

Equations with Brackets and Unknowns on Both Sides

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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 $3(2x - 1) = 21$

Expand the bracket: $6x - 3 = 21$

Add 3 to both sides: $6x = 24$

Divide both sides by 6: $x = 4$

Answer: $x = 4$

Tip: Multiply **both** terms in the bracket by 3: $3(2x - 1) = 6x - 3$, not $6x - 1$.

Marks: 1 mark for $6x - 3 = 21$ or $2x - 1 = 7$. 1 mark for $x = 4$.

2 (2 marks)

Solve $5(x + 3) = 40$

Divide both sides by 5: $x + 3 = 8$

Subtract 3 from both sides: $x = 5$

(Or expand first: $5x + 15 = 40$, so $5x = 25$ and $x = 5$.)

Answer: $x = 5$

Marks: 1 mark for $5x + 15 = 40$ or $x + 3 = 8$. 1 mark for $x = 5$.

3 (3 marks)

Solve $7x - 10 = 38 - x$

Add x to both sides: $8x - 10 = 38$

Add 10 to both sides: $8x = 48$

Divide both sides by 8: $x = 6$

Check: $42 - 10 = 32$ and $38 - 6 = 32$ ✓

Answer: $x = 6$

Tip: To move $-x$ you **add** x to both sides, giving $8x$. Subtracting x (to get $6x$) is the most common mistake here.

Marks: 1 mark for $8x - 10 = 38$ (or similar). 1 mark for $8x = 48$. 1 mark for $x = 6$.

4 (2 marks)

Solve $6x + 5 = 2x + 21$

Subtract $2x$ from both sides: $4x + 5 = 21$

Subtract 5 from both sides: $4x = 16$

Divide both sides by 4: $x = 4$

Answer: $x = 4$

Marks: 1 mark for $4x = 16$. 1 mark for $x = 4$.

5 (3 marks)

Solve $4(x + 3) = 2x + 20$

Expand the bracket: $4x + 12 = 2x + 20$

Subtract $2x$ from both sides: $2x + 12 = 20$

Subtract 12 from both sides: $2x = 8$

Divide both sides by 2: $x = 4$

Answer: $x = 4$

Marks: 1 mark for $4x + 12$. 1 mark for $2x = 8$. 1 mark for $x = 4$.

6 (3 marks)

Solve $3(2y + 1) = 2(y + 9)$

Expand both brackets: $6y + 3 = 2y + 18$

Subtract $2y$ from both sides: $4y + 3 = 18$

Subtract 3 from both sides: $4y = 15$

Divide both sides by 4: $y = \frac{15}{4}$

$$\frac{15}{4} = 3.75 \text{ (or } 3\frac{3}{4}\text{)}$$

Answer: $y = 3.75$

Tip: $4y = 15$ means $y = 15 \div 4$, not $4 \div 15$. The answer does not have to be a whole number.

Marks: 1 mark for $6y + 3$ and $2y + 18$. 1 mark for $4y = 15$. 1 mark for 3.75 (or $\frac{15}{4}$).

7 (3 marks)

Solve $\frac{x + 11}{2} = 5 - x$

Multiply both sides by 2: $x + 11 = 2(5 - x)$

Expand the bracket: $x + 11 = 10 - 2x$

Add $2x$ to both sides: $3x + 11 = 10$

Subtract 11 from both sides: $3x = -1$

Divide both sides by 3: $x = -\frac{1}{3}$

Answer: $x = -\frac{1}{3}$

Tip: Put a bracket round $5 - x$ when you multiply by 2, so that **both** terms are doubled.

Marks: 1 mark for $x + 11 = 2(5 - x)$. 1 mark for $3x = -1$. 1 mark for $-\frac{1}{3}$ (or $-0.333 \dots$).

8 (2 marks)

Solve $9 - 2x = 3x - 11$

Add $2x$ to both sides: $9 = 5x - 11$

Add 11 to both sides: $20 = 5x$

Divide both sides by 5: $x = 4$

Answer: $x = 4$

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

9 (2 marks)

The two base angles of an isosceles triangle are $(2x + 10)^\circ$ and $(5x - 20)^\circ$.
Work out the value of x .

The two base angles of an isosceles triangle are equal.

