Day 9 **B Tier 10-a-day: Model Solutions**

1 Angles in quadrilaterals

PQRS is a trapezium with PQ parallel to SR.
Angle SPQ = 91°.
Angle QRS = 102°.
Work out the size of angle PQR.

PQ is parallel to SR, so angles PQR and QRS are co-interior
Co-interior angles add up to 180°
180 − 102 = 78
Answer: 78°

2 Estimation

Estimate the value of
9.18 × 28.7 + 4.04
Show your rounding to 1 significant figure.

Round each number to 1 significant figure: 9.18 → 9, 28.7 → 30, 4.04 → 4
Estimate = 9 × 30 + 4 = 274
Answer: 274

3 Column vectors

$\mathbf{a} = \begin{pmatrix} -5 \\ 5 \end{pmatrix}$ $\mathbf{b} = \begin{pmatrix} 7 \\ -4 \end{pmatrix}$

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

(a) $\begin{pmatrix} -10 \\ 10 \end{pmatrix} - \begin{pmatrix} 7 \\ -4 \end{pmatrix} = \begin{pmatrix} -17 \\ 14 \end{pmatrix}$

(b) $\begin{pmatrix} -5 \\ 5 \end{pmatrix} + \begin{pmatrix} 21 \\ -12 \end{pmatrix} = \begin{pmatrix} 16 \\ -7 \end{pmatrix}$

Answer: (a) $\begin{pmatrix} \mathbf{-17} \\ \mathbf{14} \end{pmatrix}$ **(b)** $\begin{pmatrix} \mathbf{16} \\ \mathbf{-7} \end{pmatrix}$

4 Solving equations

Solve $\frac{y}{3} + 5 = 10$

Subtract 5 from both sides: $\frac{y}{3} = 5$

Multiply both sides by 3
Answer: y = 15

5 Wages and overtime

Mohammed is paid £14 per hour for a 30 hour week. (Calculator)
Overtime is paid at double time.
In one week he works 4 hours of overtime.
Work out his total pay for that week.

Normal pay: 30 × £14 = £420
Overtime rate: £14 × 2 = £28 per hour
Overtime pay: 4 × £28 = £112
Total: £420 + £112 = £532
Answer: £532

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6 Expanding squared brackets

Expand and simplify $(x - 6)^2$

Write as a product of two brackets: $(x - 6)(x - 6)$

$x^2 - 6x - 6x + 36$

$x^2 - 12x + 36$

Answer: $x^2 - 12x + 36$

7 Growth in standard form

There are 5.5×10^6 fish in a lake.
The number triples every day.
How many are there after 4 days?
Give your answer in standard form.

Each day multiply by 3, so multiply by $3^4 = 81$

$5.5 \times 10^6 \times 81 = 445.5 \times 10^6$

In standard form: 4.455×10^8

Answer: 4.455×10^8

8 Speed unit conversion

A bus travels at 162 km/h.
Work out its speed in metres per second.

162 km = 162,000 m
1 hour = 3600 seconds
162,000 ÷ 3600 = 45 m/s
Answer: 45 m/s

9 Simultaneous equations problem

A theme park sells adult tickets and child tickets.
2 adult tickets and 3 child tickets cost £43.
1 adult ticket and 3 child tickets cost £35.
Work out the cost of one adult ticket and the cost of one child ticket.

Let a = cost of one adult ticket and b = cost of one child ticket
$2a + 3b = 43$ and $1a + 3b = 35$
Subtract: $1a = 43 - 35 = 8$, so $a = 8$
Substitute: $2 \times 8 + 3b = 43$, so $3b = 27$ and $b = 9$
Answer: One adult ticket costs £8 and one child ticket costs £9

10 Direct proportion

C is directly proportional to t.
When t = 12, C = 9.
Find a formula for C in terms of t.

$C = kt$
$9 = k \times 12$, so $k = 9 \div 12 = 0.75$
Answer: $C = 0.75t$