Day 69 **A Tier 10-a-day: Model Solutions**

1 Best buys

A shop sells rice in 3 different sizes.
Small bag: 200 g for £1.00
Medium bag: 250 g for £1.05
Large bag: 400 g for £1.65
Which bag is the best value for money? You must show your working.

Small bag: 100p ÷ 2 = 50p per 100 g
Medium bag: 105p ÷ 2.5 = 42p per 100 g
Large bag: 165p ÷ 4 = 41.25p per 100 g
The large bag has the lowest price per 100 g, so it is the best value
Answer: The large bag

2 Circle theorems: angle in a semicircle

XY is a diameter of the circle.
Angle YXZ = 58°.
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 − 58 = 32
Answer: x = 32°

3 Mixed number multiplication and division

Work out $5\frac{1}{3} \times 1\frac{3}{8}$
Give your answer as a mixed number in its simplest form.

Improper fractions: $\frac{16}{3}$ and $\frac{11}{8}$

Multiply: $\frac{16}{3} \times \frac{11}{8} = \frac{176}{24}$

Simplify: $7\frac{1}{3}$

Answer: $\mathbf{7\frac{1}{3}}$

4 Loci and constructions

Angle XYC is drawn on a piece of paper.
A point P moves so that it is always the same distance from line YX and line YC.
Describe the locus of P.

Points the same distance from two intersecting lines lie on the angle bisector
The line through Y that cuts angle XYC in half
Answer: The bisector of angle XYC

5 Tree diagrams

The tree diagram shows probabilities for two events.
(a) Work out the values of p and q.
(b) Work out the probability that Omar walks to work.

(a) Probabilities on pairs of branches add up to 1.
p = 1 − 0.1 = 0.9 and q = 1 − 0.3 = 0.7
(b) P(walks) = 0.3 × 0.1 + 0.7 × 0.9
= 0.03 + 0.63 = 0.66
Answer: (a) p = 0.9, q = 0.7 (b) 0.66

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6 Area of a trapezium

The diagram shows a trapezium.
Work out the area of the trapezium.
The diagram is not drawn accurately.

Area = $\frac{1}{2} \times (5 + 16) \times 8$

$= \frac{1}{2} \times 21 \times 8$

$= 84$

Answer: 84 cm^2

7 Rationalising the denominator

Rationalise the denominator of $\frac{8}{\sqrt{7}}$

Give your answer in its simplest form.

Multiply top and bottom by $\sqrt{7}$: $\frac{8}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{8\sqrt{7}}{7}$

$= \frac{8\sqrt{7}}{7}$

Answer: $\frac{8\sqrt{7}}{7}$

8 Functions

f(x) = $-3x - 2$
g(x) = $x^2 + 8$
(a) Find f(2)
(b) Find fg(x). Give your answer in its simplest form.

(a) f(2) = $-3 \times 2 - 2 = -8$

(b) fg(x) means f(g(x)), so replace x in f with $x^2 + 8$

fg(x) = $-3(x^2 + 8) - 2$

$= -3x^2 - 26$

Answer: (a) -8 (b) $-3x^2 - 26$

9 Stratified sampling

A club has 50 members in junior, 40 in intermediate and 80 in senior.
A stratified sample of 17 members is to be taken.
Work out how many members should be chosen from intermediate.

Total = 50 + 40 + 80 = 170

Number from intermediate = $\frac{40}{170} \times 17$

= 4

Answer: 4

10 Rearranging formulae (subject twice)

Make x the subject of $y = \frac{2x - 5}{3x + 4}$

Multiply both sides by (3x + 4): $y(3x + 4) = 2x - 5$
Expand the bracket: $3xy + 4y = 2x - 5$
Collect the x terms on one side: $3xy - 2x = -4y - 5$
Factorise: $x(3y - 2) = -4y - 5$
Divide by $(3y - 2)$: $x = \frac{-4y - 5}{3y - 2}$

Answer: $x = \frac{-4y - 5}{3y - 2}$