4 (a)	$\dfrac{4x^3+2x^2+3x+8}{x^2+4} \equiv Ax+B+\dfrac{Cx+D}{x^2+4}$	
(i)	Any correct value of $A=4,\ B=2$ or $C=-13$	B1
	Full method to find values for A, B and C E.g. $4x^3+2x^2+3x+8 \equiv (Ax+B)\left(x^2+4\right)+Cx+D$ Or $x^2+0x+4\,\overline{)4x^3+2x^2+3x+8}$ giving $4x+2$, remainder $-13x$	M1
	$A=4,\ B=2$ and $C=-13$	A1
(ii)	E.g. Using $4x^3+2x^2+3x+8 \equiv (Ax+B)\left(x^2+4\right)+Cx+D$ For example $x^2 \Rightarrow B=2 \qquad x=0 \Rightarrow 4\times2+D=8 \qquad D=0$ *	B1*
		(4)
(b)	$\int\left(Ax+B+\dfrac{Cx}{x^2+4}\right)\mathrm{d}x=\dfrac{Ax^2}{2}+Bx,+\dfrac{1}{2}C\ln\left(k\left(x^2+4\right)\right)$ k any constant	B1 ft, M1 A1ft
	$\int_1^4 \dfrac{4x^3+2x^2+3x-8}{x^2+4}\mathrm{d}x=\left[2x^2+2x-\dfrac{13}{2}\ln\left(k\left(x^2+4\right)\right)\right]_1^4$	
	$=\left(32+8-\dfrac{13}{2}\ln 20\right)-\left(2+2-\dfrac{13}{2}\ln 5\right)=36+\dfrac{13}{2}\ln\dfrac{1}{4}=36-13\ln 2$	dM1 A1
		(5)
		(9 marks)

4(a)	Any correct constant, so for $A=2$ or $B=3$ or $C=-1$ or $D=5$	B1
	$2x^4+15x^3+35x^2+21x-4=Ax^2(x+3)^2+Bx(x+3)^2+C(x+3)^2+D$ $\Rightarrow A=\ldots, B=\ldots, C=\ldots, D=\ldots$ or $2x^4+15x^3+35x^2+21x-4\div\left(x^2+6x+9\right)=\ldots x^2+\ldots x+\ldots+\dfrac{\ldots}{(x+3)^2}$	M1
	2 correct of $A=2, B=3, C=-1, D=5$	A1
	$A=2, B=3, C=-1, D=5$	A1
		(4)
(b)	$\int \mathrm{f}(x)\mathrm{d}x=\int\left(2x^2+3x-1+\dfrac{5}{(x+3)^2}\right)\mathrm{d}x=\dfrac{2x^3}{3}+\dfrac{3x^2}{2}-x-\dfrac{5}{x+3}(+c)$	M1A1ftA1
		(3)
		Total 7

2	$$\mathrm{g}(x)=\frac{2x^2-5x+8}{x-2}$$	
(a)	Sets $2x^2-5x+8=(Ax+B)(x-2)+C$ with an attempt at one constant	M1
	Attempts all 3 constants. E.g. Sets $x=2\Rightarrow C=...,-2B+C=8\Rightarrow B=...$ and compares x^2 terms gives $A=...$	dM1
	$$2x-1+\frac{6}{x-2}$$	A1
		(3)

(b)	$\int 2x-1+\frac{6}{x-2}\,\mathrm{d}x=x^2-x+6\ln(x-2)$	M1 A1ft
	$\int_4^8 2x-1+\frac{6}{x-2}\,\mathrm{d}x=\left[x^2-x+6\ln(x-2)\right]_4^8=56+6\ln 6-12-6\ln 2$	
	$=44+6\ln 3$	dM1 A1
		(4)
		(7 marks)

9 (a)	$$\mathrm{f}'(x)=\frac{(2x+1)\times(12x+4)-2\left(6x^2+4x-2\right)}{(2x+1)^2}$$	M1 A1
	$$=\frac{12x^2+12x+8}{(2x+1)^2}\text{ o.e}$$	A1
		(3)
(b)	At $x=2\ \Rightarrow \mathrm{f}'(x)=\frac{12\times2^2+12\times2+8}{(2\times2+1)^2}=\left(\frac{16}{5}\right)$	M1
	Full method of normal $y-6=-\frac{5}{16}(x-2)$	dM1
	$16y-96=-5x+10\Rightarrow\ 16y+5x=106\quad *$	A1*
		(3)
(c)	Any correct value $A=3,\ B=\frac{1}{2}\ or\ D=-\frac{5}{2}$	B1
	$6x^2+4x-2=(Ax+B)(2x+1)+D\Rightarrow$ Values of A, B and D	M1
	$$3x+\frac{1}{2}+\frac{-5/2}{2x+1}\text{ o.e}$$	A1
		(3)
(d)	$$\int 3x+\frac{1}{2}+\frac{-5/2}{2x+1}\,\mathrm{d}x=\frac{3}{2}x^2+\frac{1}{2}x-\frac{5}{4}\ln(2x+1)$$	M1, A1 ft
	Area under curve = $\left[\frac{3}{2}x^2+\frac{1}{2}x-\frac{5}{4}\ln(2x+1)\right]_{\frac{1}{3}}^{2}=\left(\frac{3}{2}\times2^2+\frac{1}{2}\times2-\frac{5}{4}\ln(5)\right)-\left(\frac{3}{2}\times\left(\frac{1}{3}\right)^2+\frac{1}{2}\times\left(\frac{1}{3}\right)-\frac{5}{4}\ln\left(\frac{5}{3}\right)\right)$	dM1
	Area of $R=\int_{\frac{1}{3}}^{2}3x+\frac{1}{2}+\frac{-5/2}{2x+1}\mathrm{d}x+\frac{1}{2}\times6\times\left(\frac{106}{5}-2\right)$	M1
	$$\text{Area of }R=\frac{964}{15}-\frac{5}{4}\ln 3$$	A1
		(5)
		Total 14

