

Forming and Solving Equations

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 (3 marks)

Lena thinks of a number, n .
She multiplies it by 3 and then adds 5
Her answer is 26

(a) Write an equation in n .

Multiply n by 3: $3n$

Then add 5: $3n + 5$

The answer is 26, so $3n + 5 = 26$

Answer: $3n + 5 = 26$

Tip: An equation must have an equals sign. $3n + 5$ on its own is an expression, not an equation.

(b) Solve your equation to find the number.

Subtract 5 from both sides: $3n = 21$

Divide both sides by 3: $n = 7$

Check: $3 \times 7 + 5 = 26$ ✓

Answer: $n = 7$

Marks: 1 mark for $3n = 21$. 1 mark for $n = 7$.

2 (1 mark)

I multiply a number x by 5 and then add 3

The answer is 17

Circle the equation that shows this.

Options: $5x + 3 = 17$, $3x + 5 = 17$, $5(x + 3) = 17$, $5x - 3 = 17$

Multiply x by 5: $5x$

Then add 3: $5x + 3$

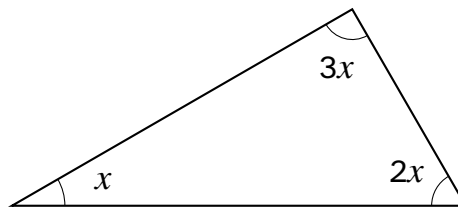
The answer is 17, so $5x + 3 = 17$

($5(x + 3)$ would mean adding 3 **first**.)

Answer: $5x + 3 = 17$

3 (3 marks)

The angles in this triangle are x , $2x$ and $3x$.



Not drawn accurately

Work out the size of the largest angle.

Angles in a triangle add up to 180° .

So $x + 2x + 3x = 180$

Collect like terms: $6x = 180$

Divide both sides by 6: $x = 30$

The largest angle is $3x$.

$$3x = 3 \times 30 = 90^\circ$$

Answer: 90°

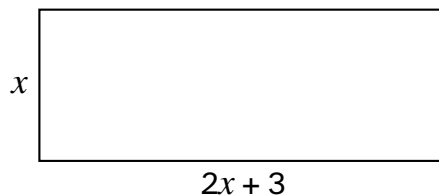
Tip: Finding $x = 30$ is not the end. The question asks for the largest angle, $3x$.

Marks: 1 mark for $x + 2x + 3x = 180$. 1 mark for $x = 30$. 1 mark for 90 .

4 (3 marks)

Here is a rectangle.

All lengths are in centimetres.



Not drawn accurately

The perimeter of the rectangle is 36 cm.

Work out the value of x .

The perimeter is the total of all four sides.

$$(2x + 3) + x + (2x + 3) + x$$

Collect like terms: $6x + 6$

$$\text{So } 6x + 6 = 36$$

$$\text{Subtract 6 from both sides: } 6x = 30$$

$$\text{Divide both sides by 6: } x = 5$$

Answer: $x = 5$

Tip: A rectangle has four sides. Adding only the two labelled sides gives $3x + 3$, which is half the perimeter.

Marks: 1 mark for $6x + 6$ (or similar). 1 mark for $6x + 6 = 36$. 1 mark for $x = 5$.

5 (3 marks)

Sam and Kim share 40 sweets.
Kim has 6 more sweets than Sam.

How many sweets does Kim have?

Call the number of sweets Sam has s .

Kim has 6 more, so Kim has $s + 6$.

Together they have 40: $s + (s + 6) = 40$

Collect like terms: $2s + 6 = 40$

Subtract 6 from both sides: $2s = 34$

Divide both sides by 2: $s = 17$

So Sam has 17, and Kim has $17 + 6 = 23$.

Check: $17 + 23 = 40$ ✓

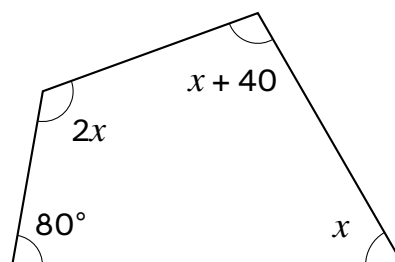
Answer: 23

Tip: Do not just halve 40. Take away the extra 6 first ($40 - 6 = 34$), then share equally. And check whose sweets the question asks for.

Marks: 1 mark for $s + s + 6 = 40$ (or similar). 1 mark for $s = 17$. 1 mark for 23.

6 (3 marks)

Here is a quadrilateral.



Not drawn accurately

Work out the value of x .

