Day 324 **A Tier 10-a-day: Model Solutions**

1 Time

(a) A coach leaves Leeds at 1345. The journey takes 1 hours 13 minutes. Work out the time it ends.
(b) Change 3.8 hours into hours and minutes.

(a) 1345 + 1 hours = 1445, then + 13 minutes = 1458
(b) 0.8 hours = 0.8 × 60 = 48 minutes, so 3.8 hours = 3 hours 48 minutes
Answer: (a) 1458 (b) 3 hours 48 minutes

2 nth term of a linear sequence

Here are the first four terms of a sequence.
8, 15, 22, 29
(a) Find an expression for the nth term.
(b) Work out the 50th term.

The terms go up by 7 each time, so the nth term starts with 7n
8 − 7 = 1, so the nth term is 7n + 1
(b) 50 × 7 + 1 = 351
Answer: (a) 7n + 1 (b) 351

3 Median and interquartile range

Here are the ages, in years, of 11 people.
22 19 20 70 11 18 72 61 29 21 9
(a) Work out the median.
(b) Work out the interquartile range.

Put in order: 9, 11, 18, 19, 20, 21, 22, 29, 61, 70, 72
(a) The middle value is number 6, so the median is 21
(b) Lower half: 9, 11, 18, 19, 20, so LQ = 18
Upper half: 22, 29, 61, 70, 72, so UQ = 61
IQR = 61 − 18 = 43
Answer: (a) 21 (b) 43

4 Profit and loss

Oscar buys a watch for £260 and sells it for £312.
Work out Oscar's percentage profit.

Profit = £312 − £260 = £52

Percentage profit = $\frac{52}{260} \times 100 = 20\%$

Answer: 20%

5 Stem and leaf diagrams

The stem and leaf diagram shows the ages of 11 people.
Key: 1 | 4 represents 14 years
(a) Work out the median age.
(b) Work out the interquartile range.

(a) 11 values, so the median is the 6th value
Counting along the leaves gives 31
(b) LQ is the middle of the lower 5 values = 20
UQ is the middle of the upper 5 values = 36
IQR = 36 − 20 = 16
Answer: (a) 31 years (b) 16 years

6 Describing transformations

Describe fully the single transformation that maps shape A onto shape B.

The shape has been turned, so this is a rotation
Compare the matching vertices to find the angle and direction: a quarter turn anticlockwise
The centre is the point that stays fixed: (2, 1)
Answer: Rotation, 90° anticlockwise, centre (2, 1)

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7 Reverse compound change

The value of a painting increases by 20% each year. (Calculator)
After 2 years it is worth £2,160.
Work out its value at the start.

Yearly multiplier = 1.2

Overall multiplier = $1.2^2 = 1.44$

Original value = £2,160 ÷ 1.44 = £1,500

Answer: £1,500

8 Finding an interest rate

Nia invests £2000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £2420 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $2000 \times m^2 = 2420$

$m^2 = 2420 \div 2000 = 1.21$

$m = \sqrt{1.21} = 1.1$

Rate = $(1.1 - 1) \times 100 = 10\%$

Answer: 10%

9 Rearranging formulae (powers and roots)

Make x the subject of $y = 3\sqrt{x} + 4$

Subtract 4 from both sides: $y - 4 = 3\sqrt{x}$

Divide by 3: $\frac{y-4}{3} = \sqrt{x}$

Square both sides

Answer: $\mathbf{x = \left(\frac{y-4}{3}\right)^2}$

10 Bearings with the cosine rule

Boat P sails 24 km from a harbour on a bearing of 170°.
Boat Q sails 21 km from the same harbour on a bearing of 210°. (Calculator)
Work out the distance between the two boats.
Give your answer to 3 significant figures.

The angle between the two paths = $|170° - 210°| = 40°$

$d^2 = 24^2 + 21^2 - 2 \times 24 \times 21 \times \cos 40°$

$d^2 = 244.83$

$d = 15.6$

Answer: 15.6 km