So $2x + 10 = 5x - 20$

Subtract $2x$ from both sides: $10 = 3x - 20$

Add 20 to both sides: $30 = 3x$

Divide both sides by 3: $x = 10$

Check: both angles are 30° ✓

Answer: $x = 10$

Tip: Set the two angles **equal**. Adding them and making the total 180 does not work here, because the third angle is unknown.

Marks: 1 mark for $2x + 10 = 5x - 20$. 1 mark for $x = 10$.

10 (4 marks)

Every sheet of stickers has the same number of stickers.

Freya has 4 sheets of stickers and 3 loose stickers.

Omar has 2 sheets of stickers and 15 loose stickers.

Freya and Omar have the same number of stickers.

- (a) Work out the number of stickers on one sheet.

Let n be the number of stickers on one sheet.

Freya has $4n + 3$ stickers.

Omar has $2n + 15$ stickers.

They have the same number, so $4n + 3 = 2n + 15$

Subtract $2n$ from both sides: $2n + 3 = 15$

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

Divide both sides by 2: $n = 6$

Check: Freya has $24 + 3 = 27$ and Omar has $12 + 15 = 27$ ✓

Answer: 6

Tip: Write an expression for each person first, then set them equal. The loose stickers are added on; they are not multiplied by the number of sheets.

Marks: 1 mark for $4n + 3 = 2n + 15$ (or a correct trial). 1 mark for 6.

- (b) Freya and Omar sell all of their stickers for 5p each.
Work out the total amount of money they get.
Give your answer in pounds.

Freya has $4 \times 6 + 3 = 27$ stickers.

Omar also has 27 stickers.

Total: $27 + 27 = 54$ stickers

Money: $54 \times 5 = 270\text{p}$

$270\text{p} = \text{£}2.70$

Answer: $\text{£}2.70$

Tip: Give money in pounds with two decimal places: $\text{£}2.70$, not $\text{£}2.7$ or 270.

Marks: 1 mark for 54 stickers, or for 27×5 (using your answer to part (a)). 1 mark for $\text{£}2.70$

11 (2 marks)

Show that $x = 2$ is the solution of $4(x + 1) = 2(x + 5) - 2$

Expand the brackets: $4x + 4 = 2x + 10 - 2$

Simplify the right-hand side: $4x + 4 = 2x + 8$

Subtract $2x$ from both sides: $2x + 4 = 8$

Subtract 4 from both sides: $2x = 4$

Divide both sides by 2: $x = 2$, as required.

(Another way: put $x = 2$ into both sides.

Left side: $4 \times 3 = 12$. Right side: $2 \times 7 - 2 = 12$.

Both sides are equal, so $x = 2$ is the solution.)

Marks: 1 mark for expanding both sides, or for substituting $x = 2$ into both sides. 1 mark for a complete method that shows $x = 2$.

12 (1 mark)

Tom solves $3(x - 2) = 12$

$$3x - 2 = 12$$

$$3x = 14$$

$$x = \frac{14}{3}$$

Explain the mistake Tom has made.

Tom did not multiply the -2 by 3.

$$3(x - 2) = 3x - 6, \text{ not } 3x - 2.$$

So $3x - 6 = 12$, which gives $3x = 18$ and $x = 6$.

Answer: $3(x - 2) = 3x - 6$, not $3x - 2$. (The correct answer is $x = 6$.)

13 (3 marks)

Ann is 3 times as old as Beth.

In 10 years' time, Ann will be twice as old as Beth.

Work out Beth's age now.

Call Beth's age now b .

Ann is 3 times as old, so Ann is $3b$.

In 10 years, Beth will be $b + 10$ and Ann will be $3b + 10$.

Ann will be twice as old as Beth: $3b + 10 = 2(b + 10)$

Expand the bracket: $3b + 10 = 2b + 20$

Subtract $2b$ from both sides: $b + 10 = 20$

Subtract 10 from both sides: $b = 10$

Check: Ann is 30. In 10 years, 40 is twice 20 ✓

Answer: 10 years

Tip: Add 10 years to **both** people's ages. Ann in 10 years is $3b + 10$, not $3(b + 10)$.

Marks: 1 mark for $3b$ and $b + 10$. 1 mark for $3b + 10 = 2(b + 10)$. 1 mark for 10.