Day 364 **A Tier 10-a-day: Model Solutions**

1 Bearings

The bearing of B from A is 070°.
Work out the bearing of A from B.
The diagram is not drawn accurately.

The north lines at A and B are parallel
Back bearing = 70° + 180° = 250°
Answer: 250°

2 Standard form calculations

Work out $(7.5 \times 10^9) \times (2.5 \times 10^3)$
Give your answer in standard form.

Multiply the numbers and add the powers of 10: $7.5 \times 2.5 = 18.75$ and $10^9 \times 10^3 = 10^{12}$
18.75×10^{12}
18.75 is not between 1 and 10, so $= 1.875 \times 10^{13}$
Answer: 1.875×10^{13}

3 Simultaneous equations

Solve the simultaneous equations
$5x + 2y = 9$
$3x - 3y = 18$

Multiply (1) by 3 and (2) by 2 to make the y coefficients match
$15x + 6y = 27$ (1)
$6x - 6y = 36$ (2)
The y terms have opposite signs, so add the equations
$21x = 63$, so $x = 3$
Substitute $x = 3$ into equation (1) to find $y = -3$
Answer: $x = 3$, $y = -3$

4 Compound interest

Ben invests £7,500 in an investment bond. (Calculator)
The account pays compound interest at 3% per year.
Work out the total interest earned after 3 years.

Multiplier = 1 + 3 ÷ 100 = 1.03
$£7{,}500 \times 1.03^3 = £8{,}195.45$
Interest = £8,195.45 − £7,500 = £695.45
Answer: £695.45

5 Box plots

The box plot shows the scores of the students in Class A in a test.
(a) Write down the median and the interquartile range.
For Class B the median is 45 and the interquartile range is 5.
(b) Compare the distributions of the two classes.

(a) Median = 55
Interquartile range = 65 − 50 = 15
(b) The median for Class A is higher (55 compared with 45), so it has the higher values on average
The IQR for Class B is smaller (5 compared with 15), so its values are more consistent
Answer: (a) Median 55, IQR 15 (b) Class A has the higher median; Class B has the smaller IQR so is more consistent

6 Index equations

Solve $5^x = 25$

Write the right-hand side as a power of 5: $25 = 5^2$
So $x = 2$
Answer: $x = 2$

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7 Finding an interest rate

Femi invests £8000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £8652.80 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $8000 \times m^2 = 8652.8$

$m^2 = 8652.8 \div 8000 = 1.0816$

$m = \sqrt{1.0816} = 1.04$

Rate = $(1.04 - 1) \times 100 = 4\%$

Answer: 4%

8 Pythagoras in three dimensions

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

$AG^2 = 4^2 + 8^2 + 1^2$

$= 16 + 64 + 1 = 81$

$AG = \sqrt{81} = 9$

Answer: 9 cm

9 Perpendicular bisector

A is the point (0, −1) and B is the point (8, 1).
Find the equation of the perpendicular bisector of AB.

Midpoint of AB = $(\frac{0+8}{2}, \frac{(-1)+1}{2}) = (4, 0)$

Gradient of AB = $\frac{2}{8} = \frac{1}{4}$

Perpendicular gradient = $-1 \div \frac{1}{4} = -4$

$y = -4x + c$ through (4, 0): $0 = -4 \times 4 + c$, so $c = 16$

$y = -4x + 16$

Answer: $y = -4x + 16$

10 Percentage change

Ali buys a second-hand car for £20.
He sells it for £29.
Work out his percentage profit.

Profit = £29.00 − £20.00 = £9.00

Percentage profit = $\frac{£9.00}{£20.00} \times 100 = 45\%$

Answer: 45%