Day 50 **B Tier 10-a-day: Model Solutions**

1 Number machines

Here is a number machine.
Input → × 3 → + 9 → Output
(a) The input is 3. Work out the output.
(b) The output is 30. Work out the input.

(a) 3 × 3 = 9, then 9 + 9 = 18
(b) Work backwards: undo + 9 to get 21, then undo × 3 to get 7
Answer: (a) 18 (b) 7

2 Unitary method

7 cakes cost £5.60.
Work out the cost of 5 cakes.

1 cake costs £5.60 ÷ 7 = 80p
5 cakes cost 5 × 80p = £4
Answer: £4

3 Angles in quadrilaterals

WXYZ is a rhombus.
Angle ZWX = 84°.
(a) Write down the size of angle XYZ.
(b) Work out the size of angle WXY.

(a) Opposite angles are equal, so angle XYZ = 84°
(b) Angles next to each other add up to 180°
180 − 84 = 96
Answer: (a) 84° (b) 96°

4 Expanding and simplifying

Expand and simplify 3(x + 5) + 4(x + 3)

Expand each bracket: 3x + 15 + 4x + 12
Collect like terms: 7x + 27
Answer: 7x + 27

5 Ordering standard form

Write these numbers in order of size.
Start with the smallest.
6.3×10^3, 5.9×10^{-5}, 2.9×10^1, 820,000

Write each in standard form: 6.3×10^3, 5.9×10^{-5}, 2.9×10^1, 8.2×10^5
Compare the powers of 10 first (the bigger the power, the bigger the number)
Order: 5.9×10^{-5}, 2.9×10^1, 6.3×10^3, 820,000
Answer: 5.9×10^{-5}, 2.9×10^1, 6.3×10^3, 820,000

6 Midpoint and length of a line

A is the point (0, −3) and B is the point (−1, −11). (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 = (−1 ÷ 2, −14 ÷ 2) = (−0.5, −7)
(b) Horizontal distance = 1, vertical distance = 8
$AB^2 = 1^2 + 8^2 = 1 + 64 = 65$
$AB = \sqrt{65} = 8.062...$
Answer: (a) (−0.5, −7) (b) 8.1

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7 Repeated percentage change

The price of a laptop is £80.
The price is first increased by 20%, then the new price is reduced by 25%.
(a) Work out the final price.
(b) Work out the overall percentage decrease in the price.

(a) Multipliers: 1.2 and 0.75
80 × 1.2 × 0.75 = £72
(b) Overall multiplier = 0.9
Overall decrease = 10%
Answer: (a) £72 (b) 10% decrease

8 Expanding double brackets

Expand and simplify $(x - 4)(x + 8)$

Multiply every term in the first bracket by every term in the second:
$x^2 + 8x - 4x - 32$
Collect the x terms: $x^2 + 4x - 32$
Answer: $x^2 + 4x - 32$

9 Fraction problems

A water tank is $\frac{3}{8}$ full.

72 litres of water are added.

The water tank is now $\frac{3}{5}$ full.

Work out the capacity of the water tank.

Fraction added = $\frac{3}{5} - \frac{3}{8} = \frac{9}{40}$

$\frac{9}{40}$ of the capacity = 72 litres

$\frac{1}{40}$ of the capacity = 72 ÷ 9 = 8 litres

Whole capacity = 8 × 40 = 320 litres
Answer: 320 litres

10 Capture-recapture

50 fish in a lake are caught, tagged and returned to the lake.
Later, a sample of 40 fish is caught and 2 of them are tagged.
Estimate the total number of fish in the lake.

Proportion tagged in the sample = 2 ÷ 40
This is the same proportion as 50 out of the whole population
Population ≈ 50 × 40 ÷ 2 = 1000
Answer: 1000