Day 33 **A Tier 10-a-day: Model Solutions**

1 Expanding double brackets

Expand and simplify

$(3x - 5)(3x + 7)$

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

$= 9x^2 + 21x - 15x - 35$

$= 9x^2 + 6x - 35$

Answer: $9x^2 + 6x - 35$

2 Sharing in a ratio

Tara and Noah share some sweets in the ratio 3 : 1.

Tara gets 45 sweets.

How many sweets does Noah get?

3 parts = 45, so 1 part = 45 ÷ 3 = 15

Noah gets 1 parts: 1 × 15 = 15

Answer: 15

3 Fractions of an amount

Jack has £150.

Jack spends $\frac{2}{5}$ of the money on a phone case and $\frac{1}{5}$ of the money that is left on headphones.

How much money does Jack have left?

$\frac{2}{5}$ of £150 = £60, so after buying a phone case, £90 is left.

$\frac{1}{5}$ of £90 = £18

£90 − £18 = £72

Answer: £72

4 Two dice

Two fair dice are thrown.

The two scores are subtracted (smaller from larger).

Work out the probability that the difference is greater than 3.

Outcomes with a difference that is greater than 3: (1, 5), (1, 6), (2, 6), (5, 1), (6, 1), (6, 2)

There are 6 of these out of 36 equally likely outcomes

$\frac{6}{36} = \frac{1}{6}$

Answer: $\frac{1}{6}$

5 Rearranging to solve quadratics

Solve $x^2 + x = 30$

Move everything to one side: $x^2 + x - 30 = 0$

Factorise: $(x + 6)(x - 5) = 0$

$x = -6$ or $x = 5$

Answer: $x = -6$ or $x = 5$

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6 Similar triangles with parallel lines

In triangle ABC, DE is parallel to BC.
D is on AB and E is on AC.
Work out the value of x.
The diagram is not drawn accurately.

Triangles ADE and ABC are similar (DE is parallel to BC)

Scale factor = AB ÷ AD = 9 ÷ 6 = $\frac{3}{2}$

x = 8 × $\frac{3}{2}$ = 12

Answer: x = 12

7 Recurring decimals, show that

(a) Show that $0.\dot{2}\dot{3} = \frac{23}{99}$

(b) Hence write $4.\dot{2}\dot{3}$ as a mixed number in its simplest form.

(a) Let x = 0.232323..., so 100x = 23.2323...

100x − x = 23, so 99x = 23 and x = $\frac{23}{99}$

(b) $4.\dot{2}\dot{3} = 4 + \frac{23}{99} = 4\frac{23}{99}$

Answer: (b) $\mathbf{4\frac{23}{99}}$

8 Inverse functions

f(x) = $\frac{x + 5}{6}$

(a) Find $f^{-1}(x)$

(b) Work out $f^{-1}(-5)$

Let y = $\frac{x + 5}{6}$

Multiply by 6: 6 y = x + 5, so x = 6y − 5

Swap y for x: $f^{-1}(x) = 6x - 5$

(b) $f^{-1}(-5) = -35$

Answer: (a) $\mathbf{f^{-1}(x) = 6x - 5}$ **(b) −35**

9 Mixing in a ratio

Jug A contains 12 litres of a mixture of concentrate and water in the ratio 1 : 5.
Jug B contains 14 litres of a mixture of concentrate and water in the ratio 1 : 6.
The contents of both jugs are mixed together.
Work out the ratio of concentrate to water in the mixture. Give your answer in its simplest form.

Jug A: concentrate = 1 × 12 ÷ 6 = 2 litres, water = 10 litres
Jug B: concentrate = 2 litres, water = 12 litres
Total: concentrate = 4 litres, water = 22 litres
Ratio = 4 : 22 = 2 : 11

Answer: 2 : 11

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10 Volume of a prism

The diagram shows a prism.
The cross-section of the prism is a right-angled triangle.
Work out the volume of the prism.
The diagram is not drawn accurately.

Area of cross-section = $\frac{1}{2} \times 9 \times 13 = 58.5$

Volume = area of cross-section × length
= 58.5 × 5
= 292.5

Answer: 292.5 cm^3