Day 254 **A Tier 10-a-day: Model Solutions**

1 Equation of a straight line

A straight line passes through the points (−4, 6) and (−3, 3).
Find the equation of the line.

Gradient = $\frac{3-6}{-3-(-4)} = \frac{-3}{1}$

Use y = mx + c with m = −3 and the point (−4, 6): 6 = −3 × (−4) + c
c = −6
y = −3x − 6
Answer: y = −3x − 6

2 Converting speeds

A lorry travels at 144 km/h.
Work out this speed in metres per minute.

In 1 hour: 144 km = 144000 m
1 hour = 60 minutes, so 144000 ÷ 60 = 2400 m per minute
Answer: 2400 m/min

3 Simultaneous equations

Solve the simultaneous equations
−3x + 3y = 3
−4x − 2y = 22

Multiply (1) by 2 and (2) by 3 to make the y coefficients match
−6x + 6y = 6 (1)
−12x − 6y = 66 (2)
The y terms have opposite signs, so add the equations
−18x = 72, so x = −4
Substitute x = −4 into equation (1) to find y = −3
Answer: x = −4, y = −3

4 Volume of a pyramid

The diagram shows a pyramid with a square base of side 6 cm.
The perpendicular height of the pyramid is 11 cm.
Work out the volume of the pyramid.
The diagram is not drawn accurately.

Volume = $\frac{1}{3}$ × base area × height

= $\frac{1}{3}$ × 6 × 6 × 11

= 132

Answer: 132 cm^3

5 Standard form in context

One grain of sand has a mass of 1.2×10^{-6} kg.
A sample contains 3×10^5 grains of sand.
Work out the total mass of the sample.
Give your answer in standard form.

Total mass = $(1.2 \times 10^{-6}) \times (3 \times 10^5)$
$1.2 \times 3 = 3.6$ and $10^{-6} \times 10^5 = 10^{-1}$
Answer: 3.6×10^{-1} kg

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6 Reverse percentages

In a sale, all prices are reduced by 40%.
A jacket costs £72 in the sale.
Work out the original price of the jacket.

60% represents £72
1% = £72 ÷ 60 = £1.2
100% = £1.2 × 100 = £120.00
Answer: £120.00

7 Inverse functions

$f(x) = \frac{x - 6}{5}$

(a) Find $f^{-1}(x)$
(b) Work out $f^{-1}(-3)$

Let $y = \frac{x - 6}{5}$
$x = 5y + 6$
$f^{-1}(x) = 5x + 6$
(b) $f^{-1}(-3) = -9$
Answer: (a) $f^{-1}(x) = 5x + 6$ (b) -9

8 Mixing in a ratio

Jug A contains 15 litres of a mixture of orange juice and lemonade in the ratio 3 : 2.
Jug B contains 36 litres of a mixture of orange juice and lemonade in the ratio 5 : 7.
The contents of both jugs are mixed together.
Work out the ratio of orange juice to lemonade in the mixture. Give your answer in its simplest form.

Jug A: orange juice = 3 × 15 ÷ 5 = 9 litres, lemonade = 6 litres
Jug B: orange juice = 15 litres, lemonade = 21 litres
Total: orange juice = 24 litres, lemonade = 27 litres
Ratio = 24 : 27 = 8 : 9
Answer: 8 : 9

9 Enlargements and coordinates

Triangle LMN has vertices L(2, 4), M(2, 6), N(−4, −2).

The triangle is enlarged with scale factor $\frac{3}{2}$ and centre (0, 2).

Write down the coordinates of the vertices of the image.

Each vertex moves to: centre + scale factor × (vertex − centre)
L: (2, 4) → (3, 5)
M: (2, 6) → (3, 8)
N: (−4, −2) → (−6, −4)
Answer: L'(3, 5), M'(3, 8), N'(−6, −4)

10 Finding a percentage change

The population of a village was 220 and is now 88.
Work out the percentage decrease.

Change = 220 − 88 = 132
Percentage decrease = $\frac{132}{220} \times 100 = 60\%$
Answer: 60% decrease