



- 1 The angles of a triangle are $(x + 10)^\circ$, $2x^\circ$ and $(3x - 10)^\circ$.

Work out the size of the largest angle of the triangle.

(3 marks)

Angles in a triangle add to 180

$$(x + 10) + 2x + (3x - 10) = 180$$

$$6x = 180, \text{ so } x = 30$$

The angles are 40, 60 and 80 degrees

Check

$$40 + 60 + 80 = 180$$

The largest angle is 80 degrees

80°

- 2 Dan and Ella share 45 sweets.

Ella gets 7 more sweets than Dan.

Dan says, "I got 20 sweets."

Is Dan right? You must show how you get your answer.

(3 marks)

Let d be the number of sweets Dan gets, so Ella gets $d + 7$

$$d + d + 7 = 45$$

$$2d = 38, \text{ so } d = 19$$

Check

$$19 + 26 = 45$$

Dan is wrong, he got 19 sweets, not 20

No, Dan got 19 sweets

3

A pen costs c pence.

a. Write an expression for the cost, in pence, of 8 pens.

b. A ruler costs 35p. Write an expression for the total cost, in pence, of 8 pens and 1 ruler.

(2 marks)

a)

$$8 \times c$$

$$8c$$

b)

pens $8c$, ruler 35

$$8c + 35$$

4

A trapezium has parallel sides of length $(2x + 1)$ cm and $(4x + 3)$ cm.

The perpendicular height of the trapezium is 6 cm.

Show that the area of the trapezium is $6(3x + 2)$ cm².

(3 marks)

Area of a trapezium = half the sum of the parallel sides times the height

$$\text{Area} = \left(\frac{1}{2}\right)(2x + 1 + 4x + 3)(6)$$

$$\text{Area} = 3(6x + 4)$$

$$\text{Area} = 18x + 12 = 6(3x + 2), \text{ as required}$$

$$\text{Area} = 18x + 12 = 6(3x + 2)$$

5

A rectangle has length $(3x + 2)$ cm and width $(x - 1)$ cm.

The perimeter of the rectangle is 50 cm.

Work out the length of the rectangle.

(4 marks)

$$\text{Perimeter} = 2(3x + 2) + 2(x - 1) = 6x + 4 + 2x - 2 = 8x + 2$$

$$8x + 2 = 50$$

$$8x = 48, \text{ so } x = 6$$

$$\text{Length} = 3(6) + 2 = 20 \text{ cm}$$

Check

$$\text{width} = 5 \text{ cm}, \text{ perimeter} = 2(20) + 2(5) = 50 \text{ cm}$$

$$20 \text{ cm}$$

- 6 Rod A is x cm long. Rod B is 15 mm longer than rod A.

Write an expression, in mm, for the length of rod B.

(2 marks)

$$1 \text{ cm} = 10 \text{ mm}$$

$$\text{rod A} = 10x \text{ mm}$$

$$\text{rod B} = 10x + 15$$

$$10x + 15 \text{ mm}$$

- 7 Tom is t years old. His sister is 4 years younger than Tom. His father is 3 times as old as Tom.

- Write an expression for the sister's age.
- Write an expression for the father's age.
- The sum of the three ages is 51. Form an equation in t and solve it.

(4 marks)

a)

$$t - 4$$

b)

$$3t$$

c)

$$t + (t - 4) + 3t = 51$$

$$5t - 4 = 51$$

+4

$$5t = 55$$

+4

÷5

$$t = 11$$

÷5

$$t = 11$$

- 8 A plumber charges £40 as a call-out fee plus £25 for each hour of work.

- Write a formula for the total cost, C pounds, for h hours of work.
- Use your formula to work out the cost of 3.5 hours of work.

(3 marks)

a)

$$C = 40 + 25h$$

b)

$$C = 40 + 25 \times 3.5$$

$$= 40 + 87.50$$

$$£127.50$$

- 9 The angles of a quadrilateral are x° , $(x + 30)^\circ$, $(2x - 10)^\circ$ and 100° .

Work out the size of the largest angle of the quadrilateral.

