Day 200 **A Tier 10-a-day: Model Solutions**

1 Map scales

The scale of a map is 1 : 25000.
A road is 1 km long.
Work out the length of the road on the map, in centimetres.

1 km = 100000 cm
Length on map = 100000 ÷ 25000 = 4 cm
Answer: 4 cm

2 Error intervals

t = 4,900 is rounded to the nearest 100.
Write down the error interval for t.

The rounding unit is 100, so the value could be up to half of this, 50, either side.
Lower bound = 4,900 − 50 = 4,850, upper bound = 4,900 + 50 = 4,950
Answer: $4{,}850 \leq t < 4{,}950$

3 Iteration

$x_{n+1} = \sqrt{2x_n + 8}$
$x_0 = 4$
Work out the values of x_1, x_2 and x_3.
Give your answers correct to 3 decimal places. (Calculator)

Substitute $x_0 = 4$ into the formula, then use each answer in the next step (keep the full calculator display)
$x_1 = 4$
$x_2 = 4$
$x_3 = 4$
Answer: $x_1 = 4.000$, $x_2 = 4.000$, $x_3 = 4.000$

4 Prime factors

Write 308 as a product of its prime factors. Give your answer in index form.

Divide by prime numbers in turn: 308 ÷ 2 = 154, 154 ÷ 2 = 77, 77 ÷ 7 = 11, 11 ÷ 11 = 1
308 = 2 × 2 × 7 × 11
In index form: $308 = 2^2 \times 7 \times 11$
Answer: $308 = 2^2 \times 7 \times 11$

5 Scatter graphs

The scatter graph shows the hours of sunshine and the number of ice creams sold on some days.
A line of best fit is drawn.
(a) Describe the correlation.
(b) Estimate the number of ice creams sold on a day with 4 hours of sunshine.

(a) As hours of sunshine increases, ice creams sold increases, so there is positive correlation
(b) Draw a line up from 4 on the horizontal axis to the line of best fit, then across to the vertical axis
The line gives a value of 18
Answer: (a) Positive correlation (b) 18

6 Circle theorems: angles in the same segment

A, B, C and D are points on a circle. AC and BD meet at E.
Angle BAC = 45° and angle ACD = 30°.
Work out the size of angle x (angle AEB).
Give reasons for your working.

Angles in the same segment are equal, so angle ABD = angle ACD = 30°
In triangle ABE: angle BAE = 45° and angle ABE = 30°
x = 180 − 45 − 30 = 105
Answer: x = 105°

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7 Adding algebraic fractions

Write as a single fraction

$\frac{4}{(x-3)} - \frac{5}{(x+1)}$

Common denominator is $(x-3)(x+1)$

$= \frac{4(x+1) - 5(x-3)}{(x-3)(x+1)}$

$= \frac{-x+19}{(x-3)(x+1)}$

Answer: $\frac{-x+19}{(x-3)(x+1)}$

8 Changing a ratio

A bag contains red counters and blue counters in the ratio 3 : 4.
7 more blue counters are added to the bag.
The ratio of red counters to blue counters is now 5 : 9.
How many counters were in the bag at the start?

Let red = 3x and blue = 4x. After adding: 3x : (4x + 7) = 5 : 9

$\frac{3x}{4x+7} = \frac{5}{9}$, so $9 \times 3x = 5(4x+7)$

$27x = 20x + 35$, so $7x = 35$, $x = 5$

Start: $3x + 4x = 7 \times 5 = 35$ counters

Answer: 35

9 Reverse compound change

The value of an investment grows by 5% each year. (Calculator)
After 2 years it is worth £22,050.
Work out its value at the start.

Yearly multiplier = 1.05

Overall multiplier = $1.05^2 = 1.1025$

Original value = £22,050 ÷ 1.1025 = £20,000

Answer: £20,000

10 Area of a segment

The diagram shows a circle with centre O and radius 10 cm.
Angle AOB = 150°. (Calculator)
Work out the area of the shaded segment.
Give your answer to 3 significant figures.

Area of sector = $\frac{150}{360} \times \pi \times 10^2 = 130.90$

Area of triangle OAB = $\frac{1}{2} \times 10 \times 10 \times \sin 150° = 25.000$

Segment = 130.90 − 25.000 = 106

Answer: 106 cm^2