Day 197 **A Tier 10-a-day: Model Solutions**

1 Area of parallelograms and kites

The diagram shows a kite.
The diagonals are 13 cm and 12 cm and cross at right angles.
Work out the area of the kite.
The diagram is not drawn accurately.

Area = $\frac{1}{2}$ × (diagonal 1) × (diagonal 2)

= $\frac{1}{2}$ × 13 × 12

= 78

Answer: 78 cm^2

2 Inverse proportion

3 pumps take 5 hours to empty a pond.
All the pumps work at the same rate.
How many pumps are needed to empty a pond in 3 hours?

Total work = 3 × 5 = 15 pump-hour
Number needed = 15 ÷ 3 = 5
Answer: 5

3 Laws of indices

Simplify fully

(a) $\frac{16x^5y^2}{2x^3y^3}$

(b) $\frac{(4x^2)^2}{3x^3}$

(a) Divide the numbers: 16 ÷ 2 = 8
Subtract the powers: $x^5 \div x^3 = x^2$ and $y^2 \div y^3 = y^{-1}$

= $\frac{8x^2}{y}$

(b) Square the top: $(4x^2)^2 = 16x^4$

Divide the numbers: 16 ÷ 3 = $\frac{16}{3}$. Subtract the powers of x: 4 − 3 = 1

= $\frac{16x}{3}$

Answer: (a) $\frac{8x^2}{y}$ (b) $\frac{16x}{3}$

4 Angles in regular polygons around a point

A square and a regular pentagon share the side AB and are on opposite sides of it.
The two shapes meet at the point A.
Work out the size of the angle at A that is not inside either shape.

Interior angle of the square = 180 − 360 ÷ 4 = 90°
Interior angle of the regular pentagon = 180 − 360 ÷ 5 = 108°
Angles round a point add up to 360°
360 − 90 − 108 = 162
Answer: 162°

Day 197 **A Tier 10-a-day: Model Solutions**

5 Reverse fractions

Jack reads $\frac{3}{8}$ of a book and has now read 60 pages.

How many pages does the whole book have?

$\frac{3}{8}$ of the total = 60

$\frac{1}{8}$ of the total = 60 ÷ 3 = 20

Whole = 20 × 8 = 160

Answer: 160

6 Quadratic graph from its roots

The diagram shows the graph of $y = x^2 + bx + c$.
Find the value of b and the value of c.

The curve crosses the x-axis at $x = -3$ and $x = 3$

So $y = (x + 3)(x - 3)$

Expand: $y = x^2 - 9$

b = 0 and c = −9

Answer: b = 0, c = −9

7 Recurring decimals to fractions

Write the recurring decimal $0.\dot{8}7\dot{0}$ as a fraction in its simplest form.

Let x = 0.870870870...

Multiply by 1000: 1000x = 870.870870...

Subtract: 999x = 870

$x = \frac{870}{999} = \frac{290}{333}$

Answer: $\frac{290}{333}$

8 Venn diagram probability

The Venn diagram shows information about 27 people.
One person is chosen at random.
(a) Find the probability that the person is in Netball only.
(b) Find the probability that the person is in neither set.

(a) Netball only: 7 out of 27 = $\frac{7}{27}$

(b) Neither: 4 out of 27 = $\frac{4}{27}$

Answer: (a) $\frac{7}{27}$ (b) $\frac{4}{27}$

9 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{4x - 1}{2x - 3}$

Multiply both sides by (2x − 3): $y(2x - 3) = 4x - 1$

Expand the bracket: $2xy - 3y = 4x - 1$

Collect the x terms on one side: $2xy - 4x = 3y - 1$

Factorise: $x(2y - 4) = 3y - 1$

Divide by (2y − 4): $x = \frac{3y - 1}{2y - 4}$

Answer: $x = \frac{3y - 1}{2y - 4}$

Day 197 **A Tier 10-a-day: Model Solutions**

10 Probability with three selections

A bag contains 7 red counters and 2 blue counters.
Three counters are taken at random without replacement.
Work out the probability that exactly one of the three counters is blue.

One order, for example blue, red, red: $\frac{2}{9} \times \frac{7}{8} \times \frac{6}{7} = \frac{1}{6}$

There are 3 possible orders, each with the same probability

$3 \times \frac{1}{6} = \frac{1}{2}$

Answer: $\mathbf{\frac{1}{2}}$