Day 134 **A Tier 10-a-day: Model Solutions**

1 Map scales

The scale of a map is 1 : 100000.
A road is 5 km long.
Work out the length of the road on the map, in centimetres.

5 km = 500000 cm
Length on map = 500000 ÷ 100000 = 5 cm
Answer: 5 cm

2 Surface area of a cuboid

A cuboid has length 8 cm and width 11 cm.
Its total surface area is 290 cm^2.
Work out the height of the cuboid.

$2 \times (8 \times 11 + 8\,h + 11\,h) = 290$
$88 + 19h = 145$
$19h = 57$
$h = 57 \div 19 = 3$
Answer: 3 cm

3 Equation of a line from a graph

Find the equation of the straight line shown.
Give your answer in the form y = mx + c

The line crosses the y-axis at (0, 1), so c = 1

Gradient = $\frac{\text{change in y}}{\text{change in x}}$: from (0, 1) to (−4, 5), y changes by 4 and x changes by −4

$m = -1$
$y = -x + 1$
Answer: y = −x + 1

4 Rates of flow

A tank is in the shape of a cuboid measuring 80 cm by 150 cm by 60 cm.
Water flows in at 20 litres per minute until the tank is full.
Work out how long this takes. Give your answer in minutes.

Volume = 80 × 150 × 60 = 720000 cm^3 = 720 litres
Time = 720 ÷ 20 = 36 minutes
Answer: 36 minutes

5 Sectors: finding an angle or radius

A sector of a circle has radius 16 cm and an arc length of 8π cm.
Work out the angle at the centre of the sector.

Arc length = $\frac{\theta}{360} \times 2 \times \pi \times 16$

$8\pi = \frac{\theta}{360} \times 32\pi$
$\theta = 8 \times 360 \div 32$
$\theta = 90$
Answer: 90°

6 Standard form notation

(a) Write 0.0009 in standard form.
(b) Write 8.9×10^3 as an ordinary number.

(a) Move the decimal point 4 places to get 9: 9×10^{-4}
(b) Move the decimal point 3 places to the right: 8,900
Answer: (a) 9×10^{-4} (b) 8,900

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7 Angles in regular polygons around a point

A regular dodecagon and a square share the side AB and are on opposite sides of it.
The two shapes meet at the point A.
Work out the size of the angle at A that is not inside either shape.

Interior angle of the regular dodecagon = 180 − 360 ÷ 12 = 150°
Interior angle of the square = 180 − 360 ÷ 4 = 90°
Angles round a point add up to 360°
360 − 150 − 90 = 120
Answer: 120°

8 Equations with algebraic fractions

Solve $\frac{2}{(x-3)} + \frac{6}{(x+5)} = 1$

Multiply every term by $(x-3)(x+5)$
$2(x+5) + 6(x-3) = (x-3)(x+5)$
$8x - 8 = x^2 + 2x - 15$
$x^2 - 6x - 7 = 0$
$(x+1)(x-7) = 0$
$x = -1$ or $x = 7$
Answer: $x = -1$ or $x = 7$

9 Perpendicular bisector

A is the point (3, −1) and B is the point (−5, −5).
Find the equation of the perpendicular bisector of AB.

Midpoint of AB = $(\frac{3+(-5)}{2}, \frac{(-1)+(-5)}{2}) = (-1, -3)$

Gradient of AB = $\frac{-4}{-8} = \frac{1}{2}$

Perpendicular gradient = $-1 \div \frac{1}{2} = -2$

$y = -2x + c$ through $(-1, -3)$: $-3 = -2 \times (-1) + c$, so $c = -5$
$y = -2x - 5$
Answer: $y = -2x - 5$

10 Bounds and accuracy

A cyclist travels 790 metres in 4.6 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 = 795 ÷ 4.55 = 174.7253
Lower bound = 785 ÷ 4.65 = 168.8172
(b) Both bounds round to 170 to 2 s.f. but not to the same value to 3 s.f.
So the speed is 170 m/s to 2 significant figures.
Answer: (a) 174.7253, 168.8172 (b) 170 m/s (2 s.f.)