Question Number	Scheme	Marks
5 (a)	$(1,10)$	B1, B1 **(2)**
(b)	$\frac{dy}{dt}=4t-4$, $\frac{dx}{dt}=\frac{4(2t+1)-2(4t-5)}{(2t+1)^2}$	B1, M1
	$\frac{dy}{dx}=\frac{dy/dt}{dx/dt}=\frac{(4t-4)}{14/(2t+1)^2}=\frac{2(t-1)(2t+1)^2}{7}$	dM1 A1 **(4)**
(c)	Substitutes $t=3$ into their $\frac{dy}{dx}=(28)$	
	$y-10=28(x-1)\Rightarrow y=28x-18$	M1, A1 **(2)**
(d) (i)	-5,, $x<2$	M1 A1
(ii)	$f(x)\ldots 2$	B1 **(3)** **(11 marks)**

(a)

B1: One correct coordinate. E.g. $(1,...)$ or $(...,10)$. Allow as $x=1$ or $y=10$

B1: $(1,10)$. Allow as $x=1$, $y=10$

(b)

B1: $\frac{dy}{dt}=4t-4$. You may see this written as $y'=4t-4$ or $\dot{y}=2\times 2t-4$ which is fine.

M1: Attempts to use the quotient rule (or equivalent) to differentiate $x=\frac{4t-5}{2t+1}$.

Look for the form $\frac{dx}{dt}=\frac{p(2t+1)-q(4t-5)}{(2t+1)^2}$ with p, $q>0$

You may see $x=\frac{4t-5}{2t+1}\equiv 2-\frac{7}{2t+1}\Rightarrow\frac{dx}{dt}=\frac{14}{(2t+1)^2}$ with M1 scored for the form

$x=a+\frac{b}{2t+1}\Rightarrow\frac{dx}{dt}=\frac{c}{(2t+1)^2}$

Or the product rule $x=(4t-5)(2t+1)^{-1}\Rightarrow\frac{dx}{dt}=4(2t+1)^{-1}-2(4t-5)(2t+1)^{-2}$ but condone sign and coefficient slips. Look for the form $\alpha(2t+1)^{-1}\pm\beta(4t-5)(2t+1)^{-2}$

dM1: Attempts to apply the rule $\frac{dy}{dx}=\frac{dy/dt}{dx/dt}$. Dependent upon the previous M and $\frac{dy}{dt}$ being linear

A1: A correct **simplified** expression for $\frac{dy}{dx}$ ISW after a correct answer

Allow $\frac{2(t-1)(2t+1)^2}{7}$, $\frac{(2t-2)(2t+1)^2}{7}$, $\frac{2(4t^3-3t-1)}{7}$ or $\frac{8t^3-6t-2}{7}$

Note that if division was used to find $\frac{dx}{dt}$, all calculations must have been correct.

(c)

M1: Uses the value of their gradient at $t = 3$ and their point from (a) to form the equation of the tangent.

Look for $y-'10'=m(x-'1')$ with m being the value of their $\frac{2(t-1)(2t+1)^2}{7}$ at $t = 3$

If the form $y=mx+c$ is used the method must proceed as far as $c =$…

A1: CSO $y=28x-18$

(d) (i)

M1: Achieves the correct value for the upper or lower bound. Condone $x > -5$ or x „ 2 or, with incorrect variables e.g. $y > -5$. Solutions such as $x < -5$ OR $x = 2$ will be M0

A1: -5 „ $x < 2$ or equivalent form such as $[-5, 2)$. The notation must be correct

(d)(ii)

B1: $f(x) \ldots 2$ but allow $f \ldots 2$, $y \ldots 2$ or $[2, \infty)$. Do not allow with x

Question Number	Scheme	Marks
6 (a)	Position vector of a general point on $l_1 = \begin{pmatrix} -3+2\lambda \\ 0+1\lambda \\ 5-3\lambda \end{pmatrix}$	
	$\begin{pmatrix} -3+2\lambda \\ 0+1\lambda \\ 5-3\lambda \end{pmatrix} \bullet \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix} = 0 \Rightarrow -6+4\lambda+\lambda-15+9\lambda=0 \Rightarrow \lambda = \frac{3}{2}$	M1, A1
	Substitute $\lambda = \frac{3}{2}$ into $\begin{pmatrix} -3+2\lambda \\ 0+1\lambda \\ 5-3\lambda \end{pmatrix} \Rightarrow P = \left(0, \frac{3}{2}, \frac{1}{2}\right)$	dM1, A1
		(4)
(b)	Lines intersect when $\begin{pmatrix} -3 \\ 0 \\ 5 \end{pmatrix} + \lambda \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} + \mu \begin{pmatrix} 4 \\ a \\ -2 \end{pmatrix}$	
	Solves $-3+2\lambda = 4\mu$ and $5-3\lambda = -2\mu \Rightarrow \lambda = \frac{7}{4}, \mu = \frac{1}{8}$	M1, A1
	Uses $\mu a = \lambda \Rightarrow \frac{1}{8}a = \frac{7}{4} \Rightarrow a = 14$	dM1, A1
		(4)
(c)	For Example: Attempts $\mu \begin{pmatrix} 4 \\ a \\ -2 \end{pmatrix}$ o.e. with their a and $\mu \Rightarrow Q = \left(\frac{1}{2}, \frac{7}{4}, -\frac{1}{4}\right)$	M1, A1
		(2)
		(10 marks)
6 (a) ALT way	$OP^2 = (-3+2\lambda)^2 + (\lambda)^2 + (5-3\lambda)^2 = 14\lambda^2 - 42\lambda + 34$	
	Find the value of λ at the minimum, e.g. $\frac{\mathrm{d}\left(OP^2\right)}{\mathrm{d}\lambda} = 28\lambda - 42 = 0 \Rightarrow \lambda = \frac{3}{2}$	M1, A1
	Substitute $\lambda = \frac{3}{2}$ into $\begin{pmatrix} -3+2\lambda \\ 0+1\lambda \\ 5-3\lambda \end{pmatrix} \Rightarrow P = \left(0, \frac{3}{2}, \frac{1}{2}\right)$	dM1, A1
		(4)