(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 $\frac{1}{2}\sqrt{\left(6 - "\frac{51}{2}"\right)^2 + "13"^2} \times \sqrt{6^2 + ("13" - "4")^2} + \frac{1}{2} \times "\frac{51}{2}" \times "4"$

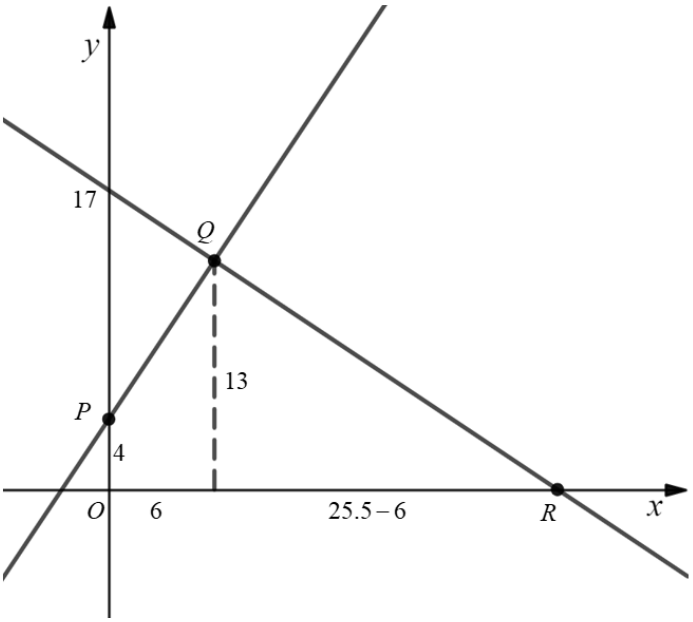
e.g. rectangle + triangle − triangle $6 \times "13" - \frac{1}{2}("13" - "4") \times 6 + \frac{1}{2} \times "13" \times \left("\frac{51}{2}" - 6\right)$

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. $\frac{711}{4}$

4(c) Further guidance:



There are lots of different methods to find the total area so look carefully at their work.

e.g. triangle − triangle: $\frac{1}{2}\times 17\times 25.5-\frac{1}{2}(17-4)\times 6$

An unusual one is triangle OPQ + triangle OQR = $\frac{1}{2}\times 4\times 6+\frac{1}{2}\times 25.5\times 13$

Allow integration attempts e.g. $\int_0^6\left(\frac{3}{2}x+4\right)\mathrm{d}x+\int_6^{\frac{51}{2}}\left(17-\frac{2}{3}x\right)\mathrm{d}x=\ldots$

In this case, an attempt to evaluate the expression as shown is fine for the method mark and allow A1 if correctly evaluated on a calculator.

If you are unsure if a particular method deserves credit then use Review.

Question Number	Scheme	Marks
5(a)	(8, 5)	B1
		(1)
(b)	$y = 7$	B1
		(1)
(c)	$5 < k < 10$	M1A1
		(2)

Notes

(a)

B1: Accept (8, 5) or $x = 8, y = 5$ or a sketch of $y = \mathrm{f}\left(\frac{1}{4}x\right)$ with a minimum point marked at (8, 5)

Condone missing brackets e.g. $8, 5$ or unusual punctuation e.g. $(8; 5)$ or a vector e.g. $\begin{pmatrix} 8 \\ 5 \end{pmatrix}$

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

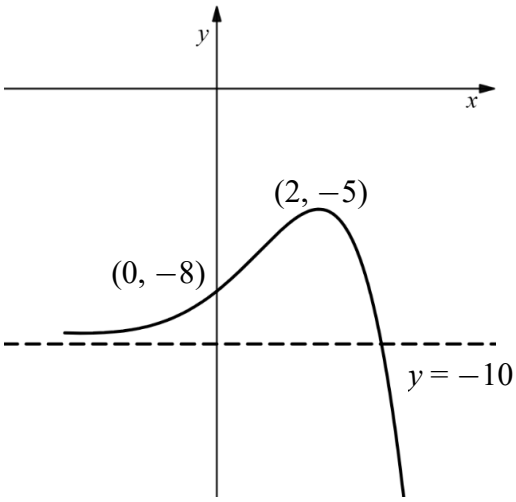
(b)

B1: $y = 7$. It must be an equation and not just '7'

(c)

M1: For one "end" of the interval condoning strictness so allow for $k > 5$, $k \geqslant 5$, $k < 10$, $k \leqslant 10$
Condone use of x or y rather than k for this mark.

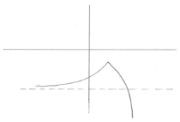
A1: cao $5 < k < 10$. Allow "$k > 5$ **and** $k < 10$", $(5, 10)$, $\{k \in \mathbb{R} : 5 < k < 10\}$
Must be in terms of k.
Do not allow "$k > 5$ **or** $k < 10$" or "$k > 5$, $k < 10$"

(d)		Shape	B1
		(0, −8) and (2, −5)	B1
		Asymptote	B1
			(3)
			(7 marks)

(d) Notes

There must be a sketch to score any marks.
If the original curve is included on their sketch it can be ignored.
If more than 1 sketch is given, mark the final attempt.

B1: For a reflection of the original curve in the x-axis.
The curve must be in quadrants 3 and 4 only.
There should be a maximum in quadrant 4.

Condone a maximum that is cusp-like e.g.  as long as the intention is clear.

The right hand tail should be below the left hand tail i.e. must at least touch the asymptote if it was drawn.
Condone a right hand tail that starts to bend to the right as long as it does not head back towards the x-axis to create a clear minimum.
The coordinates of the y intercept, the maximum and the position of the asymptote can be ignored for this mark.

B1: For the intercept of $(0, -8)$ and the maximum point $(2, -5)$ correctly labelled that correspond with the sketch.

Allow -8 marked in the correct place and condone $(-8, 0)$ as long as it is the correct place.

Allow the $(2, -5)$ to be indicated by the labels 2 and -5 on the appropriate axes.

Allow to appear away from the sketch but they must be fully correct.
If there is any ambiguity, the sketch takes precedence.

B1: For the asymptote equation of $y = -10$ that corresponds with their sketch.

It must be an **equation** i.e. not just -10 marked on the y-axis.

The curve must be asymptotic to $y = -10$ from above for one of the branches.

See extra document for some example sketches.