Question number	Scheme	Marks
4 (a)	$\mathrm{f}(x) = 2(x-3)^2 - 5$ $\Rightarrow \mathrm{f}(x) = 2(x^2 - 6x + 9) - 5 = 2x^2 - 12x + 13$ $p = -12,^{*}\ \ q = 13$ **ALT** $\dfrac{\mathrm{d}y}{\mathrm{d}x} = 4x + p = 0$ at $(3, -5)$ $\Rightarrow 4 \times 3 + p = 0 \Rightarrow p = -12^{*}$ $-5 = 2 \times 3^2 - 12 \times 3 + q \Rightarrow q = 13$	M1M1 M1A1 cso [4] M1 M1 M1A1 cso [4]
(b)	Minimum since coefficient of x^2 is positive	B1 [1]
(c)	$\dfrac{\mathrm{d}y}{\mathrm{d}x} = 4x - 12 \Rightarrow$ when $x = 1$ $\dfrac{\mathrm{d}y}{\mathrm{d}x} = -8$ So gradient of normal = $\dfrac{1}{8}$ When $x = 1$ $y = 3$ $y - '3' = \dfrac{1}{'8'}(x-1)$ Eg. $y - 3 = \dfrac{1}{8}(x-1)$, $x - 8y + 23 = 0$ oe	B1 B1ft M1 M1 A1, A1 [6]
		Total 11 marks

Part	Mark	Notes
(a)	M1	For using the coordinate of the stationary point and forming the expression: $\mathrm{f}(x)=2(x-3)^2-5$ This must be correct for this mark
	M1	Expands their $2(x-3)^2-5$ to form a 3TQ
	M1	For equating coefficients with the given equation to find the value of p and q
	A1	For $p=-12,*$ $q=13$ **NB:** The value of p is given in the question.
	ALT – Uses differentiation	
	M1	For a correct differentiation of the expression for y This must be correct for this mark
	M1	For equating their $\frac{\mathrm{d}y}{\mathrm{d}x}=0$, substituting in $x = 3$ and attempting to find a value for p
	M1	For substituting the given value of p into $y=2x^2+px+q$ using the coordinates $(3,-5)$ to find the value of q. Explicit substitution of the value of p into the equation must be seen if p has not been found using differentiation. [M0M0M1A0 can be scored]
	A1	For $p=-12,*$ $q=13$ **NB:** The value of p is given in the question.
(b)	B1	For the correct statement: Minimum since coefficient of x^2 is positive
	ALT	
	B1	For $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}=4\Rightarrow$ positive, hence minimum. A correct conclusion is required.
(c)	B1	For the value of the gradient when $x = 1$ $[m=-8]$
	B1ft	For the gradient of the normal which must have come from differentiation. Ft their -8
	M1	For the value of y when $x = 1$ using their value of q
	M1	For a complete equation of the line in any form using their normal and their value of y Allow this mark for an equation of the line with $x = 1$ and $y =$ '3' with their normal, provided there is evidence that the normal comes from the negative reciprocal of their value of the tangent. For this mark the gradient of the tangent need not have come from differentiation.
	A1	For the correct equation in any form.
	A1	For the correct equation in the required form or any multiples of the coefficients.