Day 77 **A Tier 10-a-day: Model Solutions**

1 Pressure

A machine exerts a force of 5 N on the floor.
The area in contact with the floor is 0.2 m^2.
Work out the pressure on the floor in N/m^2.

Pressure = force ÷ area
= 5 ÷ 0.2 = 25
Answer: 25 N/m^2

2 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle BAC = 40°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle ABC = (180 − 40) ÷ 2 = 70°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 40 + 70 = 110
Answer: x = 110°

3 Estimation

Estimate the value of $\sqrt{24.9} \times 2.2$, by rounding 24.9 to the nearest square number and 2.2 to 1 significant figure.

Round to values we can work with: 24.9 ≈ 25 and 2.2 ≈ 2
$\sqrt{25} \times 2 = 5 \times 2 = 10$
Answer: 10

4 Reverse percentages

Leah's weekly pay is increased by 10%.
Her new weekly pay is £22.
Work out her weekly pay before the increase.

110% represents £22
1% = £22 ÷ 110 = £0.2
100% = £0.2 × 100 = £20.00
Answer: £20.00

5 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 = $\frac{1}{2} \times 6 \times 6 = 18$

Volume = area of cross-section × length
= 18 × 4
= 72
Answer: 72 cm^3

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6 Estimating the mean from grouped data

The table shows the heights, in cm, of 50 plants.
(a) Write down the class that contains the median.
(b) Work out an estimate for the mean.

(a) The median is in position (50 + 1) ÷ 2 = 25.5. Cumulative frequencies: 2, 30, 40, 50
The median is in the class $5 < h \leq 10$
(b) Midpoints: 2.5, 7.5, 12.5, 17.5
2.5 × 2 + 7.5 × 28 + 12.5 × 10 + 17.5 × 10 = 515
Estimate = 515 ÷ 50 = 10.3
Answer: (a) $5 < h \leq 10$ (b) 10.3

7 Compound interest

Jack invests £6,500 in a savings account. (Calculator)
The account pays compound interest at 4% per year.
Work out the value of the investment after 4 years.

Multiplier = 1 + 4 ÷ 100 = 1.04
£6,500 × 1.04^4 = £7,604.08
Answer: £7,604.08

8 Expanding three brackets

Expand and simplify
$(x + 4)(x + 1)(x + 2)$

Expand the first two brackets: $(x + 4)(x + 1) = x^2 + 5x + 4$
Multiply by the third bracket: $(x^2 + 5x + 4)(x + 2)$
$= x^3 + 5x^2 + 4x + 2x^2 + 10x + 8$
$= x^3 + 7x^2 + 14x + 8$
Answer: $x^3 + 7x^2 + 14x + 8$

9 Bounds in measurement

The length and width of a rectangle are 10.8 cm and 6.3 cm.
Each measurement is correct to 1 decimal place.
Work out the upper bound for the area.

Upper bound of length = 10.8 cm, upper bound of width = 6.3 cm
Upper bound of area = 10.85 × 6.35 = 68.8975
Answer: 68.8975 cm^2

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$y = x^2 - 5x - 3$
$y = -7$

Set the y values equal: $x^2 - 5x - 3 = -7$
$x^2 - 5x + 4 = 0$
$(x - 1)(x - 4) = 0$
$x = 1$ or $x = 4$
Substitute into $y = -7$: $y = -7$ and $y = -7$
Answer: $x = 1, y = -7$ and $x = 4, y = -7$