Day 147 **A Tier 10-a-day: Model Solutions**

1 Converting units of area and volume

Convert 0.08 m^3 into cm^3.

1 m = 100 cm, so 1 m^3 = 100 × 100 × 100 = 1 000 000 cm^3
0.08 × 1 000 000 = 80000
Answer: 80000 cm^3

2 Finding a percentage change

The number of members of a club was 340 and is now 476.
Work out the percentage increase.

Change = 476 − 340 = 136
Percentage increase = $\frac{136}{340}$ × 100 = 40%
Answer: 40% increase

3 Volume of a pyramid

The diagram shows a pyramid with a square base of side 10 cm.
The perpendicular height of the pyramid is 9 cm.
Work out the volume of the pyramid.
The diagram is not drawn accurately.

Volume = $\frac{1}{3}$ × base area × height
= $\frac{1}{3}$ × 10 × 10 × 9
= 300
Answer: 300 cm^3

4 Double inequalities

(a) Solve $-11 < 2x - 3 < -1$
(b) Write down all the integer values of x that satisfy this inequality.

(a) Add 3 to every part: $-8 < 2x < 2$
Divide every part by 2: $-4 < x < 1$
(b) The integers are −3, −2, −1, 0
Answer: (a) $-4 < x < 1$ (b) −3, −2, −1, 0

5 Volume of a prism

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

Area of cross-section = 8 × 8 = 64
Volume = area of cross-section × length
= 64 × 9
= 576
Answer: 576 cm^3

6 Estimating the mean from grouped data

The table shows the heights, in cm, of 25 plants.
(a) Write down the class that contains the median.
(b) Work out an estimate for the mean.

(a) The median is in position (25 + 1) ÷ 2 = 13. Cumulative frequencies: 2, 15, 18, 22, 25
The median is in the class $30 < h \leq 50$
(b) Midpoints: 20, 40, 60, 80, 100
20 × 2 + 40 × 13 + 60 × 3 + 80 × 4 + 100 × 3 = 1360
Estimate = 1360 ÷ 25 = 54.4
Answer: (a) $30 < h \leq 50$ (b) 54.4

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7 Quadratic inequalities

Solve $x^2 \leq 4$

$x^2 = 4$ at $x = \pm 2$

The curve $y = x^2$ is below 4 between the roots

$-2 \leq x \leq 2$

Answer: $-2 \leq x \leq 2$

8 Combined means

The mean of 9 numbers is 44.
Another number is added. The mean of the 10 numbers is now 46.9.
Work out the number that was added.

Total of the first 9 numbers = $9 \times 44 = 396$
Total of the 10 numbers = $10 \times 46.9 = 469$
Number added = $469 - 396 = 73$
Answer: 73

9 Finding an interest rate

Hugo invests £1000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £1060.90 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $1000 \times m^2 = 1060.9$

$m^2 = 1060.9 \div 1000 = 1.0609$

$m = \sqrt{1.0609} = 1.03$

Rate = $(1.03 - 1) \times 100 = 3\%$
Answer: 3%

10 Rationalising with conjugates

Rationalise the denominator of $\frac{7}{3 - \sqrt{2}}$

Give your answer in the form $a + b\sqrt{c}$ where a and b are integers.

Multiply top and bottom by the conjugate $3 + \sqrt{2}$: $\frac{7(3 + \sqrt{2})}{(3 - \sqrt{2})(3 + \sqrt{2})}$

Denominator: $9 - 2 = 7$

$\frac{7(3 + \sqrt{2})}{7} = 1(3 + \sqrt{2})$

$= 3 + \sqrt{2}$

Answer: $3 + \sqrt{2}$