

Simultaneous Equations: Substitution

ANSWERS

1

Solve the simultaneous equations.

$$(1) \quad y = x + 2$$

$$(2) \quad 3x + y = 18$$

Substitute (1) into (2)

$$3x + (x + 2) = 18$$

$$3x + x + 2 = 18$$

$$4x = 16$$

$$x = 4$$

$$(1) \quad y = 4 + 2$$

$$y = 6$$

$$x = 4, y = 6$$

Check in (2): $12 + 6 = 18 \checkmark$

2

Solve the simultaneous equations.

$$(1) \quad y = x - 2$$

$$(2) \quad 3x + y = 18$$

Substitute (1) into (2)

$$3x + (x - 2) = 18$$

$$3x + x - 2 = 18$$

$$4x = 20$$

$$x = 5$$

$$(1) \quad y = 5 - 2$$

$$y = 3$$

$$x = 5, y = 3$$

Check in (2): $15 + 3 = 18 \checkmark$

3

Solve the simultaneous equations.

$$(1) \quad y = 2x + 1$$

$$(2) \quad 4x + 3y = 23$$

Substitute (1) into (2)

$$4x + 3(2x + 1) = 23$$

$$4x + 6x + 3 = 23$$

$$10x = 20$$

$$x = 2$$

$$(1) \quad y = 2 \times 2 + 1$$

$$y = 5$$

$$x = 2, y = 5$$

Check in (2): $8 + 15 = 23 \checkmark$

4

Solve the simultaneous equations.

$$(1) \quad y = 3x - 1$$

$$(2) \quad 2x + 2y = 22$$

Substitute (1) into (2)

$$2x + 2(3x - 1) = 22$$

$$2x + 6x - 2 = 22$$

$$8x = 24$$

$$x = 3$$

$$(1) \quad y = 3 \times 3 - 1$$

$$y = 8$$

$$x = 3, y = 8$$

Check in (2): $6 + 16 = 22 \checkmark$

5

Solve the simultaneous equations.

$$(1) \quad y = x - 2$$

$$(2) \quad 3x - y = 18$$

Substitute (1) into (2)

$$3x - (x - 2) = 18$$

$$3x - x + 2 = 18$$

$$2x = 16$$

$$x = 8$$

$$(1) \quad y = 8 - 2$$

$$y = 6$$

$$x = 8, y = 6$$

Check in (2): $24 - 6 = 18 \checkmark$

6

Solve the simultaneous equations.

$$(1) \quad y = 2x + 8$$

$$(2) \quad 3x + y = 3$$

Substitute (1) into (2)

$$3x + (2x + 8) = 3$$

$$3x + 2x + 8 = 3$$

$$5x = -5$$

$$x = -1$$

$$(1) \quad y = 2 \times (-1) + 8$$

$$y = 6$$

$$x = -1, y = 6$$

Check in (2): $-3 + 6 = 3 \checkmark$

7

Solve the simultaneous equations.

$$(1) \quad y = 10 - 2x$$

$$(2) \quad 5x - 2y = 7$$

Substitute (1) into (2)

$$5x - 2(10 - 2x) = 7$$

$$5x - 20 + 4x = 7$$

$$9x = 27$$

$$x = 3$$

$$(1) \quad y = 10 - 2 \times 3$$

$$y = 4$$

$$x = 3, y = 4$$

Check in (2): $15 - 8 = 7 \checkmark$

8

Solve the simultaneous equations.

$$(1) \quad 6x + y = 7$$

$$(2) \quad y = 2x + 3$$

Substitute (2) into (1)

$$6x + (2x + 3) = 7$$

$$6x + 2x + 3 = 7$$

$$8x = 4$$

$$x = \frac{1}{2}$$

$$(2) \quad y = 2 \times \frac{1}{2} + 3$$

$$y = 4$$

$$x = \frac{1}{2}, y = 4$$

Check in (1): $3 + 4 = 7 \checkmark$

Simultaneous Equations: Substitution further practice

ANSWERS

9

Solve the simultaneous equations.

$$(1) \quad y = x + 3$$

$$(2) \quad 4x - 3y = -4$$

Substitute (1) into (2)

$$4x - 3(x + 3) = -4$$

$$4x - 3x - 9 = -4$$

$$x = 5$$

$$(1) \quad y = 5 + 3$$

$$y = 8$$

Answer $x = 5, y = 8$

10

Choose a method, then solve the simultaneous equations.

$$(1) \quad 2x + 5y = 3$$

$$(2) \quad 2x - y = 9$$

Elimination: the x terms match.

$$(1) - (2)$$

$$6y = -6$$

$$y = -1$$

$$(2) \quad 2x + 1 = 9$$

$$2x = 8$$

$$x = 4$$

Answer $x = 4, y = -1$

11

The lines $y = 2x + 1$ and $y = 5x - 8$ cross at the point P.

Find the coordinates of P.

$$2x + 1 = 5x - 8$$

$$9 = 3x, \text{ so } x = 3$$

$$y = 2 \times 3 + 1 = 7$$

Answer $P(3, 7)$

12

A rectangle is 3 cm longer than it is wide. Its perimeter is 38 cm.

Let l be its length and w its width, in cm. Find its length and width.

Substitute (1) into (2)

$$2w + 2(w + 3) = 38$$

$$2w + 2w + 6 = 38$$

$$4w = 32$$

$$w = 8$$

$$(1) \quad l = 8 + 3$$

$$l = 11$$

Answer length 11 cm, width 8 cm

13

A large bottle holds 3 times as much as a small bottle. 2 large bottles and 5 small bottles hold 4400 ml. How much does each bottle hold?

$$L = 3S$$

Substitute (1) into (2)

$$5S + 2(3S) = 4400$$

$$5S + 6S = 4400$$

$$11S = 4400$$

$$S = 400$$

$$(1) \quad L = 3 \times 400$$

$$L = 1200$$

Answer $L = 1200 \text{ ml}, S = 400 \text{ ml}$

14

Sam substitutes $y = x - 4$ into $5x - 2y = 17$ and writes $5x - 2x - 8 = 17$. What has Sam done wrong? Solve the equations.

Sam wrote $-8: -2 \times (-4) = +8$

Substitute (1) into (2)

$$5x - 2(x - 4) = 17$$

$$5x - 2x + 8 = 17$$

$$3x = 9$$

$$x = 3$$

$$(1) \quad y = 3 - 4$$

$$y = -1$$

Answer $x = 3, y = -1$

15

Solve the simultaneous equations.

$$(1) \quad x = 3 - 2y$$

$$(2) \quad 4x + 5y = 0$$

Substitute (1) into (2)

$$4(3 - 2y) + 5y = 0$$

$$12 - 8y + 5y = 0$$

$$-3y = -12$$

$$y = 4$$

$$(1) \quad x = 3 - 2 \times 4$$

$$x = -5$$

Answer $x = -5, y = 4$

16

Jo says: "You can only use substitution when one of the equations starts $y =$." Explain why Jo is wrong.

An equation that starts $x =$ (as in Q15) is substituted the same way. And an equation like $4x + y = 9$ can be rearranged to $y = 9 - 4x$ first.

Answer No: any letter on its own