) = x^3 + 3ax^2 + 11x - 6$ $f(-2) = -16 - 20 - 4a + 48 = -4a + 12$.........(1) $g(-2) = -8 + 12a - 22 - 6 = 12a - 36$..........(2) $g(-2) = f(-2)$ $12a - 36 = -4a + 12$ $16a = 48$	(6)	✓✓ substitution ✓✓ simplification for f and g ✓ equation ✓ answer

		$a = 3$	**[10]**	

3.1.	3.1.1	A(2;3) and B(0;1) Gradient of AB = $m_{AB} = \frac{y_B - y_A}{x_B - x_A}$ $= \frac{1-5}{0-2} = 2$ Equation of AB: $y - y_B = m_{AB}(x - x_B)$ $y - 1 = 2(x - 0)$ $y = 2x + 1$ **OR** …… $c = 1$; and $m_{AB} = 2$ $y = m_{AB}x + c$ $= 2x + 1$	(4)	✓✓ gradient ✓ substitution ✓ equation ✓✓ gradient/ y-intercept ✓ formula ✓ equation
	3.1.2	Form of the equation: $y = a(x - p)^2 + q$ $y = a(x - 2)^2 + 5$ $1 = a(0 - 2)^2 + 5$ $4a + 5 = 1$ $a = \frac{-4}{4} = -1$ Equation of the parabola: $y = -1(x - 2)^2 + 5$ $= -1(x^2 - 4x + 4) + 5$ $= -x^2 + 4x - 4 + 5$ $= -x^2 + 4x + 1$	(6)	✓✓ Substitution ✓ substitution ✓ value of a ✓ substitution ✓ form of the equation
	3.1.3	$1 \le x \le 2,\ x \in R$	(2)	✓✓Interval
3.2	3.2.1	$f(x) = 4 - x$	(2)	f: ✓intercepts with axes ✓line
	3.2.2	$g(x) = \sqrt{16 - x^2}$  	(2)	g: ✓shape ✓ radius [or any point]

3.3		$x = 4$ or $x = 0$	(2)	✓✓ values of x
	3.4.1	A(3;4) Form of the equation: $xy = k$ $k = 3\text{x}4 = 12$ Equation of the hyperbola: $xy = 12$	(3)	✓ form ✓ value of k ✓ Equation
	3.4.2	$B(4;3)$	(1)	✓ answer
	3.4.3.	$C(-3;-4)$	(1) **/23/**	✓ answer

4.1	4.1.1	$\frac{4^{n-3}.10^{n+2}}{8^{n-1}.5^{1+n}}$ $= \frac{2^{2n-6}.2^{n+2}.5^{n+2}}{2^{3n-3}.5^{1+n}}$ $= 2^{2n-6+n+2-3n+3}.5^{n+2-1-n}$ $= 2^{-1}.5^{1}$ $= \frac{5}{2}$ or 2,5	(6)	✓✓✓ converting composite numbers to prime factors ✓ Application of laws ✓simplification ✓ answer
	4.1.2	$2\log x + 3\log\sqrt{x}$ $= 2\log x + 3\log x^{\frac{1}{2}}$ $= 2\log x + \frac{3}{2}\log x$ $= \frac{7}{2}\log x$ **or** $2\log x + 3\log\sqrt{x}$ $= \log x^2 + \log\left(x^{\frac{1}{2}}\right)^3$ $= \log(x^2)\left(x^{\frac{3}{2}}\right)$ $= \log x^{\frac{4}{2}+\frac{3}{2}}$ $= \log x^{\frac{7}{2}}$ or $\frac{7}{2}\log x$	(3)	✓ removing radical sign ✓ application of the law ✓ answer ✓ removing radical sign ✓ application of the laws ✓ answer

4.2	4.2.1	$2.3^x + 5.3^{x+1} - 17 = 0$ $2.3^x + 5.3^x.3^1 = 17$ $3^x(2 + 5.3^1) = 17$ $17.3^x = 17$ $3^x = 1 = 3^0$ $x = 0$	(4)	✓ application of law ✓ common factor ✓simplification ✓ answer
	4.2.2	$27x^{\frac{3}{4}} = 8$ $x^{\frac{3}{4}} = \frac{8}{27}$ $x = \left(\frac{8}{27}\right)^{\frac{4}{3}} = \left(\frac{2^3}{3^3}\right)^{\frac{4}{3}} = \frac{2^4}{3^4}$ $= \frac{16}{81}$	(4)	✓ subject of the formula ✓ reciprocal of exponent ✓simplification ✓ answer
	4.2.3	$\log_2(x+1) - \log_2 x = 1$ $\log_2 \frac{x+1}{x} = 1$ $\frac{x+1}{x} = 2^1 = 2$ $2x = x + 1$ $x = 1$	(3)	✓ application of the laws ✓ Exponential form ✓ answer
	4.2.4	$2.3^{x+2} = 9$ $2 \times 9 \times 3^x = 9$ $3^x = \frac{1}{2} = 2^{-1}$ $x \log 3 = -\log 2$ $x = \frac{-\log 2}{\log 3}$ $= -0{,}6224$ $= -0{,}62$ OR $3^{x+2} = \frac{9}{2}$ $(x+2)\log 3 = \log\frac{9}{2}$ $x + 2 = \frac{\log 9 - \log 2}{\log 3}$ $= 1{,}38$ $x = 1{,}38 - 2$ $= -0{,}62$	(5)	✓ ✓simplification ✓ log both sides ✓ simplification ✓ answer ✓ subject of the formula ✓ logging both sides ✓ simplification ✓ simplification ✓ answer

