Solutions:		
1	$\int \frac{3(1-x)^3-2}{1-x}\,dx = \int\left[\frac{3(1-x)^3}{1-x}-\frac{2}{1-x}\right]dx$ $= \int\left[3(1-x)^2-\frac{2}{1-x}\right]dx$ $= \frac{3(1-x)^3}{(3)(-1)}+2\ln(1-x)+c$ $= -(1-x)^3+2\ln(1-x)+c$	
2	$p+q\sqrt{2} = \frac{3+2\sqrt{2}}{1-\sqrt{2}}\times\frac{1+\sqrt{2}}{1+\sqrt{2}}$ $= \frac{3+3\sqrt{2}+2\sqrt{2}+2(2)}{1-2}$ $= \frac{7+5\sqrt{2}}{-1}$ $= -7-5\sqrt{2}$ $\therefore\ p=-7,\ q=-5$	
3	$V=\frac{4}{3}\pi r^3$ $\frac{dV}{dr}=4\pi r^2$ $\frac{dV}{dt}=\frac{dV}{dr}\times\frac{dr}{dt}$ $20-4=4\pi r^2\times\frac{dr}{dt}$ $\frac{dr}{dt}=\frac{4}{\pi r^2}$ When r = 11, $\frac{dr}{dt}=\frac{4}{\pi(11)^2}$ ≈ 0.0105 cm/s (correct to 3 s.f.)	
4	$2x^2+5xy-y^2+48=0$ --- (1)	

Solutions:		
	$y+8=2x$ --- (2) From (2): $y=2x-8$ --- (3) Put (3) into (1): $2x^2+5x(2x-8)-(2x-8)^2+48=0$ $2x^2+10x^2-40x-(4x^2-32x+64)+48=0$ $2x^2+10x^2-40x-4x^2+32x-64+48=0$ $8x^2-8x-16=0$ $x^2-x-2=0$ $(x+1)(x-2)=0$ $x=-1$ or $x=2$ Put $x=-1$ into (3): $y=2(-1)-8$ $=-10$ Put $x=2$ into (3): $y=2(2)-8$ $=-4$ $\therefore$ Coordinates of the points of intersection are (–1, –10) and (2, –4).	
5	Let $\frac{8x^2+3x+1}{x(2x+1)^2}=\frac{A}{x}+\frac{B}{2x+1}+\frac{C}{(2x+1)^2}$ Multiplying throughout by the denominator, $8x^2+3x+1=A(2x+1)^2+Bx(2x+1)+Cx$ When $x=0$, $A=1$ When $x=-\frac{1}{2}$, $8\left(-\frac{1}{2}\right)^2+3\left(-\frac{1}{2}\right)+1=-\frac{1}{2}C$ $\frac{3}{2}=-\frac{1}{2}C$ $C=-3$ When $x=1$, $8(1)^2+3(1)+1=(1)(3)^2+3B-3(1)$ $12=9+3B-3$ $B=2$	

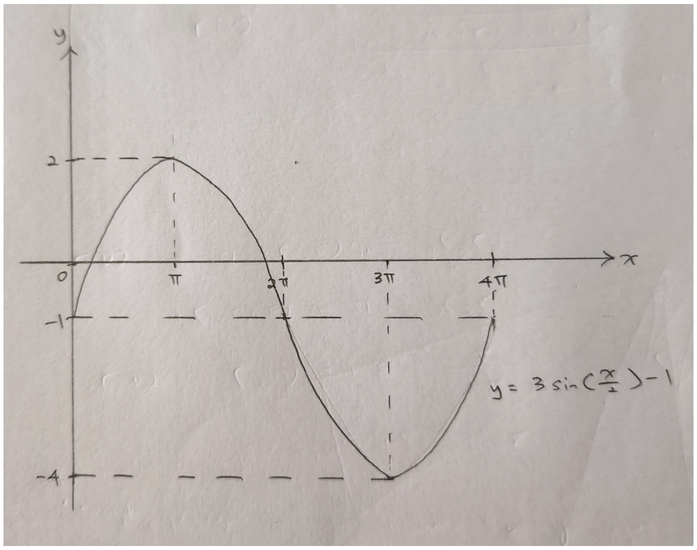
Solutions:		
	$\therefore \quad \dfrac{8x^2+3x+1}{x(2x+1)^2}=\dfrac{1}{x}+\dfrac{2}{2x+1}-\dfrac{3}{(2x+1)^2}$	
6(a)	$4^{x-1}=3+2^{x+2}$ $\dfrac{(2^x)^2}{4}=3+2^2(2^x)$ $(2^x)^2-16(2^x)-12=0$	
(b)	Let $u=2^x$. $u^2-16u-12=0$ $u=\dfrac{-(-16)\pm\sqrt{(-16)^2-4(1)(-12)}}{2(1)}$ $u=\dfrac{16\pm\sqrt{304}}{2}$ $u=-0.7177978871$ or $u=16.71779789$ $2^x=-0.7177978871$ or $2^x=16.71779789$ (no solutions) * $\quad x=\dfrac{\ln 16.71779789}{\ln 2}$ ≈ 4.06 ** (correct to 2 d.p.)	
7(a)	$\mathrm{C}(x)=40x^2-480x+1442$ $=40(x^2-12x)+1442$ $=40\left[x^2-12x+\left(\dfrac{-12}{2}\right)^2-\left(\dfrac{-12}{2}\right)^2\right]+1442$ $=40\left[(x-6)^2-36\right]+1442$ $=40(x-6)^2+2$	
(b)	Minimum value of C(x) = 2 Corresponding value of x = 6	

