Day 101 **A Tier 10-a-day: Model Solutions**

1 Recurring decimals (mixed)

Write $0.6\dot{3}$ as a fraction in its simplest form.

Let x = 0.633...
Multiply by 10: 10x = 6.33...
Multiply by 100: 100x = 63.33...
Subtract: 90x = 63 − 6 = 57
$x = \frac{57}{90} = \frac{19}{30}$

Answer: $\frac{19}{30}$

2 Isosceles triangles and exterior angles

PQR is an isosceles triangle with PQ = PR.
QRS is a straight line.
Angle PRS = 137°.
Work out the size of angle x.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
Angle PRQ = 180 − 137 = 43°
Base angles are equal, so angle PQR = 43°
x = 180 − 43 − 43 = 94
Answer: x = 94°

3 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, 2), so c = 2
Gradient = $\frac{\text{change in y}}{\text{change in x}}$: from (0, 2) to (4, 4), y changes by 2 and x changes by 4
$m = \frac{1}{2}$
$y = \frac{1}{2}x + 2$

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

4 Inverse proportion

11 painters take 20 days to paint a hall.
All the painters work at the same rate.
How many painters are needed to paint a hall in 10 days?

Total work = 11 × 20 = 220 painter-day
Number needed = 220 ÷ 10 = 22
Answer: 22

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5 Circles and tangents

The point P(6, −8) lies on a circle with centre O(0, 0).
(a) Work out the equation of the circle, in the form $x^2 + y^2 = r^2$.
(b) Find the equation of the tangent to the circle at P.

(a) The circle is $x^2 + y^2 = r^2$, so $r^2 = 6^2 + (-8)^2 = 100$

(b) Gradient of the radius OP = $\frac{-8}{6} = -\frac{4}{3}$

The tangent is perpendicular to the radius, so its gradient = $-1 \div (-\frac{4}{3}) = \frac{3}{4}$

$y = \frac{3}{4}x + c$ through (6, −8): $-8 = \frac{3}{4} \times 6 + c$, so $c = -\frac{25}{2}$

$y = \frac{3}{4}x - \frac{25}{2}$

Answer: (a) $x^2 + y^2 = 100$ (b) $y = \frac{3}{4}x - \frac{25}{2}$

6 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 40 and the interquartile range is 30.
(b) Compare the distributions of the two classes.

(a) Median = 50
Interquartile range = 75 − 40 = 35
(b) The median for Class A is higher (50 compared with 40), so it has the higher values on average
The IQR for Class B is smaller (30 compared with 35), so its values are more consistent
Answer: (a) Median 50, IQR 35 (b) Class A has the higher median; Class B has the smaller IQR so is more consistent

7 Solving quadratic equations

Solve $3x^2 + 2x - 5 = 0$

Factorise: $(x - 1)(3x + 5) = 0$
$x - 1 = 0$ or $3x + 5 = 0$
$x = 1$ or $x = -\frac{5}{3}$

Answer: $x = 1$ or $x = -\frac{5}{3}$

8 Reverse compound change

The value of a car falls by 10% each year. (Calculator)
After 3 years it is worth £14,580.
Work out its value at the start.

Yearly multiplier = 0.9
Overall multiplier = $0.9^3 = 0.729$
Original value = £14,580 ÷ 0.729 = £20,000
Answer: £20,000

9 Pythagoras in three dimensions

The diagram shows a cuboid.
Work out the length of the diagonal AG.
The diagram is not drawn accurately.

$AG^2 = 4^2 + 12^2 + 3^2$
$= 16 + 144 + 9 = 169$
$AG = \sqrt{169} = 13$
Answer: 13 cm

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10 Probability without replacement

A bag contains 2 yellow, 6 white and 2 black balls.
Two balls are taken at random without replacement.
Work out the probability that the two balls are the same colour.

P(yellow, yellow) = $\frac{2}{10} \times \frac{1}{9} = \frac{2}{90}$

P(white, white) = $\frac{6}{10} \times \frac{5}{9} = \frac{30}{90}$

P(black, black) = $\frac{2}{10} \times \frac{1}{9} = \frac{2}{90}$

Add: $\frac{2}{90} + \frac{30}{90} + \frac{2}{90} = \frac{17}{45}$

Answer: $\mathbf{\frac{17}{45}}$