Day 91 **A Tier 10-a-day: Model Solutions**

1 Ordering numbers

Write these numbers in order of size, starting with the smallest.

0.82 $\frac{3}{4}$ 91% 18%

Change each to a decimal: 0.82 = 0.82, $\frac{3}{4}$ = 0.75, 91% = 0.91, 18% = 0.18

Order the decimals: 0.18 < 0.75 < 0.82 < 0.91

Answer: 18%, $\frac{3}{4}$, 0.82, 91%

2 Equations with brackets

Solve $-6(x - 6) = 2(x - 6) - 8$

Expand the brackets: $-6x + 36 = 2x - 12 - 8$
Simplify: $-6x + 36 = 2x - 20$
Collect x terms on one side and numbers on the other: $-8x = -56$
$x = 7$
Answer: x = 7

3 Stem and leaf diagrams

The stem and leaf diagram shows the ages of 11 people.
Key: 2 | 1 represents 21 years
(a) Work out the median age.
(b) Work out the interquartile range.

(a) 11 values, so the median is the 6th value
Counting along the leaves gives 47
(b) LQ is the middle of the lower 5 values = 33
UQ is the middle of the upper 5 values = 57
IQR = 57 − 33 = 24
Answer: (a) 47 years (b) 24 years

4 Loci and constructions

PQ is a straight line.
A point P moves so that it is always 9 cm from the line PQ, on one side of it.
Describe the locus of P.

Points a fixed distance from a straight line, on one side, form a parallel line
It is parallel to PQ and 9 cm from it
Answer: A straight line parallel to PQ, 9 cm away from it

5 Capture-recapture

A scientist wants to estimate the number of fish in a lake.
She catches 100 fish, marks each one and returns them.
Later she catches a second sample of 40 fish. 10 of these are tagged.
Work out an estimate for the total number of fish in a lake.

Proportion tagged in the second sample = $\frac{10}{40}$

This is the same as the proportion in the whole population: $\frac{100}{N}$

$\frac{100}{N} = \frac{10}{40}$, so $N = 100 \times 40 \div 10 = 400$
Answer: 400

6 Volume of cones and spheres

A sphere has radius 3 cm.
Work out the volume of the sphere. Give your answer in terms of π.

Volume = $\frac{4}{3} \times \pi \times r^3$

= $\frac{4}{3} \times \pi \times 3^3$

= $\frac{4}{3} \times 27\ \pi$

= 36π

Answer: 36π cm^3

7 Average speed

A coach travels for 1 hour 30 minutes at 95 km/h,
then for 1 hour at 50 km/h.
Work out the average speed for the whole journey.

Distance 1 = 95 × 1.5 = 142.5 km
Distance 2 = 50 × 1 = 50 km
Total distance = 192.5 km and total time = 2.5 hours
Average speed = 192.5 ÷ 2.5 = 77 km/h
Answer: 77 km/h

8 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.

$\cos x = \frac{16^2 + 10^2 - 18^2}{2 \times 16 \times 10}$

$\cos x = \frac{32}{320}$

$x = \cos^{-1}(0.1000)$
$x = 84.3°$
Answer: x = 84.3°

9 Compound interest

Oscar invests £2,000 in an investment bond. (Calculator)
The account pays compound interest at 4% per year.
Work out the total interest earned after 4 years.

Multiplier = 1 + 4 ÷ 100 = 1.04
£2,000 × 1.04^4 = £2,339.72
Interest = £2,339.72 − £2,000 = £339.72
Answer: £339.72

10 Equations with algebraic fractions

Solve $\frac{4}{(x+5)} + \frac{1}{(x+2)} = 1$

Multiply every term by (x + 5)(x + 2)
4(x + 2) + 1(x + 5) = (x + 5)(x + 2)
$5x + 13 = x^2 + 7x + 10$
$x^2 + 2x - 3 = 0$
(x + 3)(x − 1) = 0
x = −3 or x = 1
Answer: x = −3 or x = 1