Day 335 **A Tier 10-a-day: Model Solutions**

1 Probabilities adding to 1

The table shows the probabilities of the outcomes of a biased spinner.
(a) Work out the value of y.
(b) The spinner is spun 300 times. Estimate the number of times it lands on blue.

(a) Probabilities add to 1: 0.35 + y + y + 0.15 = 1
0.5 + 2y = 1, so 2y = 0.5
y = 0.25
(b) P(blue) = 0.25, so expected number = 0.25 × 300 = 75
Answer: (a) y = 0.25 (b) 75

2 Algebraic formulae in context

A plumber charges a call-out fee of £30 plus £30 for each hour of work.
(a) Write a formula for the total cost, £C, after h hours.
(b) Leo pays £300 in total. Work out the number of hours.

(a) C = 30 + 30h
(b) 30 + 30h = 300
30h = 270
h = 9
Answer: (a) C = 30 + 30h (b) 9

3 Angles in parallel lines

The diagram shows two parallel lines crossed by a straight line.
(a) Work out the value of x.
(b) Work out the size of the angle marked (5x + 15)°.
The diagram is not drawn accurately.

(a) Corresponding angles are equal
5x + 15 = 3x + 41
2x = 26
x = 13
(b) 5 × 13 + 15 = 80
Answer: (a) x = 13 (b) 80°

4 Rearranging formulae (powers and roots)

Make x the subject of $y = (x + 4)^2 - 1$

Add 1 to both sides: $y + 1 = (x + 4)^2$
Square root both sides (positive and negative roots): $x + 4 = \pm\sqrt{y + 1}$
Subtract 4 from both sides
Answer: $x = -4 \pm \sqrt{y + 1}$

5 Simple and compound interest

Maya and Jack each invest £2500 for 3 years. (Calculator)
Maya's account pays 10% simple interest per year.
Jack's account pays 10% compound interest per year.
Work out how much more interest Jack earns than Maya.

Simple interest = £2500 × 10% × 3 = £750
Compound: £2500 × 1.1^3 = £3327.50, so interest = £827.50
Difference = 827.50 − 750 = £77.50 (to the nearest penny)
Answer: £77.50

6 Converting units

(a) Change 2.5 cm^2 to mm^2.
(b) Change 2,500,000 cm^3 to m^3.

(a) 2.5 cm^2 × 100 = 250 mm^2
(b) 2,500,000 cm^3 ÷ 1 000 000 = 2.5 m^3
Answer: (a) 250 mm^2 (b) 2.5 m^3

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7 Circle theorems: tangents

PA and PB are tangents to a circle with centre O.
Angle APB = 52°.
Work out the size of angle x (angle AOB).
Give a reason for each step of your working.

A tangent is perpendicular to the radius, so angles OAP and OBP are both 90°
The angles in quadrilateral OAPB add up to 360°
x = 360 − 90 − 90 − 52 = 128
Answer: x = 128°

8 Estimation

By rounding each number to 1 significant figure, estimate the value of

$$\frac{37 + 4.5}{0.53}$$

Round each number to 1 significant figure: 40, 5, 0.5

$$\frac{40 + 5}{0.5} = 90$$

Answer: 90

9 Successive percentage changes

The value of a painting is increased by 10%.
The new value is then decreased by 10%.
Work out the overall percentage change.

First change: multiplier 1.1. Second change: multiplier 0.9
Overall multiplier = 1.1 × 0.9 = 0.99
0.99 − 1 = −0.01, so the overall change is 1%
Answer: 1% decrease

10 Bounds in measurement

A circle has a radius of 20 cm, correct to the nearest cm. (Calculator)
Work out the lower bound for the area of the circle.
Give your answer to 3 significant figures.

Lower bound of radius = 19.5 cm
Area = $\pi \times 19.5^2 = 1190$
Answer: 1190 cm^2