Day 203 **B Tier 10-a-day: Model Solutions**

1 Solving equations

Solve $a - 9 = 20$

Add 9 to both sides

Answer: a = 29

2 Angles on a line and round a point

The diagram shows 3 angles on a straight line.
Work out the value of y.
The diagram is not drawn accurately.

Angles on a straight line add up to 180°
$(2y + 45) + (4y + 5) + (3y + 4) = 180$
$9y + 54 = 180$
$9y = 126$
$y = 126 \div 9 = 14$
Answer: y = 14°

3 Ratio, one part known

The ratio of red to blue among the counters in a bag is 2 : 3.
There are 8 red.
How many blue are there?

2 parts = 8 red
1 part = $8 \div 2 = 4$
blue: $3 \times 4 = 12$
Answer: 12

4 Perimeter with algebra

An isosceles triangle has two equal sides of length $(4x + 2)$ cm and a third side of length $(3x - 2)$ cm.
The perimeter of the triangle is 90 cm.
Work out the value of x.

$2(4x + 2) + (3x - 2) = 90$
$11x + 2 = 90$
$11x = 88$
$x = 8$
Answer: x = 8

5 Adding fractions

Work out

(a) $\frac{2}{9} + \frac{5}{8}$

(b) $\frac{2}{3} - \frac{3}{8}$

Give each answer in its simplest form.

(a) Common denominator 72: $\frac{16}{72} + \frac{45}{72} = \frac{61}{72}$

(b) Common denominator 24: $\frac{16}{24} - \frac{9}{24} = \frac{7}{24}$

Answer: (a) $\frac{61}{72}$ (b) $\frac{7}{24}$

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6 Area of shaded regions

The diagram shows a square of side 4 m with a circle of radius 2 m cut out.
The circle is in the centre of the square.
Work out the area of the shaded region.
Give your answer in terms of π.
The diagram is not drawn accurately.

Area of square = $4 \times 4 = 16$
Area of circle = $\pi \times 2^2 = 4\pi$
Shaded area = $16 - 4\pi$
Answer: $16 - 4\pi$ m^2

7 Laws of indices

Write each answer as a single power of 10.
(a) $10^7 \times 10^3$
(b) $10^{10} \div 10^3$

(a) Add the powers: $7 + 3 = 10$
(b) Subtract the powers: $10 - 3 = 7$
Answer: (a) 10^{10} (b) 10^7

8 Simultaneous equations problem

A theme park sells adult tickets and child tickets.
2 adult tickets and 1 child ticket cost £33.
4 adult tickets and 1 child ticket cost £63.
Work out the cost of one adult ticket and the cost of one child ticket.

Let a = cost of one adult ticket and b = cost of one child ticket
$2a + 1b = 33$ and $4a + 1b = 63$
Subtract: $2a = 63 - 33 = 30$, so $a = 15$
Substitute: $2 \times 15 + 1b = 33$, so $1b = 3$ and $b = 3$
Answer: One adult ticket costs £15 and one child ticket costs £3

9 Capture-recapture

40 birds in a lake are caught, tagged and returned to the lake.
Later, a sample of 30 birds is caught and 4 of them are tagged.
Estimate the total number of birds in the lake.

Proportion tagged in the sample = $4 \div 30$
This is the same proportion as 40 out of the whole population
Population $\approx 40 \times 30 \div 4 = 300$
Answer: 300

10 Metric units

A jug holds 1.05 litres of juice.
Each glass holds 150 ml.
How many glasses can be filled from the jug?

1.05 litres = $1.05 \times 1000 = 1050$ ml
$1050 \div 150 = 7$
Answer: 7 glasses