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5.1.		$2x-1;\ 4x-5;\ 3x+3$		
	5.1.1	$d=T_2-T_1=T_3-T_2$ $4x-5-(2x-1)=3x+3-(4x-5)$ $4x-5-2x+1=3x+3-4x+5$ $2x-4=-x+8$ $3x=12$ $x=4$ $\therefore T_1=7,\ T_2=11,\ T_3=15$ OR For $x=4$ $T_1=2x-1=2(4)-1=7$ $T_2=4x-5=4(4)-5=11$ $T_3=3x+3=3(4)+3=15$ This is an Arithmetic sequence with common difference $=d=4$	(5)	✓ common difference ✓ substitution ✓simplification ✓✓sequence ✓ substitution ✓ substitution ✓ substitution ✓ ✓ common difference
	5.1.2	$T_n=a+(n-1)d$ $=7+(n-1)4$ $=7+4n-4$ $=4n+3$	(3)	✓ formula ✓ substitution ✓ simplification
	5.1.3	$T_n=43$ $4n+3=43$ $4n=40$ $n=10$	(2)	✓ equation ✓ value of n
5.2.		$\sum_{k=1}^{10}(2k+4)$ $=6+8+10+\ldots\ldots\ldots\ldots+24$ This is an Arithmetic sequence with $d=2$ $S_n=\frac{n}{2}(a+l)$ $S_{10}=\frac{10}{2}(6+24)$ $=5(30)$ $=150$ OR $S_n=\frac{n}{2}[2a+(n-1)d]$ $S_{10}=\frac{10}{2}[2(6)+9(2)]$ $=5(12+18)$ $=5(30)$ $=150$	(5)	✓ Expanded form ✓common difference ✓formula ✓ substitution ✓ answer ✓formula ✓ substitution ✓ answer

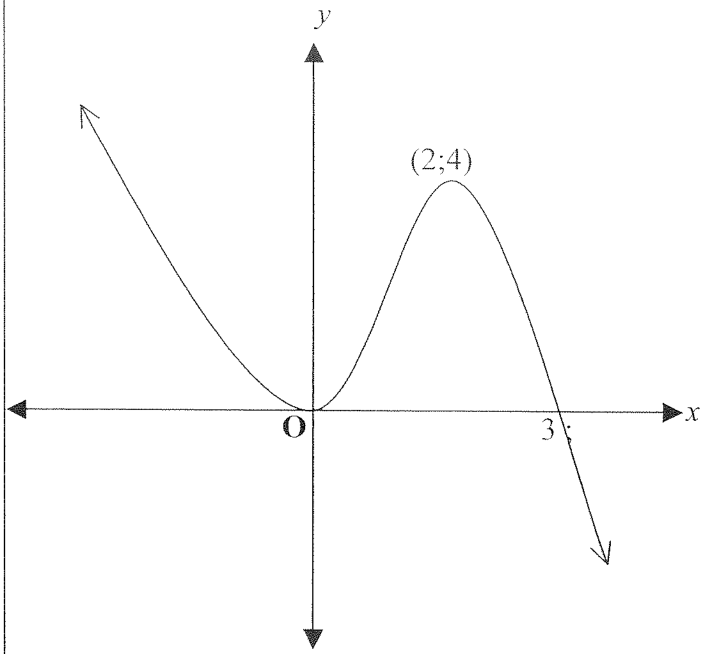
5.3		$T_1 = 48,\quad r = \frac{1}{2},\quad n = 12$ $S_n = \frac{a(1-r^n)}{1-r}$ $= \frac{48\left[1-\left(\frac{1}{2}\right)^{12}\right]}{1-\frac{1}{2}}$ $= 96(1-\frac{1}{4096})$ $= 96(\frac{4095}{4096})$ $= 95{,}98$	(4)	✓ formula ✓ substitution ✓simplification ✓ answer

5.4.		P = R150 000, r = 5,6% per year. n = 5 years $r = \frac{5{,}6}{4} = 1{,}4\%$ per quarter $n = 5x4 = 20$ time periods when compounded quarterly $A = P(1+\frac{r}{100})^n$ $= 150000(1+\frac{1{,}4}{100})^{20}$ $= 150000(1{,}014)^{20}$ $= 198\ 084{,}4386$ A = R198 084,44	(5) **[24]**	✓ rate per quarter ✓ number of time periods ✓formula ✓ substitution ✓ answer

