Day 103 **A Tier 10-a-day: Model Solutions**

1 Standard form calculations

Work out $(7.2 \times 10^{-6}) \div (6 \times 10^{-3})$
Give your answer in standard form.

Divide the numbers and subtract the powers of 10: $7.2 \div 6 = 1.2$ and $10^{-6} \div 10^{-3} = 10^{-3}$
1.2×10^{-3}
Answer: 1.2×10^{-3}

2 Algebraic formulae in context

A mechanic charges £55 plus £60 for each hour of work.
(a) Write a formula for the total cost, £C, after t hours.
(b) Aisha pays £775 in total. Work out the number of hours.

(a) C = 55 + 60t
(b) 55 + 60t = 775
60t = 720
t = 12
Answer: (a) C = 55 + 60t (b) 12

3 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 80 and the interquartile range is 45.
(b) Compare the distributions of the two deliveries.

(a) Median = 65
Interquartile range = 85 − 50 = 35
(b) The median for Delivery B is higher (80 compared with 65), so it has the higher values on average
The IQR for Delivery A is smaller (35 compared with 45), so its values are more consistent
Answer: (a) Median 65, IQR 35 (b) Delivery B has the higher median; Delivery A has the smaller IQR so is more consistent

4 Circle theorems: angle at the centre

A, B and C are points on a circle with centre O.
Angle AOB = 138°.
Work out the size of angle x.
Give a reason for your answer.

The angle at the centre is twice the angle at the circumference
x = 138 ÷ 2 = 69
Answer: x = 69°

5 Equation of a straight line

A straight line passes through the points (−1, 0) and (0, 2).
Find the equation of the line.

Gradient = $\frac{2-0}{0-(-1)} = \frac{2}{1}$
Use y = mx + c with m = 2 and the point (−1, 0): $0 = 2 \times (-1) + c$
c = 2
y = 2x + 2
Answer: y = 2x + 2

6 Profit and loss

Dev buys a phone for £240 and sells it for £120.
Work out Dev's percentage loss.

Loss = £240 − £120 = £120
Percentage loss = $\frac{120}{240} \times 100 = 50\%$
Answer: 50%

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7 The sine rule

Work out the size of angle x. (Calculator)
Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\frac{\sin x}{13} = \frac{\sin 79°}{16}$

$\sin x = \frac{13 \times \sin 79°}{16}$

$x = \sin^{-1}(0.7976)$

$x = 52.9°$

Answer: x = 52.9°

8 Mixing in a ratio

Jug A contains 36 litres of a mixture of red paint and white paint in the ratio 5 : 1.
Jug B contains 18 litres of a mixture of red paint and white paint in the ratio 7 : 2.
The contents of both jugs are mixed together.
Work out the ratio of red paint to white paint in the mixture. Give your answer in its simplest form.

Jug A: red paint = 5 × 36 ÷ 6 = 30 litres, white paint = 6 litres
Jug B: red paint = 14 litres, white paint = 4 litres
Total: red paint = 44 litres, white paint = 10 litres
Ratio = 44 : 10 = 22 : 5
Answer: 22 : 5

9 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{2x + 4}{x - 3}$

Multiply both sides by $(x - 3)$: $y(x - 3) = 2x + 4$
Expand the bracket: $xy - 3y = 2x + 4$
Collect the x terms on one side: $xy - 2x = 3y + 4$
Factorise: $x(y - 2) = 3y + 4$
Divide by $(y - 2)$: $x = \frac{3y + 4}{y - 2}$

Answer: $x = \frac{3y + 4}{y - 2}$

10 The cosine rule: finding an angle

Work out the size of angle x. (Calculator)
Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\cos x = \frac{8^2 + 17^2 - 15^2}{2 \times 8 \times 17}$

$\cos x = \frac{128}{272}$

$x = \cos^{-1}(0.4706)$

$x = 61.9°$

Answer: x = 61.9°