Day 23 **A Tier 10-a-day: Model Solutions**

1 Box plots

The box plot shows the times taken, in seconds, by the students in Class A to run 100 m.
(a) Write down the median and the interquartile range.
For Class B the median is 15 and the interquartile range is 20.
(b) Compare the distributions of the two classes.

(a) Median = 30
Interquartile range = 40 − 25 = 15
(b) The median for Class A is higher (30 compared with 15), so it has the higher values on average
The IQR for Class A is smaller (15 compared with 20), so its values are more consistent
Answer: (a) Median 30, IQR 15 (b) Class A has the higher median; Class A has the smaller IQR so is more consistent

2 Exchange rates

The exchange rate is £1 = CHF 1.10. (Calculator)
A hotel room costs CHF 286 a night.
Work out the cost in pounds.

Divide by the exchange rate: 286 ÷ 1.1
= £260
Answer: £260

3 Median from a frequency table

The table shows information about 25 households.
(a) Find the median.
(b) Work out the range.

(a) The median is the 13th value (25 + 1) ÷ 2 = 13
Cumulative frequencies: 2, 7, 15, 18, 25
The 13th value is 2
(b) Range = 4 − 0 = 4
Answer: (a) 2 (b) 4

4 Dividing fractions in context

A roll of ribbon is $16\frac{1}{4}$ metres long. Pieces of $\frac{5}{8}$ metre are cut from it.
How many pieces can be cut?

Divide: $16\frac{1}{4} \div \frac{5}{8}$

As improper fractions and multiplying by the reciprocal: $\frac{65}{4} \times \frac{8}{5}$

= 26
Answer: 26

5 Midpoints and length of a line segment

A is the point (−1, −5) and B is the point (−2, 1).
(a) Find the midpoint of AB.

(a) Midpoint = $(\frac{-1 + (-2)}{2}, \frac{-5 + 1}{2}) = (-1.5, -2)$
Answer: (a) (−1.5, −2)

6 Completing the square

(a) Write $x^2 - 12x - 10$ in the form $(x + a)^2 + b$
(b) Write down the coordinates of the turning point of the curve $y = x^2 - 12x - 10$

(a) Half of −12 is −6, so $(x - 6)^2$
$(x - 6)^2 = x^2 - 12x + 36$, so subtract 36 to get back to −10
So $x^2 - 12x - 10 = (x - 6)^2 - 46$
(b) The turning point is where the bracket is 0, so x = 6 and y = −46
Answer: (a) $(x - 6)^2 - 46$ (b) (6, −46)

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7 Reverse percentages

The price of a monthly gym fee increases by 20%.
The new price is £360.
Work out the price before the increase.

120% represents £360
1% = £360 ÷ 120 = £3
100% = £3 × 100 = £300.00
Answer: £300.00

8 Loci: area of a region

A dog is tied by a rope of length 12 m to a point on a long straight wall.
The dog can graze on any grass on one side of the wall.
Work out the area it can graze. Give your answer in terms of π.
The diagram is not drawn accurately.

The rope can sweep a semicircle (180°)

Area = $\frac{1}{2} \times \pi \times 12^2$

$= 72\pi$

Answer: 72π m^2

9 Finding a rate of compound change

Grace invests £15,000 in a savings account. (Calculator)
Compound interest is paid at a fixed rate each year.
After 2 years the investment is worth £19,837.50.
Work out the annual rate of interest.

Overall multiplier = £19,837.50 ÷ £15,000 = 1.3225
Take the square root: $\sqrt{1.3225} = 1.15$
Rate = (1.15 − 1) × 100 = 15%
Answer: 15%

10 Equations with algebraic fractions

Solve $\frac{6}{(x + 1)} + \frac{3}{(x + 5)} = 1$

Multiply every term by (x + 1)(x + 5)
$6(x + 5) + 3(x + 1) = (x + 1)(x + 5)$
$9x + 33 = x^2 + 6x + 5$
$x^2 - 3x - 28 = 0$
$(x + 4)(x - 7) = 0$
$x = -4$ or $x = 7$
Answer: $x = -4$ or $x = 7$