Solutions:		
(c)	Minimum average cost per chair = \$2 Number of chairs produced = 6000	
8(a)	$\angle ABC = \angle CAF$ (Alternate Segment Theorem) $= \angle DEF$ ($\angle$s in the same segment) Since $\angle ABC = \angle DEF$, by the Alternate Angles Property, *AB* is parallel to *ED*. (proven)	
(b)	In ΔACF and ΔBAF, $\angle AFC = \angle BFA$ (common $\angle$) $\angle CAF = \angle ABF$ (Alternate Segment Theorem) $\therefore$ Triangle *ACF* is similar to triangle *BAF*. (proven)	
(c)	$\frac{AF}{BF} = \frac{CF}{AF}$ $AF^2 = BF \times CF$ (shown)	
9(a)	L.H.S. $= \frac{\cos 2\theta + 1}{3 + 3\sin\theta}$ $= \frac{1 - 2\sin^2\theta + 1}{3(1+\sin\theta)}$ $= \frac{2 - 2\sin^2\theta}{3(1+\sin\theta)}$ $= \frac{2(1-\sin^2\theta)}{3(1+\sin\theta)}$ $= \frac{2(1-\sin\theta)(1+\sin\theta)}{3(1+\sin\theta)}$ $= \frac{2(1-\sin\theta)}{3}$ = R.H.S. (proven)	
(b)	$\frac{\cos 2\theta + 1}{3 + 3\sin\theta} = \frac{1}{2}$	

Solutions:		
	$\frac{2(1-\sin\theta)}{3}=\frac{1}{2}$ $1-\sin\theta=\frac{3}{4}$ $\sin\theta=\frac{1}{4}$ Basic angle, $\alpha = \sin^{-1}\frac{1}{4}$ $=14.47751219^{\circ}$ $\theta=14.47751219^{\circ}$, $180^{\circ}-14.47751219^{\circ}$ $\approx 14.5^{\circ},\ 165.5^{\circ}$ (correct to 1 d.p.)	
10(a)	$\frac{d}{dx}\ln(\sin x)=\frac{\cos x}{\sin x}$ $=\cot x$	
(b)	$y=\cot x$ --- (1) $y=\sqrt{2}$ --- (2) (1) = (2): $\cot x=\sqrt{2}$ $\tan x=\frac{1}{\sqrt{2}}$ $x=\tan^{-1}\frac{1}{\sqrt{2}}$ Area of shaded region $=\int_{\tan^{-1}\frac{1}{\sqrt{2}}}^{\frac{\pi}{2}}\cot x\ dx$ $=\left[\ln(\sin x)\right]_{\tan^{-1}\frac{1}{\sqrt{2}}}^{\frac{\pi}{2}}$ $=\ln\left(\sin\frac{\pi}{2}\right)-\ln\left[\sin\left(\tan^{-1}\frac{1}{\sqrt{2}}\right)\right]$ $=0-(-0.5493061443)$	

