

Forming and Solving Equations

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 (3 marks)

Asha thinks of a number, x .

She multiplies it by 4 and then subtracts 9

Her answer is 31

(a) Write down an equation for x .

Multiply x by 4: $4x$

Then subtract 9: $4x - 9$

The answer is 31, so $4x - 9 = 31$

Answer: $4x - 9 = 31$

(b) Solve your equation.

Add 9 to both sides: $4x = 40$

Divide both sides by 4: $x = 10$

Check: $4 \times 10 - 9 = 31$ ✓

Answer: $x = 10$

Marks: 1 mark for $4x = 40$. 1 mark for $x = 10$.

2 (3 marks)

The diagram shows an isosceles triangle.

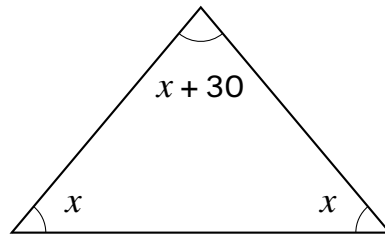


Diagram **NOT** accurately drawn

Work out the size of the largest angle.

Angles in a triangle add up to 180° .

So $x + x + (x + 30) = 180$

Collect like terms: $3x + 30 = 180$

Subtract 30 from both sides: $3x = 150$

Divide both sides by 3: $x = 50$

The angles are 50° , 50° and $50 + 30 = 80^\circ$.

The largest angle is 80° .

Answer: 80°

Tip: After finding $x = 50$, work out the angle the question asks for. The largest angle is $x + 30$.

Marks: 1 mark for $3x + 30 = 180$. 1 mark for $x = 50$. 1 mark for 80.

3 (3 marks)

The diagram shows three angles on a straight line.

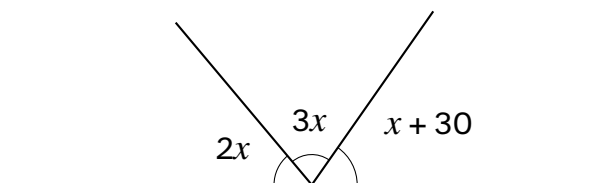


Diagram **NOT** accurately drawn

Work out the value of x .

Angles on a straight line add up to 180° .

So $2x + 3x + x + 30 = 180$

Collect like terms: $6x + 30 = 180$

Subtract 30 from both sides: $6x = 150$

Divide both sides by 6: $x = 25$

Check: $50 + 75 + 55 = 180$ ✓

Answer: $x = 25$

Marks: 1 mark for $6x + 30 = 180$. 1 mark for $6x = 150$. 1 mark for $x = 25$.

4 (5 marks)

On Monday a café sold only tea, coffee and hot chocolate.

It sold x cups of tea, $(3x - 10)$ cups of coffee and $(2x + 30)$ cups of hot chocolate.

It sold 200 drinks altogether.

(a) Work out the number of cups of coffee the café sold.

Add the three types of drink: $x + (3x - 10) + (2x + 30) = 200$

Collect like terms: $6x + 20 = 200$

Subtract 20 from both sides: $6x = 180$

Divide both sides by 6: $x = 30$

Cups of coffee: $3 \times 30 - 10 = 80$

Answer: 80

Tip: $x = 30$ is the number of teas. Substitute it into $3x - 10$ to find the coffees.

Marks: 1 mark for $6x + 20 = 200$. 1 mark for $x = 30$. 1 mark for 80.

(b) What percentage of the drinks sold were hot chocolate?

Cups of hot chocolate: $2 \times 30 + 30 = 90$

Fraction of the drinks: $\frac{90}{200}$

As a percentage: $\frac{90}{200} = \frac{45}{100} = 45\%$

Check: $30 + 80 + 90 = 200$ ✓

Answer: 45%

Marks: 1 mark for 90 hot chocolates. 1 mark for 45.

5 (3 marks)

The diagram shows a rectangle.

All measurements are in centimetres.

The perimeter of the rectangle is 40 cm.

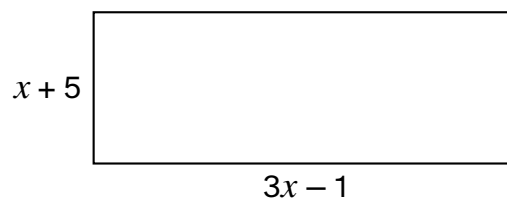


Diagram **NOT** accurately drawn

Work out the value of x .

A rectangle has two pairs of equal sides.

Perimeter = $2(3x - 1) + 2(x + 5)$

Expand the brackets: $6x - 2 + 2x + 10$

Collect like terms: $8x + 8$

So $8x + 8 = 40$

Subtract 8 from both sides: $8x = 32$

Divide both sides by 8: $x = 4$

Answer: $x = 4$

Tip: Use all four sides for the perimeter. Adding only the two labelled sides gives half the perimeter.

