Question	Answer	Marks	Partial Marks
3(b)	$\mathbf{q} = \begin{pmatrix} 24 \\ -12 \end{pmatrix}$ oe	**2**	**M1** for $12\sqrt{5} \times \frac{1}{\sqrt{6^2 + (-3)^2}} \begin{pmatrix} 6 \\ -3 \end{pmatrix}$ oe, soi
	$\mathbf{r} = \begin{pmatrix} -15 \\ 15 \end{pmatrix}$ oe	**2**	**M1** for $15\sqrt{2} \times \frac{1}{\sqrt{(-5)^2 + 5^2}} \begin{pmatrix} -5 \\ 5 \end{pmatrix}$ oe, soi If M0 M0, then **SC1** for the unit direction vectors $\frac{1}{\sqrt{45}} \begin{pmatrix} 6 \\ -3 \end{pmatrix}$ or better and $\frac{1}{\sqrt{50}} \begin{pmatrix} -5 \\ 5 \end{pmatrix}$ or better
	$\lvert\mathbf{q} + \mathbf{r}\rvert = \left\lvert \begin{pmatrix} 9 \\ 3 \end{pmatrix} \right\rvert = \sqrt{9^2 + 3^2}$	**M1**	**FT** *their* (**q** + **r)** providing at least M1 previously awarded
	[unit vector in direction **q** + **r** =] $\frac{1}{\sqrt{90}} \begin{pmatrix} 9 \\ 3 \end{pmatrix}$ oe, isw	**A1**	
4(a)(i)	$\frac{\mathrm{d}y}{\mathrm{d}x} = 6\sin x \cos x - \sin x$ oe, isw	**B2**	**B1** for an attempt to differentiate both terms with one term correct
	$3\sin^2 x + \cos x + \frac{\cos x}{\sin x}(6\sin x \cos x - \sin x)$	**M1**	**FT** *their* $\frac{\mathrm{d}y}{\mathrm{d}x}$ of the form $k\sin x \cos x \pm \sin x$
	Correct simplified step e.g. $3\sin^2 x + \cos x + 6\cos^2 x - \cos x$ or $3\sin^2 x + 6\cos^2 x$ or $3 + 3\cos^2 x$ leading to $3(1 + \cos^2 x)$ nfww	**A1**	
4(a)(ii)	$\cos^2 x = \frac{1}{3}$	**M1**	**FT** *their k* providing $0 < k \leq 4$
	$\cos x = [\pm]\sqrt{\frac{1}{3}}$ oe	**M1**	**dep** on previous **M1; FT** *their k*
	±0.955 or ±0.9553[1...] rot to 4 or more sf ±2.19 or ±2.186[2...] rot to 4 or more sf	**A2**	and no other angles in range **A1** for any two correct angles, ignoring extras

Question	Answer	Marks	Partial Marks
4(b)(i)	$\left(1-\frac{1}{2}x^{-\frac{1}{2}}\right)\sec^2\left(x-\sqrt{x}\right)$ oe, isw	**2**	**M1** for $\mathrm{f}(x)\sec^2\left(x-\sqrt{x}\right)$
4(b)(ii)	Correctly writes $\left(1-\frac{1}{2}x^{-\frac{1}{2}}\right)\sec^2\left(x-\sqrt{x}\right)=$ $\frac{2\sqrt{x}-1}{2\sqrt{x}}\sec^2(x-\sqrt{x})$ or $\frac{2\sqrt{x}-1}{2\sqrt{x}\cos^2(x-\sqrt{x})}$ **and** states an answer $k\tan\left(x-\sqrt{x}\right)$ or states $\frac{1}{2}\int\frac{2\sqrt{x}-1}{\sqrt{x}\cos^2(x-\sqrt{x})}\,\mathrm{d}x=\tan(x-\sqrt{x})$	**M1**	where k is a non-zero constant; dependent on **part (b)(i)**
	$2\tan\left(x-\sqrt{x}\right)+c$ nfww	**A1**	
5	Correct quotient rule: $\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{(\ln 3x)[1]-x\left(\frac{1}{3x}\times 3\right)}{(\ln 3x)^2}$ oe OR correct product rule using $y = x(\ln 3x)^{-1}$: $\frac{\mathrm{d}y}{\mathrm{d}x}=x\left(-(\ln 3x)^{-2}\times\frac{3}{3x}\right)+[1](\ln 3x)^{-1}$	**2**	**M1** for $\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{(\ln 3x)[1]-x\times \textit{their}\left(\frac{1}{3x}\times 3\right)}{(\ln 3x)^2}$ OR for $\frac{\mathrm{d}y}{\mathrm{d}x}=x\times \textit{their}\left(-(\ln 3x)^{-2}\times\frac{3}{3x}\right)$ $+[1](\ln 3x)^{-1}$
	$\frac{\delta y}{h}=\frac{\ln 3-1}{(\ln 3)^2}$ oe, soi	**M1**	**FT** *their* $\left.\frac{\mathrm{d}y}{\mathrm{d}x}\right\vert_{x=1}$ providing quotient rule or appropriate product rule attempted
	$\delta y=\frac{\ln 3-1}{(\ln 3)^2}h$ or $\delta y = 0.0817h$ nfww	**A1**	must have evidence of correct derivative
6	$\left[-\frac{1}{4}\mathrm{e}^{2-4x}\right]_{-0.25}^{0.5}$ oe	**B2**	**B1** for $k\mathrm{e}^{2-4x}$, $k \neq -4$
	Correct use of correct limits: $-\frac{1}{4}\mathrm{e}^{0}-\left(-\frac{1}{4}\mathrm{e}^{3}\right)$ oe	**M1**	**FT** *their* $-\frac{1}{4}\mathrm{e}^{2-4x}$ providing **B1** awarded
	$-\frac{1}{4}+\frac{1}{4}\mathrm{e}^{3}$ or exact equivalent, isw	**A1**	

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