Day 143 **B Tier 10-a-day: Model Solutions**

1 Place value

Here are four digit cards.
3 4 2 8
Use all four cards to make the largest possible even number.

The last digit must be even. Put the biggest remaining digits first.
The largest even number is 8432
Answer: 8432

2 Ratio, one part known

The ratio of boys to girls among the students in a class is 2 : 3.
There are 16 boys.
How many girls are there?

2 parts = 16 boys
1 part = 16 ÷ 2 = 8
girls: 3 × 8 = 24
Answer: 24

3 Forming equations

I think of a number.
I divide it by 3 and then add 1.
The answer is 3.
Work out my number.

Let the number be n: $\frac{n}{3} + 1 = 3$

Subtract 1: $\frac{n}{3} = 2$

Multiply by 3
Answer: 6

4 Midpoint and length of a line

A is the point (2, 2) and B is the point $(-2, -1)$.
(a) Work out the coordinates of the midpoint of AB.
(b) Work out the length of AB.

(a) Midpoint = (0 ÷ 2, 1 ÷ 2) = (0, 0.5)
(b) Horizontal distance = 4, vertical distance = 3
$AB^2 = 4^2 + 3^2 = 16 + 9 = 25$
$AB = \sqrt{25} = 5$
Answer: (a) (0, 0.5) (b) 5

5 Negative and zero indices

Work out
(a) 5^{-1}
(b) $7^0 + \sqrt{9}$

(a) A negative power means the reciprocal: $5^{-1} = \frac{1}{5^1} = \frac{1}{5}$

(b) Anything to the power 0 is 1, so $7^0 = 1$
$\sqrt{9} = 3$, so 1 + 3 = 4
Answer: (a) $\frac{1}{5}$ (b) 4

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6 Pythagoras in context

A kite is flown on a string 25 m long.
The kite is directly above a point 7 m from the person flying it, on level ground.
Work out the height of the kite above the ground, ignoring the height of the person.

The string is the hypotenuse of a right-angled triangle

$h^2 = 25^2 - 7^2 = 625 - 49 = 576$

$h = \sqrt{576} = 24$

Answer: 24 m

7 Quadratic graphs

The diagram shows the graph of

$y = x^2 + 2x$

(a) Write down the solutions of $x^2 + 2x = 0$
(b) Write down the coordinates of the minimum point of the graph.

(a) The solutions are where the graph crosses the x-axis
(b) The lowest point of the curve is halfway between the two solutions, at $x = -1$

Answer: (a) $x = -2$ and $x = 0$ (b) $(-1, -1)$

8 Best buys

Pasta is sold in two sizes.
Small: 500 g for £1.70
Large: 750 g for £2.92
Which size is better value for money?
You must show your working.

Compare the cost of 1500 g of each
Small: 3 × £1.70 = £5.10
Large: 2 × £2.92 = £5.84
The small is cheaper for the same amount

Answer: The small size

9 Fraction problems

A paddling pool is $\frac{1}{4}$ full.

10 litres of water are added.

The paddling pool is now $\frac{1}{2}$ full.

Work out the capacity of the paddling pool.

Fraction added = $\frac{1}{2} - \frac{1}{4} = \frac{1}{4}$

$\frac{1}{4}$ of the capacity = 10 litres

Whole capacity = 10 × 4 = 40 litres

Answer: 40 litres

10 Chords and the centre of a circle

A circle has centre O and radius 15 cm.
AB is a chord and M is the midpoint of AB. OM is perpendicular to AB.
Work out the value of x.
The diagram is not drawn accurately.

Triangle OMA has a right angle at M, and OA is the hypotenuse

$AM^2 = 15^2 - 9^2 = 225 - 81 = 144$

$AM = \sqrt{144} = 12$

$x = 2 \times AM = 24$

Answer: $x = 24$ cm