Question	Answer	Marks	Partial Marks
1(a)	$\begin{pmatrix}-2.5\\5\end{pmatrix}$ oe	**B2**	**B1** for $-\frac{1}{4}\begin{pmatrix}-2\\8\end{pmatrix}\left[+\begin{pmatrix}-3\\7\end{pmatrix}\right]$ oe, soi
1(b)	$3\alpha - 8 = 2\alpha + 5\beta$ or $18 - 2\beta = 20$	**M1**	Equates like vectors at least once
	$\alpha = 3$ $\beta = -1$	**A2**	**A1** for either value correct
2	$5x^2 - 10x - 15 * 0$ oe	**M1**	where * is any inequality sign or =
	Factorises *their* 3-term quadratic expression or solves *their* 3-term quadratic equation	**M1**	
	Critical values –1 and 3	**A1**	
	$-1 \leqslant x \leqslant 3$	**A1**	Do not accept separate inequalities unless connected with 'and'
3(a)	$(3-4)^2 + (-1+3)^2 = 5$ or showing that distance between point A and centre of circle = radius e.g. $\sqrt{(3-4)^2 + (-1+3)^2} = \sqrt{5}$	**B1**	Accept if x-coordinate substituted to find y- coordinate
3(b)	$\begin{pmatrix}4\\-3\end{pmatrix}+\begin{pmatrix}1\\-2\end{pmatrix}$ oe, soi or using centre and point A e.g. $\frac{3+x}{2} = 4$ and $\frac{-1+y}{2} = -3$ or solve simultaneously the line $y = -2x + 5$ with the circle leading to 3 term quadratic $x^2 - 8x + 15[=0]$ with an attempt to solve	**M1**	Award **M1** for the 2 equations Award the **M1** for the quadratic
	(5, –5)	**A1**	

Question	Answer	Marks	Partial Marks
3(c)	gradient of radius $= \frac{-3+1}{4-3} = -2$ soi by gradient of tangent	**M1**	
	gradient of tangent $= \frac{-1}{their(-2)}$	**M1**	**FT** *their* –2 Allow if differentiation is used e.g.:
	$y + 1 = \frac{1}{2}(x - 3)$ oe	**A1**	**FT** $\frac{-1}{their - 2}$ ISW from a correct unsimplified answer
	Alternative		
	use of differentiation e.g.: $(y+3)^2 = 5-(x-4)^2$ $y = \sqrt{-x^2+8x-11} - 3$ $\frac{dy}{dx} = \frac{-2x+8}{2\sqrt{-x^2+8x-11}}$	**(M1)**	allow one error or use of implicit differentiation (not on syllabus) e.g.: $2x + 2y\frac{dy}{dx} - 8 + 6\frac{dy}{dx} = 0$ leading to $\frac{dy}{dx} = \frac{8-2x}{2y+6}$
	Substitute $(3,-1)$ in *their* $\frac{dy}{dx}$ to get gradient $= \frac{1}{2}$	**(M1)**	**Dep** on first **M1**
	$y + 1 = \frac{1}{2}(x - 3)$ oe	**(A1)**	ISW from a correct unsimplified answer
4(a)	Solves or factorises $x^{\frac{1}{3}} - x^{\frac{1}{6}} - 2 = 0$ oe: $\left(x^{\frac{1}{6}}+1\right)\left(x^{\frac{1}{6}}-2\right)$ or when substituting $y = x^{\frac{1}{3}}$ factorises to $\left(y^{\frac{1}{2}}+1\right)\left(y^{\frac{1}{2}}-2\right)$	**M1**	A substitution may be used $\left(x^{\frac{1}{3}}\right)^6 - \left(x^{\frac{1}{6}}\right)^6 = 2^6$ scores 0 marks $\left(x^{\frac{1}{3}}\right) - \left(x^{\frac{1}{6}}\right) = x^{\log_x 2}$ then $\frac{1}{3} - \frac{1}{6} = \log_x 2$ scores 0 marks
	$\left[x^{\frac{1}{6}} = -1\right]$, $x^{\frac{1}{6}} = 2$	**A1**	
	$x = 64$ [$x = 1$]	**A1**	
	Rejects $x^{\frac{1}{6}} = -1$ or $x = 1$ ignored at some stage, soi	**B1**	

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