Day 130 **A Tier 10-a-day: Model Solutions**

1 Pythagoras' theorem

Work out the length of x.
The diagram is not drawn accurately.

$x^2 = 10^2 + 24^2$
$x^2 = 100 + 576 = 676$
$x = \sqrt{676} = 26$
Answer: x = 26 cm

2 Box plots

The box plot shows the masses, in kg, of the parcels in delivery A.
(a) Write down the median and the interquartile range.
For delivery B the median is 30 and the interquartile range is 20.
(b) Compare the distributions of the two deliveries.

(a) Median = 45
Interquartile range = 65 − 40 = 25
(b) The median for Delivery A is higher (45 compared with 30), so it has the higher values on average
The IQR for Delivery B is smaller (20 compared with 25), so its values are more consistent
Answer: (a) Median 45, IQR 25 (b) Delivery A has the higher median; Delivery B has the smaller IQR so is more consistent

3 Inequalities

Solve $5x + 5 \leq 3x + 13$

Collect the x terms on the left: $2x + 5 \leq 13$
Subtract 5: $2x \leq 8$
Divide by 2
$x \leq 4$
Answer: $x \leq 4$

4 Estimation

By rounding each number to 1 significant figure, estimate the value of
$\frac{39.0 \times 96}{0.52}$

Round each number to 1 significant figure: 40, 100, 0.5
$\frac{40 \times 100}{0.5} = 8000$
Answer: 8000

5 Sectors: finding an angle or radius

A pizza slice is a sector of a circle has radius 18 cm and an arc length of 15π cm.
Work out the angle at the centre of the sector.

Arc length = $\frac{\theta}{360} \times 2 \times \pi \times 18$
$15\pi = \frac{\theta}{360} \times 36\pi$
$\theta = 15 \times 360 \div 36$
$\theta = 150$
Answer: 150°

6 Percentages of percentages

There are 200 passengers on a plane.
45% of the passengers are children.
30% of the children are under 5 years old.
How many passengers are children under 5?

Children = 45% of 200 = 90
Under 5 = 30% of 90 = 27
Answer: 27

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7 Capture-recapture

A scientist wants to estimate the number of frogs in a pond.
She catches 100 frogs, marks each one and returns them.
Later she catches a second sample of 30 frogs. 10 of these are marked.
Work out an estimate for the total number of frogs in a pond.

Proportion marked in the second sample = $\frac{10}{30}$

This is the same as the proportion in the whole population: $\frac{100}{N}$

$\frac{100}{N} = \frac{10}{30}$, so N = 100 × 30 ÷ 10 = 300

Answer: 300

8 Rationalising with conjugates

Rationalise the denominator of $\frac{87}{6+\sqrt{7}}$

Give your answer in the form $a + b\sqrt{c}$ where a and b are integers.

Multiply top and bottom by the conjugate $6 - \sqrt{7}$: $\frac{87(6-\sqrt{7})}{(6+\sqrt{7})(6-\sqrt{7})}$

Denominator: $36 - 7 = 29$

$\frac{87(6-\sqrt{7})}{29} = 3(6-\sqrt{7})$

$= 18 - 3\sqrt{7}$

Answer: $18 - 3\sqrt{7}$

9 Transformations of graphs

The graph of y = f(x) has a minimum point at (3, −2).
Write down the coordinates of the turning point of the graph of
(a) y = 2f(x)
(b) y = f(x) − 5

(a) Multiplying f(x) by 2 stretches the graph vertically by a factor of 2, so the y-coordinate is multiplied by 2
The minimum point is (3, −4)
(b) Subtracting 5 from f(x) moves the graph 5 units down
The minimum point is (3, −7)
Answer: (a) (3, −4) (b) (3, −7)

10 Reading a histogram

The histogram shows information about the age of some items.
(a) Work out the number of items with a age in the class 30 to 50 years.
(b) Work out an estimate for the number with a age greater than 40 years.

(a) Frequency = frequency density × class width
1.8 × 20 = 36
(b) 40 to 50: 1.8 × 10 = 18
Class 50 to 80: 1.4 × 30 = 42
Class 80 to 90: 0.8 × 10 = 8
Total = 18 + 42 + 8 = 68
Answer: (a) 36 (b) 68