Marks: 1 mark for a correct expression for the perimeter. 1 mark for $8x + 8 = 40$. 1 mark for $x = 4$.

6 (4 marks)

A garden centre sells small plant pots and large plant pots.

A large pot costs £3.50 more than a small pot.

Ella buys 4 small pots and 2 large pots.

She pays £19 altogether.

Work out the cost of one large pot.

Call the cost of a small pot $£s$.

A large pot costs £3.50 more: $£(s + 3.5)$

4 small pots and 2 large pots: $4s + 2(s + 3.5) = 19$

Expand the bracket: $4s + 2s + 7 = 19$

Collect like terms: $6s + 7 = 19$

Subtract 7 from both sides: $6s = 12$

Divide both sides by 6: $s = 2$

A large pot costs $2 + 3.50 = £5.50$

Check: $4 \times 2 + 2 \times 5.50 = 8 + 11 = 19$ ✓

Answer: £5.50

Tip: $s = 2$ is the cost of a **small** pot. The question asks for a large pot, so add £3.50.

Marks: 1 mark for $s + 3.5$. 1 mark for $4s + 2(s + 3.5)$. 1 mark for $6s + 7 = 19$ (or $s = 2$). 1 mark for 5.50.

7 (3 marks)

Ali, Ben and Cat share £90

Ali gets twice as much as Ben.

Cat gets £10 more than Ben.

Work out how much money Ali gets.

Everything is compared with Ben, so call Ben's share $£b$.

Ali gets twice as much: $2b$

Cat gets £10 more: $b + 10$

The total is 90: $2b + b + (b + 10) = 90$

Collect like terms: $4b + 10 = 90$

Subtract 10 from both sides: $4b = 80$

Divide both sides by 4: $b = 20$

Ali gets $2 \times 20 = £40$.

Check: $40 + 20 + 30 = 90$ ✓

Answer: £40

Tip: $b = 20$ is Ben's share. The question asks for Ali's share, so work out $2b$.

Marks: 1 mark for $2b$ and $b + 10$. 1 mark for $4b + 10 = 90$. 1 mark for 40.

8 (3 marks)

A square has sides of length $(x + 1)$ cm.

An equilateral triangle has sides of length $(x + 5)$ cm.

The perimeter of the square is equal to the perimeter of the triangle.

Work out the value of x .

The square has 4 equal sides: perimeter = $4(x + 1)$

The triangle has 3 equal sides: perimeter = $3(x + 5)$

The perimeters are equal: $4(x + 1) = 3(x + 5)$

Expand the brackets: $4x + 4 = 3x + 15$

Subtract $3x$ from both sides: $x + 4 = 15$

Subtract 4 from both sides: $x = 11$

Check: $4 \times 12 = 48$ and $3 \times 16 = 48$ ✓

Answer: $x = 11$

Marks: 1 mark for $4(x + 1)$ or $3(x + 5)$. 1 mark for $4x + 4 = 3x + 15$. 1 mark for $x = 11$.

9 (3 marks)

Karen's mum is 3 times as old as Karen.

In 12 years' time, Karen's mum will be twice as old as Karen.

Work out Karen's age now.

Call Karen's age now k .

Her mum is 3 times as old: $3k$

In 12 years, Karen will be $k + 12$ and her mum will be $3k + 12$.

Mum will be twice as old: $3k + 12 = 2(k + 12)$

Expand the bracket: $3k + 12 = 2k + 24$

Subtract $2k$ from both sides: $k + 12 = 24$

Subtract 12 from both sides: $k = 12$

Check: mum is 36. In 12 years, 48 is twice 24 ✓

Answer: 12 years

Tip: Add 12 years to **both** ages, and put a bracket round Karen's future age: $2(k + 12)$.

Marks: 1 mark for $3k + 12$ and $k + 12$. 1 mark for $3k + 12 = 2(k + 12)$. 1 mark for 12.

10 (3 marks)

The sum of three consecutive even numbers is 84

Work out the three numbers.

Consecutive even numbers go up in 2s, like 6, 8, 10.

Call the smallest number n .

The numbers are n , $n + 2$ and $n + 4$.

Their sum is 84: $n + (n + 2) + (n + 4) = 84$

Collect like terms: $3n + 6 = 84$

Subtract 6 from both sides: $3n = 78$

Divide both sides by 3: $n = 26$

So the numbers are 26, 28 and 30.

Check: $26 + 28 + 30 = 84$ ✓

Answer: 26, 28 and 30

Marks: 1 mark for $n + (n + 2) + (n + 4)$. 1 mark for $3n + 6 = 84$. 1 mark for 26, 28, 30.
