Day 93 **A Tier 10-a-day: Model Solutions**

1 Decimal calculations

(a) Work out 0.5 × 0.4
(b) Work out 0.08 ÷ 0.04

(a) 5 × 4 = 20, and there are 2 decimal places in total, so 0.2
(b) Multiply both numbers by 100: 8 ÷ 4 = 2
Answer: (a) 0.2 (b) 2

2 Inverse proportion formulae

y is inversely proportional to x^2.
When x = 1, y = 11.
(a) Find a formula for y in terms of x.
(b) Work out the positive value of x when y = 0.44.

(a) $y = \frac{k}{x^2}$. Substitute: $11 = \frac{k}{1}$, so k = 11 × 1 = 11

$y = \frac{11}{x^2}$

(b) $0.44 = \frac{11}{x^2}$, so $x^2 = 11 \div 0.44 = 25$, so x = 5

Answer: (a) $y = \frac{11}{x^2}$ (b) x = 5

3 Simultaneous equations

Solve the simultaneous equations
3x + y = −6
4x + 2y = −6

Multiply (1) by 2 to make the y coefficients match
6x + 2y = −12 (1)
4x + 2y = −6 (2)
The y terms have the same sign, so subtract equation (2) from equation (1)
2x = −6, so x = −3
Substitute x = −3 into equation (1) to find y = 3
Answer: x = −3, y = 3

4 Laws of indices

Write $7^9 \times (7^7)^6$ as a single power of 7.

$(7^7)^6 = 7^{42}$
Add the powers: 9 + 42 = 51
$= 7^{51}$

Answer: 7^{51}

5 Pythagoras in context

An isosceles triangle has sides of length 41 cm, 41 cm and 80 cm.
Work out the area of the triangle.

Split the triangle into two right-angled triangles with base 40 cm and hypotenuse 41 cm
Height = $\sqrt{41^2 - 40^2} = \sqrt{81}$ = 9 cm
Area = $\frac{1}{2} \times 80 \times 9 = 360$

Answer: 360 cm^2

6 Converting units

(a) Change 250 cm^3 to litres.
(b) Change 12 litres to cm^3.

(a) 250 $cm^3 \div 1000$ = 0.25 litres
(b) 12 litres × 1,000 = 12,000 cm^3
Answer: (a) 0.25 litres (b) 12,000 cm^3

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7 Transformations of graphs

The graph of y = f(x) has a maximum point at (−1, 4).
Write down the coordinates of the turning point of the graph of
(a) y = f(x) − 5
(b) y = −f(x)

(a) Subtracting 5 from f(x) moves the graph 5 units down
The maximum point is (−1, −1)
(b) The graph is reflected in the x-axis, so the y-coordinate changes sign
The maximum point becomes a minimum point at (−1, −4)
Answer: (a) (−1, −1) (b) (−1, −4)

8 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 = $\sqrt{12^2 + 9^2}$ = 15 cm
Two triangular ends: $2 \times \frac{1}{2} \times 12 \times 9 = 108$
Three rectangles: (12 + 9 + 15) × 6 = 216
Total = 108 + 216 = 324
Answer: 324 cm^2

9 Finding an interest rate

Grace invests £8000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £8820 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $8000 \times m^2 = 8820$
$m^2 = 8820 \div 8000 = 1.1025$
$m = \sqrt{1.1025} = 1.05$
Rate = (1.05 − 1) × 100 = 5%
Answer: 5%

10 Pythagoras in three dimensions

The diagram shows a cuboid.
Work out the length of the diagonal AG.
The diagram is not drawn accurately.

$AG^2 = 6^2 + 2^2 + 3^2$
= 36 + 4 + 9 = 49
$AG = \sqrt{49} = 7$
Answer: 7 cm