Day 155 **A Tier 10-a-day: Model Solutions**

1 Converting units of area and volume

Convert 0.45 m^2 into cm^2.

1 m = 100 cm, so 1 m^2 = 100 × 100 = 10 000 cm^2
0.45 × 10 000 = 4500
Answer: 4500 cm^2

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 40 and the interquartile range is 5.
(b) Compare the distributions of the two deliveries.

(a) Median = 25
Interquartile range = 35 − 20 = 15
(b) The median for Delivery B is higher (40 compared with 25), so it has the higher values on average
The IQR for Delivery B is smaller (5 compared with 15), so its values are more consistent
Answer: (a) Median 25, IQR 15 (b) Delivery B has the higher median; Delivery B has the smaller IQR so is more consistent

3 Circle area and circumference

The area of a circle is 196π cm^2.
(a) Work out the radius of the circle.
(b) Work out the circumference. Give your answer in terms of π.

(a) $\pi r^2 = 196\pi$, so $r^2 = 196$
r = 14
(b) Circumference = $2\pi r = 2 \times \pi \times 14 = 28\pi$
Answer: (a) 14 cm (b) 28π cm

4 Simultaneous equations in context

5 burgers and 3 milkshakes cost £60.
2 burgers and 1 milkshake cost £23.
Work out the cost of one burger.

Let b = cost of one burger in £ and m = cost of one milkshake in £
5b + 3m = 60 (1)
2b + m = 23 (2)
Multiply (2) by 3 to make the m coefficients match
5b + 3m = 60 (1)
6b + 3m = 69 (2)
The m terms have the same sign, so subtract equation (1) from equation (2)
b = 9
Substitute b = 9 into equation (1) to find m = 5
Answer: £9

5 Percentages of percentages

In a school, 40% of the students are boys. (Calculator)
30% of the boys and 60% of the girls walk to school.
What percentage of all the students walk to school?

Take 200 students: boys = 80, girls = 120
Boys who walk = 80 × 0.3 = 24
Girls who walk = 120 × 0.6 = 72
Total = 96, so 96 ÷ 200 × 100 = 48%
Answer: 48%

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6 Growth and decay

The population of a town is 40000. (Calculator)
It increases by 8% each year.
Work out the population after 3 years.
Give your answer to the nearest whole number.

Multiplier = 100% + 8% = 1.08
$40000 \times 1.08^3 = 50388.48$
= 50388 to the nearest whole number
Answer: 50388

7 Rationalising the denominator

Rationalise the denominator of $\frac{5}{5\sqrt{2}}$
Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{2}$: $\frac{5\sqrt{2}}{5 \times 2}$
$= \frac{5\sqrt{2}}{10} = \frac{\sqrt{2}}{2}$
Answer: $\frac{\sqrt{2}}{2}$

8 Expanding three brackets

Expand and simplify
$(x - 1)(3x + 4)(x + 5)$

Expand the first two brackets: $(x - 1)(3x + 4) = 3x^2 + x - 4$
Multiply by the third bracket: $(3x^2 + x - 4)(x + 5)$
$= 3x^3 + x^2 - 4x + 15x^2 + 5x - 20$
$= 3x^3 + 16x^2 + x - 20$
Answer: $3x^3 + 16x^2 + x - 20$

9 Finding an interest rate

Isla invests £4000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £4840 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $4000 \times m^2 = 4840$
$m^2 = 4840 \div 4000 = 1.21$
$m = \sqrt{1.21} = 1.1$
Rate = $(1.1 - 1) \times 100 = 10\%$
Answer: 10%

10 Adding algebraic fractions

Write as a single fraction in its simplest form
$\frac{x - 1}{3} - \frac{x + 2}{5}$

Common denominator is 15
$= \frac{5(x - 1) - 3(x + 2)}{15}$
$= \frac{2x - 11}{15}$
Answer: $\frac{2x - 11}{15}$