Day 210 **A Tier 10-a-day: Model Solutions**

1 Mixed number multiplication and division

Work out $2\frac{1}{2} \times 4\frac{4}{7}$

Give your answer as a mixed number in its simplest form.

Improper fractions: $\frac{5}{2}$ and $\frac{32}{7}$

Multiply: $\frac{5}{2} \times \frac{32}{7} = \frac{160}{14}$

Simplify: $11\frac{3}{7}$

Answer: $11\frac{3}{7}$

2 Median from a frequency table

Here are the results for 25 households.
(a) Find the median.
(b) Work out the range.

(a) The median is the 13th value $(25 + 1) \div 2 = 13$
Cumulative frequencies: 7, 15, 19, 24, 25
The 13th value is 1
(b) Range $= 4 - 0 = 4$
Answer: (a) 1 (b) 4

3 Factorising quadratics

Factorise $x^2 + x - 6$

Find two numbers that multiply to -6 and add to 1
The numbers are -2 and 3
$(x - 2)(x + 3)$
Answer: $(x - 2)(x + 3)$

4 Exact trigonometric values

Without using a calculator, work out the exact value of
$5 \sin 30° - 6 \cos 30°$
Give your answer in its simplest form.

$\sin 30° = \frac{1}{2}$ and $\cos 30° = \frac{\sqrt{3}}{2}$

$5 \times \frac{1}{2} - 6 \times \frac{\sqrt{3}}{2} = \frac{5 - 6\sqrt{3}}{2}$

Answer: $\frac{5 - 6\sqrt{3}}{2}$

5 Expanding and simplifying

Expand and simplify
$(x - 3)^2 - (x - 6)(x + 2)$

$(x - 3)^2 = x^2 - 6x + 9$
$(x - 6)(x + 2) = x^2 - 4x - 12$
Subtract (take care with the signs): $(x^2 - 6x + 9) - (x^2 - 4x - 12)$
$= -2x + 21$
Answer: $-2x + 21$

6 Describing transformations

Describe fully the single transformation that maps shape A onto shape B.

The shape has been turned, so this is a rotation
Compare the matching vertices to find the angle and direction: a quarter turn anticlockwise
The centre is the point that stays fixed: $(2, -2)$
Answer: Rotation, 90° anticlockwise, centre $(2, -2)$

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7 Venn diagram probability

The Venn diagram shows information about 27 people.
One person is chosen at random.
(a) Find the probability that the person is in both Tea and Coffee.
(b) Find the probability that the person is in Tea or Coffee or both.

(a) Both: 5 out of 27 = $\frac{5}{27}$

(b) 10 + 5 + 4 = 19, so 19 out of 27 = $\frac{19}{27}$

Answer: (a) $\frac{5}{27}$ (b) $\frac{19}{27}$

8 Recurring decimals (mixed)

Write $0.4\dot{8}$ as a fraction in its simplest form.

Let x = 0.488...
Multiply by 10: 10x = 4.88...
Multiply by 100: 100x = 48.88...
Subtract: 90x = 48 − 4 = 44
x = $\frac{44}{90} = \frac{22}{45}$

Answer: $\frac{22}{45}$

9 Volume of composite solids

A solid is made from a cylinder of radius 3 cm and a hemisphere on top, with the same radius.
The total volume of the solid is 81π cm^3.
Work out the height of the cylinder.

Hemisphere = $\frac{2}{3} \times \pi \times 3^3 = 18\pi$

Cylinder volume = $81\pi - 18\pi = 63\pi$

$\pi \times 3^2 \times h = 63\pi$

h = 63 ÷ 9 = 7

Answer: 7 cm

10 Quadratic inequalities

Solve $x^2 \geq 100$

$x^2 = 100$ at x = ±10

The curve $y = x^2$ is above 100 outside the roots

$x \leq -10$ or $x \geq 10$

Answer: $x \leq -10$ or $x \geq 10$