(4 marks)

Angles in a quadrilateral add to 360

$$x + (x + 30) + (2x - 10) + 100 = 360$$

$$4x + 120 = 360$$

$$4x = 240, \text{ so } x = 60$$

The angles are 60, 90, 110 and 100 degrees

Check

$$60 + 90 + 110 + 100 = 360$$

The largest angle is 110 degrees

$$\boxed{110^\circ}$$

- 10 A plumber charges a fixed call-out fee of £40 plus £28 for each hour of work.

The plumber works for h hours on a job.

The total charge for the job is £ C .

Write a formula for C in terms of h .

(3 marks)

The hourly part of the charge is $28 \times h = 28h$ pounds

Add the fixed £40 call-out fee

$$C = 40 + 28h$$

$$\boxed{C = 40 + 28h}$$

- 11 Priya thinks of a number.

She multiplies the number by 4 and then subtracts 9.

Her answer is 35.

Work out the number Priya thought of.

(3 marks)

Let n be the number, so $4n - 9 = 35$

$$\begin{array}{rcl} +9 & 4n & = 44 \\ \hline \div 4 & n & = 11 \end{array}$$

Check

$$4 \text{ times } 11 = 44, 44 - 9 = 35$$

$$\boxed{11}$$

- 12 Rectangle A has length 8 cm and width $(x + 2)$ cm.

Rectangle B has length 12 cm and width x cm.

The two rectangles have equal areas.

Work out the area of rectangle A.

(4 marks)

$$\text{Area of A} = 8(x + 2) = 8x + 16$$

$$\text{Area of B} = 12x$$

The areas are equal

$$8x + 16 = 12x$$

$$16 = 4x, \text{ so } x = 4$$

$$\text{Area of A} = 8(4 + 2) = 48 \text{ cm}^2$$

Check

$$\text{area of B} = 12(4) = 48 \text{ cm}^2$$

$$48 \text{ cm}^2$$

- 13 Three consecutive whole numbers add up to 111.

Let the smallest number be n . Form an equation and solve it to find the three numbers.

(3 marks)

numbers: $n, n + 1, n + 2$

$$3n + 3 = 111$$

$$\begin{array}{rcl} -3 & 3n & = 108 \end{array}$$

$$\begin{array}{rcl} \div 3 & n & = 36 \end{array}$$

$$36, 37, 38$$

14

Anna is a years old. Ben is 3 years older than Anna.

- Write an expression for the sum of their ages in 2 years' time.
- Show that this sum is always 7 more than twice Anna's age, whatever her age is.

(3 marks)

a)

Anna: $a + 2$

Ben: $a + 3 + 2 = a + 5$

$$(a + 2) + (a + 5) = 2a + 7$$

$$\boxed{2a + 7}$$

b)

twice Anna's age = $2a$

$$2a + 7 = 2a + 7 \text{ for every } a$$

$\boxed{\text{always 7 more}}$

15

A rectangle has length $(3x + 2)$ cm and width $(x + 1)$ cm. The perimeter is 54 cm.

Form an equation and solve it to find the length of the rectangle.

(3 marks)

$$2(3x + 2) + 2(x + 1) = 54$$

$$8x + 6 = 54$$

-6

$$8x = 48$$

-6

÷8

$$x = 6$$

÷8

$$\text{Length} = 3 \times 6 + 2 = 20$$

$$\boxed{20 \text{ cm}}$$

16

Tom is y years old.

His sister Freya is 7 years older than Tom.

- Write down an expression, in terms of y , for Freya's age.
- The sum of Tom's age and Freya's age is 23 years.
Work out Tom's age.

(3 marks)

a) Freya is 7 more than Tom, so her age is $y + 7$

b) Sum of ages

$$y + (y + 7) = 23, \text{ so } 2y + 7 = 23$$

$$\text{b) } 2y = 16, \text{ so } y = 8. \text{ Tom is 8 years old}$$

Check

$$\text{Tom 8, Freya 15, and } 8 + 15 = 23$$

17

A square has sides of length $(x + 3)$ cm.

