

Fix it 1 Make one side 0

Solving quadratics · ANSWERS

Do the same to both sides until one side is 0 and the other side starts with x^2 . Write x^2 first, then the x term, then the number.

EXAMPLE

Make one side 0:

$$x^2 + 2x = 8$$

1. Take 8 from both sides.
2. $x^2 + 2x - 8 = 8 - 8$
3. $x^2 + 2x - 8 = 0$

YOUR TURN

- 1 Make one side 0:
 $x^2 + 6x = 16$

$$x^2 + 6x - 16 = 0$$

- 2 Make one side 0:
 $x^2 = 5x - 6$

$$x^2 - 5x + 6 = 0$$

- 3 Make one side 0:
 $x^2 + 3x + 7 = 2x + 37$

$$x^2 + x - 30 = 0$$

Check: Every term that moved has changed its sign, and the other side is now 0.

The Maths Habit

Fix it 2 Find the two numbers

Solving quadratics · ANSWERS

Find two numbers that multiply to the number at the end and add to the number in front of x . List the factor pairs with their signs.

EXAMPLE

$$x^2 + 5x - 14 = 0$$

Find two numbers that multiply to -14 and add to 5.

1. 1×-14 : adds to -13
2. -1×14 : adds to 13
3. 2×-7 : adds to -5
4. -2×7 : adds to 5 ✓

YOUR TURN

- 1 $x^2 + 10x + 21 = 0$
Find two numbers that multiply to 21 and add to 10.

3 and 7

- 2 $x^2 + 2x - 48 = 0$
Find two numbers that multiply to -48 and add to 2.

-6 and 8

- 3 $x^2 - 9x + 20 = 0$
Find the two numbers.

-5 and -4

Check: Multiply your numbers: you get the number at the end. Add them: you get the number in front of x .

The Maths Habit

Fix it 3 Write the brackets

Solving quadratics · ANSWERS

Each number goes in a bracket with x , sign and all: -3 and 5 give $(x-3)(x+5) = 0$. They are the headings of the grid.

EXAMPLE

The two numbers for $x^2 + 5x - 14 = 0$ are -2 and 7 . Write it with brackets.

1. Each number goes in a bracket with x .
2. -2 gives $(x-2)$, 7 gives $(x+7)$
3. $(x-2)(x+7) = 0$

YOUR TURN

- 1 The two numbers for $x^2 + 11x + 24 = 0$ are 3 and 8 . Write it with brackets.

$$(x+3)(x+8) = 0$$

- 2 The two numbers for $x^2 - 7x - 30 = 0$ are -10 and 3 . Write it with brackets.

$$(x-10)(x+3) = 0$$

- 3 The two numbers for $x^2 - 13x + 12 = 0$ are -1 and -12 . Write it with brackets.

$$(x-1)(x-12) = 0$$

Check: The numbers in your brackets multiply to the number at the end of the quadratic.

The Maths Habit

Fix it 4 Check the brackets

Solving quadratics · ANSWERS

Expand your brackets with the grid: four terms. Collect the two x terms. You must get the quadratic back, signs and all.

EXAMPLE

Check $(x-2)(x+7)$ gives $x^2 + 5x - 14$.

1. Expand: $x \times x = x^2$, $x \times 7 = 7x$
2. $-2 \times x = -2x$, $-2 \times 7 = -14$
3. $x^2 + 7x - 2x - 14 = x^2 + 5x - 14 \checkmark$

YOUR TURN

- 1 Expand $(x+2)(x+9)$ to check it gives $x^2 + 11x + 18$.

$$x^2 + 11x + 18 \checkmark$$

- 2 Lee writes $x^2 - x - 42 = (x-7)(x+6)$. Expand to check. Is Lee right?

$$\text{Yes: it gives } x^2 - x - 42$$

- 3 Kim writes $x^2 - 3x - 40 = (x-5)(x+8)$. Expand to check. Is Kim right?

$$\text{No: it gives } x^2 + 3x - 40$$

Check: Substitute $x = 1$ into the quadratic and into the brackets. Both give the same number.

The Maths Habit

Fix it 5 Each bracket = 0

Solving quadratics · ANSWERS

Two numbers multiply to make 0, so one of them must be 0. Set each bracket equal to 0. An x on its own outside a bracket counts too.

EXAMPLE

$$(x-2)(x+7)=0$$

Set each bracket equal to 0.

1. Two numbers multiply to make 0.
2. One of them must be 0.
3. $x-2=0$ or $x+7=0$

YOUR TURN

1 $(x+4)(x-8)=0$

Set each bracket equal to 0.

$$x+4=0 \text{ or } x-8=0$$

2 $(x-6)(x-1)=0$

Set each bracket equal to 0.

$$x-6=0 \text{ or } x-1=0$$

3 $x(x-11)=0$

Set each bracket equal to 0.

$$x=0 \text{ or } x-11=0$$

Check: Two brackets, two small equations: one for each bracket, nothing left out.

The Maths Habit

Fix it 6 Solve each one

Solving quadratics · ANSWERS

Solve each small equation. The number moves to the other side, so its sign flips: $x+3=0$ gives $x=-3$.

EXAMPLE

Solve $x-2=0$ and $x+7=0$.

1. $x-2=0$: add 2 to both sides, $x=2$
2. $x+7=0$: take 7 from both sides,
 $x=-7$
3. $x=2$ or $x=-7$

YOUR TURN

1 Solve $x-5=0$ and $x+9=0$.

$$x=5 \text{ or } x=-9$$

2 Solve $x+10=0$ and $x+3=0$.

$$x=-10 \text{ or } x=-3$$

3 $x(x+12)=0$ gives $x=0$ or $x+12=0$. Write both solutions.

$$x=0 \text{ or } x=-12$$

Check: Put each answer back into its bracket. The bracket comes to 0.

The Maths Habit

Substitute each solution into the equation you were given, not the one you rearranged. Both sides must come to the same number.

EXAMPLE

Check $x = -4$ in $x^2 + 2x = 8$.

1. Left: $(-4)^2 + 2 \times (-4)$
2. $= 16 - 8 = 8$
3. Right: 8. Both 8 ✓

YOUR TURN

- 1 Is $x = 6$ a solution of $x^2 + 3x = 54$? Substitute it.

Yes: $36 + 18 = 54$

- 2 Mo solves $x^2 = x + 30$ and gets $x = -6$ or $x = 5$. Check $x = 5$. Is Mo right?

No: 25 on the left, 35 on the right

- 3 Is $x = -8$ a solution of $x^2 + 5x + 2 = 26$? Substitute it.

Yes: $64 - 40 + 2 = 26$

Check: Square a negative number in a bracket: $(-4)^2 = 16$, not -16 .

The Maths Habit