Day 220 **B Tier 10-a-day: Model Solutions**

1 Collecting like terms

Simplify $2x + 9y - 5x + 4y$

Collect the x terms: $2x - 5x = -3x$
Collect the y terms: $9y + 4y = 13y$
Answer: $-3x + 13y$

2 Column vectors

$\mathbf{a} = \begin{pmatrix} -5 \\ -2 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 2 \\ 6 \end{pmatrix}$

Work out
(a) $2\mathbf{a} - \mathbf{b}$
(b) $2\mathbf{a} - 3\mathbf{b}$

(a) $\begin{pmatrix} -10 \\ -4 \end{pmatrix} - \begin{pmatrix} 2 \\ 6 \end{pmatrix} = \begin{pmatrix} -12 \\ -10 \end{pmatrix}$

(b) $\begin{pmatrix} -10 \\ -4 \end{pmatrix} - \begin{pmatrix} 6 \\ 18 \end{pmatrix} = \begin{pmatrix} -16 \\ -22 \end{pmatrix}$

Answer: (a) $\begin{pmatrix} -12 \\ -10 \end{pmatrix}$ (b) $\begin{pmatrix} -16 \\ -22 \end{pmatrix}$

3 Rounding

Write 5428.2671
(a) correct to 2 decimal places,
(b) correct to 3 significant figures.

(a) Look at the next digit after the second decimal place: 7
So 5428.2671 rounds to 5428.27
(b) The first significant figure is the first non-zero digit. Count 3 figures and look at the next digit.
5428.2671 rounds to 5430
Answer: (a) 5428.27 (b) 5430

4 Probability of not happening

The probability that Dev wins a game of chess is 0.6.
Work out the probability that Dev does not win a game of chess.

Probabilities add up to 1
$1 - 0.6 = 0.4$
Answer: 0.4

5 Term-to-term rules

The first term of a sequence is 4.
The term-to-term rule is: multiply by 3 and then add 6.
Work out the 4th term.

2nd term: $4 \times 3 + 6 = 18$
3rd term: $18 \times 3 + 6 = 60$
4th term: $60 \times 3 + 6 = 186$
Answer: 186

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6 Circle theorems

The diagram shows a circle, centre O.
PT is a tangent to the circle at T.
Angle TOP = 58°.
Work out the size of angle a.
Give a reason for each step of your working.
The diagram is not drawn accurately.

Angle OTP = 90° (a tangent is perpendicular to the radius)
a = 180 − 90 − 58 = 32°
(angles in a triangle add up to 180°)
Answer: a = 32°

7 Error intervals

The number x is rounded to the nearest 100.
The result is 5500.
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 5500
Lower bound = 5500 − 50 = 5450 and upper bound = 5500 + 50 = 5550
Answer: $5450 \leq x < 5550$

8 Expanding squared brackets

Expand and simplify $(2x - 1)^2$

Write as a product of two brackets: $(2x - 1)(2x - 1)$
$4x^2 - 2x - 2x + 1$
$4x^2 - 4x + 1$
Answer: $4x^2 - 4x + 1$

9 Ratio and changes

In a room, the ratio of cats to dogs is 3 : 5.
There are 20 dogs.
More cats join so that there are equal numbers of cats and dogs.
How many cats join?

5 parts = 20, so 1 part = 4
Originally there are 3 × 4 = 12 cats
To equal 20, add 20 − 12 = 8
Answer: 8

10 Perimeter and area of compound shapes

The diagram shows the shape of a patio.
All the corners are right angles. All lengths are in m.
(a) Find the perimeter.
(b) Find the area.

(a) Missing lengths: 20 − 17 = 3 and 15 − 5 = 10
Perimeter = 20 + 5 + 3 + 10 + 17 + 15 = 70
(b) Split into two rectangles: 20 × 5 = 100 and 17 × 10 = 170
100 + 170 = 270
Answer: (a) 70 m (b) 270 m^2