Day 308 **A Tier 10-a-day: Model Solutions**

1 Direct proportion

Here are the ingredients for 6 muffins.
Oats: 150 g
Flour: 90 g
Sugar: 180 g
(a) Work out how much oats is needed for 18 muffins.
(b) Hannah has 400 g of flour. What is the greatest number of muffins she can make?

(a) oats for one: 150 ÷ 6 = 25 g
For 18: 25 × 18 = 450 g
(b) flour for one: 90 ÷ 6 = 15 g
400 ÷ 15 = 26 remainder 10, so she can make 26
Answer: (a) 450 g (b) 26

2 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle BAC = 38°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle ABC = (180 − 38) ÷ 2 = 71°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 38 + 71 = 109
Answer: x = 109°

3 Pie charts

The pie chart shows how some students travel to school.
25 students chose walk.
(a) Work out the angle for cycle.
(b) How many students chose cycle?

(a) 360 − 125 − 115 − 30 = 90°
(b) 25 students is 125°, so 1 student is 125 ÷ 25 = 5°
Cycle: 90 ÷ 5 = 18
Answer: (a) 90° (b) 18

4 Fractions of an amount

Priya spends $\frac{2}{5}$ of the money on a bike and $\frac{2}{5}$ of the money that is left on a helmet.

Priya has £108 left.
How much money did Priya have to begin with?

After the second purchase $\frac{3}{5}$ of what was left after the first purchase remains.

£108 = $\frac{3}{5}$ of the amount left, so $\frac{1}{5}$ of it is £108 ÷ 3 = £36

So the amount left after the first purchase is £36 × 5 = £180

This is $\frac{3}{5}$ of the original amount, so the original amount is £180 ÷ 3 × 5 = £300

Answer: £300

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5 Quadratic inequalities

Solve $x^2 + 5x < 0$

Solve $x^2 + 5x = 0$: $(x + 5)(x + 0) = 0$
$x = -5$ or $x = 0$
Sketch the U-shaped curve $y = x^2 + 5x$, crossing the x-axis at -5 and 0
The curve is below the x-axis between the roots
$-5 < x < 0$
Answer: $-5 < x < 0$

6 Area of a triangle using sine

Work out the area of triangle ABC. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

Area = $\frac{1}{2} \times a \times b \times \sin C$

$= \frac{1}{2} \times 5 \times 19 \times \sin 61°$

$= 41.5$

Answer: 41.5 cm^2

7 Expanding three brackets

Expand and simplify
$(x - 5)(x + 5)(x - 1)$

Expand the first two brackets: $(x - 5)(x + 5) = x^2 - 25$
Multiply by the third bracket: $(x^2 - 25)(x - 1)$
$= x^3 - 25x - x^2 + 25$
$= x^3 - x^2 - 25x + 25$
Answer: $x^3 - x^2 - 25x + 25$

8 Decimal calculations

(a) Work out 0.2×0.03
(b) Work out $1.08 \div 0.09$

(a) $2 \times 3 = 6$, and there are 3 decimal places in total, so 0.006
(b) Multiply both numbers by 100: $108 \div 9 = 12$
Answer: (a) 0.006 (b) 12

9 Simplifying algebraic fractions

Simplify fully

$$\frac{5x^2 - 19x - 30}{2x^2 - 9x - 5}$$

Factorise the top: $(5x + 6)(x - 5)$
Factorise the bottom: $(2x + 1)(x - 5)$
Cancel the common factor $(x - 5)$
Answer: $\frac{5x + 6}{2x + 1}$

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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 = $\frac{1}{2} \times 3 \times 3 = 4.5$

Volume = area of cross-section × length
= 4.5 × 17
= 76.5

Answer: 76.5 cm^3