Day 65 **B Tier 10-a-day: Model Solutions**

1 Circle theorems

A and B are points on a circle, centre O.
Angle AOB = 126°.
Work out the size of angle b.
Give a reason for your answer.
The diagram is not drawn accurately.

OA = OB because they are radii, so triangle OAB is isosceles
b = (180 − 126) ÷ 2 = 27
The base angles of an isosceles triangle are equal
Answer: b = 27°

2 Laws of indices

Simplify fully
(a) $(2p^3)^2$
(b) $(y^3)^4$

(a) $2^2 = 4$ and the powers multiply: 3 × 2 = 6
(b) Multiply the powers: 3 × 4 = 12
Answer: (a) $4p^6$ (b) y^{12}

3 Decimal calculations

Work out
(a) 5.5 × 0.8
(b) 0.2 × 7

(a) 55 × 8 = 440
There are 2 decimal places in total, so the answer is 4.4
(b) 20 × 7 = 140, then divide by 100: 1.4
Answer: (a) 4.4 (b) 1.4

4 Loci

Two straight paths meet at a point X.
A point P is always the same distance from both paths.
Describe the locus of the point P.

Points equal distances from two lines that meet lie on the angle bisector
It cuts the angle between the paths exactly in half
Answer: The bisector of the angle between the two paths

5 Sample space of two dice

Two fair spinners, numbered 1 to 6 and 1 to 10, are spun.
Work out the probability that the difference between the two scores is 3.

There are 6 × 10 = 60 equally likely outcomes
Pairs with difference 3: 9 outcomes
P = 9 out of 60
Answer: $\frac{3}{20}$

6 Gradient and intercept

A straight line has equation y = −6x + 9
(a) Write down the gradient of the line.
(b) Write down the equation of a line that is parallel to this line and passes through the point (0, −6).

(a) The line is in the form y = mx + c, so the gradient m is the number in front of x
(b) Parallel lines have the same gradient, −6
It crosses the y-axis at −6, so c = −6
Answer: (a) −6 (b) y = −6x − 6

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7 Frequency trees

There are 200 bus passengers.

$\frac{1}{10}$ of them are adults and the rest are children.

$\frac{2}{5}$ of the adults and $\frac{2}{5}$ of the children have a pass.

One person is chosen at random. Work out the probability that they have a pass.

adults: $\frac{1}{10} \times 200 = 20$ and children: $200 - 20 = 180$

adults who have a pass: $\frac{2}{5} \times 20 = 8$

children who have a pass: $\frac{2}{5} \times 180 = 72$

P = (8 + 72) out of 200

Answer: $\frac{2}{5}$

8 Algebraic proof

Show that $(2n + 6)^2 - 36$ is a multiple of 4 for any whole number n.

Expand: $(2n + 6)^2 = 4n^2 + 24n + 36$

Subtract 36: $4n^2 + 24n$

Factorise: $4n(n + 6)$, which is a multiple of 4

Answer: $4n(n + 6)$ is a multiple of 4

9 Growth in standard form

There are 5.6×10^5 fish in a lake.
The number doubles every day.
How many are there after 4 days?
Give your answer in standard form.

Each day multiply by 2, so multiply by $2^4 = 16$

$5.6 \times 10^5 \times 16 = 89.6 \times 10^5$

In standard form: 8.96×10^6

Answer: 8.96×10^6

10 Speed unit conversion

A motorbike travels at 9 km/h.
Work out its speed in metres per second.

9 km = 9,000 m

1 hour = 3600 seconds

9,000 ÷ 3600 = 2.5 m/s

Answer: 2.5 m/s