15. **In this question you must show detailed reasoning.**

Solutions relying on calculator technology are not acceptable.

The curve C_1 has equation $y = 8 - 10x + 6x^2 - x^3$

The curve C_2 has equation $y = x^2 - 12x + 14$

(a) Verify that when $x = 1$ the curves C_1 and C_2 intersect.

(2)

The curves also intersect when $x = k$.

Given that $k < 0$

(b) use algebra to find the exact value of k.

(5)

(a) When $x = 1$ y for $C_1 = 3$ $(8-10+6-1)$

y for $C_2 = 3$ $(1-12+14)$

So at $x = 1$ the curves intersect at $(1, 3)$.

(b) When the curves intersect

$$8 - 10x + 6x^2 - x^3 = x^2 - 12x + 14$$

Collecting terms and rearranging

$$x^3 - 5x^2 - 2x + 6 = 0$$

But we know $x = 1$ is a solution, so $(x-1)$ must be a factor.

$$\begin{array}{r|l} & x^2 + 4x - 6 \\ \hline x - 1 & x^3 - 5x^2 - 2x + 6 \\ & x^3 - x^2 \\ & \hline & -4x^2 - 2x \\ & -4x^2 + 4x \\ & \hline & -6x + 6 \\ & -6x + 6 \\ & \hline \end{array}$$

So the second factor is $x^2 - 4x - 6$

This does not factorise so $x = \dfrac{4 \pm \sqrt{16 + 24}}{2}$

$= 2 \pm \sqrt{4 + 6} = 2 \pm \sqrt{10}$

But we are told to find the negative value of k

So $k = 2 - \sqrt{10}$