Angles in a quadrilateral add up to 360° .

So $x + (x + 40) + 2x + 80 = 360$

Collect like terms: $4x + 120 = 360$

Subtract 120 from both sides: $4x = 240$

Divide both sides by 4: $x = 60$

Check: $60 + 100 + 120 + 80 = 360$ ✓

Answer: $x = 60$

Tip: Use 360° for a quadrilateral, not 180° (that is for a triangle).

Marks: 1 mark for adding the four angles and making them equal to 360. 1 mark for $4x + 120 = 360$. 1 mark for $x = 60$.

7 (3 marks)

Jay buys 3 pens and 1 ruler for 95p.

The ruler costs 15p more than a pen.

How much does one pen cost?

Call the cost of one pen p pence.

The ruler costs 15p more, so it costs $p + 15$.

3 pens and 1 ruler: $3p + (p + 15) = 95$

Collect like terms: $4p + 15 = 95$

Subtract 15 from both sides: $4p = 80$

Divide both sides by 4: $p = 20$

Answer: 20p

Marks: 1 mark for $3p + p + 15$. 1 mark for $4p = 80$. 1 mark for 20.

8 (3 marks)

A car park has only red, blue and silver cars in it.
There are twice as many silver cars as blue cars.
There are 5 fewer red cars than blue cars.
There are 43 cars in the car park altogether.

How many silver cars are in the car park?

Everything is compared with the blue cars, so call the number of blue cars b .

Silver: twice as many as blue: $2b$

Red: 5 fewer than blue: $b - 5$

The total is 43: $b + 2b + (b - 5) = 43$

Collect like terms: $4b - 5 = 43$

Add 5 to both sides: $4b = 48$

Divide both sides by 4: $b = 12$

Silver cars: $2 \times 12 = 24$

Check: $12 + 24 + 7 = 43$ ✓

Answer: 24

Tip: $b = 12$ is the number of blue cars. The question asks for the silver cars, so work out $2b$.

Marks: 1 mark for $2b$ and $b - 5$. 1 mark for $4b - 5 = 43$ (or $b = 12$). 1 mark for 24.

9 (3 marks)

Here is the rule for a sequence.

Multiply the previous term by 2, then subtract 3

The 1st term is x

The 3rd term is 27

Work out the value of x .

Use the rule on the 1st term to find the 2nd term: $2x - 3$

Use the rule again to find the 3rd term: $2(2x - 3) - 3$

Expand and simplify: $4x - 6 - 3 = 4x - 9$

The 3rd term is 27, so $4x - 9 = 27$

Add 9 to both sides: $4x = 36$

Divide both sides by 4: $x = 9$

Check: the sequence is 9, 15, 27 ✓

Answer: $x = 9$

Tip: Put a bracket round the 2nd term before you multiply it by 2: $2(2x - 3)$, not $2 \times 2x - 3$.

Marks: 1 mark for the 2nd term, $2x - 3$. 1 mark for $4x - 9 = 27$ (or $2(2x - 3) - 3 = 27$). 1 mark for 9.

10 (4 marks)

A square has side length x cm.

An equilateral triangle has side length $(x + 2)$ cm.

The square and the triangle have the same perimeter.

Work out the length of one side of the square.

A square has 4 equal sides, so its perimeter is $4x$.

An equilateral triangle has 3 equal sides.

So its perimeter is $3(x + 2) = 3x + 6$.

The perimeters are equal: $4x = 3x + 6$

Subtract $3x$ from both sides: $x = 6$

The side of the square is x , so it is 6 cm.

Check: square $4 \times 6 = 24$, triangle $3 \times 8 = 24$ ✓

Answer: 6 cm

Marks: 1 mark for $4x$. 1 mark for $3(x + 2)$. 1 mark for $4x = 3x + 6$. 1 mark for 6.

11 (3 marks)

The sum of three consecutive whole numbers is 78

Work out the three numbers.

Consecutive numbers follow on from each other, like 5, 6, 7.

Call the smallest number n .

The three numbers are n , $n + 1$ and $n + 2$.

Their sum is 78: $n + (n + 1) + (n + 2) = 78$

Collect like terms: $3n + 3 = 78$

Subtract 3 from both sides: $3n = 75$

Divide both sides by 3: $n = 25$

So the numbers are 25, 26 and 27.

Check: $25 + 26 + 27 = 78$ ✓

Answer: 25, 26 and 27

Marks: 1 mark for $n + n + 1 + n + 2$. 1 mark for $3n + 3 = 78$. 1 mark for 25, 26, 27.