6.1		$f(x) = -2x + 3$		
		$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$		✓ Definition
		$= \lim_{h \to 0} \frac{-2(x+h) + 3 - (-2x+3)}{h}$		✓substitution
		$= \lim_{h \to 0} \frac{-2x - 2h + 3 + 2x - 3}{h}$		✓simplification
		$= \lim_{h \to 0} \frac{-2h}{h}$		
		$= \lim_{h \to 0} (-2)$		✓ simplification
		= -2		✓ answer
		OR		
		$f(x) = -2x + 3$		✓substitution
		$f(x+h) = -2(x+h) + 3 = -2x - 2h + 3$		✓substitution
		$f(x+h) - f(x) = -2x - 2h + 3 - (-2x+3)$		✓difference
		$= -2x - 2h + 3 + 2x - 3 = -2h$		✓ Definition
		$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$		
		$= \lim_{h \to 0} \frac{-2h}{h}$		
		$= \lim_{h \to 0} (-2)$		✓ answer
		= -2	(5)	
6.2.		$f(x) = 2x^3 - 3$		
		$f(2) = 2(2^3) - 3 = 16 - 3 = 13$		✓ y value at 2
		$f(3) = 2(3^3) - 3 = 54 - 3 = 51$		✓ y value at 3
		Average gradient $= \frac{f(3) - f(2)}{3 - 2}$		✓ formula
		$= \frac{51 - 13}{1}$		
		$= 38$		✓ answer
		OR		
		Average gradient $= \frac{f(x+h) - f(x)}{h}$		✓ definition
		$= \frac{2(x+h)^3 - 3 - (2x^3 - 3)}{h}$		✓ substitution
		$= \frac{6x^2 h + 6xh^2 + 2h^3}{h}$		
		$= 6x^2 + 6xh + 2h^2$		
		For $x = 2$ and $x = 3$		✓ simplification
		Average gradient $= 6(2)^2 + 6(2)(3-2) + 2(3-2)^2$		
		$= 24 + 12 + 2$		

		$= 38$	(4)	✓ answer
6.3	6.3.1	$f(x) = \sqrt[3]{x} - \frac{3}{x}$ $= x^{\frac{1}{3}} - 3x^{-1}$ $f'(x) = \frac{1}{3}x^{\frac{-2}{3}} + 3x^{-2}$	(4)	✓✓ Simplification ✓✓ each derivative

	6.3.2	$f(x) = \frac{x^3 + x}{x}$ $= \frac{(x)(x^2+1)}{(x)}$ $= x^2 + 1$ $f'(x) = 2x$	(3)	✓ factors ✓✓ each derivative
6.4.		$f(x) = -x^3 + 3x^2$		
	6.4.1	For x intercepts (roots) : $y = 0$ $-x^3 + 3x^2 = 0$ $x^3 - 3x^2 = 0$ $x^2(x-3) = 0$ $x = 0$ or $x = 3$ Coordinates: $(0 ; 0)$ or $(3 ; 0)$	(4)	✓ substitution ✓factors ✓ roots ✓ coordinates
	6.4.2	For turning points: $f'(x) = 0$ $-3x^2 + 6x = 0$ $-3x(x-2) = 0$ $x = 0$ or $x = 2$ for $x = 0$ $y = 0$ for $x = 2$ $y = -8 + 12 = 4$ Turning points: (0;0) and (2;4)	(6)	✓ definition ✓ application of rules ✓ factors ✓ values of x ✓✓ turning points

	6.4.3		(4) **[30]**	✓shape ✓TP (2; 4) ✓TP (0; 0) ✓x- intercept 3

7.1.		$f(x) = 24x - 3x^2 \quad 0 \le x \le 4.$ $f(2) = 24(2) - 3(2^2)$ $= 48 - 12$ $= 36$ dm $= 3{,}6$ m	(2)	✓ substitution ✓ height
7.2		It will reach its maximum height when $f'(x) = 0$. $\therefore 24 - 6x = 0$ $x = 4$ years **OR** $x = \frac{-b}{2a} = \frac{-24}{2(-3)} = 4$ years **OR** $f(x) = -3x^2 + 24x$ $= -3(x^2 - 8x)$ $= -3(x^2 - 8x + 16 - 16)$ $= -3(x-4)^2 + 48$ $\therefore x = 4$ years for the tree to reach its maximum height	(2)	✓ derivative =0 ✓ value of x
7.3		Maximum height = $f(4) = 24(4) - 3(4^2)$ $= 96 - 48$ $= 48$ dm $= 4{,}8$ m **OR** Maximum height = $\frac{-\Delta}{4a} = \frac{4ac - b^2}{4a}$ $= \frac{4(-3)(0) - 24^2}{4(-3)}$ $= \frac{-576}{-12}$ $= 48$ dm $= 4{,}8$ m **OR** From 7.2. (the third alternate solution) The maximum height is 48dm $= 4{,}8$ m	(2) **[6]**	✓ substitution ✓ value of height ✓ substitution ✓ value of height
		TOTAL	**[150]**	