

Equations with Brackets and Unknowns on Both Sides

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (2 marks)

Solve $3(x + 4) = 27$

Expand the bracket: $3x + 12 = 27$

Subtract 12 from both sides: $3x = 15$

Divide both sides by 3: $x = 5$

(Another way: divide both sides by 3 first, giving $x + 4 = 9$, so $x = 5$.)

Answer: $x = 5$

Tip: Multiply **both** terms in the bracket by 3: $3(x + 4) = 3x + 12$, not $3x + 4$.

Marks: 1 mark for $3x + 12 = 27$ or $x + 4 = 9$. 1 mark for $x = 5$.

2 (3 marks)

Solve $5(2d - 3) = 45$

Expand the bracket: $10d - 15 = 45$

Add 15 to both sides: $10d = 60$

Divide both sides by 10: $d = 6$

Check: $5 \times (12 - 3) = 5 \times 9 = 45$ ✓

Answer: $d = 6$

Tip: After $10d - 15 = 45$, you **add** 15 to both sides (not subtract). Dividing both sides by 5 first ($2d - 3 = 9$) also works well.

Marks: 1 mark for $10d - 15$ or $2d - 3 = 9$. 1 mark for $10d = 60$ or $2d = 12$. 1 mark for $d = 6$.

3 (3 marks)

Solve $7x + 4 = 3x + 24$

Get the x -terms on one side.

Subtract $3x$ from both sides: $4x + 4 = 24$

Subtract 4 from both sides: $4x = 20$

Divide both sides by 4: $x = 5$

Answer: $x = 5$

Tip: When you move $3x$ to the other side you **subtract** it. Adding gives $10x$, which is wrong.

Marks: 1 mark for $4x + 4 = 24$ (or similar). 1 mark for $4x = 20$. 1 mark for $x = 5$.

4 (3 marks)

Solve $8x - 5 = 3x + 25$

Subtract $3x$ from both sides: $5x - 5 = 25$

Add 5 to both sides: $5x = 30$

Divide both sides by 5: $x = 6$

Answer: $x = 6$

Marks: 1 mark for $5x - 5 = 25$ (or similar). 1 mark for $5x = 30$. 1 mark for $x = 6$.

5 (3 marks)

Solve $9x - 15 = 5x + 21$

Subtract $5x$ from both sides: $4x - 15 = 21$

Add 15 to both sides: $4x = 36$

Divide both sides by 4: $x = 9$

Check: $81 - 15 = 66$ and $45 + 21 = 66$ ✓

Answer: $x = 9$

Tip: Deal with the -15 carefully. A common slip is $4x = 21 - 15 = 6$. To remove -15 you add 15.

Marks: 1 mark for $4x - 15 = 21$ (or similar). 1 mark for $4x = 36$. 1 mark for $x = 9$.

6 (3 marks)

Solve $3(2x - 5) = 4x + 7$

Expand the bracket: $6x - 15 = 4x + 7$

Subtract $4x$ from both sides: $2x - 15 = 7$

Add 15 to both sides: $2x = 22$

Divide both sides by 2: $x = 11$

Answer: $x = 11$

Marks: 1 mark for $6x - 15$. 1 mark for $2x = 22$. 1 mark for $x = 11$.

7 (3 marks)

Solve $2(4x + 1) = 3x + 22$

Expand the bracket: $8x + 2 = 3x + 22$

Subtract $3x$ from both sides: $5x + 2 = 22$

Subtract 2 from both sides: $5x = 20$

Divide both sides by 5: $x = 4$

Answer: $x = 4$

Tip: Only the left-hand side is multiplied by 2. Do not multiply the right-hand side as well.

Marks: 1 mark for $8x + 2$. 1 mark for $5x = 20$. 1 mark for $x = 4$.

8 (3 marks)

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

Expand both brackets: $3x + 6 = 2x + 14$

Subtract $2x$ from both sides: $x + 6 = 14$

Subtract 6 from both sides: $x = 8$

Check: $3 \times 10 = 30$ and $2 \times 15 = 30$ ✓

Answer: $x = 8$

Marks: 1 mark for $3x + 6$ and $2x + 14$. 1 mark for $x = 14 - 6$. 1 mark for $x = 8$.

9 (1 mark)

Which equation has the solution $x = 4$?

Circle your answer.

Options: $2(x + 1) = 10$, $3x + 2 = 2x + 4$, $5x - 4 = 3x$, $x + 7 = 3x + 1$

Substitute $x = 4$ into each equation.

