Question	Scheme	Marks
8(a)	$\frac{2x}{16}+\frac{2y}{9}\frac{\mathrm{d}y}{\mathrm{d}x}=0$ or $\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{\mathrm{d}y}{\mathrm{d}\theta}\frac{\mathrm{d}x}{\mathrm{d}\theta}=\frac{3\cos\theta}{-4\sin\theta}$ or $\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{9}{2}\left(1-\frac{x^2}{16}\right)^{-\frac{1}{2}}\times-\frac{2x}{16}$	B1
	$m_N=-\frac{\mathrm{d}x}{\mathrm{d}y}=\frac{4\sin\theta}{3\cos\theta}\left(=\left(\frac{-2(4\cos\theta)\times9}{16\times2(3\sin\theta)}\right)^{-1}\right)$	M1
	$y-3\sin\theta="\frac{4\sin\theta}{3\cos\theta}"(x-4\cos\theta)$	M1
	$3y\cos\theta-9\sin\theta\cos\theta=4x\sin\theta-16\sin\theta\cos\theta$ $\Rightarrow 4x\sin\theta-3y\cos\theta=7\sin\theta\cos\theta$	A1*
		(4)
(b)	$x_A=\frac{7\cos\theta}{4}$	B1
	Area $OAP=\frac{1}{2}x_A\times y_P=\frac{1}{2}\times"\frac{7}{4}\cos\theta"\times3\sin\theta$	M1
	$=\frac{21}{8}\sin\theta\cos\theta=\frac{21}{8}\times\frac{1}{2}\sin2\theta$	M1
	$=\frac{21}{16}\sin2\theta$	A1
		(4)
(c)	$\frac{21}{16}$	B1ft
		(1)
		(9 marks)

Notes:

(a)

B1: Any correct differential statement for the ellipse given.

M1: Substitutes P and applies the negative reciprocal to find the gradient of the normal in terms of θ

M1: Attempts the equation of the normal using their attempt at the normal gradient – any adapted $\frac{\mathrm{d}y}{\mathrm{d}x}$ or equivalent method. If using the $'y=mx+c'$ method then they must make progress to finding the 'c'.

A1*: Multiplies by the $"4\cos\theta"$ to get rid of the fractions in the equation and correctly reaches the given equation with derivative having been seen and no errors in the working.

(b)

B1: States or uses the correct x coordinate at point A.

M1: Correct method for the area of triangle OAP.

M1: Applies the double angle identity for sin to reach the required form.

A1: Correct answer.

(c)

B1ft: Identifies their value of k as the maximum value for the area.