Day 125 **A Tier 10-a-day: Model Solutions**

1 Simplifying surds

(a) Simplify $\sqrt{245}$

(b) Simplify $\sqrt{245} + \sqrt{45}$

(a) $\sqrt{245} = \sqrt{49} \times \sqrt{5} = 7\sqrt{5}$

(b) $\sqrt{45} = 3\sqrt{5}$, so $7\sqrt{5} + 3\sqrt{5} = 10\sqrt{5}$

Answer: (a) $7\sqrt{5}$ (b) $10\sqrt{5}$

2 Inequalities

Solve $-2x + 9 > 13$

Subtract 9: $-2x > 4$

Divide by -2. Dividing by a negative number reverses the inequality sign

$x < -2$

Answer: $x < -2$

3 Surface area of a cuboid

A closed block is a cuboid measuring 13 cm by 6 cm by 3 cm.

Work out the total surface area.

Faces: 13 × 6, 13 × 3 and 6 × 3 each appear twice

2 × (78 + 39 + 18)

= 2 × 135 = 270

Answer: 270 cm^2

4 Density

A solid cuboid measures 10 cm by 6 cm by 5 cm.

It is made of a material with density 1.2 g/cm^3.

Work out the mass of the cuboid in kilograms.

Volume = 10 × 6 × 5 = 300 cm^3

Mass = 1.2 × 300 = 360 g

360 g = 0.36 kg

Answer: 0.36 kg

5 Successive percentage changes

The price of a product increases by 30% each year for 2 years.

Work out the overall percentage increase over the 2 years.

Multiplier for each year = 1.3

Overall multiplier = $1.3^2 = 1.69$

Percentage increase = 69%

Answer: 69%

6 Similar shapes: area and volume

Two similar bottles have heights 12 cm and 30 cm.

The smaller one has a volume of 56 cm^3.

Work out the volume of the larger one.

Length scale factor = $30 \div 12 = \frac{5}{2}$

Volume scale factor = $(\frac{5}{2})^3 = \frac{125}{8}$

Volume = $56 \times \frac{125}{8} = 875$

Answer: 875 cm^3

Day 125 **A Tier 10-a-day: Model Solutions**

7 Venn diagram probability

The Venn diagram shows information about 18 people.
One person is chosen at random.
(a) Find the probability that the person is in French only.
(b) Find the probability that the person is in neither set.

(a) French only: 4 out of 18 = $\frac{2}{9}$

(b) Neither: 2 out of 18 = $\frac{1}{9}$

Answer: (a) $\frac{2}{9}$ (b) $\frac{1}{9}$

8 Rationalising the denominator

Rationalise the denominator of $\frac{7}{\sqrt{2}}$
Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{2}$: $\frac{7}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{7\sqrt{2}}{2}$

$= \frac{7\sqrt{2}}{2}$

Answer: $\frac{7\sqrt{2}}{2}$

9 Frequency density

The table gives information about 154 measurements.
A histogram is drawn using this information.
(a) Work out the missing frequency.
(b) Work out the height of the bar for the class $55 < t \leq 70$.

(a) Missing frequency = 154 − (21 + 16 + 39) = 78
(b) Class width = 70 − 55 = 15
Frequency density = 39 ÷ 15 = 2.6
Answer: (a) 78 (b) 2.6

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$y = x^2 + x - 9$
$y = x - 8$

Set the y values equal: $x^2 + x - 9 = x - 8$
$x^2 - 1 = 0$
$(x + 1)(x - 1) = 0$
$x = -1$ or $x = 1$
Substitute into $y = x - 8$: $y = -9$ and $y = -7$
Answer: $x = -1$, $y = -9$ and $x = 1$, $y = -7$