Question	Scheme	Marks
10(a)	$f'(4)=6(4)-\frac{7\times14}{4}=-\frac{1}{2}$	B1
	$m_T=-\frac{1}{2}\Rightarrow m_N=\frac{-1}{-1/2}$	M1
	$y-12=2(x-4)$ or $y=mx+c\Rightarrow y=2x+c\Rightarrow 12=2(4)+c\Rightarrow c=...$	M1 (A1 on ePen)
	$y=2x+4$	A1
		(4)
(b)	$...\frac{(2x-1)(3x+2)}{2\sqrt{x}}=...\frac{6x^2+x-2}{2\sqrt{x}}=...3x^{\frac{3}{2}}+\frac{1}{2}x^{\frac{1}{2}}-x^{-\frac{1}{2}}$	M1
	$f(x)=\frac{6x^2}{2}-\frac{6}{5}x^{\frac{5}{2}}-\frac{1}{3}x^{\frac{3}{2}}+2x^{\frac{1}{2}}(+c)$ or e.g. $f(x)=\frac{6x^2}{2}-\frac{3}{5/2}x^{\frac{5}{2}}-\frac{1/2}{3/2}x^{\frac{3}{2}}+\frac{x^{\frac{1}{2}}}{1/2}(+c)$ or e.g. $f(x)=\frac{6x^2}{2}-\left(\frac{3}{5/2}x^{\frac{5}{2}}+\frac{1/2}{3/2}x^{\frac{3}{2}}-\frac{x^{\frac{1}{2}}}{1/2}\right)(+c)$	M1A1A1
	$12=\frac{6(4)^2}{2}-\frac{6}{5}(4)^{\frac{5}{2}}-\frac{1}{3}(4)^{\frac{3}{2}}+2(4)^{\frac{1}{2}}+c\Rightarrow c=...$	M1
	$(f(x)=)3x^2-\frac{6}{5}x^{\frac{5}{2}}-\frac{1}{3}x^{\frac{3}{2}}+2x^{\frac{1}{2}}+\frac{16}{15}$	A1
		(6)
		Total 10

Notes:

(a)

B1: Correct gradient at *P* (may be implied)

M1: Attempts to use the perpendicular gradient rule to find the normal gradient.

Look for e.g. $m_N=\frac{-1}{m_T}$ or e.g. $m_T\times m_N=-1\Rightarrow -\frac{1}{2}m_N=-1\Rightarrow m_N=...$

May be implied by their normal gradient.

M1(A1 on Epen): Attempts the equation of the normal using a "changed" gradient with $x = 4$ and $y = 12$ correctly placed.

Alternatively uses $y = mx + c$ with a "changed" gradient with $x = 4$ and $y = 12$ to find a value for c.

A1: Correct equation in the required form

(b) **Allow work for part (b) seen in part (a) to score in (b) provided it is seen or used in (b)**

M1: Expands the numerator of the fraction and attempts to split.

Score for one correct index achieved from correct work e.g. $\frac{..x^2}{\sqrt{x}} \rightarrow ...x^{\frac{3}{2}}$ or $\frac{...x}{\sqrt{x}} \rightarrow ...x^{\frac{1}{2}}$ or $\frac{...}{\sqrt{x}} \rightarrow ...x^{-\frac{1}{2}}$

M1: Attempts to integrate a fractional power. E.g. $...x^{\frac{3}{2}} \rightarrow ...x^{\frac{5}{2}}$ or $x^{\frac{1}{2}} \rightarrow ...x^{\frac{3}{2}}$ or $x^{-\frac{1}{2}} \rightarrow ...x^{\frac{1}{2}}$ etc.

Do not allow this mark for an attempt to integrate the $\sqrt{x}$ in the denominator.

A1: Any 2 correct terms simplified or unsimplified.

A1: All correct simplified or unsimplified. The "+ *c*" is not required here.

M1: Uses $x = 4$ and $y = 12$ following an attempt to increase at least one power x by 1 to find a value for their c.

Their c may not be fully evaluated but must be a numerical expression.

A1: Correct simplified form. The $"\mathrm{f}(x) ="$ is not required just look for the correct expression.

Accept equivalent simplified forms and allow $\left(\mathrm{f}(x) =\right) 3x^2 - \left(\frac{6}{5}x^{\frac{5}{2}} + \frac{1}{3}x^{\frac{3}{2}} - 2x^{\frac{1}{2}}\right) + \frac{16}{15}$

Apply isw if applicable unless they multiply all terms by e.g. 15

Question	Scheme	Marks
11(a)	$x = \frac{5\pi}{2}$ **or** $y = 12$	B1
	$x = \frac{5\pi}{2}$ **and** $y = 12$	B1
		(2)
(b)	$x = \frac{3\pi}{2}$ **or** $y = -21$	B1
	$x = \frac{3\pi}{2}$ **and** $y = -21$	B1
		(2)
(c)(i)	$(A =) -12$	B1
(ii)	$(B =) \frac{5\pi}{4}$	B1
		(2)
		Total 6

Notes:

Look for answers written in the body of the question or on the sketch.

In all cases, answers written in the body of the script take precedence over answers written on the diagram.

Angles and numbers must be written as <u>single</u> terms e.g. not $2\pi + \frac{\pi}{2}$ for $\frac{5\pi}{2}$

Penalise the use of degrees <u>once</u> the first time it occurs

e.g. (a) (450°, 12) (b) (270°, −21) (c) $A = -12$, $B = 225°$ scores (a) B1B0 (b) B1B1 (c) B1B1

The degrees symbol is not required

If both coordinates in (a) and (b) are correct but the wrong way round score as B1B0 each time

e.g. (a) $\left(12, \frac{5\pi}{2}\right)$ (b) $\left(-21, \frac{3\pi}{2}\right)$ scores (a) B1B0 (b) B1B0

If the coordinates in (a) or (b) are the wrong way round and only one is correct score as B0B0 each time

If the coordinates are the wrong way round <u>and</u> correct in degrees in (a) and (b)

e.g. (a) (12, 450°) (b) (−21, 270°) award (a) B0B0 (b) B1B0

The degrees symbol is not required