Question Number	Scheme	Marks
4 (a)	Attempt at chain rule $y^2 \to ...y\frac{dy}{dx}$	M1
	Attempt at product rule $2xy \to \alpha x\frac{dy}{dx}+\beta y$	M1
	Correct differentiation $8x+2y\frac{dy}{dx}-2y-2x\frac{dy}{dx}=24$ oe	A1
	Collects terms in $(2y-2x)\frac{dy}{dx} = 24-8x+2y$	M1
	$\left(\frac{dy}{dx} =\right) \frac{12-4x+y}{y-x}$ oe	A1
		(5)
(b)	Sets $\frac{12-4x+y}{y-x}=2 \Rightarrow y=12-2x$ or $x=6-\frac{1}{2}y$	M1
	Substitute $y=12-2x$ or $x=6-\frac{1}{2}y$ into $4x^2+y^2-2xy=24x$	dM1
	$x^2-8x+12=0$ oe or $y^2-8y=0$	A1
	Solves $x=6, y=0$ or $x=2, y=8$	ddM1
	Chooses $a(x)=2, b(y)=8$ or states $(2, 8)$ only	A1
		(5)
		(10 marks)

(a) **Allow use of y' for $\frac{dy}{dx}$**

M1: Attempt at chain rule $y^2 \to ...y\frac{dy}{dx}$ where ... is a constant

M1: Attempt at product rule $2xy \to \alpha x\frac{dy}{dx}+\beta y$ where α, β ... are non-zero constants.

Condone $-2xy \to \pm\alpha x\frac{dy}{dx}\pm\beta y$

A1: Correct differentiation $8x+2y\frac{dy}{dx}-2y-2x\frac{dy}{dx}=24$ oe

M1: Collects their two different terms in $\frac{dy}{dx}$ which must have come from differentiating y^2 and $2xy$ (however poorly the differentiation was carried out) on one side of the equation with the remaining terms on the other side proceeding to $(...\pm...)\frac{dy}{dx}=.....$. May be implied by a correct answer.

Ignore a spurious $\frac{dy}{dx}$ e.g. on the left hand side as long as it is not included in the collecting of terms.

A1: $\left(\frac{dy}{dx} =\right) \frac{12-4x+y}{y-x}$ oe including $\left(\frac{dy}{dx} =\right) \frac{4x-y-12}{x-y}$ **Must be in simplest form and seen in (a)**

(b) May work in terms of *a* and *b* which is acceptable

M1: Sets their $\frac{dy}{dx} = 2$ and proceeds to a linear equation in *x* and *y*. May be unsimplified. Alternatively, substitutes in $\frac{dy}{dx} = 2$ into the given equation $8x+2y\times 2-2y-2x\times 2=24 \left(\Rightarrow 4x+2y=24\right)$

dM1: Substitutes their linear equation in *x* and *y* in the equation for C **and proceeds to a quadratic equation in *x* or *y***. Do not be concerned by the mechanics of their rearrangement. Terms should be collected but all terms do not need to be on the same side of the equation. (if all on one side then = 0 must be seen or may be implied by further work). It is dependent on the previous method mark.

A1: Correct quadratic in *x* or *y*. $x^2-8x+12=0$ oe or $y^2-8y=0$ oe terms should be collected but all terms do not need to be on the same side of the equation. (if all on one side then = 0 may be implied by further work)

ddM1: Solves their quadratic in *x* or *y* and proceeds to a pair of coordinates for *P*. Allow any valid method (usual rules apply). If via a calculator to find *x* then they must have rearranged to a three term quadratic with all terms on one side. You may need to check their roots are correct for their quadratic. It is dependent on both of the previous method marks.

Note when finding a value for *b* they may substitute into C resulting in false solutions.
e.g. ("6", "0"), ("6", "6") or ("2", "8"), ("2", "−4") which is acceptable for this mark.

A1: $P(2,8)$ only but allow other forms such as $a=2, b=8$. Condone if labelled as *x* and *y*.

If they find the coordinates $(6,0)$ then they must clearly identify $(2,8)$ as their chosen answer.

Question Number	Scheme	Marks
5. (i)	Attempts to solve $2+\lambda=-1+2\mu$ and $3+2\lambda=6+7\mu$	M1
	Correct solution $\lambda=-9,\ \mu=-3$	A1
	Substitutes their $\lambda=-9,\ \mu=-3$ into $-1+4\lambda=\beta-\mu$	dM1
	$\beta=-40$	A1
(ii)	E.g. Substitutes their $\lambda=-9$ into $\mathbf{r}=\begin{pmatrix}2\\-1\\3\end{pmatrix}+\lambda\begin{pmatrix}1\\4\\2\end{pmatrix}$	dM1
	$(-7,-37,-15)$	A1
		(6)
		(6 marks)

(i)

M1: Attempts to write down and solve equations (1) and (3) to find the value of either λ or μ

Do not be concerned by the mechanics of the rearrangement in solving.

May be implied by $\lambda=-9$ or $\mu=-3$.

A1: Correct solution **for both** $\lambda=-9,\ \mu=-3$

dM1: Substitutes their values for λ and μ into equation (2) and solves to find a value for β

Do not be concerned by the mechanics of the rearrangement in solving. It is dependent on the previous method mark.

A1: $\beta=-40$

(ii)

dM1: Scored for either substituting their $\lambda=-9$ into $\mathbf{r}=\begin{pmatrix}2\\-1\\3\end{pmatrix}+\lambda\begin{pmatrix}1\\4\\2\end{pmatrix}$ or

substituting their $\mu=-3$ and $\beta=-40$ into $\mathbf{r}=\begin{pmatrix}-1\\\beta\\6\end{pmatrix}+\mu\begin{pmatrix}2\\-1\\7\end{pmatrix}$ **and**

proceeding to find coordinates for *P*. Do not allow this mark to be scored if they then do some further manipulation.