(b)	$f'(4) = -1 - \frac{12}{8} = -2\frac{1}{2}$	M1
	$y - 25 = -\frac{5}{2}(x-4) \Rightarrow y = -\frac{5}{2}x + 35$ or $y = -\frac{5}{2}x + c \Rightarrow 25 = -\frac{5}{2} \times 4 + c \Rightarrow c = ...$ $\Rightarrow y = -\frac{5}{2}x + 35$	**d**M1 A1
		(3)
		8 marks

(b) Notes

M1: Substitutes $x = 4$ into their $f'(x)$ from part (a) to find a value which may be implied.
There must have been an attempt to differentiate so do not allow for finding e.g. $f(4)$.
If no substitution is seen and their value is incorrect for their derivative (you may need to check) then score M0

dM1: Attempts an equation of the tangent (**not the normal**) at (4, 25) using a correct method with the values correctly placed. If using $y = mx + c$ must reach as far as finding a value for c.
Depends on the first method mark.

A1: $y = -\frac{5}{2}x + 35$ oe e.g. $y = -2.5x + 35$

Part (a) Using quotient rule:

$$f(x) = \frac{\left(4+3\sqrt{x}\right)^2}{x} \Rightarrow f'(x) = \frac{x \times 2\left(4+3\sqrt{x}\right) \times \frac{3}{2}x^{-\frac{1}{2}} - \left(4+3\sqrt{x}\right)^2}{x^2}$$

M1 for $f'(x) = \frac{...x\left(4+3\sqrt{x}\right) \times x^{-\frac{1}{2}} - \left(4+3\sqrt{x}\right)^2}{x^2}$

A1 can then be scored for fully correct differentiation

Then,

M1 for an attempt to expand, collect terms and simplify to obtain $\frac{...x^{\frac{1}{2}} + ...}{x^2}$

A1 for $\frac{-12x^{\frac{1}{2}} - 16}{x^2}$

A1 for $-\frac{16}{x^2} - \frac{12}{x^{\frac{3}{2}}}$

Part (a) Using product rule:

$$f(x) = \frac{\left(4+3\sqrt{x}\right)^2}{x} = x^{-1}\left(4+3\sqrt{x}\right)^2 \Rightarrow f'(x) = x^{-1} \times 2\left(4+3\sqrt{x}\right) \times \frac{3}{2}x^{-\frac{1}{2}} + \left(4+3\sqrt{x}\right)^2 \times -x^{-2}$$

M1 for $f'(x) = ...x^{-1}\left(4+3\sqrt{x}\right) \times x^{-\frac{1}{2}} + ...\left(4+3\sqrt{x}\right)^2 x^{-2}$

A1 can then be scored for fully correct differentiation

Then,

M1 for an attempt to expand, collect terms and simplify to obtain $...x^{-\frac{3}{2}}$ or $...x^{-2}$

Then the **A** marks as in the main scheme.

Question Number	Scheme	Marks
4(a)(i)	$(0, 4)$	B1
(ii)	$(6, 13)$	B1

(a) Notes

(i)

B1: Allow the coordinates to be written separately as $x = \ldots$, $y = \ldots$ and allow $y = 4$ as long as there is no suggestion that x is anything other than 0.

Condone missing brackets e.g. $0, 4$ or unusual punctuation e.g. $(0;4)$ or a vector e.g. $\begin{pmatrix}0\\4\end{pmatrix}$

Do **not** allow coordinates the wrong way round unless the correct answer is seen previously then apply isw.

Condone $\frac{8}{2}$ for 4.

Do not allow $P = 4$

(ii)

B1: Allow the coordinates to be written separately as $x = \ldots$, $y = \ldots$

Condone missing brackets e.g. $6,13$ or unusual punctuation e.g. $(6;13)$ or a vector e.g. $\begin{pmatrix}6\\13\end{pmatrix}$

Do **not** allow coordinates the wrong way round unless the correct answer is seen previously then apply isw.

Condone $\frac{26}{2}$ for 13.

Allow work that implies the correct coordinates e.g. $x = 6 \rightarrow 2y = 18 + 8 = 26 \rightarrow y = 13$

(b)	The gradient of line $l_1 = \frac{3}{2}$ oe	B1
	Perpendicular gradient $"-\frac{2}{3}"$	M1
	$y - "13" = "-\frac{2}{3}"(x-6)$ or $y = "-\frac{2}{3}"x + c \Rightarrow "13" = "-\frac{2}{3}" \times 6 + c \Rightarrow c = ...$	M1
	$2x + 3y - 51 = 0$	A1
		(4)
(c)	$y = 0 \Rightarrow 2x - 51 = 0 \Rightarrow x = ...\left(\frac{51}{2}\right)$	M1
	Full and correct method of finding required area e.g. trapezium + triangle: $\frac{6}{2}("4" + "13") + \frac{1}{2} \times "13" \times \left("\frac{51}{2}" - 6\right)$	**d**M1
	= 177.75	A1
		(3)
		(9 marks)

Notes

(b)

B1: The gradient of line $l_1 = \frac{3}{2}$ oe which may be implied.

M1: Attempts $l_2 = -\frac{1}{\text{their gradient of } l_1}$ which may be implied.

M1: Uses $x = 6$ and their y coordinate of Q with a changed $"\frac{3}{2}"$ in an attempt to find an equation for l_2 using a correct method with the values correctly placed.

If using $y = mx + c$ must reach as far as finding a value for c.

A1: $2x + 3y - 51 = 0$ or any integer multiple of this equation. (Allow terms in any order).

(c)

M1: Substitutes $y = 0$ into their equation from part (b) to find the x coordinate of R.

dM1: For a full and correct method using their values to find the area of shape $OPQR$

e.g. trapezium + triangle. (See scheme)

e.g. rectangle + triangle + triangle $"4" \times 6 + \frac{6}{2}("13" - "4") + \frac{1}{2} \times "13" \times \left("\frac{51}{2}" - 6\right)$

e.g. triangle PQR + triangle OPR $\frac{1}{2}\sqrt{\left(6 - "\frac{51}{2}"\right)^2 + "13"^2} \times \sqrt{6^2 + ("13" - "4")^2} + \frac{1}{2} \times "\frac{51}{2}" \times "4"$

e.g. rectangle + triangle − triangle $6 \times "13" - \frac{1}{2}("13" - "4") \times 6 + \frac{1}{2} \times "13" \times \left("\frac{51}{2}" - 6\right)$

May see shoelace method for areas e.g. for PQR: $\frac{1}{2}\begin{vmatrix} 0 & \frac{51}{2} & 6 & 0 \\ 4 & 0 & 13 & 4 \end{vmatrix} = \frac{1}{2}\left(\frac{51}{2} \times 13 + 6 \times 4 - \frac{51}{2} \times 4\right)$

Depends on the first method mark.

A1: 177.75 oe e.g. $\frac{711}{4}$