Day 251 **B Tier 10-a-day: Model Solutions**

1 Multiplying and dividing fractions

Work out

(a) $\frac{4}{5} \times \frac{1}{2}$

(b) $\frac{2}{5} \div \frac{2}{3}$

Give each answer in its simplest form.

(a) Multiply the tops and the bottoms: $\frac{4}{10} = \frac{2}{5}$

(b) Turn the second fraction upside down and multiply: $\frac{2}{5} \times \frac{3}{2} = \frac{6}{10} = \frac{3}{5}$

Answer: (a) $\frac{2}{5}$ (b) $\frac{3}{5}$

2 Perimeter expressions

A rectangle has length (4x + 4) cm and width (4x + 2) cm.
Write down an expression, in terms of x, for the perimeter of the rectangle.
Give your answer in its simplest form.

Perimeter = 2 × length + 2 × width
2(4x + 4) + 2(4x + 2) = 8x + 8 + 8x + 4
= 16x + 12
Answer: 16x + 12 cm

3 Rounding

Write 56.9264
(a) correct to 2 decimal places,
(b) correct to 3 significant figures.

(a) Look at the next digit after the second decimal place: 6
So 56.9264 rounds to 56.93
(b) The first significant figure is the first non-zero digit. Count 3 figures and look at the next digit.
56.9264 rounds to 56.9
Answer: (a) 56.93 (b) 56.9

4 Equations with fractions

Solve $\frac{3x + 9}{4} = 3$

Multiply both sides by 4: 3x + 9 = 12
Subtract 9 from both sides: 3x = 3
Divide both sides by 3
Answer: x = 1

5 Column vectors

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

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

(a) $\begin{pmatrix} 6 \\ -18 \end{pmatrix} + \begin{pmatrix} 3 \\ 7 \end{pmatrix} = \begin{pmatrix} 9 \\ -11 \end{pmatrix}$

(b) $\begin{pmatrix} 6 \\ -18 \end{pmatrix} - \begin{pmatrix} 3 \\ 7 \end{pmatrix} = \begin{pmatrix} 3 \\ -25 \end{pmatrix}$

Answer: (a) $\begin{pmatrix} 9 \\ -11 \end{pmatrix}$ (b) $\begin{pmatrix} 3 \\ -25 \end{pmatrix}$

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6 Sequences from patterns

Matchsticks are used to make a row of triangles.
1 triangle needs 3 matchsticks, 2 triangles need 5 and 3 triangles need 7.
(a) Find an expression, in terms of n, for the number of matchsticks needed for n triangles.
(b) Dan uses 43 matchsticks to make a row. How many triangles are in his row?

(a) The number of matchsticks goes up by 2 each time, so the rule starts with 2n
When n = 1 we need 3, and 2 × 1 = 2, so add 1: 2n + 1
(b) 2n + 1 = 43
2n = 42
n = 42 ÷ 2 = 21
Answer: (a) 2n + 1 (b) 21

7 Cumulative frequency

The cumulative frequency graph shows the times taken by 40 students to complete a puzzle.
(a) Use the graph to estimate the median.
(b) Work out an estimate for the interquartile range.

(a) Median is at 40 ÷ 2 = 20: read across from 20 on the vertical axis to the curve, then down: 64
(b) Lower quartile at 10: 40. Upper quartile at 30: 85
IQR = 85 − 40 = 45
Answer: (a) 64 minutes (b) 45 minutes

8 Trigonometry: finding a side

Calculate the length of x. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Label the sides: x is the opposite and 21 cm is the adjacent
We use tan (opposite and adjacent)

$\tan 27° = \frac{x}{21}$

x = 21 × tan 27° = 10.700...
x = 10.7 cm (1 d.p.)
Answer: x = 10.7 cm

9 Repeated percentage change

The price of a laptop is £80.
The price is first reduced by 25%, then the new price is increased by 5%.
(a) Work out the final price.
(b) Work out the overall percentage decrease in the price.

(a) Multipliers: 0.75 and 1.05
80 × 0.75 × 1.05 = £63
(b) Overall multiplier = 0.7875
Overall decrease = 21.25%
Answer: (a) £63 (b) 21.25% decrease

10 Direct proportion

y is directly proportional to x.
When x = 12, y = 60.
Find the value of y when x = 9.

y = kx
60 = k × 12, so k = 60 ÷ 12 = 5
y = 5 × 9 = 45
Answer: y = 45