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

1 Standard form notation

(a) Write 0.0036 in standard form.
(b) Write 5.07×10^3 as an ordinary number.

(a) Move the decimal point 3 places to get 3.6: 3.6×10^{-3}
(b) Move the decimal point 3 places to the right: 5,070
Answer: (a) 3.6×10^{-3} (b) 5,070

2 Converting units of area and volume

A jug holds 7500 cm^3 of water.
Write this volume in litres.

1 litre = 1000 cm^3
7500 ÷ 1000 = 7.5
Answer: 7.5 litres

3 Forming and solving equations

An isosceles triangle has two equal sides of length (2x + 10) cm and (x + 20) cm.
The third side is 13 cm.
Work out the perimeter of the triangle.

The two equal sides give 2x + 10 = x + 20
x = 10
x = 10
Equal sides = 2 × 10 + 10 = 30 cm
Perimeter = 30 + 30 + 13 = 73
Answer: 73 cm

4 Terminating and recurring decimals

Here are four fractions: $\frac{6}{16}$ $\frac{12}{15}$ $\frac{5}{16}$ $\frac{4}{6}$
Which one of these fractions is equal to a recurring decimal?

Simplify each fraction: $\frac{6}{16} = \frac{3}{8}$, $\frac{12}{15} = \frac{4}{5}$, $\frac{5}{16}$, $\frac{4}{6} = \frac{2}{3}$
A fraction in simplest form is a terminating decimal only if its denominator has no prime factors other than 2 and 5.
$\frac{2}{3}$ has denominator 3, which includes a factor other than 2 and 5.

Answer: $\frac{4}{6}$

5 Simultaneous equations

Solve the simultaneous equations
$6x - 3y = -3$
$-x + 3y = -2$

The y terms have opposite signs, so add the equations
5x = −5, so x = −1
Substitute x = −1 into equation (1) to find y = −1
Answer: x = −1, y = −1

6 Standard form calculations

Work out $(2.5 \times 10^{-2}) \times (8 \times 10^2)$
Give your answer in standard form.

Multiply the numbers and add the powers of 10: $2.5 \times 8 = 20$ and $10^{-2} \times 10^2 = 10^0$
20×10^0
20 is not between 1 and 10, so = 2×10^1
Answer: 2×10^1

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7 Combining ratios

a : b = 3 : 5
b : c = 5 : 8
(a) Work out the ratio a : b : c
(b) a, b and c add up to 80. Work out the value of c.

(a) Make the b parts equal: lowest common multiple of 5 and 5 is 5
a : b = 3 : 5 and b : c = 5 : 8
a : b : c = 3 : 5 : 8
(b) 3 + 5 + 8 = 16 parts, so 1 part = 80 ÷ 16 = 5
c = 8 × 5 = 40
Answer: (a) 3 : 5 : 8 (b) 40

8 Adding algebraic fractions

Write as a single fraction

$$\frac{-4}{(x-4)} + \frac{4}{(x+5)}$$

Common denominator is $(x - 4)(x + 5)$

$$= \frac{-4(x+5) + 4(x-4)}{(x-4)(x+5)}$$

$$= \frac{-36}{(x-4)(x+5)}$$

Answer: $\mathbf{\frac{-36}{(x-4)(x+5)}}$

9 Frequency density

The table gives information about 59 measurements.
A histogram is drawn using this information.
(a) Work out the missing frequency.
(b) Work out the height of the bar for the class $20 < t \leq 30$.

(a) Missing frequency = 59 − (13 + 14 + 18) = 14
(b) Class width = 30 − 20 = 10
Frequency density = 14 ÷ 10 = 1.4
Answer: (a) 14 (b) 1.4

10 Bearings with the cosine rule

Ship A sails 20 km from a port on a bearing of 040°.
Ship B sails 10 km from the same port on a bearing of 265°. (Calculator)
Work out the distance between the two ships.
Give your answer to 3 significant figures.

The angle between the two paths = 360° − |40° − 265°| = 135°
$d^2 = 20^2 + 10^2 - 2 \times 20 \times 10 \times \cos 135°$
$d^2 = 782.84$
$d = 28.0$
Answer: 28.0 km