Question	Scheme	Marks	AOs
1(a)	$$\frac{\mathrm{d}}{\mathrm{d}x}\left(3y^2\right)=6y\frac{\mathrm{d}y}{\mathrm{d}x}$$ or $$\frac{\mathrm{d}}{\mathrm{d}x}\left(qxy\right)=qx\frac{\mathrm{d}y}{\mathrm{d}x}+qy$$	M1	2.1
	$$3px^2+qx\frac{\mathrm{d}y}{\mathrm{d}x}+qy+6y\frac{\mathrm{d}y}{\mathrm{d}x}=0$$	A1	1.1b
	$$\left(qx+6y\right)\frac{\mathrm{d}y}{\mathrm{d}x}=-3px^2-qy\Rightarrow\frac{\mathrm{d}y}{\mathrm{d}x}=...$$	dM1	2.1
	$$\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{-3px^2-qy}{qx+6y}$$	A1	1.1b
		(4)	
(b)	$$p\left(-1\right)^3+q\left(-1\right)\left(-4\right)+3\left(-4\right)^2=26$$	M1	1.1b
	$$19x+26y+123=0\Rightarrow m=-\frac{19}{26}$$	B1	2.2a
	$$\frac{-3p\left(-1\right)^2-q\left(-4\right)}{q\left(-1\right)+6\left(-4\right)}=\frac{26}{19}\quad\text{or}\quad\frac{q\left(-1\right)+6\left(-4\right)}{3p\left(-1\right)^2+q\left(-4\right)}=-\frac{19}{26}$$	M1	3.1a
	$$p-4q=22,\ 57p-102q=624\Rightarrow p=...,q=...$$	dM1	1.1b
	$$p=2,\ q=-5$$	A1	1.1b
		(5)	
		(9 marks)	
	Notes		

(a)

M1: For selecting the appropriate method of differentiating:

Allow this mark for either $3y^2\rightarrow\alpha y\dfrac{\mathrm{d}y}{\mathrm{d}x}$ or $qxy\rightarrow\alpha x\dfrac{\mathrm{d}y}{\mathrm{d}x}+\beta y$

A1: Fully correct differentiation. Ignore any spurious $\dfrac{\mathrm{d}y}{\mathrm{d}x}=...$

dM1: A valid attempt to make $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ the subject with 2 terms only in $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ coming from qxy and $3y^2$

Depends on the first method mark.

A1: Fully correct expression

(b)

M1: Uses $x=-1$ and $y=-4$ in the equation of C to obtain an equation in p and q

B1: Deduces the correct gradient of the given normal.

This may be implied by e.g.

$19x+26y+123=0\Rightarrow y=-\dfrac{19}{26}x+...\Rightarrow$ Tangent equation is $y=\dfrac{26}{19}x+...$

M1: Fully correct strategy to establish an equation connecting p and q using $x=-1$ and $y=-4$ in

their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and the gradient of the normal. E.g. $(a)=-1\div\text{their}-\dfrac{19}{26}$ or $-1\div(a)=\text{their}-\dfrac{19}{26}$

dM1: Solves simultaneously to obtain values for p and q.

Depends on both previous method marks.

A1: Correct values

Alternative for (b):

$$\frac{dy}{dx} = \frac{-3p+4q}{-q-24} \Rightarrow y+4 = \frac{q+24}{4q-3p}(x+1)$$

M1A1

$$\Rightarrow y(4q-3p) + 4(4q-3p) = (q+24)x + q + 24$$

M1

$$19x + 26y + 123 = 0 \Rightarrow q + 24 = 19 \Rightarrow q = -5$$

$$3p - 4q = 26 \Rightarrow 3p + 20 = 26 \Rightarrow p = 2$$

M1A1

M1: Uses $(-1, -4)$ in the tangent gradient and attempts to form normal equation
A1: Correct equation for normal
M1: Multiplies up so that coefficients can be compared
dM1: Full method comparing coefficients to find values for p and q
A1: Correct values