Day 72 **A Tier 10-a-day: Model Solutions**

1 Recurring decimals, show that

(a) Show that $0.\dot{4}\dot{0} = \frac{40}{99}$

(b) Hence write $2.\dot{4}\dot{0}$ as a mixed number in its simplest form.

(a) Let x = 0.404040..., so 100x = 40.4040...

$100x - x = 40$, so $99x = 40$ and $x = \frac{40}{99}$

(b) $2.\dot{4}\dot{0} = 2 + \frac{40}{99} = 2\frac{40}{99}$

Answer: (b) $2\frac{40}{99}$

2 Factorising quadratics

Factorise $x^2 - 14x + 48$

Find two numbers that multiply to 48 and add to −14
The numbers are −6 and −8
(x − 6)(x − 8)
Answer: (x − 6)(x − 8)

3 Median and interquartile range

Here are the ages, in years, of 11 people.
54 14 27 25 78 74 41 7 20 6 45
(a) Work out the median.
(b) Work out the interquartile range.

Put in order: 6, 7, 14, 20, 25, 27, 41, 45, 54, 74, 78
(a) The middle value is number 6, so the median is 27
(b) Lower half: 6, 7, 14, 20, 25, so LQ = 14
Upper half: 41, 45, 54, 74, 78, so UQ = 54
IQR = 54 − 14 = 40
Answer: (a) 27 (b) 40

4 Area of a sector

The diagram shows a sector of a circle of radius 15 cm.
Work out the area of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Area = $\frac{200}{360} \times \pi \times 15^2$

$= \frac{5}{9} \times 225\,\pi$

$= 125\pi$

Answer: 125π cm^2

5 Reverse percentages

The price of a monthly gym fee increases by 12%.
The new price is £896.
Work out the price before the increase.

112% represents £896
1% = £896 ÷ 112 = £8
100% = £8 × 100 = £800.00
Answer: £800.00

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6 Isosceles triangles and exterior angles

ABC is an isosceles triangle with AB = AC.
BCD is a straight line.
Angle BAC = 106°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle ABC = (180 − 106) ÷ 2 = 37°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 106 + 37 = 143
Answer: x = 143°

7 Error intervals

y = 0.6 is rounded to 1 significant figure.
Write down the error interval for y.

The rounding unit is 0.1, so the value could be up to half of this, 0.05, either side.
Lower bound = 0.6 − 0.05 = 0.55, upper bound = 0.6 + 0.05 = 0.65
Answer: $0.55 \leq y < 0.65$

8 Forming quadratic equations

A rectangle has width x cm and length (x + 1) cm.
The area of the rectangle is 30 cm^2.
(a) Show that $x^2 + 1x - 30 = 0$
(b) Work out the value of x.

(a) Area = length × width, so $x(x + 1) = 30$
$x^2 + 1x = 30$
$x^2 + 1x - 30 = 0$
(b) Factorise: $(x - 5)(x + 6) = 0$
$x = 5$ or $x = -6$
A length cannot be negative, so $x = 5$
Answer: (a) Shown (b) x = 5

9 Rearranging formulae (powers and roots)

Make x the subject of $y = 4x^2 + 4$

Subtract 4 from both sides: $y - 4 = 4x^2$
Divide by 4: $x^2 = \frac{y - 4}{4}$
Square root both sides (positive and negative roots)
Answer: $x = \pm\sqrt{\frac{y - 4}{4}}$

10 Surface area of a prism

The diagram shows a triangular prism.
The cross-section is a right-angled triangle.
Work out the total surface area of the prism.
The diagram is not drawn accurately.

Hypotenuse = $\sqrt{8^2 + 6^2}$ = 10 cm
Two triangular ends: $2 \times \frac{1}{2} \times 8 \times 6 = 48$
Three rectangles: (8 + 6 + 10) × 11 = 264
Total = 48 + 264 = 312
Answer: 312 cm^2