Day 8 **A Tier 10-a-day: Model Solutions**

1 Rearranging formulae

Make a the subject of $b = 3a - 6$

Add 6 to both sides: $3a = b + 6$
Divide both sides by 3
$a = \frac{b + 6}{3}$

Answer: $a = \frac{b + 6}{3}$

2 Loci and constructions

A garden has a straight fence. A tree is planted so that it is always 5 m from the fence.
A point T on a plan is 5 m from the fence, on either side.
Describe the locus of T.

Points a fixed distance from a line, on both sides, form two parallel lines
Each is 5 m from the fence
Answer: Two straight lines parallel to the fence, 5 m on each side

3 Equations with fractions

Solve $\frac{5x - 2}{4} = \frac{3x + 4}{5}$

Multiply both sides by 20
$5(5x - 2) = 4(3x + 4)$
$25x - 10 = 12x + 16$
$13x = 26$
$x = 2$
Answer: $x = 2$

4 Midpoints and length of a line segment

M is the midpoint of AB.
A is the point $(-5, 0)$ and M is the point $(-5, 2)$.
Work out the coordinates of B.

From A to M: x changes by 0 and y changes by 2
Do the same again from M to get B
$B = (-5 + 0, 2 + 2) = (-5, 4)$
Answer: $(-5, 4)$

5 Bounds

A rectangle has length 21 cm and width 12 cm.
Each measurement is correct to the nearest cm.
Work out the upper bound for the area of the rectangle.

Upper bound of length = 21 + 0.5 = 21.5 cm
Upper bound of width = 12 + 0.5 = 12.5 cm
Upper bound of area = $21.5 \times 12.5 = 268.75$ cm^2
Answer: 268.75 cm^2

6 Venn diagram probability

The Venn diagram shows information about 36 people.
One person is chosen at random.
(a) Find the probability that the person is in both French and Spanish.
(b) Find the probability that the person is in French or Spanish or both.

(a) Both: 9 out of 36 = $\frac{1}{4}$

(b) 11 + 9 + 14 = 34, so 34 out of 36 = $\frac{17}{18}$

Answer: (a) $\frac{1}{4}$ (b) $\frac{17}{18}$

7 Successive percentage changes

The price of a product increases by 25% each year for 2 years.
Work out the overall percentage increase over the 2 years.

Multiplier for each year = 1.25

Overall multiplier = $1.25^2 = 1.5625$

Percentage increase = 56.25%

Answer: 56.25%

8 Finding an interest rate

Grace invests £5000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £5408 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $5000 \times m^2 = 5408$

$m^2 = 5408 \div 5000 = 1.0816$

$m = \sqrt{1.0816} = 1.04$

Rate = $(1.04 - 1) \times 100 = 4\%$

Answer: 4%

9 Reverse compound change

The value of a house increases by 10% each year. (Calculator)
After 3 years it is worth £49,247.
Work out its value at the start.

Yearly multiplier = 1.1

Overall multiplier = $1.1^3 = 1.331$

Original value = £49,247 ÷ 1.331 = £37,000

Answer: £37,000

10 Bearings with the cosine rule

Boat P sails 8 miles from a harbour on a bearing of 255°.
Boat Q sails 18 miles from the same harbour on a bearing of 145°. (Calculator)
Work out the distance between the two boats.
Give your answer to 3 significant figures.

The angle between the two paths = $|255° - 145°| = 110°$

$d^2 = 8^2 + 18^2 - 2 \times 8 \times 18 \times \cos 110°$

$d^2 = 486.50$

$d = 22.1$

Answer: 22.1 miles