Day 157 **B Tier 10-a-day: Model Solutions**

1 Tree diagrams

A bag contains 4 black socks and 4 white socks.
Nia takes one at random and does not replace it, then takes a second.
Work out the probability that both are black.

P(first black) = $\frac{1}{2}$

P(second black) = $\frac{3}{7}$

P(both black) = $\frac{1}{2} \times \frac{3}{7} = \frac{3}{14}$

Answer: $\mathbf{\frac{3}{14}}$

2 Reflection

The diagram shows triangle ABC on a grid.
(a) Write down the coordinates of the image of A after a reflection in the line y = x.
(b) Write down the coordinates of the image of C after a reflection in the x-axis.

(a) A is at (3, 1). Reflect in the line y = x: (1, 3)
(b) C is at (1, 4). Reflect in the x-axis: (1, −4)
Answer: (a) (1, 3) (b) (1, −4)

3 Fractions in simplest form

What fraction of 1 hour is 24 minutes?
Give your answer in its simplest form.

1 hour = 60 minutes
$\frac{24}{60} = \frac{2}{5}$

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

4 Sample space of two dice

Two fair six-sided dice are rolled.
Work out the probability that both dice show the same number.

There are 6 × 6 = 36 equally likely outcomes
Matching pairs: 1-1, 2-2, 3-3, 4-4, 5-5, 6-6
P = 6 out of 36

Answer: $\mathbf{\frac{1}{6}}$

5 Loci

A point P is always exactly 3 m from a lamp post, L.
Describe the locus of the point P.

The points are all the same distance from L
This forms a circle
Answer: A circle with centre L and radius 3 m

6 Expanding squared brackets

Expand and simplify $(x + 8)^2$

Write as a product of two brackets: (x + 8)(x + 8)
$x^2 + 8x + 8x + 64$
$x^2 + 16x + 64$
Answer: $x^2 + 16x + 64$

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7 Combined mean

In a test, the mean mark of 10 Class A is 61.
The mean mark of 5 Class B is 79.
Work out the mean mark of all 15 students.

Total for Class A = 10 × 61 = 610
Total for Class B = 5 × 79 = 395
Overall mean = (610 + 395) ÷ 15 = 1005 ÷ 15 = 67
Answer: 67

8 Solving quadratic equations

Solve $x^2 - 9x + 20 = 0$

Factorise: $(x - 5)(x - 4) = 0$
Either $x - 5 = 0$ or $x - 4 = 0$
Answer: x = 4 or x = 5

9 Bounds

The length of a rectangle is 13 cm and its width is 6 cm.
Both measurements are correct to the nearest cm.
Work out the lower bound for the area of the rectangle.

Lower bound of each side = value − 0.5: 12.5 cm and 5.5 cm
Area = 12.5 × 5.5 = 68.75 cm^2
Answer: 68.75 cm^2

10 Trigonometry in isosceles triangles

Triangle XYZ is isosceles with XY = XZ = 12 m. (Calculator)
The base YZ = 10 m.
Work out the size of angle XYZ.
Give your answer correct to 1 decimal place.

Split the triangle into two right-angled triangles. Half the base = 10 ÷ 2 = 5

$\cos Y = \frac{5}{12}$

Angle XYZ = $\cos^{-1}(\frac{5}{12})$ = 65.376...

= 65.4° (1 d.p.)
Answer: 65.4°