Day 18 **A Tier 10-a-day: Model Solutions**

1 Volume of a prism

The diagram shows a prism.
The cross-section of the prism is a right-angled triangle.
Work out the volume of the prism.
The diagram is not drawn accurately.

Area of cross-section = $\frac{1}{2} \times 12 \times 3 = 18$

Volume = area of cross-section × length
= 18 × 17
= 306

Answer: 306 cm^3

2 Venn diagrams from information

There are 37 students in a class.
16 students do football and 17 students do hockey.
7 students do neither.
(a) Work out how many students do both.
(b) One student is chosen at random. Find the probability that they do football only.

(a) Students doing at least one = 37 − 7 = 30
Both = 16 + 17 − 30 = 3
(b) football only = 16 − 3 = 13

Probability = $\frac{13}{37}$

Answer: (a) 3 (b) $\frac{13}{37}$

3 Compound shapes with circles

The diagram shows a shape made from a rectangle and a semicircle.
Work out the area of the shape.
Give your answer in terms of π.
The diagram is not drawn accurately.

Rectangle: 4 × 6 = 24

Semicircle: $\frac{1}{2} \times \pi \times 2^2 = 2\pi$

Total = $24 + 2\pi$

Answer: $24 + 2\pi$ cm^2

4 Negative and fractional indices

Work out the value of

(a) $4^{\frac{3}{2}}$

(b) $(\frac{1}{4})^{-2}$

(a) $4^{\frac{3}{2}} = (\sqrt{4})^3 = 2^3 = 8$

(b) $(\frac{1}{4})^{-2} = 4^2 = 16$

Answer: (a) 8 (b) 16

5 Finding a missing value from an average

The mean of the five numbers 10, 3, 19, 20, x is 11.
Work out the value of x.

Total = 5 × 11 = 55
Known numbers add to 52
x = 55 − 52 = 3

Answer: x = 3

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6 Functions

f(x) = 3x + 2
g(x) = $x^2 - 8$
Find fg(−2)

g(−2) = $(-2)^2 - 8 = -4$
f(−4) = 3 × (−4) + 2 = −10
Answer: −10

7 Surface area of a prism

The diagram shows a triangular prism.
The cross-section is a right-angled triangle.
Work out the total surface area of the prism.
The diagram is not drawn accurately.

Hypotenuse = $\sqrt{24^2 + 10^2}$ = 26 cm

Two triangular ends: $2 \times \frac{1}{2} \times 24 \times 10 = 240$

Three rectangles: (24 + 10 + 26) × 6 = 360
Total = 240 + 360 = 600
Answer: 600 cm^2

8 Converting units

(a) Change 4,800 cm^3 to litres.
(b) Change 3,500,000 cm^3 to m^3.

(a) 4,800 cm^3 ÷ 1000 = 4.8 litres
(b) 3,500,000 cm^3 ÷ 1 000 000 = 3.5 m^3
Answer: (a) 4.8 litres (b) 3.5 m^3

9 Cumulative frequency graphs

The cumulative frequency graph shows information about the length of 40 leaves.
Use the graph to find an estimate for
(a) the median,
(b) the number of leaves with a length greater than 10 cm.

(a) Median at cumulative frequency 40 ÷ 2 = 20
Read across from 20 to the graph, then down to the axis
Median = 25 cm
(b) At 10 cm the cumulative frequency is 5
40 − 5 = 35
Answer: (a) 25 cm (b) 35

10 Simplifying algebraic fractions

Simplify fully

$$\frac{x^2 - 5x - 14}{x^2 + 7x + 10}$$

Factorise the top: (x + 2)(x − 7)
Factorise the bottom: (x + 2)(x + 5)
Cancel the common factor (x + 2)
Answer: $\frac{x - 7}{x + 5}$