$2(4 + 1) = 2 \times 5 = 10$ ✓

$3 \times 4 + 2 = 14$ but $2 \times 4 + 4 = 12$ ✗

$5 \times 4 - 4 = 16$ but $3 \times 4 = 12$ ✗

$4 + 7 = 11$ but $3 \times 4 + 1 = 13$ ✗

Answer: $2(x + 1) = 10$

10 (3 marks)

Solve $12 - x = 2x + 3$

Add x to both sides: $12 = 3x + 3$

Subtract 3 from both sides: $9 = 3x$

Divide both sides by 3: $x = 3$

Check: $12 - 3 = 9$ and $6 + 3 = 9$ ✓

Answer: $x = 3$

Tip: To remove $-x$ from the left, **add** x to both sides. Subtracting x gives $12 - 2x$, which does not help.

Marks: 1 mark for $12 = 3x + 3$ (or similar). 1 mark for $3x = 9$. 1 mark for $x = 3$.

11 (1 mark)

Priya solves $5x + 3 = 2x + 12$

Her first line of working is

$$7x + 3 = 12$$

What mistake has Priya made?

To move $2x$ from the right, Priya should **subtract** $2x$ from both sides.

She added it instead, getting $7x$.

It should be $3x + 3 = 12$

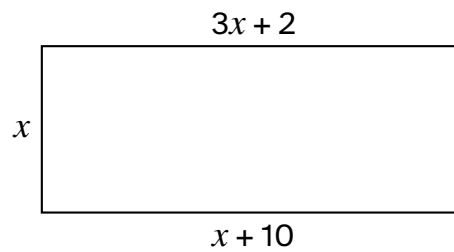
Then $3x = 9$, so $x = 3$.

Answer: She added $2x$ instead of subtracting it. It should be $3x + 3 = 12$, giving $x = 3$.

12 (3 marks)

Here is a rectangle.

All lengths are in centimetres.



Not drawn accurately

The opposite sides of a rectangle are equal.

Work out the value of x .

The top and bottom sides are opposite, so they are equal.

So $3x + 2 = x + 10$

Subtract x from both sides: $2x + 2 = 10$

Subtract 2 from both sides: $2x = 8$

Divide both sides by 2: $x = 4$

Answer: $x = 4$

Tip: Set the two opposite sides **equal** to each other. Do not add them together.

Marks: 1 mark for $3x + 2 = x + 10$. 1 mark for $2x = 8$. 1 mark for $x = 4$.

13 (3 marks)

Solve $2(x - 3) + 4(x + 1) = 22$

Expand the first bracket: $2(x - 3) = 2x - 6$

Expand the second bracket: $4(x + 1) = 4x + 4$

So $2x - 6 + 4x + 4 = 22$

Collect like terms: $6x - 2 = 22$

Add 2 to both sides: $6x = 24$

Divide both sides by 6: $x = 4$

Answer: $x = 4$

Marks: 1 mark for expanding both brackets correctly. 1 mark for $6x - 2 = 22$. 1 mark for $x = 4$.

14 (3 marks)

Solve $\frac{x+5}{2} = x-1$

Multiply both sides by 2: $x+5 = 2(x-1)$

Expand the bracket: $x+5 = 2x-2$

Subtract x from both sides: $5 = x-2$

Add 2 to both sides: $x = 7$

Check: $(7+5) \div 2 = 6$ and $7-1 = 6$ ✓

Answer: $x = 7$

Tip: When you multiply both sides by 2, put a bracket round $x-1$ so that **both** terms are doubled.

Marks: 1 mark for $x+5 = 2(x-1)$. 1 mark for $x+5 = 2x-2$. 1 mark for $x = 7$.

15 (3 marks)

Ali and Ben think of the same number.

Ali multiplies the number by 5 and then subtracts 8

Ben multiplies the number by 3 and then adds 12

They both get the same answer.

Work out the number they both think of.

Call the number n .

Ali gets $5n - 8$.

Ben gets $3n + 12$.

They are the same, so $5n - 8 = 3n + 12$

Subtract $3n$ from both sides: $2n - 8 = 12$

Add 8 to both sides: $2n = 20$

Divide both sides by 2: $n = 10$

Check: $5 \times 10 - 8 = 42$ and $3 \times 10 + 12 = 42$ ✓

Answer: 10

Marks: 1 mark for $5n - 8 = 3n + 12$. 1 mark for $2n = 20$. 1 mark for 10.
