Day 110 **A Tier 10-a-day: Model Solutions**

1 Direct and inverse proportion

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

(a) $y = \frac{k}{x}$. Substitute x = 2 and y = 5: $5 = \frac{k}{2}$, so $k = 5 \times 2 = 10$

$y = \frac{10}{x}$

(b) $y = \frac{10}{5} = 2$

Answer: (a) $y = \frac{10}{x}$ (b) 2

2 Density

A solid cuboid measures 6 cm by 10 cm by 6 cm.
It is made of a material with density 0.8 g/cm^3.
Work out the mass of the cuboid in kilograms.

Volume = $6 \times 10 \times 6 = 360$ cm^3
Mass = $0.8 \times 360 = 288$ g
288 g = 0.288 kg
Answer: 0.288 kg

3 Area of a trapezium

The diagram shows a trapezium.
Work out the area of the trapezium.
The diagram is not drawn accurately.

Area = $\frac{1}{2} \times (7 + 12) \times 9$

$= \frac{1}{2} \times 19 \times 9$

$= 85.5$

Answer: 85.5 cm^2

4 HCF and LCM in index form

A = $2 \times 3 \times 7$
B = $2^3 \times 7^3$
Find the highest common factor (HCF) and the lowest common multiple (LCM) of A and B.
Give your answers as products of prime factors.

HCF: for each prime take the lower power (a missing prime has power 0): 2×7
LCM: for each prime take the higher power: $2^3 \times 3 \times 7^3$
Answer: HCF = 2×7, LCM = $2^3 \times 3 \times 7^3$

5 Congruent triangles

Triangle DEF: angle E = 90°, DF = 16 cm, DE = 14 cm.
Triangle XYZ: angle Z = 90°, XY = 16 cm, XZ = 14 cm.
Are the two triangles congruent?
Give a reason for your answer.

Both triangles have a right angle
DF and XY are the hypotenuses: both 16 cm
DE = XZ = 14 cm
Right angle, hypotenuse and one other side are equal, so the triangles are congruent (RHS)
Answer: Yes, congruent (RHS)

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6 Terminating and recurring decimals

Here are four fractions: $\frac{5}{12}$ $\frac{4}{5}$ $\frac{13}{40}$ $\frac{9}{20}$

Which one of these fractions is equal to a recurring decimal?

Simplify each fraction: $\frac{5}{12}$, $\frac{4}{5}$, $\frac{13}{40}$, $\frac{9}{20}$

A fraction in simplest form is a terminating decimal only if its denominator has no prime factors other than 2 and 5.

$\frac{5}{12}$ has denominator 12 = 2 × 2 × 3, which includes a factor other than 2 and 5.

Answer: $\mathbf{\frac{5}{12}}$

7 Equations with fractions

Solve $\frac{2x + 2}{3} = \frac{3x + 8}{7}$

Multiply both sides by 21
7(2x + 2) = 3(3x + 8)
14x + 14 = 9x + 24
5x = 10
x = 2
Answer: x = 2

8 Reading a histogram

The histogram shows information about the mass of some items.
(a) Work out the number of items with a mass in the class 70 to 90 g.
(b) Work out an estimate for the number with a mass greater than 60 g.

(a) Frequency = frequency density × class width
1 × 20 = 20
(b) 60 to 70: 1.2 × 10 = 12
Class 70 to 90: 1 × 20 = 20
Total = 12 + 20 = 32
Answer: (a) 20 (b) 32

9 Simplifying algebraic fractions

Simplify fully

$$\frac{5x^2 - 16x + 12}{3x^2 - 7x + 2}$$

Factorise the top: (5x − 6)(x − 2)
Factorise the bottom: (3x − 1)(x − 2)
Cancel the common factor (x − 2)

Answer: $\mathbf{\frac{5x - 6}{3x - 1}}$

10 Two dice

Two fair dice are thrown.
The two scores are added together.
Work out the probability that the sum is 8.

Outcomes with a sum that is 8: (2, 6), (3, 5), (4, 4), (5, 3), (6, 2)
There are 5 of these out of 36 equally likely outcomes

$\frac{5}{36}$

Answer: $\mathbf{\frac{5}{36}}$