Day 54 **B Tier 10-a-day: Model Solutions**

1 Angles in triangles

The angles in a triangle are x°, 3x° and (x + 25)°.
(a) Work out the value of x.
(b) Work out the size of the largest angle.

(a) x + 3x + x + 25 = 180
5x + 25 = 180
5x = 155, so x = 31
(b) The angles are 31°, 93° and 56°
Answer: (a) x = 31 (b) 93°

2 Expanding squared brackets

Expand and simplify $(x + 4)^2$

Write as a product of two brackets: (x + 4)(x + 4)
$x^2 + 4x + 4x + 16$
$x^2 + 8x + 16$
Answer: $x^2 + 8x + 16$

3 Laws of indices

Write each answer as a single power of 7.
(a) $(7^2)^4$
(b) $7^4 \times 7^4 \div 7^1$

(a) Multiply the powers: 2 × 4 = 8
(b) Add then subtract: 4 + 4 − 1 = 7
Answer: (a) 7^8 (b) 7^7

4 Circumference and area of a circle

The diagram shows a circle with diameter 23 m. (Calculator)
Work out the circumference of the circle.
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Circumference = π × diameter
π × 23 = 72.257...
= 72.3 m (1 d.p.)
Answer: 72.3 m

5 Substitution into formulae

$y = 4x^2 - 6x + 3$
Work out the value of y when x = 4

$y = 4 \times 4^2 + (-6) \times 4 + 3$
y = 64 + (−24) + 3 = 43
Answer: y = 43

6 Column vectors

$\mathbf{a} = \begin{pmatrix} 5 \\ 3 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 7 \\ 5 \end{pmatrix}$
Work out
(a) $2\mathbf{a} - \mathbf{b}$
(b) $3\mathbf{a} + 2\mathbf{b}$

(a) $\begin{pmatrix} 10 \\ 6 \end{pmatrix} - \begin{pmatrix} 7 \\ 5 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$
(b) $\begin{pmatrix} 15 \\ 9 \end{pmatrix} + \begin{pmatrix} 14 \\ 10 \end{pmatrix} = \begin{pmatrix} 29 \\ 19 \end{pmatrix}$
Answer: (a) $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$ (b) $\begin{pmatrix} 29 \\ 19 \end{pmatrix}$

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7 Fuel use

A car travels 25 km on each litre of petrol. (Calculator)
Petrol costs £1.30 per litre.
Work out the cost of the petrol for a journey of 500 km.

Litres needed = 500 ÷ 25 = 20
Cost = 20 × £1.30 = £26
Answer: £26

8 Bounds

The length of a rectangle is 17 cm and its width is 13 cm.
Both measurements are correct to the nearest cm.
Work out the upper bound for the perimeter of the rectangle.

Upper bound of each side = value + 0.5: 17.5 cm and 13.5 cm
Perimeter = 2 × (17.5 + 13.5) = 62 cm
Answer: 62 cm

9 Trial and improvement

The equation $x^3 + 3x = 71$ has a solution between 3 and 4. (Calculator)
Use trial and improvement to find this solution.
Give your answer correct to 1 decimal place.

x = 3.5: $3.5^3 + 3 \times 3.5 = 53.375$ (too small)
x = 3.7: $3.7^3 + 3 \times 3.7 = 61.753$ (too small)
x = 3.8: $3.8^3 + 3 \times 3.8 = 66.272$ (too small)
x = 3.9: $3.9^3 + 3 \times 3.9 = 71.019$ (too big)
x = 3.85: value = 68.617 (too small), so the solution is above 3.85
So x = 3.9 to 1 decimal place
Answer: x = 3.9

10 Tree diagrams

A bag contains 7 mint sweets and 6 toffee sweets.
Leo takes one at random and does not replace it, then takes a second.
Work out the probability that both are mint.

P(first mint) = $\frac{7}{13}$

P(second mint) = $\frac{1}{2}$

P(both mint) = $\frac{7}{13} \times \frac{1}{2} = \frac{7}{26}$

Answer: $\frac{7}{26}$