Day 315 **A Tier 10-a-day: Model Solutions**

1 Interior angles of polygons

The size of each angle of a quadrilateral is shown as an expression:
(2x + 5)°, (2x − 20)°, (x + 25)°, (3x + 6)°
Work out the value of x.

Sum of angles = (4 − 2) × 180 = 360°
2x + 5 + 2x − 20 + x + 25 + 3x + 6 = 360
8x + 16 = 360
8x = 344
x = 43
Answer: x = 43

2 Estimating the mean from grouped data

The table shows the times, in minutes, taken by 50 people to finish a race.
(a) Write down the class that contains the median.
(b) Work out an estimate for the mean.

(a) The median is in position (50 + 1) ÷ 2 = 25.5. Cumulative frequencies: 20, 27, 47, 50
The median is in the class $20 < t \leq 40$
(b) Midpoints: 10, 30, 50, 70
10 × 20 + 30 × 7 + 50 × 20 + 70 × 3 = 1620
Estimate = 1620 ÷ 50 = 32.4
Answer: (a) $20 < t \leq 40$ (b) 32.4

3 Finding a percentage change

The number of students in a school was 120 and is now 102.
Work out the percentage decrease.

Change = 120 − 102 = 18
Percentage decrease = $\frac{18}{120}$ × 100 = 15%
Answer: 15% decrease

4 Scatter graphs

The scatter graph shows the hours of practice and the marks in a test for some students.
A line of best fit is drawn.
(a) Describe the correlation.
(b) Estimate the marks for a student who practised for 2 hours.

(a) As hours of practice increases, marks in test increases, so there is positive correlation
(b) Draw a line up from 2 on the horizontal axis to the line of best fit, then across to the vertical axis
The line gives a value of 8
Answer: (a) Positive correlation (b) 8

5 Angles in regular polygons around a point

An equilateral triangle and a regular decagon share the side AB and are on opposite sides of it.
The two shapes meet at the point A.
Work out the size of the angle at A that is not inside either shape.

Interior angle of the equilateral triangle = 180 − 360 ÷ 3 = 60°
Interior angle of the regular decagon = 180 − 360 ÷ 10 = 144°
Angles round a point add up to 360°
360 − 60 − 144 = 156
Answer: 156°

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6 Forming and solving equations

The sum of 4 consecutive whole numbers is 98.
Work out the largest of the numbers.

Let the smallest number be n. The numbers are n, n + 1, n + 2, n + 3
Sum = 4n + 6 = 98
4n = 92
n = 23
The numbers are 23, 24, 25, 26
Answer: 26

7 Density

A piece of wood has a mass of 3164 g.
The density of the material is 11.3 g/cm^3.
Work out the volume of the piece of wood.

Volume = mass ÷ density
= 3164 ÷ 11.3 = 280 cm^3
Answer: 280 cm^3

8 Inverse functions

$f(x) = \frac{5}{x} - 6$

(a) Find $f^{-1}(x)$
(b) Work out $f^{-1}(5)$

Let $y = \frac{5}{x} - 6$

$y + 6 = \frac{5}{x}$, so $x = \frac{5}{(y + 6)}$

Swap y for x: $f^{-1}(x) = \frac{5}{(x + 6)}$

(b) $f^{-1}(5) = \frac{5}{11}$

Answer: (a) $f^{-1}(x) = \frac{5}{(x + 6)}$ (b) $\frac{5}{11}$

9 Surd fractions

Show that $\frac{\sqrt{28} + \sqrt{175}}{\sqrt{7}}$ is an integer, and find its value.

$\sqrt{28} = 2\sqrt{7}$ and $\sqrt{175} = 5\sqrt{7}$
Numerator = $2\sqrt{7} + 5\sqrt{7} = 7\sqrt{7}$
$\frac{7\sqrt{7}}{\sqrt{7}} = 7$
Answer: 7

10 Equations with algebraic fractions

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

Multiply every term by $(x - 1)(x + 5)$
$4(x + 5) + 4(x - 1) = (x - 1)(x + 5)$
$8x + 16 = x^2 + 4x - 5$
$x^2 - 4x - 21 = 0$
$(x + 3)(x - 7) = 0$
$x = -3$ or $x = 7$
Answer: $x = -3$ or $x = 7$