

# Solving simultaneous equations graphically

## A LEVEL LINKS

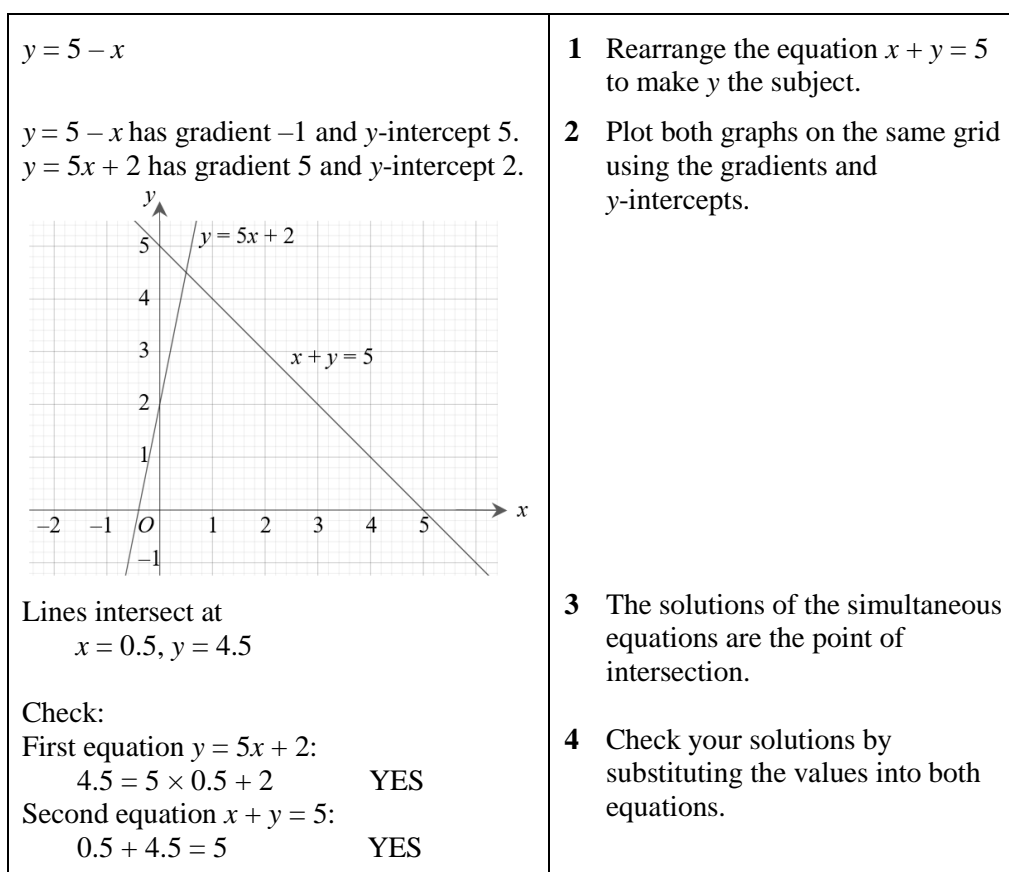
Scheme of work: 1c. Equations – quadratic/linear simultaneous

## Key points

- You can solve any pair of simultaneous equations by drawing the graph of both equations and finding the point/points of intersection.

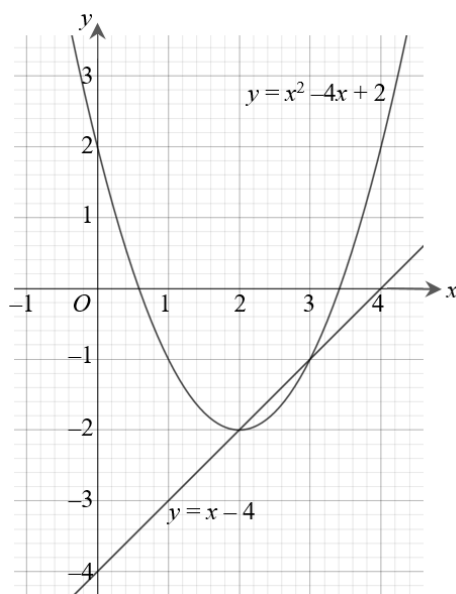
## Examples

**Example 1** Solve the simultaneous equations  $y = 5x + 2$  and  $x + y = 5$  graphically.



**Example 2** Solve the simultaneous equations  $y = x - 4$  and  $y = x^2 - 4x + 2$  graphically.

<b>x</b>	0	1	2	3	4
<b>y</b>	2	-1	-2	-1	2



The line and curve intersect at  
 $x = 3, y = -1$  and  $x = 2, y = -2$

Check:

First equation  $y = x - 4$ :

$$-1 = 3 - 4 \quad \text{YES}$$

$$-2 = 2 - 4 \quad \text{YES}$$

Second equation  $y = x^2 - 4x + 2$ :

$$-1 = 3^2 - 4 \times 3 + 2 \quad \text{YES}$$

$$-2 = 2^2 - 4 \times 2 + 2 \quad \text{YES}$$

**1** Construct a table of values and calculate the points for the quadratic equation.

**2** Plot the graph.

**3** Plot the linear graph on the same grid using the gradient and y-intercept.  
 $y = x - 4$  has gradient 1 and y-intercept -4.

**4** The solutions of the simultaneous equations are the points of intersection.

**5** Check your solutions by substituting the values into both equations.

## Practice

**1** Solve these pairs of simultaneous equations graphically.

**a**  $y = 3x - 1$  and  $y = x + 3$

**b**  $y = x - 5$  and  $y = 7 - 5x$

**c**  $y = 3x + 4$  and  $y = 2 - x$

**2** Solve these pairs of simultaneous equations graphically.

**a**  $x + y = 0$  and  $y = 2x + 6$

**b**  $4x + 2y = 3$  and  $y = 3x - 1$

**c**  $2x + y + 4 = 0$  and  $2y = 3x - 1$

### Hint

Rearrange the equation to make  $y$  the subject.

- 3** Solve these pairs of simultaneous equations graphically.
- a**  $y = x - 1$  and  $y = x^2 - 4x + 3$
  - b**  $y = 1 - 3x$  and  $y = x^2 - 3x - 3$
  - c**  $y = 3 - x$  and  $y = x^2 + 2x + 5$
- 4** Solve the simultaneous equations  $x + y = 1$  and  $x^2 + y^2 = 25$  graphically.

## Extend

- 5 a** Solve the simultaneous equations  $2x + y = 3$  and  $x^2 + y = 4$
- i** graphically
  - ii** algebraically to 2 decimal places.
- b** Which method gives the more accurate solutions? Explain your answer.

## Answers

- 1
  - a  $x = 2, y = 5$
  - b  $x = 2, y = -3$
  - c  $x = -0.5, y = 2.5$
  
- 2
  - a  $x = -2, y = 2$
  - b  $x = 0.5, y = 0.5$
  - c  $x = -1, y = -2$
  
- 3
  - a  $x = 1, y = 0$  and  $x = 4, y = 3$
  - b  $x = -2, y = 7$  and  $x = 2, y = -5$
  - c  $x = -2, y = 5$  and  $x = -1, y = 4$
  
- 4  $x = -3, y = 4$  and  $x = 4, y = -3$
  
- 5
  - a
    - i  $x = 2.5, y = -2$  and  $x = -0.5, y = 4$
    - ii  $x = 2.41, y = -1.83$  and  $x = -0.41, y = 3.83$
  - b Solving algebraically gives the more accurate solutions as the solutions from the graph are only estimates, based on the accuracy of your graph.