- A conclusion that $x = 16$

Allow as a minimum e.g. $\sqrt{x} = -\frac{11}{4}$ (which is) **< 0** (so reject) so $x = 16$

Do not allow incorrect arguments such as "$\sqrt{x} \neq -\frac{11}{4}$ as you can't square root a negative number"

or insufficient reasoning e.g. $\sqrt{x} = -\frac{11}{4}$ (reject)

An alternative for the A1* would be to check which values of *x* are valid e.g.

$x = \frac{121}{16} \Rightarrow 4\left(\frac{121}{16}\right) - 5\left(\frac{11}{4}\right) - 44 = -\frac{55}{2}$

$x = 16 \Rightarrow 4(16) - 5(4) - 44 = 0$

$x = 16$ is the only solution

This must follow M1 and requires:

- Correct values of x
- Correct evaluation of $4x - 5x^{\frac{1}{2}} - 44$ for $x = \frac{121}{16}$ and $x = 16$
- A (minimal) conclusion e.g. $x = 16$, QED, tick etc.

(10 marks)

Question Number	Scheme	Marks
5(a)	$-2x^2+12x+7 \equiv -2(x\pm...)^2+...$	B1
	$\equiv -2(x-3)^2+25$	M1 A1
		(3)
(b)	$(3, 25)$	M1 A1
		(2)

Notes

(a)

B1: States that $a=-2$ or else writes $-2x^2+12x+7$ in the form $-2(x\pm\alpha)^2+\beta,\ \alpha,\beta\neq 0$ or e.g. $-2\left[(x\pm\alpha)^2+\beta\right],\ \alpha,\beta\neq 0$

M1: For $-2x^2+12x+7\equiv -2(x\pm 3)^2\pm k$ or e.g. $-2\left[(x\pm 3)^2\pm k\right],\ k\neq 0$

A1: Correct values of a, b and c or writes $-2x^2+12x+7$ as $-2(x-3)^2+25$

Special case – candidates who change the sign of the expression:

e.g. $-2x^2+12x+7\rightarrow 2x^2-12x-7\equiv 2(x-3)^2-25$

Can score a maximum of B0M1A0 if they obtain $2(x\pm 3)^2\pm k, k\neq 0$ or equivalent.

If the signs are subsequently reversed then the main scheme can be applied and all marks are available.

(b) **May be seen on the Figure or within the body of the question.**
Note that this is an independent part of the question and not a "Hence…"
As such they can either score the method mark (and possibly the A mark) as described below if they use their completed square form from part (a) or they can answer it in isolation and score M1 for one correct coordinate and A1 for both correct coordinates.

M1: Award for **either** $x=3$ or $y=25$ **or** follow through their $-2(x-3)^2+25$ so for their $a(x+b)^2+c$ award for $x=-b$ or $y=c$

Note that x may be found from $y=-2x^2+12x+7\Rightarrow \frac{dy}{dx}=-4x+12,\ -4x+12=0\Rightarrow x=3$

or $y=-2x^2+12x+7\Rightarrow$ vertex is at $x=-\frac{12}{2\times -2}=3$

May be seen as $x=\ldots$ or $y=\ldots$ or as part of a coordinate pair.

A1: $(3, 25)$ Condone missing brackets e.g. $3, 25$ or unusual punctuation e.g. $(3;25)$ or a vector e.g. $\begin{pmatrix}3\\25\end{pmatrix}$ Do **not** allow coordinates the wrong way round unless the correct answer is seen previously then apply isw. This mark is **not** follow through so the coordinates must be correct. Correct answer only scores both marks.

(c)	$y \leqslant -2x^2 + 12x + 7$, $y \geqslant "\frac{25}{3}"x$, $x \geqslant 0$	B1ft B1ft
		(2)
		(7 marks)

(c) Notes

Allow use of f(x) for y.

Do not allow use of R for y e.g. $R \leqslant -2x^2 + 12x + 7$ or e.g. $y >$ line

B1ft: Any 2 of $y \leqslant -2x^2 + 12x + 7$, $y \geqslant "\frac{25}{3}"x$, $x \geqslant 0$ with inequalities in the correct directions and ignore any other inequalities for this mark.

Allow strict or non-strict inequalities and condone a mix of both for this mark.

Follow through their equation for $l\left(y = \frac{c}{-b}\right)$ or their coordinates from part (b) and their possibly incorrect completed square form for C.

Examples:

$$y \leqslant -2x^2 + 12x + 7, \quad y \geqslant "\frac{25}{3}"x$$

$$"\frac{25}{3}"x < y < -2x^2 + 12x + 7$$

$$y \leqslant -2x^2 + 12x + 7,\ x > 0$$

For the restriction on x, allow $0 < x < a$ where $a \geqslant "3"$

B1ft: Correct and fully **consistent** inequalities and no incorrect inequalities.

Follow through their equation for $l\left(y = \frac{c}{-b}\right)$ or their coordinates from part (b) and their possibly incorrect completed square form for C.

For the restriction on x, allow $0 < x < a$ where $a \geqslant "3"$ but must be consistent with the other inequalities i.e. strict or non-strict and must not contradict the inequalities given for the line and the curve if "3" is the upper limit.

e.g. $"\frac{25}{3}x" \leqslant y \leqslant -2x^2 + 12x + 7, \quad 0 \leqslant x < 3$ scores B1ftB0ft

If extra inequalities are given that do not contradict then they can be ignored (see examples below)

<u>Examples of full marks in (c):</u>

$$y \leqslant -2x^2 + 12x + 7, \quad y \geqslant "\frac{25}{3}x", \quad x \geqslant 0$$

$$"\frac{25}{3}x" < y < -2x^2 + 12x + 7, \quad 0 < x < 3$$

$$"\frac{25}{3}x" < y,\ y < -2x^2 + 12x + 7, \quad 0 < x,\ y > 0$$