Day 42 **A Tier 10-a-day: Model Solutions**

1 Loci and constructions

Angle ABL is drawn on a piece of paper.
A point P moves so that it is always the same distance from line BA and line BL.
Describe the locus of P.

Points the same distance from two intersecting lines lie on the angle bisector
The line through B that cuts angle ABL in half
Answer: The bisector of angle ABL

2 Error intervals

x = 3.18 has been truncated to 2 decimal places.
Write down the error interval for x.

Truncating means cutting off the digits after the second decimal place.
The original value is at least 3.18 and less than 3.18 + 0.01 = 3.19
Answer: $3.18 \leq x < 3.19$

3 nth term of a linear sequence

Here are the first four terms of a sequence.
14, 21, 28, 35
(a) Find an expression for the nth term.
(b) Is 252 a term of this sequence? You must show your working.

The terms go up by 7 each time, so the nth term starts with 7n
14 − 7 = 7, so the nth term is 7n + 7
(b) 7n + 7 = 252
7n = 245, so n = 35
n is a whole number, so 252 is a term of the sequence
Answer: (a) 7n + 7 (b) Yes (n = 35)

4 Calculator and significant figures

Work out $\frac{3.9 \times 4.2}{2.4}$ (Calculator)
Give your answer correct to 3 significant figures.

3.9 × 4.2 = 16.38
= 6.82500...
= 6.83 to 3 significant figures
Answer: 6.83

5 Changing a ratio

A bag contains red counters and blue counters in the ratio 5 : 7.
5 more blue counters are added to the bag.
The ratio of red counters to blue counters is now 5 : 8.
How many counters were in the bag at the start?

Let red = 5x and blue = 7x. After adding: 5x : (7x + 5) = 5 : 8
$\frac{5x}{7x+5} = \frac{5}{8}$, so 8 × 5x = 5(7x + 5)
40x = 35x + 25, so 5x = 25, x = 5
Start: 5x + 7x = 12 × 5 = 60 counters
Answer: 60

6 Quadratic graph from its roots

The diagram shows the graph of $y = x^2 + bx + c$.
Find the value of b and the value of c.

The curve crosses the x-axis at x = −1 and x = 3
So y = (x + 1)(x − 3)
Expand: $y = x^2 - 2x - 3$
b = −2 and c = −3
Answer: b = −2, c = −3

Day 42 **A Tier 10-a-day: Model Solutions**

7 Simple and compound interest

Ella and Maya each invest £4000 for 2 years. (Calculator)
Ella's account pays 2% simple interest per year.
Maya's account pays 2% compound interest per year.
Work out how much more interest Maya earns than Ella.

Simple interest = £4000 × 2% × 2 = £160

Compound: £4000 × 1.02^2 = £4161.60, so interest = £161.60

Difference = 161.60 − 160 = £1.60 (to the nearest penny)

Answer: £1.60

8 Fraction calculations

Work out $(1\frac{5}{6} + 3\frac{2}{3}) \div 2\frac{1}{2}$

Give your answer as a mixed number in its simplest form.

Brackets first, as improper fractions: $\frac{11}{6} + \frac{11}{3} = \frac{11}{2}$

Then divide by multiplying by the reciprocal: $\frac{11}{2} \times \frac{2}{5} = \frac{11}{5}$

$= 2\frac{1}{5}$

Answer: $2\frac{1}{5}$

9 Volume of composite solids

A solid is made from a cylinder and a cone.
The cylinder has radius 6 cm and height 12 cm.
The cone has the same radius as the cylinder and perpendicular height 8 cm.
Work out the total volume. Give your answer in terms of π.

Cylinder = $\pi \times 6^2 \times 12 = 432\pi$

Cone = $\frac{1}{3} \times \pi \times 6^2 \times 8 = 96\pi$

Total = $432\pi + 96\pi = 528\pi$

Answer: 528π cm^3

10 Reading a histogram

The histogram shows information about the length of some items.
(a) Work out the number of items with a length in the class 0 to 30 mm.
(b) Work out an estimate for the number with a length greater than 55 mm.

(a) Frequency = frequency density × class width
2.6 × 30 = 78
(b) 55 to 70: 2.4 × 15 = 36
Class 70 to 80: 0.8 × 10 = 8
Total = 36 + 8 = 44
Answer: (a) 78 (b) 44