Day 14 **A Tier 10-a-day: Model Solutions**

1 Speed, distance and time

A train travels at 72 km/h for 1 hour 45 minutes.
Work out the distance travelled.

45 minutes = 0.75 hour, so time = 1.75 hours
Distance = speed × time = 72 × 1.75 = 126 km
Answer: 126 km

2 Circle area and circumference

A circle has diameter 26 cm.
Work out, in terms of π,
(a) the circumference,
(b) the area.

(a) Circumference = $\pi d = \pi \times 26 = 26\pi$
(b) Area = $\pi r^2 = \pi \times 13^2 = 169\pi$
Answer: (a) 26π cm (b) 169π cm^2

3 Expanding and simplifying

Expand and simplify
$(x + 2)^2 - (x + 1)(x - 4)$

$(x + 2)^2 = x^2 + 4x + 4$
$(x + 1)(x - 4) = x^2 - 3x - 4$
Subtract (take care with the signs): $(x^2 + 4x + 4) - (x^2 - 3x - 4)$
$= 7x + 8$
Answer: 7x + 8

4 Area of a triangle using sine

The area of triangle ABC is 47.2 m^2. (Calculator)
Angle x is acute.
Work out the size of angle x. Give your answer to 1 decimal place.
The diagram is not drawn accurately.

$\frac{1}{2} \times 9 \times 12 \times \sin x = 47.2$
$54 \sin x = 47.2$
$\sin x = 0.8741$
$x = 60.9°$
Answer: x = 60.9°

5 HCF and LCM

(a) Write 35 and 20 as products of prime factors.
(b) Find the highest common factor (HCF) and the lowest common multiple (LCM) of 35 and 20.

(a) $35 = 5 \times 7$ and $20 = 2^2 \times 5$
(b) HCF: multiply the prime factors in both lists, taking the smaller power: 5
LCM: take the larger power of every prime: $2^2 \times 5 \times 7 = 140$
Answer: (a) $35 = 5 \times 7$, $20 = 2^2 \times 5$ (b) HCF = 5, LCM = 140

6 Rearranging formulae (powers and roots)

Make r the subject of $V = \frac{4}{3}\pi r^3$

Multiply both sides by 3: $3V = 4\pi r^3$
Divide by 4π: $r^3 = \frac{3V}{4\pi}$
Take the cube root of both sides
Answer: $r = \sqrt[3]{\frac{3V}{4\pi}}$

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7 Combining ratios

a : b = 5 : 7
b : c = 1 : 1
(a) Work out the ratio a : b : c
(b) a, b and c add up to 152. Work out the value of c.

(a) Make the b parts equal: lowest common multiple of 7 and 1 is 7
a : b = 5 : 7 and b : c = 7 : 7
a : b : c = 5 : 7 : 7
(b) 5 + 7 + 7 = 19 parts, so 1 part = 152 ÷ 19 = 8
c = 7 × 8 = 56
Answer: (a) 5 : 7 : 7 (b) 56

8 Index equations

Solve $5^x = 125$

Write the right-hand side as a power of 5: $125 = 5^3$
So x = 3
Answer: x = 3

9 Equations with algebraic fractions

Solve $\frac{5}{(x-4)} + \frac{2}{(x+2)} = 1$

Multiply every term by $(x - 4)(x + 2)$
$5(x + 2) + 2(x - 4) = (x - 4)(x + 2)$
$7x + 2 = x^2 - 2x - 8$
$x^2 - 9x - 10 = 0$
$(x + 1)(x - 10) = 0$
$x = -1$ or $x = 10$
Answer: x = −1 or x = 10

10 Finding a rate of compound change

Isla invests £9,000 in a savings account. (Calculator)
Compound interest is paid at a fixed rate each year.
After 2 years the investment is worth £12,960.
Work out the annual rate of interest.

Overall multiplier = £12,960 ÷ £9,000 = 1.44
Take the square root: $\sqrt{1.44} = 1.2$
Rate = (1.2 − 1) × 100 = 20%
Answer: 20%