Day 365 **B Tier 10-a-day: Model Solutions**

1 Scaling a recipe

Here are the amounts needed to make pancakes for 6 people.
450 ml of milk, 60 g of sugar
Work out the amounts needed to make pancakes for 15 people.

For 1 person: 450 ÷ 6 = 75 ml and 60 ÷ 6 = 10 g
For 15 people: 75 × 15 = 1125 and 10 × 15 = 150
Answer: 1125 ml of milk, 150 g of sugar

2 Decimal calculations

Work out
(a) 9.7 × 0.6
(b) 0.17 × 4

(a) 97 × 6 = 582
There are 2 decimal places in total, so the answer is 5.82
(b) 17 × 4 = 68, then divide by 100: 0.68
Answer: (a) 5.82 (b) 0.68

3 Column vectors

$\mathbf{a} = \begin{pmatrix} 7 \\ 6 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 3 \\ 2 \end{pmatrix}$
Work out
(a) $2\mathbf{a} - \mathbf{b}$
(b) $2\mathbf{a} - 3\mathbf{b}$

(a) $\begin{pmatrix} 14 \\ 12 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \end{pmatrix} = \begin{pmatrix} 11 \\ 10 \end{pmatrix}$
(b) $\begin{pmatrix} 14 \\ 12 \end{pmatrix} - \begin{pmatrix} 9 \\ 6 \end{pmatrix} = \begin{pmatrix} 5 \\ 6 \end{pmatrix}$
Answer: (a) $\begin{pmatrix} \mathbf{11} \\ \mathbf{10} \end{pmatrix}$ **(b)** $\begin{pmatrix} \mathbf{5} \\ \mathbf{6} \end{pmatrix}$

4 Equations with fractions

Solve $\frac{3x + 17}{4} = 5$

Multiply both sides by 4: 3x + 17 = 20
Subtract 17 from both sides: 3x = 3
Divide both sides by 3
Answer: x = 1

5 Transformations of a point

(a) The point P(−12, −10) is enlarged with scale factor ½ and centre the origin. Write down the coordinates of the image.
(b) The point P(−6, −5) is rotated 180° about the origin. Write down the coordinates of the image.

(a) Multiply each coordinate by $\frac{1}{2}$: (−6, −5)
(b) A half turn takes (x, y) to (−x, −y): (6, 5)
Answer: (a) (−6, −5) (b) (6, 5)

6 Map scales

The scale of a map is 1 : 20,000.
Two towns are 7.5 cm apart on the map.
Work out the real distance between the towns.
Give your answer in kilometres.

7.5 × 20,000 = 150,000 cm
100 000 cm = 1 km, so divide by 100 000
= 1.5 km
Answer: 1.5 km

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7 Compound shapes with semicircles

A badge is made from a rectangle and a semicircle. (Calculator)
The rectangle is 16 cm wide and 12 cm high.
The diameter of the semicircle is 16 cm.
(a) Work out the area of the shape.
(b) Work out the perimeter of the shape.
Give each answer correct to 1 decimal place.

(a) Rectangle: $16 \times 12 = 192$
Semicircle: $\frac{1}{2} \times \pi \times 8^2 = 100.531...$
Total = 292.5 cm^2
(b) Curved edge: $\frac{1}{2} \times \pi \times 16 = 25.133...$
Straight edges: $16 + 12 + 12 = 40$
Total = 65.1 cm
Answer: (a) 292.5 cm^2 (b) 65.1 cm

8 Harder linear equations

Solve $16 - 2x = 3x - 14$

Add 2x to both sides: $16 = 5x - 14$
Add 14 to both sides: $30 = 5x$
Divide both sides by 5
Answer: x = 6

9 Error intervals

The number x is rounded to the nearest 100.
The result is 6100.
Write down the error interval for x.

The rounding unit is 100, so x can be up to half of this, 50, either side of 6100
Lower bound = $6100 - 50 = 6050$ and upper bound = $6100 + 50 = 6150$
Answer: $6050 \leq x < 6150$

10 Quadratic equation problem

A rectangle has length $(x + 6)$ cm and width $(x - 1)$ cm.
The area of the rectangle is 60 cm^2.
(a) Show that $x^2 + 5x - 66 = 0$
(b) Hence work out the length of the rectangle.

(a) Area = length × width: $(x + 6)(x - 1) = 60$
Expand: $x^2 + 5x - 6 = 60$
Subtract 60 from both sides: $x^2 + 5x - 66 = 0$
(b) Factorise: $(x - 6)(x + 11) = 0$, so $x = 6$ or $x = -11$
A length cannot be negative, so x = 6. Length = 6 + 6 = 12
Answer: (b) 12 cm