Day 211 **A Tier 10-a-day: Model Solutions**

1 Algebraic formulae in context

A mechanic charges £25 plus £60 for each hour of work.
(a) Write a formula for the total cost, £C, after t hours.
(b) Dan pays £805 in total. Work out the number of hours.

(a) C = 25 + 60t
(b) 25 + 60t = 805
60t = 780
t = 13
Answer: (a) C = 25 + 60t (b) 13

2 Circle area and circumference

A semicircle has diameter 12 cm.
Work out, in terms of π,
(a) the perimeter of the semicircle,
(b) the area of the semicircle.

(a) Curved edge = $\frac{1}{2} \times \pi \times 12 = 6\pi$

Perimeter = $6\pi + 12$

(b) Area = $\frac{1}{2} \times \pi \times 6^2 = 18\pi$

Answer: (a) $6\pi + 12$ cm (b) 18π cm^2

3 Independent events

The probability that Tara hits the target is 0.3.
The probability that Lena hits the target is 0.3.
The two events are independent.
Work out the probability that both Tara and Lena hit the target.

Multiply the probabilities: 0.3 × 0.3 = 0.09
Answer: 0.09

4 Solving quadratic equations

Solve $2x^2 - 3x - 2 = 0$

Factorise: $(x - 2)(2x + 1) = 0$
$x - 2 = 0$ or $2x + 1 = 0$

$x = 2$ or $x = -\frac{1}{2}$

Answer: x = 2 or x = $-\frac{1}{2}$

5 Growth and decay

The population of a town is 14,000 and increases by 2% per year. (Calculator)
Work out the population after 4 years.
Give your answer to the nearest whole number.

Multiplier = 1.02
$14{,}000 \times 1.02^4 = 15{,}154.05$
= 15,154 to the nearest whole number
Answer: 15,154

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6 Estimating the mean from grouped data

The table shows the masses, in kg, of 50 parcels.
(a) Write down the class that contains the median.
(b) Work out an estimate for the mean.

(a) The median is in position (50 + 1) ÷ 2 = 25.5. Cumulative frequencies: 17, 23, 25, 33, 50
The median is in the class $110 < m \leq 130$
(b) Midpoints: 60, 80, 100, 120, 140
60 × 17 + 80 × 6 + 100 × 2 + 120 × 8 + 140 × 17 = 5040
Estimate = 5040 ÷ 50 = 100.8
Answer: (a) $110 < m \leq 130$ (b) 100.8

7 Recurring decimals (mixed)

Write $0.5\dot{7}\dot{5}$ as a fraction in its simplest form.

Let x = 0.57575...
Multiply by 10: 10x = 5.7575...
Multiply by 1000: 1000x = 575.7575...
Subtract: 990x = 575 − 5 = 570
$x = \frac{570}{990} = \frac{19}{33}$
Answer: $\frac{19}{33}$

8 Stratified sampling

A club has 280 members in junior, 280 in intermediate and 240 in senior.
A stratified sample of 40 members is to be taken.
Work out how many members should be chosen from intermediate.

Total = 280 + 280 + 240 = 800
Number from intermediate = $\frac{280}{800} \times 40$
= 14
Answer: 14

9 Equations with algebraic fractions

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

Multiply every term by (x − 1)(x − 5)
6(x − 5) + 1(x − 1) = (x − 1)(x − 5)
$7x - 31 = x^2 - 6x + 5$
$x^2 - 13x + 36 = 0$
(x − 4)(x − 9) = 0
x = 4 or x = 9
Answer: x = 4 or x = 9

10 Enlargements and coordinates

Triangle PQR has vertices P(7, −2), Q(5, 0), R(−1, 0).
The triangle is enlarged with scale factor $\frac{1}{2}$ and centre (3, −2).
Write down the coordinates of the vertices of the image.

Each vertex moves to: centre + scale factor × (vertex − centre)
P: (7, −2) → (5, −2)
Q: (5, 0) → (4, −1)
R: (−1, 0) → (1, −1)
Answer: P'(5, −2), Q'(4, −1), R'(1, −1)