Day 59 **A Tier 10-a-day: Model Solutions**

1 Ordering numbers

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

0.22 50% 79% $\frac{1}{4}$

Change each to a decimal: 0.22 = 0.22, 50% = 0.5, 79% = 0.79, $\frac{1}{4}$ = 0.25

Order the decimals: 0.22 < 0.25 < 0.5 < 0.79

Answer: 0.22, $\frac{1}{4}$, 50%, 79%

2 Forming and solving equations

Tom is x years old.
His dad is 3 times as old as Tom, plus 2 years.
The sum of their ages is 46 years.
Work out how old his dad is.

Let Tom's age be x, so his dad's age is 3x + 2
x + (3x + 2) = 46
4x = 44
x = 11
His dad's age = 3 × 11 + 2 = 35
Answer: 35 years

3 Profit and loss

Zara buys a games console for £200 and sells it making a profit of 35%.
Work out the selling price.

Selling price = 135% of the cost price
£200 × 1.35 = £270
Answer: £270

4 Arc length and perimeter of a sector

The diagram shows a sector of a circle of radius 5 cm.
Work out the length of the arc of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Arc length = $\frac{72}{360}$ × 2 × π × 5
= 2π
Answer: 2π cm

5 Quadratic sequences

Here are the first five terms of a quadratic sequence.
0, 6, 14, 24, 36
(a) Find an expression for the nth term.
(b) Work out the 15th term.

First differences: 6, 8, 10
Second differences: 2, 2, so a = 2 ÷ 2 = 1
Subtract n^2 from each term (1, 4, 9, 16): −1, 2, 5, 8
This is linear: 3n − 4
nth term = n^2 + 3n − 4
(b) Substitute n = 15: 1 × 15^2 + 3 × 15 − 4 = 266
Answer: (a) n^2 + 3n − 4 (b) 266

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6 Growth and decay

A culture starts with 2500 bacteria. (Calculator)
The number of bacteria increases by 5% every hour.
Work out the number of bacteria after 2 hours.
Give your answer to the nearest whole number.

Multiplier = 100% + 5% = 1.05
$2500 \times 1.05^2 = 2756.25$
= 2756 to the nearest whole number
Answer: 2756

7 Volume of a hollow cylinder

The diagram shows the cross-section of a metal pipe.
The outer radius is 8 cm and the inner radius is 4 cm.
The pipe is 15 cm long.
Work out the volume of metal used. Give your answer in terms of π.

Area of the ring = $\pi \times 8^2 - \pi \times 4^2 = \pi(64 - 16) = 48\pi$
Volume = area × length = $48\pi \times 15$
$= 720\pi$
Answer: 720π cm^3

8 Frequency density

The table gives information about 116 measurements.
A histogram is drawn using this information.
(a) Work out the missing frequency.
(b) Work out the height of the bar for the class $55 < m \leq 75$.

(a) Missing frequency = 116 − (18 + 56 + 12) = 30
(b) Class width = 75 − 55 = 20
Frequency density = 56 ÷ 20 = 2.8
Answer: (a) 30 (b) 2.8

9 Converting units of area and volume

A rectangular table top is 300 cm by 40 cm.
Work out its area in m^2.

Area = 300 × 40 = 12000 cm^2
1 m^2 = 10 000 cm^2
12000 ÷ 10 000 = 1.2
Answer: 1.2 m^2

10 Median and interquartile range

Here are the scores of 11 students in a test.
15 50 74 8 56 59 57 66 64 60 33
(a) Work out the median.
(b) Work out the interquartile range.

Put in order: 8, 15, 33, 50, 56, 57, 59, 60, 64, 66, 74
(a) The middle value is number 6, so the median is 57
(b) Lower half: 8, 15, 33, 50, 56, so LQ = 33
Upper half: 59, 60, 64, 66, 74, so UQ = 64
IQR = 64 − 33 = 31
Answer: (a) 57 (b) 31