Simultaneous Equations Quadratic

GCSE Maths · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Solve $y = x + 1$ and $y = x^2 - 5$ simultaneously.

Step 1 · Both equal y, so set them equal

$x^2 - 5 = x + 1$

Step 2 · Rearrange and factorise

$x^2 - x - 6 = 0 \rightarrow (x - 3)(x + 2) = 0$

Step 3 · Find y from $y = x + 1$

$x = 3 \rightarrow y = 4$; $x = -2 \rightarrow y = -1$

Answer: $x = 3, y = 4$ or $x = -2, y = -1$

Check: (3, 4): $9 - 5 = 4$ ✓ (−2, −1): $4 - 5 = -1$ ✓

2. Now try one with the steps

Solve $x^2 + y^2 = 25$ and $y = x + 1$.

Step 1 · Substitute $y = x + 1$

Step 2 · Expand and simplify

Step 3 · Factorise

Step 4 · $y = x + 1$

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Solve $y = x^2$ and $y = x + 2$ simultaneously. [4]

2. Solve $y = x^2 + 1$ and $y = 2x + 4$. [4]

3. Solve $y = x^2 - 4x + 5$ and $y = x + 1$. [4]

4. Solve $x + y = 6$ and $y = x^2$. [4]

5. Solve $y = 3x - 2$ and $y = x^2$. [4]

6. Solve $x^2 + y^2 = 10$ and $y = x + 2$. [5]

7. Solve $x^2 + y^2 = 25$ and $x + y = 7$. [5]

8. Solve $x^2 + y^2 = 13$ and $y = x - 1$. [5]

9. Solve $xy = 6$ and $y = x + 1$. [4]

10. Solve $y = x^2 + 3x$ and $y = 5x + 8$. [4]

11. Find the coordinates where the line $y = x$ meets the curve $y = x^2 - 2$. [4]

12. Show that the line $y = 4x - 4$ is a tangent to $y = x^2$, and find the point where it touches. [3]

13. Show that the line $y = x - 3$ never meets the curve $y = x^2$. [3]

14. Solve $y = x^2 - 2$ and $y = x + 1$, giving your answers to 2 decimal places. [5]

15. A rectangle has a perimeter of 22 cm and a diagonal of $\sqrt{61}$ cm. Find the length and width. [5]

4. Before you hand it in

Stopping at x = 3 or x = –2

Each x gives a point. Substitute into the LINEAR equation to find each y, and give two pairs.

Pairing x = 3 with y = –1

Work out y for each x separately and write them together: x = 3, y = 4 and x = –2, y = –1. Check each pair in both equations.

$x^2 + (x + 1)^2 = 25 \rightarrow x^2 + x^2 + 1 = 25$

$(x + 1)^2 = x^2 + 2x + 1$. Missing the middle term changes every answer.

Trying elimination: subtracting $x^2 + y^2 = 25$ from $y = x + 1$

With one quadratic equation, substitution is the reliable method. Make y (or x) the subject of the linear equation and substitute.