Day 56 **A Tier 10-a-day: Model Solutions**

1 Sharing in a ratio

Omar and Kai share some stickers in the ratio 2 : 3.
Kai gets 18 stickers.
How many stickers does Omar get?

3 parts = 18, so 1 part = 18 ÷ 3 = 6
Omar gets 2 parts: 2 × 6 = 12
Answer: 12

2 Factorising quadratics

Factorise $x^2 - 2x - 24$

Find two numbers that multiply to −24 and add to −2
The numbers are 4 and −6
(x + 4)(x − 6)
Answer: (x + 4)(x − 6)

3 Standard form calculations

Work out $(3.5 \times 10^8) \times (1.2 \times 10^{-2})$
Give your answer in standard form.

Multiply the numbers and add the powers of 10: 3.5 × 1.2 = 4.2 and $10^8 \times 10^{-2} = 10^6$
4.2×10^6
Answer: 4.2×10^6

4 Stratified sampling

A school has 140 students in Year 9, 80 in Year 10 and 200 in Year 11.
A stratified sample of 21 students is to be taken.
Work out how many students should be chosen from Year 10.

Total = 140 + 80 + 200 = 420
Number from Year 10 = $\frac{80}{420} \times 21$
= 4
Answer: 4

5 Simultaneous equations

Solve the simultaneous equations
3x − 4y = 17
−4x − 2y = −8

Multiply (2) by 2 to make the y coefficients match
3x − 4y = 17 (1)
−8x − 4y = −16 (2)
The y terms have the same sign, so subtract equation (2) from equation (1)
11x = 33, so x = 3
Substitute x = 3 into equation (1) to find y = −2
Answer: x = 3, y = −2

6 Area of a triangle using sine

The area of triangle ABC is 85.6 cm^2. (Calculator)
Angle x is acute.
Work out the size of angle x. Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\frac{1}{2} \times 18 \times 17 \times \sin x = 85.6$
153 sin x = 85.6
sin x = 0.5595
x = 34.0°
Answer: x = 34.0°

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7 Recurring decimals, show that

(a) Show that $0.\dot{7}\dot{2} = \frac{8}{11}$

(b) Hence write $1.\dot{7}\dot{2}$ as a mixed number in its simplest form.

(a) Let x = 0.727272..., so 100x = 72.7272...

100x − x = 72, so 99x = 72 and $x = \frac{72}{99} = \frac{8}{11}$

(b) $1.\dot{7}\dot{2} = 1 + \frac{8}{11} = 1\frac{8}{11}$

Answer: (b) $1\frac{8}{11}$

8 Finding a missing value from an average

The mean of the five numbers 10, 20, 5, 20, x is 15.
Work out the value of x.

Total = 5 × 15 = 75
Known numbers add to 55
x = 75 − 55 = 20
Answer: x = 20

9 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{5x - 4}{x - 5}$

Multiply both sides by (x − 5): y(x − 5) = 5x − 4
Expand the bracket: xy − 5y = 5x − 4
Collect the x terms on one side: xy − 5x = 5y − 4
Factorise: x(y − 5) = 5y − 4
Divide by (y − 5): $x = \frac{5y - 4}{y - 5}$

Answer: $x = \frac{5y - 4}{y - 5}$

10 Bearings with the cosine rule

Boat P sails 12 miles from a harbour on a bearing of 330°.
Boat Q sails 21 miles from the same harbour on a bearing of 210°. (Calculator)
Work out the distance between the two boats.
Give your answer to 3 significant figures.

The angle between the two paths = |330° − 210°| = 120°
$d^2 = 12^2 + 21^2 - 2 \times 12 \times 21 \times \cos 120°$
$d^2 = 837.00$
d = 28.9
Answer: 28.9 miles