Day 161 **A Tier 10-a-day: Model Solutions**

1 Laws of indices

Write $2^4 \times 2^6 \div 2^5$ as a single power of 2.

Add the powers when multiplying: 4 + 6 = 10
Subtract when dividing: 10 − 5 = 5
$= 2^5$

Answer: 2^5

2 Expanding double brackets

Expand and simplify
$(x - 4)(2x - 5)$

Multiply every term in the first bracket by every term in the second
$= 2x^2 - 5x - 8x + 20$
$= 2x^2 - 13x + 20$

Answer: $2x^2 - 13x + 20$

3 Box plots

The box plot shows the times taken, in seconds, by the students in Class A to run 100 m.
(a) Write down the median and the interquartile range.
For Class B the median is 65 and the interquartile range is 30.
(b) Compare the distributions of the two classes.

(a) Median = 70
Interquartile range = 85 − 60 = 25
(b) The median for Class A is higher (70 compared with 65), so it has the higher values on average
The IQR for Class A is smaller (25 compared with 30), so its values are more consistent

Answer: (a) Median 70, IQR 25 (b) Class A has the higher median; Class A has the smaller IQR so is more consistent

4 Equation of a line from a graph

Find the equation of the straight line shown.
Give your answer in the form y = mx + c

The line crosses the y-axis at (0, 1), so c = 1

Gradient = $\frac{\text{change in y}}{\text{change in x}}$: from (0, 1) to (4, 7), y changes by 6 and x changes by 4

$m = \frac{3}{2}$

$y = \frac{3}{2}x + 1$

Answer: $y = \frac{3}{2}x + 1$

5 Growth and decay

A machine is worth £25,000 and loses 5% of its value each year. (Calculator)
Work out its value after 6 years.
Give your answer to the nearest pound.

Multiplier = 0.95
$£25{,}000 \times 0.95^6 = £18{,}377.30$
= £18,377 to the nearest whole number

Answer: £18,377

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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 = 2 and x = 4
So $y = -(x - 2)(x - 4)$
Expand: $y = -x^2 + 6x - 8$
b = 6 and c = −8
Answer: b = 6, c = −8

7 Direct proportion formulae

y is directly proportional to the square of x.
When x = 6, y = 324.
(a) Find a formula for y in terms of x.
(b) Work out the positive value of x when y = 36.

(a) $y = kx^2$. Substitute: 324 = k × 36, so k = 9
$y = 9x^2$
(b) $36 = 9x^2$, so $x^2 = 36 \div 9 = 4$, so x = 2
Answer: (a) $y = 9x^2$ (b) x = 2

8 The cosine rule: finding a side

Work out the value of x. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

$x^2 = 20^2 + 7^2 - 2 \times 20 \times 7 \times \cos 124°$
$x^2 = 400 + 49 - 280 \cos 124°$
$x^2 = 605.57$
x = 24.6
Answer: x = 24.6 cm

9 Bounds of a speed or density

A metal block has mass 730 g and volume 180 cm^3. The mass is measured to the nearest 10 grams and the volume to the nearest cm^3. (Calculator)
Work out the lower bound for the density of the metal in g/cm^3.
Give your answer correct to 3 significant figures.

density = mass ÷ volume
For the lower bound of density use the lower bound of mass and the upper bound of volume.
725 ÷ 180.5 = 4.01662
= 4.02 g/cm^3 (3 s.f.)
Answer: 4.02 g/cm^3

10 Midpoints and length of a line segment

C is the point (−6, 0) and D is the point (−1, 5).
(a) Find the midpoint of CD.

(a) Midpoint = $(\frac{-6 + (-1)}{2}, \frac{0 + 5}{2}) = (-3.5, 2.5)$
Answer: (a) (−3.5, 2.5)