

Fix it 1 Rearrange the linear one

Linear and quadratic · ANSWERS

Make y the subject of the linear equation: $y = \dots$. If y has a number in front and x does not, make x the subject instead. A term that crosses the $=$ changes its sign.

EXAMPLE

Make y the subject of $2x + y = 9$

1. y has no number in front, so make it the subject.
2. Take $2x$ from both sides.
3. $y = 9 - 2x$

YOUR TURN

- 1 Make y the subject of $x + y = 7$

$$y = 7 - x$$

- 2 Make y the subject of $3x - y = 4$

$$y = 3x - 4$$

- 3 Make x the subject of $x + 3y = 10$

$$x = 10 - 3y$$

Check: Pick a value for the other letter. Your answer and the original give the same pair.

The Maths Habit

Fix it 2 Substitute

Linear and quadratic · ANSWERS

Write what the letter equals, in brackets, in place of that letter in the quadratic. If both equations start with $y =$, put them equal.

EXAMPLE

Substitute $y = x + 2$ into $x^2 + y^2 = 20$

1. Write $(x + 2)$ in place of y .
2. Keep the brackets.
3. $x^2 + (x + 2)^2 = 20$

YOUR TURN

- 1 $y = x^2 - 1$ and $y = x + 5$
Put them equal.

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

- 2 Substitute $y = 4 - x$ into $x^2 + y^2 = 40$

$$x^2 + (4 - x)^2 = 40$$

- 3 Substitute $x = 3y - 5$ into $x^2 + y^2 = 25$

$$(3y - 5)^2 + y^2 = 25$$

Check: Only one letter is left, and every bracket is still there.

The Maths Habit

Fix it 3 Expand the brackets

Linear and quadratic · ANSWERS

Write a squared bracket out twice and multiply every term by every term: $(x - 3)^2$ is $x^2 - 6x + 9$, not $x^2 + 9$.

EXAMPLE

Expand the brackets in $x^2 + (x + 3)^2 = 45$

1. $(x + 3)^2 = (x + 3)(x + 3)$

2. $= x^2 + 3x + 3x + 9$

3. $x^2 + x^2 + 6x + 9 = 45$

YOUR TURN

1 Expand the bracket in $x(x + 4) = 21$

$$x^2 + 4x = 21$$

2 Expand the brackets in $x^2 + (x - 5)^2 = 37$

$$x^2 + x^2 - 10x + 25 = 37$$

3 Expand the brackets in $(2y - 3)^2 + y^2 = 18$

$$4y^2 - 12y + 9 + y^2 = 18$$

Check: Substitute $x = 1$ into the bracket and into your expansion. They give the same number.

The Maths Habit

Fix it 4 Make it = 0

Linear and quadratic · ANSWERS

Take every term over to the side with the squared term, so the other side is 0. A term that crosses the = changes its sign. Then collect: squared terms, then x terms, then numbers.

EXAMPLE

Make one side 0: $x^2 + x^2 + 8x + 16 = 40$

1. Take 40 from both sides.

2. $x^2 + x^2$ is $2x^2$.

3. $2x^2 + 8x - 24 = 0$

YOUR TURN

1 Make one side 0: $x^2 + 3 = 5x - 1$

$$x^2 - 5x + 4 = 0$$

2 Make one side 0: $x^2 + 2x = 3x + 20$

$$x^2 - x - 20 = 0$$

3 Make one side 0: $x^2 + 9 - 6x + x^2 = 29$

$$2x^2 - 6x - 20 = 0$$

Check: Substitute $x = 2$ into the old equation and your new one. Old left take away old right gives your new left side.

The Maths Habit

Fix it 5 Solve the quadratic

Linear and quadratic · ANSWERS

If every term has a common factor, divide every term by it. Factorise, then make each bracket = 0: $(x + 4) = 0$ gives $x = -4$.

EXAMPLE

Solve $2x^2 + 8x - 24 = 0$

1. Divide every term by 2:

$$x^2 + 4x - 12 = 0$$

2. Factorise: $(x - 2)(x + 6) = 0$

3. $x = 2$ or $x = -6$

YOUR TURN

1 Solve $x^2 - 3x - 10 = 0$

$$x = 5 \text{ or } x = -2$$

2 Solve $x^2 + 9x + 14 = 0$

$$x = -2 \text{ or } x = -7$$

3 Solve $3x^2 - 3x - 18 = 0$

$$x = 3 \text{ or } x = -2$$

Check: Substitute each answer into the quadratic. Both give 0.

The Maths Habit

Fix it 6 Find the other letter

Linear and quadratic · ANSWERS

Substitute each value into the linear one you rearranged, not the quadratic. Two values give two answers.

EXAMPLE

$x = 2$ or $x = -6$, and $y = x + 4$. Find y .

1. Substitute each into $y = x + 4$.

2. $y = 2 + 4 = 6$

3. $y = -6 + 4 = -2$

YOUR TURN

1 $x = 4$ or $x = 0$, and $y = 2x - 3$. Find y .

$$y = 5 \text{ or } y = -3$$

2 $x = -2$ or $x = 5$, and $y = 6 - x$. Find y .

$$y = 8 \text{ or } y = 1$$

3 $y = 3$ or $y = 0$, and $x = 3y - 5$. Find x .

$$x = 4 \text{ or } x = -5$$

Check: Put each value and its answer into the original linear equation. It works.

The Maths Habit

Each x goes with the y it made. Write each solution as (x, y) , x first, even if you found y first.

EXAMPLE

$x = 2$ gave $y = 6$, and $x = -6$ gave $y = -2$.
Write the solutions.

1. Each x goes with the y it made.
2. x first: (x, y)
3. $(2, 6)$ and $(-6, -2)$

YOUR TURN

- 1 $x = 5$ gave $y = 1$, and $x = -1$ gave $y = -5$. Write the solutions.

$(5, 1)$ and $(-1, -5)$

- 2 You found $y = 3$ or $y = 0$ first. Then $x = 3y - 5$ gave $x = 4$ and $x = -5$.
Write the solutions.

$(4, 3)$ and $(-5, 0)$

- 3 Kai solves $x^2 + y^2 = 34$ and $y = x + 2$. He writes $(5, 3)$ and $(-3, -5)$.
Check them in $y = x + 2$. Is he right?

No: $(3, 5)$ and $(-5, -3)$

Check: Substitute each pair into both of the original equations. Both work.

The Maths Habit