Day 341 **B Tier 10-a-day: Model Solutions**

1 Powers and roots

Work out

(a) $\sqrt[3]{343} \times 12$

(b) the square root of 144

(a) $\sqrt[3]{343} = 7$ because $7 \times 7 \times 7 = 343$, so $7 \times 12 = 84$

(b) $12 \times 12 = 144$, so the square root is 12

Answer: (a) 84 (b) 12

2 Metric conversions

(a) Convert 3500 ml to litres.

(b) Convert 800 mm^2 to cm^2.

(a) ml → litres: divide by 1000: $3500 \div 1000 = 3.5$

(b) 1 cm = 10 mm, so 1 cm^2 = $10 \times 10 = 100$ mm^2. $800 \div 100 = 8$

Answer: (a) 3.5 litres (b) 8 cm^2

3 Factorising

Factorise $10x - 6$

The highest common factor of 10 and 6 is 2

Divide each term by 2: $5x - 3$

Answer: $2(5x - 3)$

4 Unitary method

3 bottles of water cost £2.70.

Work out the cost of 8 bottles of water.

1 bottle of water costs £2.70 ÷ 3 = 90p

8 bottles of water cost 8 × 90p = £7.20

Answer: £7.20

5 Fractions and decimals

(a) Write $\frac{31}{40}$ as a decimal.

(b) Write $\frac{7}{12}$ as a recurring decimal.

For part (b), write down the first 8 decimal places and say which digits repeat.

(a) 31 ÷ 40 = 0.775

(b) 7 ÷ 12: use short division, adding zeros

7 ÷ 12 = 0.58333333...

The digit 3 repeats

Answer: (a) 0.775 (b) 0.58333333... (3 repeats)

6 Population density

Town A has a population of 3,000.

Its area is 12 km^2.

Work out the population density.

Give your answer in people per km^2.

Population density = population ÷ area

3,000 ÷ 12 = 250

Answer: 250 people per km^2

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7 Radius from area or circumference

The area of a circle is 145 m^2. (Calculator)
Work out the radius of the circle.
Give your answer correct to 1 decimal place.

Area = πr^2, so $r^2 = 145 \div \pi = 46.155...$
$r = \sqrt{46.155} = 6.794...$
r = 6.8 m (1 d.p.)
Answer: 6.8 m

8 Growth in standard form

There are 8.5×10^5 fish in a lake.
The number triples every day.
How many are there after 4 days?
Give your answer in standard form.

Each day multiply by 3, so multiply by $3^4 = 81$
$8.5 \times 10^5 \times 81 = 688.5 \times 10^5$
In standard form: 6.885×10^7
Answer: 6.885×10^7

9 Frequency trees

There are 200 students.
$\frac{1}{5}$ of them are boys and the rest are girls.
$\frac{1}{5}$ of the boys and $\frac{3}{5}$ of the girls walk to school.
One person is chosen at random. Work out the probability that they walk to school.

boys: $\frac{1}{5} \times 200 = 40$ and girls: $200 - 40 = 160$

boys who walk to school: $\frac{1}{5} \times 40 = 8$

girls who walk to school: $\frac{3}{5} \times 160 = 96$

P = (8 + 96) out of 200

Answer: $\frac{13}{25}$

10 Quadratic equation problem

A rectangle has length (x + 6) cm and width (x − 2) cm.
The area of the rectangle is 20 cm^2.
(a) Show that $x^2 + 4x - 32 = 0$
(b) Hence work out the length of the rectangle.

(a) Area = length × width: $(x + 6)(x - 2) = 20$
Expand: $x^2 + 4x - 12 = 20$
Subtract 20 from both sides: $x^2 + 4x - 32 = 0$
(b) Factorise: $(x - 4)(x + 8) = 0$, so $x = 4$ or $x = -8$
A length cannot be negative, so x = 4. Length = 4 + 6 = 10
Answer: (b) 10 cm