Day 260 **B Tier 10-a-day: Model Solutions**

1 Number machines

Here is a number machine.
Input → × 2 → + 8 → Output
(a) The input is 11. Work out the output.
(b) The output is 16. Work out the input.

(a) 11 × 2 = 22, then 22 + 8 = 30
(b) Work backwards: undo + 8 to get 8, then undo × 2 to get 4
Answer: (a) 30 (b) 4

2 Rounding

Write 97.549
(a) correct to 2 decimal places,
(b) correct to 3 significant figures.

(a) Look at the next digit after the second decimal place: 9
So 97.549 rounds to 97.55
(b) The first significant figure is the first non-zero digit. Count 3 figures and look at the next digit.
97.549 rounds to 97.5
Answer: (a) 97.55 (b) 97.5

3 Solving quadratic equations

Solve $x^2 - 4x + 3 = 0$

Factorise: $(x - 3)(x - 1) = 0$
Either $x - 3 = 0$ or $x - 1 = 0$
Answer: $x = 1$ or $x = 3$

4 Best buys

Pasta is sold in two sizes.
Small: 500 g for £2.25
Large: 750 g for £2.92
Which size is better value for money?
You must show your working.

Compare the cost of 1500 g of each
Small: 3 × £2.25 = £6.75
Large: 2 × £2.92 = £5.84
The large is cheaper for the same amount
Answer: The large size

5 Midpoint and length of a line

A is the point (−5, −4) and B is the point (−2, −2). (Calculator)
(a) Work out the coordinates of the midpoint of AB.
(b) Work out the length of AB. Give your answer correct to 1 decimal place.

(a) Midpoint = (−7 ÷ 2, −6 ÷ 2) = (−3.5, −3)
(b) Horizontal distance = 3, vertical distance = 2
$AB^2 = 3^2 + 2^2 = 9 + 4 = 13$
$AB = \sqrt{13} = 3.606...$
Answer: (a) (−3.5, −3) (b) 3.6

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6 Fraction problems

A paddling pool is $\frac{1}{3}$ full.

50 litres of water are added.

The paddling pool is now $\frac{1}{2}$ full.

Work out the capacity of the paddling pool.

Fraction added = $\frac{1}{2} - \frac{1}{3} = \frac{1}{6}$

$\frac{1}{6}$ of the capacity = 50 litres

Whole capacity = 50 × 6 = 300 litres

Answer: 300 litres

7 Volume of a prism

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

Area of cross-section = ½ × 8 × 5 = 20

Volume of prism = area of cross-section × length

20 × 6 = 120

Answer: 120 cm^3

8 Simplifying expressions

Simplify fully

(a) 3p × 3q

(b) $30m^2 \div 5m$

(a) Multiply the numbers: 3 × 3 = 9, then the letters: p × q = pq

(b) 30 ÷ 5 = 6 and $m^2 \div m = m$

Answer: (a) 9pq (b) 6m

9 LCM problems

Two lights flash at 11:15.
One light flashes every 24 minutes.
The other light flashes every 15 minutes.
At what time do both lights next flash together?

Multiples of 24: 24, 48, 72, 96, 120

Multiples of 15: 15, 30, 45, 60, 75, 90, 105, 120

The first common multiple is 120, so the LCM is 120 minutes

11:15 + 120 minutes = 13:15

Answer: 13:15

10 Cumulative frequency

The cumulative frequency graph shows the times taken by 40 students to complete a puzzle.
(a) Use the graph to estimate the median.
(b) Work out an estimate for the interquartile range.

(a) Median is at 40 ÷ 2 = 20: read across from 20 on the vertical axis to the curve, then down: 16

(b) Lower quartile at 10: 8. Upper quartile at 30: 67.5

IQR = 67.5 − 8 = 59.5

Answer: (a) 16 minutes (b) 59.5 minutes