Day 61 **B Tier 10-a-day: Model Solutions**

1 Perimeter with algebra

An isosceles triangle has two equal sides of length (2x + 2) m and a third side of length (3x + 2) m.
The perimeter of the triangle is 76 m.
Work out the value of x.

2(2x + 2) + (3x + 2) = 76
7x + 6 = 76
7x = 70
x = 10
Answer: x = 10

2 Place value

Here are four digit cards.
4 2 9 1
Use all four cards to make the largest possible number.
Work out the difference between the largest and smallest possible numbers.

Largest: put the digits in order, biggest first: 9421
Smallest: put the digits in order, smallest first: 1249
9421 − 1249 = 8172
Answer: 8172

3 Counting outcomes

A club has 7 members.
They choose a captain and a vice-captain from the members.
The two jobs must be done by different people.
How many different ways can the jobs be given out?

7 choices for the captain
6 choices left for the vice-captain
7 × 6 = 42
Answer: 42

4 Significant figures

Work out the value of this expression. (Calculator)

$\frac{6.2}{4.7} + \frac{5.5}{7}$

Give your answer correct to 3 significant figures.

Use a calculator: the full display is 2.104863...
Round to 3 significant figures: 2.10
Answer: 2.10

5 Congruent triangles

Triangle PQR has two sides of 4 mm and 12 mm with an angle of 60° between them.
Triangle XYZ has two sides of 12 mm and 4 mm with an angle of 60° between them.
Are the two triangles congruent?
Give a reason for your answer.

Two pairs of equal sides, with the same angle between them
So the triangles are congruent (SAS)
Answer: Yes, SAS (two sides and the included angle)

6 Difference of two squares

Factorise $16x^2 - 121$

$16x^2 = (4x)^2$ and $121 = 11^2$
$(4x)^2 - 11^2 = (4x - 11)(4x + 11)$
Answer: (4x − 11)(4x + 11)

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7 Capture-recapture

20 deer in a lake are caught, tagged and returned to the lake.
Later, a sample of 60 deer is caught and 4 of them are tagged.
Estimate the total number of deer in the lake.

Proportion tagged in the sample = 4 ÷ 60
This is the same proportion as 20 out of the whole population
Population ≈ 20 × 60 ÷ 4 = 300
Answer: 300

8 Trigonometry in context

A church spire is 31 m tall. (Calculator)
Mia stands 58 m from the base of the church spire on level ground.
Work out the angle of elevation of the top of the church spire from Mia.
Give your answer correct to 1 decimal place.

The height is the opposite side and the distance is the adjacent side

$\tan\theta = \frac{31}{58}$

$\theta = \tan^{-1}(\frac{31}{58}) = 28.124...$

$\theta = 28.1°$ (1 d.p.)
Answer: 28.1°

9 Equation of a line

Line L has equation $y = -x + 4$
Line M is parallel to line L and passes through the point (3, 1).
Find the equation of line M.

Parallel lines have the same gradient, so line M is $y = -1x + c$
Substitute $x = 3$ and $y = 1$: $1 = -1 \times 3 + c$
$c = 1 - (-3) = 4$
Answer: $y = -x + 4$

10 Cumulative frequency

The cumulative frequency graph shows the times taken by 40 students to complete a puzzle.
(a) Use the graph to estimate the median.
(b) Work out an estimate for the interquartile range.

(a) Median is at 40 ÷ 2 = 20: read across from 20 on the vertical axis to the curve, then down: 76
(b) Lower quartile at 10: 40. Upper quartile at 30: 100
IQR = 100 − 40 = 60
Answer: (a) 76 minutes (b) 60 minutes