Day 271 **B Tier 10-a-day: Model Solutions**

1 Capture-recapture

100 deer in a lake are caught, tagged and returned to the lake.
Later, a sample of 50 deer is caught and 8 of them are tagged.
Estimate the total number of deer in the lake.

Proportion tagged in the sample = 8 ÷ 50
This is the same proportion as 100 out of the whole population
Population ≈ 100 × 50 ÷ 8 = 625
Answer: 625

2 Ordering fractions

Write these in order of size.
Start with the smallest.
$\frac{4}{5}$, $\frac{7}{20}$, $\frac{2}{5}$, 0.5

Write each as a decimal:
$\frac{4}{5}$ = 0.8, $\frac{7}{20}$ = 0.35, $\frac{2}{5}$ = 0.4, 0.5 = 0.5
Order: $\frac{7}{20}$, $\frac{2}{5}$, 0.5, $\frac{4}{5}$
Answer: $\frac{7}{20}$, $\frac{2}{5}$, 0.5, $\frac{4}{5}$

3 Equations with unknowns on both sides

Solve 6x − 12 = 2x + 8

Subtract 2x from both sides: 4x − 12 = 8
Add 12 to both sides: 4x = 20
Divide both sides by 4
Answer: x = 5

4 Median and range

Here are the number of customers at a shop each day.
33, 42, 22, 43, 31, 44, 40, 27
(a) Find the median.
(b) Work out the range.

(a) Put in order: 22, 27, 31, 33, 40, 42, 43, 44
The middle two values are 33 and 40, so the median is 73 ÷ 2 = 36.5
(b) Range = largest − smallest = 44 − 22 = 22
Answer: (a) 36.5 (b) 22

5 Equation of a straight line graph

The diagram shows a straight line.
(a) Work out the gradient of the line.
(b) Find the equation of the line.

(a) The line crosses the y-axis at −3. Pick two points on the line and work out change in y divided by change in x
Gradient = −2
(b) The equation is y = mx + c with m = −2 and c = −3
Answer: (a) −2 (b) y = −2x − 3

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6 Similar shapes

The two triangles are similar.
(a) Work out the scale factor of the enlargement from the smaller triangle to the larger triangle.
(b) Work out the value of b.
The diagram is not drawn accurately.

(a) Scale factor = 32 ÷ 8 = 4
(b) b = 9 × 4 = 36
Answer: (a) 4 (b) b = 36 cm

7 Substitution into formulae

$E = \frac{1}{2}mv^2$

Work out the value of E when m = 6 and v = 7

$E = \frac{1}{2} \times 6 \times 7^2$

$E = \frac{1}{2} \times 6 \times 49 = 147$

Answer: E = 147

8 Powers and roots

Write down
(a) the square root of 100
(b) the cube root of 216

(a) 10 × 10 = 100, so the square root is 10
(b) 6 × 6 × 6 = 216, so the cube root is 6
Answer: (a) 10 (b) 6

9 Chords and the centre of a circle

A circle has centre O and radius 15 m.
AB is a chord and M is the midpoint of AB. OM is perpendicular to AB.
Work out the value of x.
The diagram is not drawn accurately.

Triangle OMA has a right angle at M, and OA is the hypotenuse
$AM^2 = 15^2 - 9^2 = 225 - 81 = 144$
$AM = \sqrt{144} = 12$
x = 2 × AM = 24
Answer: x = 24 m

10 Reverse repeated percentages

In a sale, the price of a sofa is reduced by 50%. (Calculator)
Two weeks later it is reduced by a further 25% of the new price.
The final price is £150.
Work out the original price of the sofa.

Multipliers: 0.5 and 0.75
Overall multiplier = 0.5 × 0.75 = 0.375
Original price = £150 ÷ 0.375 = £400
Answer: £400