Day 337 **A Tier 10-a-day: Model Solutions**

1 Ordering numbers

Write these numbers in order of size, starting with the smallest.

49% 0.69 $\frac{8}{10}$ $\frac{19}{20}$

Change each to a decimal: 49% = 0.49, 0.69 = 0.69, $\frac{8}{10}$ = 0.8, $\frac{19}{20}$ = 0.95

Order the decimals: 0.49 < 0.69 < 0.8 < 0.95

Answer: 49%, 0.69, $\frac{8}{10}$, $\frac{19}{20}$

2 Distance-time graphs

The graph shows the distance travelled by a van driver.

(a) For how many minutes did the van driver stop?

(b) Work out the speed during the final part of the journey. Give your answer in km/h.

(a) The graph is horizontal from 30 to 50 minutes, so the stop is 50 − 30 = 20 minutes

(b) Final part: distance 5 km in 10 minutes

Speed = distance ÷ time = 5 ÷ $\frac{10}{60}$ = 30 km/h

Answer: (a) 20 minutes (b) 30 km/h

3 Mixed number multiplication and division

Work out $5\frac{1}{2} \times 4\frac{4}{5}$

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

Improper fractions: $\frac{11}{2}$ and $\frac{24}{5}$

Multiply: $\frac{11}{2} \times \frac{24}{5} = \frac{264}{10}$

Simplify: $26\frac{2}{5}$

Answer: $26\frac{2}{5}$

4 Pie charts

The pie chart shows how some students travel to school.

7 students chose walk.

(a) Work out the angle for cycle.

(b) How many students chose cycle?

(a) 360 − 56 − 40 − 160 = 104°

(b) 7 students is 56°, so 1 student is 56 ÷ 7 = 8°

Cycle: 104 ÷ 8 = 13

Answer: (a) 104° (b) 13

5 Factorising

Factorise $4x^2 - 15x - 25$

Multiply 4 × −25 = −100. Find two numbers that multiply to −100 and add to −15: −20 and 5

$4x^2 - 15x - 25 = 4x^2 - 20x + 5x - 25$

Factorise in pairs to get (4x + 5)(x − 5)

Answer: (4x + 5)(x − 5)

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 clockwise

The centre is the point that stays fixed: (−2, −1)

Answer: Rotation, 90° clockwise, centre (−2, −1)

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7 Transformations of graphs

The graph of y = f(x) has a minimum point at (−1, −3).
Write down the coordinates of the turning point of the graph of
(a) y = f(x) − 4
(b) y = −f(x)

(a) Subtracting 4 from f(x) moves the graph 4 units down
The minimum point is (−1, −7)
(b) The graph is reflected in the x-axis, so the y-coordinate changes sign
The minimum point becomes a maximum point at (−1, 3)
Answer: (a) (−1, −7) (b) (−1, 3)

8 Square and cube numbers

n is the smallest positive integer such that 45 × n is a square number.
Find the value of n.

Write 45 as a product of prime factors: $45 = 3^2 \times 5$
For a square number every prime must have a power that is a multiple of 2.
Extra primes needed: 5 (needs 1 more)
n = 5
Answer: n = 5

9 Loci: area of a region

A horse is tied by a rope of length 10 m to a point on a long straight wall.
The horse can graze on any grass on one side of the wall.
Work out the area it can graze. Give your answer in terms of π.
The diagram is not drawn accurately.

The rope can sweep a semicircle (180°)

Area = $\frac{1}{2} \times \pi \times 10^2$

$= 50\pi$

Answer: 50π m^2

10 Capture-recapture

A scientist wants to estimate the number of fish in a lake.
She catches 60 fish, marks each one and returns them.
Later she catches a second sample of 40 fish. 6 of these are tagged.
Work out an estimate for the total number of fish in a lake.

Proportion tagged in the second sample = $\frac{6}{40}$

This is the same as the proportion in the whole population: $\frac{60}{N}$

$\frac{60}{N} = \frac{6}{40}$, so N = 60 × 40 ÷ 6 = 400

Answer: 400