Another square has sides of length x cm.

The area of the larger square is 45 cm^2 more than the area of the smaller square.

Find the value of x .

(4 marks)

$$(x + 3)^2 = x^2 + 45$$

Expand

$$x^2 + 6x + 9 = x^2 + 45$$

$$6x + 9 = 45$$

$$6x = 36, \text{ so } x = 6$$

Check

$$9^2 - 6^2 = 81 - 36 = 45$$

$$x = 6$$

18

A kite has two sides of length $(2x + 1)$ cm and two sides of length $(4x - 3)$ cm.

The perimeter of the kite is 44 cm.

Work out the length of one of the longer sides of the kite.

(4 marks)

$$\text{Perimeter} = 2(2x + 1) + 2(4x - 3) = 4x + 2 + 8x - 6 = 12x - 4$$

$$12x - 4 = 44$$

$$12x = 48, \text{ so } x = 4$$

The sides are $2(4) + 1 = 9$ cm and $4(4) - 3 = 13$ cm

Check

$$2(9) + 2(13) = 44 \text{ cm}$$

The longer sides are 13 cm

$$13 \text{ cm}$$

19

Two firms hire out a carpet cleaner.

- Firm A: £35 delivery charge plus £12 for each day
- Firm B: £20 delivery charge plus £15 for each day

a. Write a formula for the cost, £C, of hiring from Firm A for d days.

b. For how many days is the cost the same for both firms?

(4 marks)

a)

$$C = 35 + 12d$$

b)

$$\begin{array}{rclcl}
 35 + 12d & = & 20 + 15d & & \\
 -12d & & & & \\
 \hline
 35 & = & 20 + 3d & -12d & \\
 -20 & & & & \\
 \hline
 15 & = & 3d & -20 & \\
 \div 3 & & & & \\
 5 & = & d & \div 3 &
 \end{array}$$

5 days

20

ABCD is a quadrilateral. AB is parallel to DC. Angle DAB = $(4x + 5)^\circ$ and angle ADC = $(x + 60)^\circ$.a. Explain why $(4x + 5) + (x + 60) = 180$.b. Solve the equation to find x .

c. Work out the size of angle DAB.

(4 marks)

a)

AB parallel to DC: co-interior angles add to 180°

b)

$$\begin{array}{rclcl}
 (4x + 5) + (x + 60) & = & 180 & & \\
 5x + 65 & = & 180 & & \\
 -65 & & & & \\
 \hline
 5x & = & 115 & -65 & \\
 \div 5 & & & & \\
 x & = & 23 & \div 5 &
 \end{array}$$

c)

$$4 \times 23 + 5 = 97$$

97°

21

A taxi journey costs a fixed charge of £3 plus £2 for each mile travelled.

A journey of m miles costs £ C in total.

a. Write a formula for C in terms of m .

b. A journey costs £25 in total.

Work out the number of miles travelled.

(4 marks)

a) The mileage part costs $2 \times m = 2m$ pounds, plus the fixed £3,
so $C = 3 + 2m$

b) Substitute $C = 25$: $25 = 3 + 2m$

b) $2m = 22$, so $m = 11$. The journey was 11 miles

Check

$$3 + 2 \times 11 = 3 + 22 = 25$$

22

Three parcels have a total mass of 26 kg.

Parcel A has mass x kg.

Parcel B has mass $(2x + 1)$ kg.

Parcel C has mass $(3x - 5)$ kg.

Work out the mass of the heaviest parcel.

(5 marks)

$$x + (2x + 1) + (3x - 5) = 26$$

$$6x - 4 = 26$$

$$6x = 30, \text{ so } x = 5$$

Parcel A is 5 kg, parcel B is 11 kg, parcel C is 10 kg

Check

$$5 + 11 + 10 = 26$$

The heaviest parcel is B at 11 kg

11 kg

23

A box contains only red counters, blue counters and green counters.

The number of blue counters is twice the number of red counters.

The number of green counters is 9 more than the number of red counters.

There are 49 counters in the box altogether.

