Day 233 **B Tier 10-a-day: Model Solutions**

1 Scaling a recipe

Here are the amounts needed to make a fruit crumble for 2 people.
50 g of butter, 30 g of sugar
Work out the amounts needed to make a fruit crumble for 12 people.

For 1 person: 50 ÷ 2 = 25 g and 30 ÷ 2 = 15 g
For 12 people: 25 × 12 = 300 and 15 × 12 = 180
Answer: 300 g of butter, 180 g of sugar

2 Simplifying expressions

Simplify fully
(a) $10a^2 \div 5a$
(b) $9pq \div 3p$

(a) 10 ÷ 5 = 2 and $a^2 \div a = a$
(b) Divide the numbers: 9 ÷ 3 = 3. The p cancels, leaving 3q
Answer: (a) 2a (b) 3q

3 Percentage increase and decrease

A train ticket costs £250. The price goes up by 5%.
(a) Work out the new price.
(b) A car is worth £2000. Its value goes down by 40% in a year. Work out its new value.

(a) The multiplier is 1.05, so new price = £250 × 1.05 = £262.50
(b) The multiplier is 0.6, so new value = £2000 × 0.6 = £1200
Answer: (a) £262.50 (b) £1200

4 Enlargement

A rectangle is 10 m long and 2 m wide.
It is enlarged by scale factor 1.5.
(a) Write down the length and width of the enlarged rectangle.
(b) Work out the perimeter of the enlarged rectangle.

(a) 10 × 1.5 = 15 and 2 × 1.5 = 3
(b) Perimeter = 2 × (15 + 3) = 36
Answer: (a) 15 m by 3 m (b) 36 m

5 Forming equations

I think of a number.
I multiply it by 4 and then subtract 4.
The answer is 36.
Work out my number.

Let the number be n: $4n - 4 = 36$
Add 4: $4n = 40$
Divide by 4
Answer: 10

6 Ordering standard form

Write these numbers in order of size.
Start with the smallest.
3.8×10^1, 6, 6.3×10^{-5}, 0.15

Write each in standard form: 3.8×10^1, 6×10^0, 6.3×10^{-5}, 1.5×10^{-1}
Compare the powers of 10 first (the bigger the power, the bigger the number)
Order: 6.3×10^{-5}, 0.15, 6, 3.8×10^1
Answer: 6.3×10^{-5}, 0.15, 6, 3.8×10^1

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7 Trigonometry: finding a side

Work out the length of y. (Calculator)
Give your answer correct to 1 decimal place.
The diagram is not drawn accurately.

Label the sides: y is the opposite and 10 m is the hypotenuse
We use sin (opposite and hypotenuse)

$\sin 68° = \frac{y}{10}$

$y = 10 \times \sin 68° = 9.272...$
$y = 9.3$ m (1 d.p.)
Answer: y = 9.3 m

8 Combined mean

In a test, the mean mark of 12 Class A is 49.
The mean mark of 8 Class B is 79.
Work out the mean mark of all 20 students.

Total for Class A = $12 \times 49 = 588$
Total for Class B = $8 \times 79 = 632$
Overall mean = $(588 + 632) \div 20 = 1220 \div 20 = 61$
Answer: 61

9 Iteration

Here is an iteration formula.
$x_{n+1} = \sqrt{5x_n + 4}$
$x_0 = 1$
(a) Work out x_1
(b) Work out x_2. Give your answer correct to 3 decimal places. (Calculator)

(a) $x_1 = \sqrt{5 \times 1 + 4} = \sqrt{9} = 3$
(b) $x_2 = \sqrt{5 \times 3 + 4} = \sqrt{19} = 4.3589...$
$= 4.359$
Answer: (a) 3 (b) 4.359

10 Bearings with Pythagoras and trigonometry

A boat sails 3 m on a bearing of 090° from P to Q, then 4 m on a bearing of 180° to R. (Calculator)
(a) Work out the distance PR.
(b) Work out the bearing of R from P.
Give your answers correct to 1 decimal place.

(a) Triangle PQR has a right angle at Q
$PR^2 = 3^2 + 4^2 = 25$
$PR = \sqrt{25} = 5$ m

(b) tan (angle QPR) = $\frac{4}{3}$, so angle QPR = 53.130° (to 3 d.p.)

PQ is on a bearing of 090°, and R is a further 53.130° clockwise from PQ
Bearing = 90 + 53.130 = 143.1°
Answer: (a) 5 m (b) 143.1°