Day 238 **B Tier 10-a-day: Model Solutions**

1 Metric conversions

(a) Convert 12.5 tonnes to kg.

(b) Convert 1.5 cm^2 to mm^2.

(a) tonnes → kg: multiply by 1000: 12.5 × 1000 = 12 500

(b) 1 cm = 10 mm, so 1 cm^2 = 10 × 10 = 100 mm^2. 1.5 × 100 = 150

Answer: (a) 12 500 kg (b) 150 mm^2

2 Multiplying and dividing

Work out

(a) 337 × 7

(b) 1118 ÷ 13

(a) 300 × 7 = 2100 and 37 × 7 = 259, so the total is 2359

(b) 13 × 80 = 1040 and 1118 − 1040 = 78, then 78 ÷ 13 = 6, so 80 + 6 = 86

Answer: (a) 2359 (b) 86

3 Pythagoras' theorem

Work out the length of x.

The diagram is not drawn accurately.

Use Pythagoras: $a^2 + b^2 = c^2$

$x^2 = 7^2 + 24^2 = 49 + 576 = 625$

$x = \sqrt{625} = 25$

Answer: x = 25 m

4 Expanding double brackets

Expand and simplify (x + 7)(x + 5)

Multiply every term in the first bracket by every term in the second:

$x^2 + 5x + 7x + 35$

Collect the x terms: $x^2 + 12x + 35$

Answer: $x^2 + 12x + 35$

5 Multiplying and dividing fractions

Work out

(a) $\frac{3}{7} \times \frac{2}{9}$

(b) $\frac{3}{5} \div \frac{1}{2}$

Give each answer in its simplest form.

(a) Multiply the tops and the bottoms: $\frac{6}{63} = \frac{2}{21}$

(b) Turn the second fraction upside down and multiply: $\frac{3}{5} \times 2 = \frac{6}{5} = 1\frac{1}{5}$

Answer: (a) $\frac{2}{21}$ (b) $1\frac{1}{5}$

6 Midpoint of a line segment

M is the midpoint of AB.

A is the point (−6, −8) and M is the point (−7, −1).

Find the coordinates of B.

From A to M, x changes by −1 and y changes by 7

Do the same change again from M to get to B: x = −7 − 1 = −8, y = −1 + 7 = 6

Answer: (−8, 6)

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7 LCM problems

Two lights flash at 08:00.
One light flashes every 12 minutes.
The other light flashes every 20 minutes.
At what time do both lights next flash together?

Multiples of 12: 12, 24, 36, 48, 60
Multiples of 20: 20, 40, 60
The first common multiple is 60, so the LCM is 60 minutes
08:00 + 60 minutes = 09:00
Answer: 09:00

8 Median and range

Here are the times, in seconds, taken to run 100 m.
34, 34, 13, 32, 10, 14, 19, 39
(a) Find the median.
(b) Work out the range.

(a) Put in order: 10, 13, 14, 19, 32, 34, 34, 39
The middle two values are 19 and 32, so the median is 51 ÷ 2 = 25.5
(b) Range = largest − smallest = 39 − 10 = 29
Answer: (a) 25.5 (b) 29

9 Trial and improvement

The equation $x^3 + 3x = 33$ has a solution between 2 and 3. (Calculator)
Use trial and improvement to find this solution.
Give your answer correct to 1 decimal place.

x = 2.5: $2.5^3 + 3 \times 2.5 = 23.125$ (too small)
x = 2.7: $2.7^3 + 3 \times 2.7 = 27.783$ (too small)
x = 2.8: $2.8^3 + 3 \times 2.8 = 30.352$ (too small)
x = 2.9: $2.9^3 + 3 \times 2.9 = 33.089$ (too big)
x = 2.85: value = 31.699 (too small), so the solution is above 2.85
So x = 2.9 to 1 decimal place
Answer: x = 2.9

10 Venn diagram problems

35 pupils were asked.
16 of them study French and 19 of them study German.
3 of them did both.
(a) How many did neither?
(b) One is chosen at random. Find the probability that they study French but do not study German.

(a) Union = 16 + 19 − 3 = 32
Neither = 35 − 32 = 3
(b) Only study French = 16 − 3 = 13
P = 13 out of 35
Answer: (a) 3 (b) $\frac{13}{35}$