3(a)	$(\cos 2A \equiv)\cos A\cos A - \sin A\sin A \equiv \cos^2 A - (1-\cos^2 A)$	M1
	$\Rightarrow \cos 2A \equiv 2\cos^2 A - 1$ *	A1*
		(2)
(b)	$\int (3-2\cos 6x)\, dx = 3x - \frac{\sin 6x}{3} \quad (+c)$	M1A1
	$\left[3x - \frac{\sin 6x}{3}\right]_{\frac{\pi}{12}}^{\frac{\pi}{8}} = \left(3\left(\frac{\pi}{8}\right) - \frac{\sin\left(6\times\frac{\pi}{8}\right)}{3}\right) - \left(3\left(\frac{\pi}{12}\right) - \frac{\sin\left(6\times\frac{\pi}{12}\right)}{3}\right) = \frac{1}{8}\pi + \frac{2-\sqrt{2}}{6}$	dM1A1
		(4)
		(6 marks)

Question Number	Scheme	Notes
8	$\int (2\cos x - \sin x)^2\, dx = \int \left(4\cos^2 x - 4\sin x\cos x + \sin^2 x\right) dx$	M1
	$\int 4\sin x\cos x\, dx = \int 2\sin 2x\, dx = -\cos 2x$ or $\int 4\sin x\cos x\, dx = -2\cos^2 x$ or $2\sin^2 x$	M1
	$\int \left(4\cos^2 x + \sin^2 x\right) dx = \int \left(1+3\cos^2 x\right) dx = \int \left(1+3\left(\frac{\cos 2x+1}{2}\right)\right) dx$ or $\int \left(4\cos^2 x + \sin^2 x\right) dx = \int \left(4\left(\frac{\cos 2x+1}{2}\right) + \frac{1-\cos 2x}{2}\right) dx$	M1
	$\int (2\cos x - \sin x)^2\, dx = \frac{3}{4}\sin 2x + \cos 2x + \frac{5}{2}x (+c)$ or $\int (2\cos x - \sin x)^2\, dx = \frac{3}{4}\sin 2x + 2\cos^2 x + \frac{5}{2}x (+c)$ or $\int (2\cos x - \sin x)^2\, dx = \frac{3}{4}\sin 2x - 2\sin^2 x + \frac{5}{2}x (+c)$	A1A1
		(5)
		Total 5

Question Number	Scheme	Marks
6 (a)	$y=(4x-7)^{\frac{1}{2}} \quad \Rightarrow \left(\frac{\mathrm{d}y}{\mathrm{d}x}=\right)2(4x-7)^{-\frac{1}{2}}$ (see notes)	M1 A1
	At $(8,5)$ gradient of tangent is $2(4\times8-7)^{-\frac{1}{2}}\left(=\frac{2}{5}\right)$	dM1
	Equation for l is $y-5=-\frac{5}{2}(x-8)$	ddM1
	$2y-10=-5x+40 \Rightarrow 5x+2y-50=0$ *	A1*
		(5)
(b)	$\int (4x-7)^{\frac{1}{2}}\,\mathrm{d}x=\left[\frac{(4x-7)^{\frac{3}{2}}}{6}\right]$ (see notes)	M1, A1
	Complete area $=\int_{\frac{7}{4}}^{8}(4x-7)^{\frac{1}{2}}\,\mathrm{d}x=\left[\frac{(4x-7)^{\frac{3}{2}}}{6}\right]_{\frac{7}{4}}^{8}+5$	dM1
	$=\frac{155}{6}$	A1
		(4)
		(9 marks)

5(i)	$\cos 6x = 1-2\sin^2 3x \Rightarrow \sin^2 3x = \frac{1}{2}-\frac{1}{2}\cos 6x$ $\int \sin^2 3x\,\mathrm{d}x = \int\left(\frac{1}{2}-\frac{1}{2}\cos 6x\right)\mathrm{d}x$	M1
	$=\frac{1}{2}x-\frac{1}{12}\sin 6x(+c)$	A1
		(2)
(ii)	$\int x\left(x^2+4\right)^{\frac{3}{2}}\,\mathrm{d}x=\frac{1}{5}\left(x^2+4\right)^{\frac{5}{2}}(+c)$	M1A1
		(2)
		Total 4

3 (i)	$\frac{\mathrm{d}}{\mathrm{d}x}\ln\left(\sin^2 3x\right)=\frac{1}{\sin^{\cancel{2}}3x}\times 2\cancel{\sin 3x}\times 3\cos 3x=6\cot 3x$	M1 A1
		(2)
(ii) (a)	$\frac{\mathrm{d}}{\mathrm{d}x}\left(3x^2-4\right)^6=36x\left(3x^2-4\right)^5$	M1 A1
		(2)
(b)	$\int x\left(3x^2-4\right)^5\mathrm{d}x=\frac{1}{36}\left(3x^2-4\right)^6$	B1ft
	$\int_0^{\sqrt{2}} x\left(3x^2-4\right)^5\mathrm{d}x=\left[\frac{1}{36}\left(3x^2-4\right)^6\right]_0^{\sqrt{2}}=\frac{1}{36}(2)^6-\frac{1}{36}(-4)^6=-112$	M1 A1cso
		(3)
		(7 marks)