Day 190 **A Tier 10-a-day: Model Solutions**

1 Best buys

A shop sells cereal in 3 different sizes.
Small bag: 200 g for 60p
Medium bag: 500 g for £1.85
Large bag: 1000 g for £3.40
Which bag is the best value for money? You must show your working.

Small bag: 60p ÷ 2 = 30p per 100 g
Medium bag: 185p ÷ 5 = 37p per 100 g
Large bag: 340p ÷ 10 = 34p per 100 g
The small bag has the lowest price per 100 g, so it is the best value
Answer: The small bag

2 Isosceles triangles and exterior angles

PQR is an isosceles triangle with PQ = PR.
QRS is a straight line.
Angle QPR = 110°.
Work out the size of angle x.
The diagram is not drawn accurately.

Base angles of an isosceles triangle are equal
Angle PQR = (180 − 110) ÷ 2 = 35°
Exterior angle of a triangle = sum of the two opposite interior angles
x = 110 + 35 = 145
Answer: x = 145°

3 Converting units

(a) Change 8 km^2 to m^2.
(b) Change 4.5 m^2 to mm^2.

(a) 8 km^2 × 1,000,000 = 8,000,000 m^2
(b) 4.5 m^2 × 1,000,000 = 4,500,000 mm^2
Answer: (a) 8,000,000 m^2 (b) 4,500,000 mm^2

4 Stem and leaf diagrams

The stem and leaf diagram shows the ages of 11 people.
Key: 3 | 0 represents 30 years
(a) Work out the median age.
(b) Work out the interquartile range.

(a) 11 values, so the median is the 6th value
Counting along the leaves gives 50
(b) LQ is the middle of the lower 5 values = 37
UQ is the middle of the upper 5 values = 59
IQR = 59 − 37 = 22
Answer: (a) 50 years (b) 22 years

5 Profit and loss

Nadia buys a phone for £200 and sells it making a profit of 12%.
Work out the selling price.

Selling price = 112% of the cost price
£200 × 1.12 = £224
Answer: £224

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6 Stratified sampling

A club has 80 members in junior, 90 in intermediate and 110 in senior.
A stratified sample of 28 members is to be taken.
Work out how many members should be chosen from intermediate.

Total = 80 + 90 + 110 = 280

Number from intermediate = $\frac{90}{280} \times 28$

= 9

Answer: 9

7 Arc length and perimeter of a sector

The diagram shows a sector of a circle of radius 8 cm.
Work out the perimeter of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Arc length = $\frac{90}{360} \times 2 \times \pi \times 8 = 4\pi$

Perimeter = arc + two radii
= $4\pi + 16$
Answer: $4\pi + 16$ cm

8 Composite functions

f(x) = 4x + 7
g(x) = $x^2 + 3$
Solve fg(x) = 35

$fg(x) = 4(x^2 + 3) + 7 = 4x^2 + 19$
$4x^2 + 19 = 35$, so $4x^2 = 16$
$x^2 = 4$, so $x = \pm 2$
Answer: x = 2 or x = −2

9 Algebraic rearrangement and change of sign

(a) Show that the equation $x^3 + 3x - 39 = 0$ can be rearranged to give $x = \frac{39 - x^3}{3}$

(b) Show that the equation has a solution between x = 3 and x = 4

(a) Add 39 and subtract 3x from both sides: $3x = 39 - x^3$

Divide both sides by 3: $x = \frac{39 - x^3}{3}$

(b) Let $f(x) = x^3 + 3x - 39$
f(3) = −3
f(4) = 37
There is a change of sign (negative to positive) and f is continuous, so there is a solution between x = 3 and x = 4
Answer: Shown: f(3) = −3, f(4) = 37 (change of sign)

10 Pythagoras in three dimensions

The diagram shows a cuboid.
Work out the length of the diagonal AG.
The diagram is not drawn accurately.

$AG^2 = 4^2 + 8^2 + 8^2$
= 16 + 64 + 64 = 144
AG = $\sqrt{144}$ = 12
Answer: 12 cm