Day 326 **A Tier 10-a-day: Model Solutions**

1 Circle theorems: angle in a semicircle

AB is a diameter of the circle.
Angle BAC = 48°.
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 ACB = 90°
Angles in a triangle add up to 180°
x = 180 − 90 − 48 = 42
Answer: x = 42°

2 Rounding

(a) Write 0.0054791 correct to 2 significant figures.
(b) Write 3.363 correct to 1 decimal place.

(a) Count 2 significant figures and look at the next digit: 0.0054791 rounds to 0.0055
(b) Look at the digit after decimal place 1: 3.363 rounds to 3.4
Answer: (a) 0.0055 (b) 3.4

3 Similar shapes: finding a length

The two triangles are similar.
Work out the value of x.
The diagrams are not drawn accurately.

Scale factor from the large triangle to the small triangle = 18 ÷ 24 = $\frac{3}{4}$

x = 32 × $\frac{3}{4}$ = 24

Answer: x = 24 cm

4 Estimation

By rounding each number to 1 significant figure, estimate the value of
$\frac{9.6 \times 98}{0.48}$

Round each number to 1 significant figure: 10, 100, 0.5
$\frac{10 \times 100}{0.5}$ = 2000
Answer: 2000

5 Average speed

A cyclist travels for 2 hours at 55 km/h,
then for 30 minutes at 40 km/h.
Work out the average speed for the whole journey.

Distance 1 = 55 × 2 = 110 km
Distance 2 = 40 × 0.5 = 20 km
Total distance = 130 km and total time = 2.5 hours
Average speed = 130 ÷ 2.5 = 52 km/h
Answer: 52 km/h

6 Rearranging formulae (powers and roots)

Make x the subject of $y = 2x^2 + 6$

Subtract 6 from both sides: $y - 6 = 2x^2$

Divide by 2: $x^2 = \frac{y - 6}{2}$

Square root both sides (positive and negative roots)

Answer: x = $\pm\sqrt{\frac{y - 6}{2}}$

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7 Similar triangles with parallel lines

In triangle ABC, DE is parallel to BC.
D is on AB and E is on AC.
Work out the value of x.
The diagram is not drawn accurately.

Triangles ADE and ABC are similar (DE is parallel to BC)

AE ÷ AC = AD ÷ AB, so AC = $10 \times \frac{7}{2} = 35$

x = EC = 35 − 10 = 25

Answer: x = 25

8 Transformations of graphs

The graph of y = f(x) has a maximum point at (4, −4).
Write down the coordinates of the turning point of the graph of
(a) y = −f(x)
(b) y = f(x + 1)

(a) The graph is reflected in the x-axis, so the y-coordinate changes sign
The maximum point becomes a minimum point at (4, 4)
(b) Replacing x by (x + 1) moves the graph 1 unit left
The maximum point is (3, −4)
Answer: (a) (4, 4) (b) (3, −4)

9 Equations with algebraic fractions

Solve $\frac{4}{(x+3)} + \frac{3}{(x+1)} = 1$

Multiply every term by (x + 3)(x + 1)
4(x + 1) + 3(x + 3) = (x + 3)(x + 1)
$7x + 13 = x^2 + 4x + 3$
$x^2 - 3x - 10 = 0$
(x + 2)(x − 5) = 0
x = −2 or x = 5
Answer: x = −2 or x = 5

10 Probability with three selections

A bag contains 5 black pens and 3 blue pens.
Three pens are taken at random without replacement.
Work out the probability that all three pens are black.

P(all black) = $\frac{5}{8} \times \frac{4}{7} \times \frac{3}{6}$

= $\frac{60}{336} = \frac{5}{28}$

Answer: $\frac{5}{28}$