Day 53 **A Tier 10-a-day: Model Solutions**

1 Inverse proportion

5 machines take 21 hours to make a batch of bottles.
All the machines work at the same rate.
How many machines are needed to make a batch of bottles in 7 hours?

Total work = 5 × 21 = 105 machine-hour
Number needed = 105 ÷ 7 = 15
Answer: 15

2 Pythagoras in three dimensions

The diagram shows a cuboid.
Work out the length of the diagonal AG. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

$AG^2 = 8^2 + 11^2 + 7^2$
$= 64 + 121 + 49 = 234$
$AG = \sqrt{234} = 15.3$
Answer: 15.3 cm

3 Two-way tables

The table shows information about 52 people.
One person is chosen at random.
(a) Find the probability that the person chose tea.
(b) The person is a child. Find the probability that they chose coffee.

(a) Tea total = 30 out of 52 = $\frac{15}{26}$

(b) Children total = 30, of whom 7 are in the Coffee column: $\frac{7}{30}$

Answer: (a) $\frac{15}{26}$ (b) $\frac{7}{30}$

4 Surface area of a cuboid

A closed gift box is a cuboid measuring 14 cm by 5 cm by 9 cm.
Work out the total surface area.

Faces: 14 × 5, 14 × 9 and 5 × 9 each appear twice
2 × (70 + 126 + 45)
= 2 × 241 = 482
Answer: 482 cm^2

5 Rearranging to solve quadratics

Solve $x^2 - 2x = 15$

Move everything to one side: $x^2 - 2x - 15 = 0$
Factorise: $(x + 3)(x - 5) = 0$
$x = -3$ or $x = 5$
Answer: $x = -3$ or $x = 5$

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6 Fraction calculations

Work out $(3\frac{2}{3} - 3\frac{1}{6}) \times 2\frac{5}{6}$

Give your answer as a mixed number in its simplest form.

Brackets first, as improper fractions: $\frac{11}{3} - \frac{19}{6} = \frac{1}{2}$

Then multiply: $\frac{1}{2} \times \frac{17}{6} = \frac{17}{12}$

$= 1\frac{5}{12}$

Answer: $1\frac{5}{12}$

7 Surface area of cones and spheres

A solid hemisphere has radius 13 cm.
Work out the total surface area of the hemisphere.
Give your answer in terms of π.

Curved surface = $\frac{1}{2} \times 4\pi r^2 = 338\pi$

Flat circular face = $\pi r^2 = 169\pi$
Total = 507π
Answer: 507π cm^2

8 Surd fractions

Show that $\frac{\sqrt{48} - \sqrt{12}}{\sqrt{3}}$ is an integer, and find its value.

$\sqrt{48} = 4\sqrt{3}$ and $\sqrt{12} = 2\sqrt{3}$
Numerator = $4\sqrt{3} - 2\sqrt{3} = 2\sqrt{3}$
$\frac{2\sqrt{3}}{\sqrt{3}} = 2$
Answer: 2

9 Frequency density

The table gives information about 79 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 $40 < l \leq 45$.

(a) Missing frequency = 79 − (28 + 7 + 4) = 40
(b) Class width = 45 − 40 = 5
Frequency density = 7 ÷ 5 = 1.4
Answer: (a) 40 (b) 1.4

10 Direct and inverse proportion

y is inversely proportional to the square of x.
When x = 1, y = 12.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 2.

(a) $y = \frac{k}{x^2}$. Substitute x = 1 and y = 12: $12 = \frac{k}{1}$, so $k = 12 \times 1 = 12$

$y = \frac{12}{x^2}$

(b) $y = \frac{12}{4} = 3$

Answer: (a) $y = \frac{12}{x^2}$ (b) 3