Day 342 **B Tier 10-a-day: Model Solutions**

1 Compound areas

A rectangular wall measures 13 m by 16 m.
A rectangle measuring 5 m by 7 m is cut out.
Work out the area that is left.

Whole area = 13 × 16 = 208
Area cut out = 5 × 7 = 35
208 − 35 = 173
Answer: 173 m^2

2 Speed

A car travels 120 km in 1 hour 30 minutes.
Work out its average speed in km per hour.

Speed = distance ÷ time
Time = 1.5 hours
120 ÷ 1.5 = 80
Answer: 80 km per hour

3 Factorising

Factorise $t^2 - 6t$

Both terms have t as a factor
$t^2 \div t = t$ and $-6t \div t = -6$
Answer: $t(t - 6)$

4 Multiplying and dividing fractions

Work out
(a) $\frac{5}{9} \times \frac{1}{4}$
(b) $\frac{1}{2} \div \frac{9}{10}$
Give each answer in its simplest form.

(a) Multiply the tops and the bottoms: $\frac{5}{36}$

(b) Turn the second fraction upside down and multiply: $\frac{1}{2} \times \frac{10}{9} = \frac{10}{18} = \frac{5}{9}$

Answer: (a) $\frac{5}{36}$ (b) $\frac{5}{9}$

5 Sequences from patterns

Matchsticks are used to make a row of hexagons.
1 hexagon needs 6 matchsticks, 2 hexagons need 11 and 3 hexagons need 16.
(a) Find an expression, in terms of n, for the number of matchsticks needed for n hexagons.
(b) Dan uses 71 matchsticks to make a row. How many hexagons are in his row?

(a) The number of matchsticks goes up by 5 each time, so the rule starts with 5n
When n = 1 we need 6, and 5 × 1 = 5, so add 1: 5n + 1
(b) 5n + 1 = 71
5n = 70
n = 70 ÷ 5 = 14
Answer: (a) 5n + 1 (b) 14

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6 Volume of a cylinder

A drum has radius 3 cm and height 18 cm. (Calculator)
Work out its volume.
Give your answer correct to 1 decimal place.

Volume = $\pi \times \text{radius}^2 \times \text{height}$
$\pi \times 3^2 \times 18 = 508.938...$
$= 508.9\ \text{cm}^3$ (1 d.p.)
Answer: 508.9 cm^3

7 Standard form

Write each number as an ordinary number.
(a) 9.7×10^5
(b) 5.2×10^{-3}

(a) Multiply by 10, 5 times: move the decimal point 5 places right
$9.7 \times 10^5 = 970{,}000$
(b) $10^{-3} = 0.001$, so move the decimal point 3 places left
$5.2 \times 10^{-3} = 0.0052$
Answer: (a) 970,000 (b) 0.0052

8 Volume of cones and pyramids

A pyramid has a rectangular base 10 m by 3 m and vertical height 6 m.
Volume of a pyramid = $\frac{1}{3} \times$ base area $\times$ height
Work out the volume of the pyramid.

Base area = $10 \times 3 = 30$
Volume = $\frac{1}{3} \times 30 \times 6 = 60$
Answer: 60 m^3

9 Algebraic proof

Show that $4(2n + 5) + 4(2n + 11)$ is always a multiple of 16, where n is a whole number.

Expand: $8n + 20 + 8n + 44$
Collect like terms: $16n + 64$
Factorise: $16(n + 4)$, which is a multiple of 16
Answer: 16(n + 4) is a multiple of 16

10 Average speed

A lorry travels at 30 km/h for 0.5 hours and then at 24 km/h for 2.5 hours.
Work out its average speed for the whole journey.

Distance: $30 \times 0.5 = 15$ km and $24 \times 2.5 = 60$ km
Total distance = 75 km and total time = 3 hours
Average speed = $75 \div 3 = 25$
Answer: 25 km/h