

3. A student was asked to solve the simultaneous equations

$$x + y = 9$$

$$x^2 - 3xy + 2y^2 = 0$$

The student's solution is shown below:

line 1: $x + y = 9 \Rightarrow y = 9 - x$

line 2: $x^2 - 3xy + 2y^2 = 0 \Rightarrow x^2 - 3x(9 - x) + 2(9 - x)^2 = 0$

line 3: $x^2 - 27x - 3x^2 + 162 - 36x + 2x^2 = 0$

line 4: $63x = 162$

line 5: $x = \frac{162}{63} \Rightarrow y = 9 - \frac{162}{63} = \frac{45}{7}$

(a) $-3x \times -x = +3x^2$
not $-3x^2$ (1 mark)

(a) Identify the error in line 3 of the solution.

(1)

(b) Using algebra and showing all your working, solve the simultaneous equations.

(4)

(b) Correct line 3:

$$x^2 - 27x + 3x^2 + 162 - 36x + 2x^2 = 0$$

$$\Rightarrow 6x^2 - 63x + 162 = 0 \quad (1 \text{ mark})$$

$$\div 3: 2x^2 - 21x + 54 = 0$$

$$\begin{array}{l} \underbrace{\hspace{10em}} \rightarrow 2 \times 54 \\ \hspace{10em} = 108 \\ \underbrace{\hspace{10em}} \rightarrow -9 \times -12 = 108 \end{array}$$

$$2x^2 - 9x - 12x + 54 = 0$$

$$x(2x - 9) - 6(2x - 9) = 0$$

$$(x - 6)(2x - 9) = 0$$

(1 mark)

(Cannot simply use calculator for quadratic because question says "using algebra and showing all your working")

$x + y = 9$ is equation which gives direct route from x to $y = 9 - x$

when $x = 6$, $y = 9 - 6 = 3$ (1 mark)

$x = \frac{9}{2}$, $y = 9 - \frac{9}{2} = \frac{9}{2}$ (1 mark)

(though you could work backwards from calculator solutions)