Work out the ratio of red counters to green counters. Give your answer in its simplest form.

(5 marks)

Let r be the number of red counters

Blue = $2r$ and green = $r + 9$

$$r + 2r + r + 9 = 49$$

$$4r = 40, \text{ so } r = 10$$

There are 10 red, 20 blue and 19 green counters

Check

$$10 + 20 + 19 = 49$$

Ratio of red to green = $10 : 19$, which is already in simplest form

$10 : 19$

24

A rectangle has length $(2x + 5)$ cm and width $(x + 2)$ cm.

The perimeter of the rectangle is 38 cm.

Work out the area of the rectangle.

(5 marks)

$$\text{Perimeter} = 2(2x + 5) + 2(x + 2) = 6x + 14$$

$$6x + 14 = 38$$

$$6x = 24, \text{ so } x = 4$$

Length = 13 cm and width = 6 cm

Check

$$2(13) + 2(6) = 38 \text{ cm}$$

$$\text{Area} = 13 \text{ times } 6 = 78 \text{ cm}^2$$

78 cm^2

25

Cuboid A measures 2 cm by 5 cm by x cm.

Cuboid B measures 4 cm by 5 cm by $(x - 3)$ cm.

The two cuboids have equal volumes.

Find the value of x .

(5 marks)

$$\text{Volume of A} = 2 \text{ times } 5 \text{ times } x = 10x$$

$$\text{Volume of B} = 4 \text{ times } 5 \text{ times } (x - 3) = 20(x - 3) = 20x - 60$$

$$10x = 20x - 60$$

$$60 = 10x, \text{ so } x = 6$$

Check

$$\text{volume of A} = 60 \text{ cm}^3 \text{ and volume of B} = 20(3) = 60 \text{ cm}^3$$

$$x = 6$$

26

A triangle has a base of $(x + 4)$ cm and a perpendicular height of x cm. Its area is 30 cm^2 .

Form an equation, solve it, and work out the base of the triangle.

(4 marks)

$$\frac{1}{2}(x + 4)x = 30$$

$$\times 2 \quad x^2 + 4x = 60 \quad \times 2$$

$$-60 \quad x^2 + 4x - 60 = 0 \quad -60$$

$$(x + 10)(x - 6) = 0$$

$$x = 6 \text{ (} x = -10 \text{ is impossible)}$$

$$\text{base} = 6 + 4 = 10$$

$$10 \text{ cm}$$

27

A cuboid has a base measuring x cm by $(x + 3)$ cm and a height of 4 cm. Its volume is 160 cm^3 .

- Show that $x^2 + 3x - 40 = 0$.
- Solve the equation to find x .
- Work out the surface area of the cuboid.

(5 marks)

a)

$$\begin{array}{rcl}
 4x(x+3) & = & 160 \\
 4x^2 + 12x & = & 160 \\
 \div 4 & & \div 4 \\
 x^2 + 3x & = & 40 \\
 -40 & & -40 \\
 x^2 + 3x - 40 & = & 0
 \end{array}$$

b)

$$(x+8)(x-5) = 0$$

$$x = 5 \quad (x = -8 \text{ is impossible})$$

c)

sides: 5, 8, 4

$$2(5 \times 8 + 5 \times 4 + 8 \times 4) = 2(40 + 20 + 32)$$

$$184 \text{ cm}^2$$

28

- x , $(x + 6)$ and $3x$ are three consecutive terms of an arithmetic sequence. Find x .
- 3, x and 12 are three consecutive terms of a geometric sequence with a positive common ratio. Find x .

(4 marks)

a)

$$\begin{array}{rcl}
 (x+6) - x & = & 3x - (x+6) \\
 6 & = & 2x - 6 \\
 +6 & & +6 \\
 12 & = & 2x \\
 \div 2 & & \div 2 \\
 6 & = & x
 \end{array}$$

$$x = 6$$

b)

$$x \div 3 = 12 \div x$$

$$x^2 = 36$$

$$x = 6 \quad (\text{ratio must be positive})$$

$$x = 6$$