Day 3 **A Tier 10-a-day: Model Solutions**

1 Scatter graphs

The scatter graph shows the temperature and the number of hot drinks sold on some days.
A line of best fit is drawn.
(a) Describe the correlation.
(b) Estimate the number of hot drinks sold on a day when the temperature is 8 °C.

(a) As temperature increases, hot drinks sold decreases, so there is negative correlation
(b) Draw a line up from 8 on the horizontal axis to the line of best fit, then across to the vertical axis
The line gives a value of 24
Answer: (a) Negative correlation (b) 24

2 Standard form calculations

Work out $(5 \times 10^{-8}) \div (2 \times 10^{-4})$
Give your answer in standard form.

Divide the numbers and subtract the powers of 10: $5 \div 2 = 2.5$ and $10^{-8} \div 10^{-4} = 10^{-4}$
2.5×10^{-4}
Answer: 2.5×10^{-4}

3 Pressure

A table exerts a force of 80 N on the floor.
The area in contact with the floor is 0.2 m^2.
Work out the pressure on the floor in N/m^2.

Pressure = force ÷ area
= 80 ÷ 0.2 = 400
Answer: 400 N/m^2

4 Rearranging formulae

Make t the subject of $s = 3t - 2$

Add 2 to both sides: $3t = s + 2$
Divide both sides by 3
$t = \frac{s + 2}{3}$
Answer: $t = \frac{s + 2}{3}$

5 Reverse fractions

Mo reads $\frac{2}{3}$ of a book and has now read 20 pages.
How many pages does the whole book have?

$\frac{2}{3}$ of the total = 20
$\frac{1}{3}$ of the total = 20 ÷ 2 = 10
Whole = 10 × 3 = 30
Answer: 30

6 Simplifying algebraic fractions

Simplify fully
$\frac{x^2 - 8x + 12}{x^2 - 9x + 14}$

Factorise the top: $(x - 2)(x - 6)$
Factorise the bottom: $(x - 2)(x - 7)$
Cancel the common factor $(x - 2)$
Answer: $\frac{x - 6}{x - 7}$

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7 Bounds in measurement

A rectangle measures 9 cm by 5 cm, each correct to the nearest cm. (Calculator)
Work out the upper bound for the length of a diagonal of the rectangle.
Give your answer to 3 significant figures.

Upper bounds of the sides are 9.5 cm and 5.5 cm

Diagonal = $\sqrt{9.5^2 + 5.5^2} = \sqrt{120.5}$
= 11.0
Answer: 11.0 cm

8 Inverse proportion formulae

y is inversely proportional to x^2.
When x = 10, y = 10.
(a) Find a formula for y in terms of x.
(b) Work out the value of y when x = 5.

(a) $y = \frac{k}{x^2}$. Substitute: $10 = \frac{k}{100}$, so $k = 10 \times 100 = 1000$

$y = \frac{1000}{x^2}$

(b) $y = \frac{1000}{25} = 40$

Answer: (a) $y = \frac{1000}{x^2}$ (b) 40

9 Rationalising with conjugates

Rationalise the denominator of $\frac{38}{5 - \sqrt{6}}$

Give your answer in the form $a + b\sqrt{c}$ where a and b are integers.

Multiply top and bottom by the conjugate $5 + \sqrt{6}$: $\frac{38(5 + \sqrt{6})}{(5 - \sqrt{6})(5 + \sqrt{6})}$

Denominator: $25 - 6 = 19$

$\frac{38(5 + \sqrt{6})}{19} = 2(5 + \sqrt{6})$

$= 10 + 2\sqrt{6}$

Answer: $10 + 2\sqrt{6}$

10 Bearings with the cosine rule

Ship A sails 13 km from a port on a bearing of 250°.
Ship B sails 7 km from the same port on a bearing of 330°. (Calculator)
Work out the distance between the two ships.
Give your answer to 3 significant figures.

The angle between the two paths = $|250° - 330°| = 80°$

$d^2 = 13^2 + 7^2 - 2 \times 13 \times 7 \times \cos 80°$

$d^2 = 186.40$

$d = 13.7$

Answer: 13.7 km