Day 97 **A Tier 10-a-day: Model Solutions**

1 Converting speeds

A lorry travels at 18 km/h.
Work out this speed in metres per minute.

In 1 hour: 18 km = 18000 m
1 hour = 60 minutes, so 18000 ÷ 60 = 300 m per minute
Answer: 300 m/min

2 Factorising quadratics

Factorise $x^2 - 4x - 45$

Find two numbers that multiply to −45 and add to −4
The numbers are 5 and −9
(x + 5)(x − 9)
Answer: (x + 5)(x − 9)

3 Converting units of area and volume

A rectangular table top is 120 cm by 100 cm.
Work out its area in m^2.

Area = 120 × 100 = 12000 cm^2
1 m^2 = 10 000 cm^2
12000 ÷ 10 000 = 1.2
Answer: 1.2 m^2

4 Rearranging formulae

Make m the subject of n = 9m + 2

Subtract 2 from both sides: 9m = n − 2
Divide both sides by 9

$$m = \frac{n - 2}{9}$$

Answer: $m = \frac{n - 2}{9}$

5 Fractions of an amount

Jack spends $\frac{1}{6}$ of the money on a phone case and $\frac{1}{5}$ of the money that is left on headphones.
Jack has £44 left.
How much money did Jack have to begin with?

After the second purchase $\frac{4}{5}$ of what was left after the first purchase remains.

£44 = $\frac{4}{5}$ of the amount left, so $\frac{1}{5}$ of it is £44 ÷ 4 = £11

So the amount left after the first purchase is £11 × 5 = £55

This is $\frac{5}{6}$ of the original amount, so the original amount is £55 ÷ 5 × 6 = £66

Answer: £66

6 Interior angles of polygons

The size of each angle of a quadrilateral is shown as an expression:
(2x + 60)°, (2x + 35)°, (x + 35)°, (2x + 41)°
Work out the value of x.

Sum of angles = (4 − 2) × 180 = 360°
2x + 60 + 2x + 35 + x + 35 + 2x + 41 = 360
7x + 171 = 360
7x = 189
x = 27
Answer: x = 27

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7 Mixing in a ratio

Jug A contains 27 litres of a mixture of orange juice and lemonade in the ratio 7 : 2.
Jug B contains 33 litres of a mixture of orange juice and lemonade in the ratio 4 : 7.
The contents of both jugs are mixed together.
Work out the ratio of orange juice to lemonade in the mixture. Give your answer in its simplest form.

Jug A: orange juice = $7 \times 27 \div 9 = 21$ litres, lemonade = 6 litres
Jug B: orange juice = 12 litres, lemonade = 21 litres
Total: orange juice = 33 litres, lemonade = 27 litres
Ratio = 33 : 27 = 11 : 9
Answer: 11 : 9

8 Volume of composite solids

A solid is made from a cylinder and a hemisphere.
The cylinder has radius 6 cm and height 9 cm.
The hemisphere has the same radius as the cylinder and sits on top of it.
Work out the total volume. Give your answer in terms of π.

Cylinder = $\pi \times 6^2 \times 9 = 324\pi$

Hemisphere = $\frac{2}{3} \times \pi \times 6^3 = 144\pi$

Total = $324\pi + 144\pi = 468\pi$

Answer: 468π cm^3

9 Parallel and perpendicular lines

The line L has equation $y = -\frac{3}{4}x + 1$

Find the equation of the line that is parallel to L and passes through the point (4, 3).

Parallel lines have the same gradient, so the gradient is $-\frac{3}{4}$

$y = -\frac{3}{4}x + c$, so $3 = -\frac{3}{4} \times 4 + c$

$c = 6$

$y = -\frac{3}{4}x + 6$

Answer: $y = -\frac{3}{4}x + 6$

10 Bounds and accuracy

A cyclist travels 550 metres in 17.2 seconds. The distance is correct to the nearest 10 metres and the time to the nearest 0.1 second.
(a) Work out the upper bound and the lower bound of the speed in m/s.
(b) Write the speed to a suitable degree of accuracy. Give a reason for your answer.

(a) Upper bound = $555 \div 17.15 = 32.3615$
Lower bound = $545 \div 17.25 = 31.5942$
(b) Both bounds round to 32 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 32 m/s to 2 significant figures.
Answer: (a) 32.3615, 31.5942 (b) 32 m/s (2 s.f.)