Day 159 **A Tier 10-a-day: Model Solutions**

1 Percentages in context

A television costs £400 plus VAT at 20%.
In a sale, the price including VAT is reduced by 25%.
Work out the sale price of the television.

VAT = 20% of £400 = £80, so the price with VAT is £480
Reduction = 25% of £480 = £120
Sale price = £480 − £120 = £360
Answer: £360

2 Mixed number multiplication and division

Work out $4\frac{4}{5} \times 3\frac{1}{3}$

Give your answer as a mixed number in its simplest form.

Improper fractions: $\frac{24}{5}$ and $\frac{10}{3}$

Multiply: $\frac{24}{5} \times \frac{10}{3} = \frac{240}{15}$

Simplify: 16
Answer: 16

3 Converting units of area and volume

A jug holds 15000 cm^3 of water.
Write this volume in litres.

1 litre = 1000 cm^3
15000 ÷ 1000 = 15
Answer: 15 litres

4 Equation of a straight line

A straight line passes through the points (3, 5) and (5, 11).
Find the equation of the line.

Gradient = $\frac{11 - 5}{5 - 3} = \frac{6}{2} = 3$

Use y = mx + c with m = 3 and the point (3, 5): 5 = 3 × 3 + c
c = −4
y = 3x − 4
Answer: y = 3x − 4

5 Converting units

(a) Change 0.8 m^2 to cm^2.
(b) Change 1,250 mm^2 to cm^2.

(a) 0.8 m^2 × 10,000 = 8,000 cm^2
(b) 1,250 mm^2 ÷ 100 = 12.5 cm^2
Answer: (a) 8,000 cm^2 (b) 12.5 cm^2

6 Transformations of graphs

The graph of y = f(x) has a maximum point at (0, −4).
Write down the coordinates of the turning point of the graph of
(a) y = f(−x)
(b) y = f(x) − 2

(a) The graph is reflected in the y-axis, so the x-coordinate changes sign
The maximum point is (0, −4)
(b) Subtracting 2 from f(x) moves the graph 2 units down
The maximum point is (0, −6)
Answer: (a) (0, −4) (b) (0, −6)

Day 159 **A Tier 10-a-day: Model Solutions**

7 Tree diagrams

The tree diagram shows probabilities for two events.
(a) Work out the values of a and b.
(b) Work out the probability of sunny and walks.

(a) Probabilities on pairs of branches add up to 1.
a = 1 − 0.4 = 0.6 and b = 1 − 0.5 = 0.5
(b) 0.5 × 0.4 = 0.2
Answer: (a) a = 0.6, b = 0.5 (b) 0.2

8 Area of a segment

The diagram shows a circle with centre O and radius 7 cm.
Angle AOB = 70°. (Calculator)
Work out the area of the shaded segment.
Give your answer to 3 significant figures.

Area of sector = $\frac{70}{360} \times \pi \times 7^2 = 29.932$

Area of triangle OAB = $\frac{1}{2} \times 7 \times 7 \times \sin 70° = 23.022$

Segment = 29.932 − 23.022 = 6.91
Answer: 6.91 cm^2

9 Simple and compound interest

Cara and Jack each invest £4000 for 3 years. (Calculator)
Cara's account pays 5% simple interest per year.
Jack's account pays 5% compound interest per year.
Work out how much more interest Jack earns than Cara.

Simple interest = £4000 × 5% × 3 = £600
Compound: £4000 × 1.05^3 = £4630.50, so interest = £630.50
Difference = 630.50 − 600 = £30.50 (to the nearest penny)
Answer: £30.50

10 Rationalising with conjugates

Rationalise the denominator of $\frac{116}{6 + \sqrt{7}}$

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

Multiply top and bottom by the conjugate $6 - \sqrt{7}$: $\frac{116(6 - \sqrt{7})}{(6 + \sqrt{7})(6 - \sqrt{7})}$

Denominator: 36 − 7 = 29

$\frac{116(6 - \sqrt{7})}{29} = 4(6 - \sqrt{7})$

$= 24 - 4\sqrt{7}$

Answer: $24 - 4\sqrt{7}$