Day 64 **A Tier 10-a-day: Model Solutions**

1 Substitution

Work out the value of $5x^2 - 2x - 9$ when $x = -3$

Substitute $x = -3$: $5 \times (-3)^2 - 2 \times (-3) - 9$
$= 45 + 6 - 9$
$= 42$
Answer: 42

2 Converting speeds

A train travels at 15 m/s.
Work out this speed in kilometres per hour.

In 1 hour there are 3600 seconds, so 15 m/s = 15×3600 m/h
= 54000 m/h = $54000 \div 1000$ km/h
= 54
Answer: 54 km/h

3 Simultaneous equations in context

3 muffins and 5 coffees cost £39.
2 muffins and 5 coffees cost £36.
Work out the cost of one coffee.

Let m = cost of one muffin in £ and c = cost of one coffee in £
$3m + 5c = 39$ (1)
$2m + 5c = 36$ (2)
The c terms have the same sign, so subtract equation (2) from equation (1)
$m = 3$
Substitute $m = 3$ into equation (1) to find $c = 6$
Answer: £6

4 Wages and overtime

Sara is paid £15.60 per hour for a basic week of 36 hours. (Calculator)
Overtime is paid at time and a quarter.
Last week Sara worked 7 hours of overtime.
Work out Sara's total pay for the week.

Basic pay = $36 \times £15.60 = £561.60$
Overtime rate = $£15.60 \times 1.25 = £19.50$ per hour
Overtime pay = $7 \times £19.50 = £136.50$
Total = $£561.60 + £136.50 = £698.10$
Answer: £698.10

5 Area of a sector

The diagram shows a sector of a circle of radius 6 cm.
Work out the area of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Area = $\frac{40}{360} \times \pi \times 6^2$

$= \frac{1}{9} \times 36\,\pi$

$= 4\pi$

Answer: 4π cm^2

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6 Recurring decimals, show that

(a) Show that $0.\dot{8}\dot{0} = \frac{80}{99}$

(b) Hence write $3.\dot{8}\dot{0}$ as a mixed number in its simplest form.

(a) Let x = 0.808080..., so 100x = 80.8080...

$100x - x = 80$, so $99x = 80$ and $x = \frac{80}{99}$

(b) $3.\dot{8}\dot{0} = 3 + \frac{80}{99} = 3\frac{80}{99}$

Answer: (b) $3\frac{80}{99}$

7 Expanding three brackets

Expand and simplify

$(x - 3)(x + 1)(x + 3)$

Expand the first two brackets: $(x - 3)(x + 1) = x^2 - 2x - 3$

Multiply by the third bracket: $(x^2 - 2x - 3)(x + 3)$

$= x^3 - 2x^2 - 3x + 3x^2 - 6x - 9$

$= x^3 + x^2 - 9x - 9$

Answer: $x^3 + x^2 - 9x - 9$

8 Converting area and volume units

Change 2.25 m^2 to cm^2.

1 m = 100 cm, so 1 m^2 = 100 × 100 = 10 000 cm^2

2.25 × 10 000 = 22500

Answer: 22500 cm^2

9 Cumulative frequency graphs

The cumulative frequency graph shows the times taken by 40 people to finish a puzzle.

Use the graph to find an estimate for

(a) the median,

(b) the number of people with a time greater than 40 minutes.

(a) Median at cumulative frequency 40 ÷ 2 = 20

Read across from 20 to the graph, then down to the axis

Median = 23 minutes

(b) At 40 minutes the cumulative frequency is 32

40 − 32 = 8

Answer: (a) 23 minutes (b) 8

10 Pythagoras in three dimensions

The diagram shows a cuboid.

Work out the length of the diagonal AG.

The diagram is not drawn accurately.

$AG^2 = 8^2 + 4^2 + 8^2$

$= 64 + 16 + 64 = 144$

$AG = \sqrt{144} = 12$

Answer: 12 cm