Day 226 **B Tier 10-a-day: Model Solutions**

1 Simplifying expressions

Simplify fully

(a) $18ab \div 3a$

(b) $12p^2 \div 6p$

(a) Divide the numbers: $18 \div 3 = 6$. The a cancels, leaving 6b

(b) $12 \div 6 = 2$ and $p^2 \div p = p$

Answer: (a) 6b (b) 2p

2 Stratified sampling

A stratified sample of 60 students is taken from the 600 students in the table.

Work out how many students should be sampled from Year 7.

Sample fraction = $60 \div 600$

Year 7: $120 \div 600 \times 60 = 12$

Answer: 12

3 Enlargement

A rectangle is 2 m long and 5 m wide.

It is enlarged by scale factor 3.

(a) Write down the length and width of the enlarged rectangle.

(b) Work out the perimeter of the enlarged rectangle.

(a) $2 \times 3 = 6$ and $5 \times 3 = 15$

(b) Perimeter = $2 \times (6 + 15) = 42$

Answer: (a) 6 m by 15 m (b) 42 m

4 Difference of two squares

Factorise $121 - y^2$

$121 = 11^2$, so this is a difference of two squares

$11^2 - y^2 = (11 - y)(11 + y)$

Answer: $(11 - y)(11 + y)$

5 Scatter graphs

The scatter graph shows information about speed and stopping distance.

A line of best fit is drawn.

(a) Describe the correlation.

(b) Use the line of best fit to estimate the stopping distance when speed is 76.

(a) As one variable goes up, the other goes up

This is positive correlation

(b) Go up from 76 on the horizontal axis to the line, then across to the vertical axis

The reading is about 62 m

Answer: (a) Positive correlation (b) about 62 m

6 Compound percentages

A new car costs £50,500. (Calculator)

Its value falls by 3% each year.

Work out its value after 2 years.

Give your answer to the nearest pound.

Multiplier = $100\% - 3\% = 0.97$

Value = 50500×0.97^2

= £47,515.45, which is £47,515 to the nearest pound

Answer: £47,515

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7 Midpoint and length of a line

A is the point (0, −5) and B is the point (8, −11).
(a) Work out the coordinates of the midpoint of AB.
(b) Work out the length of AB.

(a) Midpoint = (8 ÷ 2, −16 ÷ 2) = (4, −8)
(b) Horizontal distance = 8, vertical distance = 6
$AB^2 = 8^2 + 6^2 = 64 + 36 = 100$
$AB = \sqrt{100} = 10$
Answer: (a) (4, −8) (b) 10

8 Percentage change

Sophie bought a laptop for £800 and sold it for £480.
Work out the percentage loss.

Loss = cost − selling price = £320
Percentage loss = $\frac{£320}{£800} \times 100 = 40\%$
Answer: 40% loss

9 Bearings with Pythagoras and trigonometry

A boat sails 5 m on a bearing of 180° from P to Q, then 13 m on a bearing of 270° to R. (Calculator)
(a) Work out the distance PR.
(b) Work out the bearing of R from P.
Give your answers correct to 1 decimal place.

(a) Triangle PQR has a right angle at Q
$PR^2 = 5^2 + 13^2 = 194$
$PR = \sqrt{194} = 13.928...$ m
(b) tan (angle QPR) = $\frac{13}{5}$, so angle QPR = 68.962° (to 3 d.p.)
PQ is on a bearing of 180°, and R is a further 68.962° clockwise from PQ
Bearing = 180 + 68.962 = 249.0°
Answer: (a) 13.9 m (b) 249.0°

10 Speed unit conversion

A train travels at 72 km/h.
Work out its speed in metres per second.

72 km = 72,000 m
1 hour = 3600 seconds
72,000 ÷ 3600 = 20 m/s
Answer: 20 m/s