Question	Scheme	Marks
5(a)	$y = Q(x-6)(x+2)$ where Q is a constant Using the coordinates $(4,-6)$	M1
	$-6 = Q(4-6)(4+2) \Rightarrow Q = \dfrac{-6}{-12} = \dfrac{1}{2}$	M1
	$y = \dfrac{1}{2}(x-6)(x+2) \Rightarrow y = \dfrac{x^2}{2} - 2x - 6$ *	A1 cso [3]
(b)	$\dfrac{dy}{dx} = \dfrac{2x}{2} - 2$	M1
	$x = 4, \quad \dfrac{dy}{dx} = 4 - 2 = 2$	M1
	Gradient of normal is $-\dfrac{1}{2}$	B1ft
	Equation of l: $y - (-6) = -\dfrac{1}{2}(x-4)$	M1
	$\Rightarrow y = -\dfrac{x}{2} - 4 \Rightarrow 2y + x + 8 = 0$ *	A1 cso [5]
(c)	$\dfrac{x^2}{2} - 2x - 6 = -\dfrac{x}{2} - 4 \Rightarrow \dfrac{x^2}{2} - \dfrac{3}{2}x - 2 = 0$ $\Rightarrow (x-4)(x+1) = 0 \Rightarrow x = -1, 4$	M1 M1 A1
	Area $= \int_{-1}^{4}\left(\dfrac{x^2}{2} - 2x - 6\right) dx - \int_{-1}^{4}\left(-\dfrac{x}{2} - 4\right) dx$	M1
	$= \left[\dfrac{x^3}{6} - \dfrac{3}{4}x^2 - 2x\right]_{-1}^{4}$	M1
	$= \left(\dfrac{4^3}{6} - \dfrac{3}{4}\times 4^2 - 2\times 4\right) - \left(\dfrac{(-1)^3}{6} - \dfrac{3}{4}\times(-1)^2 - 2\times(-1)\right)$	M1
	$= \left(\dfrac{4^3}{6} - \dfrac{3}{4}\times 4^2 - 2\times 4\right) - \left(\dfrac{(-1)^3}{6} - \dfrac{3}{4}\times(-1)^2 - 2\times(-1)\right)$ $= -\dfrac{125}{12} \Rightarrow$ Area $= \dfrac{125}{12}$ (units^2) oe	A1 [7]
		Total 15 marks

Part	Mark	Notes
(a)	M1	Uses the intersections with the x-axes to form a quadratic equation of the form $y = Q(x \pm 6)(x \pm 2)$

	M1	Uses their Quadratic with the coordinates (4, – 6) to find the value of Q Allow just one processing error here.
	A1 cso	For the correct equation in the required form. Note this equation is given to candidates. Both above steps must be complete and correct for the award of this mark.
	ALT – Uses simultaneous equations	
	M1	Sets up all three equations with the given coordinates. These must be correct. $y = px^2 + qx + r$ $0 = 4p - 2q + r$ **1** $0 = 36p + 6q + r$ **2** $-6 = 16p + 4q + r$ **3**
	M1	Attempts to solve their three simultaneous equations to find the values of p, q and r At least one correct value is evidence of correct method. **2-1** $0 = 32p + 8q$ **4** **3-2** $6 = 20p + 2q$ **5** **5**$\times 4$ $24 = 80p + 8q$ **6** **6 - 4** $24 = 48p \Rightarrow p = \frac{1}{2}$, $24 = 40 + 8q \Rightarrow q = -2$ $0 = 2 + 4 + r \Rightarrow r = -6$
	A1 cso	For the correct equation in the required form. Note this equation is given to candidates. All of the above steps must be complete and correct for the award of this mark.
(b)	M1	For differentiating the given expression. This must be correct, simplified or unsimplified for this mark.
	M1	For substituting $x = 4$ into their $\frac{dy}{dx}$ to find the gradient of the tangent.
	B1ft	For finding the gradient of the normal. Ft their gradient.
	M1	For forming an equation for l using the equation of the normal which must have come from use of calculus. If they use $y = mx + c$ then they must find c and form an equation for the award of this mark. For example; $c = -4 \Rightarrow y = -\frac{x}{2} - 4$
	A1 cso	For the correct equation in the required form. Accept the terms in any order. For example: even $0 = -8 - x - 2y$
(c)	M1	For equating the equation of S to their l and forming a 3TQ
	M1	For attempting to solve the 3TQ [see General Guidance for the definition of an attempt] to find two points of intersection.
	A1	For **both** correct values of x
	M1	For a correct statement for the area using **their two points of intersection** correctly. **Do not accept limits of $x = -$ 2 and 4 or 6** They may complete these two areas separately and combine at the end. Check to the end of their work before you score this mark. Accept either $\int_{'-1'}^{'4'} \text{Curve} - \int_{'-1'}^{'4'} \text{Line}$ or $\int_{'-1'}^{'4'} \text{Line} - \int_{'-1'}^{'4'} \text{Curve}$ for this mark.
	M1	For an attempt to integrate either the expression for the line or the curve.