Solutions:		
	≈ 0.549 units^2 (correct to 3 s.f.)	
11(a)	$f(-2)=a(-2)^3+8(-2)^2+b(-2)+18$ $0=-8a+32-2b+18$ $8a=50-2b$ $a=\frac{25}{4}-\frac{1}{4}b$ --- (1) $f(-1)=a(-1)^3+8(-1)^2+b(-1)+18$ $4=-a+8-b+18$ $a=22-b$ --- (2) (1) = (2): $\frac{25}{4}-\frac{1}{4}b=22-b$ $b=21$ Put $b=21$ into (2): $a=22-21$ $=1$	
(b)	$f(x)=x^3+8x^2+21x+18$ By long division, $$\begin{array}{r l} & x^2+6x+9 \\ x+2 \,\big) & x^3+8x^2+21x+18 \\ & \underline{x^3+2x^2} \\ & 6x^2+21x+18 \\ & \underline{6x^2+12x} \\ & 9x+18 \\ & \underline{9x+18} \\ & 0 \end{array}$$ $f(x)=x^3+8x^2+21x+18$ $=(x+2)(x^2+6x+9)$ $=(x+2)(x+3)^2$	
12(a)	$x=10-3y$ --- (1) $y=x-2$ --- (2) Put (1) into (2): $y=10-3y-2$	

Solutions:		
	$y = 2$ Put $y = 2$ into (1): $x = 10 - 3(2)$ $= 4$ Coordinates of *A* are (4, 2). Let the coordinates of *C* be (*x*, *y*). $(7.5,\ 3.5) = \left(\frac{4+x}{2},\ \frac{2+y}{2} \right)$ $7.5 = \frac{4+x}{2}$ and $3.5 = \frac{2+y}{2}$ $x = 11$ $y = 5$ $\therefore$ Coordinates of *C* are (11, 5).	
(b)	Gradient of *AC* $= \frac{2-5}{4-11}$ $= \frac{3}{7}$ Equation of *AC* is $y - 2 = \frac{3}{7}(x - 4)$ $y = \frac{3}{7}x + \frac{2}{7}$ (or $7y = 3x + 2$)	
(c)	Area of triangle *ABC* $= \frac{1}{2}\begin{vmatrix} 4 & 7 & 11 & 4 \\ 2 & 1 & 5 & 2 \end{vmatrix}$ $= \frac{1}{2}\left[(4 + 35 + 22) - (14 + 11 + 20) \right]$ $= \frac{1}{2}(61 - 45)$ = 8 units^2	
13(a)	Since period $= \dfrac{2\pi}{\frac{1}{b}}$,	

Solutions:		
	$4\pi = \dfrac{2\pi}{\frac{1}{b}}$ $b = 2$ (shown)	
(b)	At (π , 2), $2 = a\sin\left(\dfrac{\pi}{2}\right) + c$ $2 = a + c$ $a = 2 - c$ --- (1) At (4π , –1), $-1 = a\sin\left(\dfrac{4\pi}{2}\right) + c$ $c = -1$ Put $c = -1$ into (1): $a = 2 - (-1)$ $= 3$	
(c)		
(d)	$\sin\left(\dfrac{x}{2}\right) = \dfrac{x}{12\pi} - \dfrac{1}{3}$ $3\sin\left(\dfrac{x}{2}\right) = \dfrac{x}{4\pi} - 1$ $3\sin\left(\dfrac{x}{2}\right) - 1 = \dfrac{x}{4\pi} - 2$	

Solutions:		
	Draw the line of $y = \dfrac{x}{4\pi} - 2$. The x-coordinates of the points of intersection of the graphs of $y = \mathrm{f}(x)$ and $y = \dfrac{x}{4\pi} - 2$ give the solutions to the equation $\sin\left(\dfrac{x}{2}\right) = \dfrac{x}{12\pi} - \dfrac{1}{3}$.	
14(a)	$r\theta + 2r = 150$ $r\theta = 150 - 2r$ $\theta = \dfrac{150}{r} - 2$ Area of sector *OAB*, $A = \dfrac{1}{2} r^2 \theta$ $= \dfrac{1}{2} r^2 \left(\dfrac{150}{r} - 2\right)$ $= 75r - r^2$ cm^2 (shown)	
(b)	$\dfrac{\mathrm{d}A}{\mathrm{d}r} = 75 - 2r$ For stationary value, $\dfrac{\mathrm{d}A}{\mathrm{d}r} = 0$ $75 - 2r = 0$ $r = 37.5$ When $r = 37.5$, $A = 75(37.5) - (37.5)^2$ $= 1406.25$ $\dfrac{\mathrm{d}^2A}{\mathrm{d}r^2} = -2$ Since $\dfrac{\mathrm{d}^2A}{\mathrm{d}r^2} < 0$, $A = 1406.25$ is maximum when $r = 37.5$.	