Day 263 **A Tier 10-a-day: Model Solutions**

1 Profit and loss

Kiran buys a games console for £230 and sells it making a profit of 30%.
Work out the selling price.

Selling price = 130% of the cost price
£230 × 1.3 = £299
Answer: £299

2 Circle theorems: angle in a semicircle

XY is a diameter of the circle.
Angle YXZ = 19°.
Work out the size of angle x.
Give a reason for each step of your working.

The angle in a semicircle is 90°, so angle XZY = 90°
Angles in a triangle add up to 180°
x = 180 − 90 − 19 = 71
Answer: x = 71°

3 Inequalities

Solve $7x + 4 < 3x - 16$

Collect the x terms on the left: $4x + 4 < -16$
Subtract 4: $4x < -20$
Divide by 4
$x < -5$
Answer: $x < -5$

4 Index equations

Solve $5^{2x-2} = 25$

$25 = 5^2$, so $2x - 2 = 2$
$2x = 2 + 2 = 4$
$x = 2$
Answer: x = 2

5 Pie charts

The pie chart shows how some students chose a sport.
3 students chose tennis.
(a) Work out the angle for hockey.
(b) How many students chose hockey?

(a) 360 − 140 − 150 − 30 = 40°
(b) 3 students is 30°, so 1 student is 30 ÷ 3 = 10°
Hockey: 40 ÷ 10 = 4
Answer: (a) 40° (b) 4

6 Trigonometry in context

A ladder of length 10 m rests against a vertical wall. (Calculator)
The foot of the ladder is 3 m from the wall on horizontal ground.
Work out the angle between the ladder and the ground. Give your answer to 1 decimal place.

$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{3}{10}$

$\theta = \cos^{-1}(\frac{3}{10})$

$\theta = 72.5°$
Answer: 72.5°

Day 263 **A Tier 10-a-day: Model Solutions**

7 Probabilities adding to 1

The table shows the probabilities of the outcomes of a biased spinner.
(a) Work out the value of x.
(b) The spinner is spun 100 times. Estimate the number of times it lands on 3.

(a) Probabilities add to 1: 0.3 + x + x + 0.6 = 1
0.9 + 2x = 1, so 2x = 0.1
x = 0.05
(b) P(3) = 0.05, so expected number = 0.05 × 100 = 5
Answer: (a) x = 0.05 (b) 5

8 Equation of a straight line

A straight line passes through the points (−2, 3) and (1, −12).
Find the equation of the line.

Gradient = $\frac{-12-3}{1-(-2)} = \frac{-15}{3} = -5$
Use y = mx + c with m = −5 and the point (−2, 3): 3 = −5 × (−2) + c
c = −7
y = −5x − 7
Answer: y = −5x − 7

9 Rationalising with conjugates

Rationalise the denominator of $\frac{4}{2+\sqrt{3}}$

Give your answer in the form $a + b\sqrt{c}$ where a and b are integers.

Multiply top and bottom by the conjugate $2 - \sqrt{3}$: $\frac{4(2-\sqrt{3})}{(2+\sqrt{3})(2-\sqrt{3})}$
Denominator: 4 − 3 = 1
$\frac{4(2-\sqrt{3})}{1} = 4(2-\sqrt{3})$
$= 8 - 4\sqrt{3}$
Answer: $8 - 4\sqrt{3}$

10 Rearranging to solve quadratics

Solve $3x^2 = 14x + 5$

Move everything to one side: $3x^2 - 14x - 5 = 0$
Factorise: (3x + 1)(x − 5) = 0
$x = -\frac{1}{3}$ or x = 5
Answer: $x = -\frac{1}{3}$ or x = 5