Day 26 **B Tier 10-a-day: Model Solutions**

1 Forming expressions

Priya is n years old.
Priya's sister is 3 years older.
Priya's father is 4 times as old as Priya.
(a) Write an expression, in terms of n, for the age of Priya's sister.
(b) Write an expression, in terms of n, for the sum of the ages of all three people. Give your answer in its simplest form.

(a) Priya's sister is 3 years older: $n + 3$
(b) Priya's father is $4n$
Sum = $n + (n + 3) + 4n$
Collect like terms: $6n + 3$
Answer: (a) n + 3 (b) 6n + 3

2 Order of operations

Work out
(a) $10 + 4 \times 4^2$
(b) $(6 + 4) \times 8 - 12$

(a) Powers first: $4^2 = 16$
Then multiply: $4 \times 16 = 64$
Then add: $10 + 64 = 74$
(b) Brackets first: $6 + 4 = 10$
Multiply: $10 \times 8 = 80$
Subtract: $80 - 12 = 68$
Answer: (a) 74 (b) 68

3 Pie charts

In a pie chart showing the answers of 45 people, the angle for walk is 96°.
How many people chose walk?

96° out of 360° = $\frac{4}{15}$

$\frac{4}{15}$ of 45 = 12
Answer: 12

4 Arc length and sector area

The diagram shows a sector of a circle with radius 9 m and angle 40°.
Work out the area of the sector.
Give your answer in terms of π.
The diagram is not drawn accurately.

Sector area = $\frac{40}{360} \times \pi \times 9^2$

$= \frac{40}{360} \times 81\pi = 9\pi$

Answer: 9π m^2

5 Gradient of a line

Work out the gradient of the straight line that passes through the points (2, 5) and (8, 13).

Gradient = $\frac{\text{change in y}}{\text{change in x}}$
Change in y = $13 - 5 = 8$
Change in x = $8 - 2 = 6$
Gradient = $\frac{8}{6} = \frac{4}{3}$

Answer: $\frac{4}{3}$

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6 Ratio with a difference

Leo and Ella share some money in the ratio 8 : 1.
Leo gets £56 more than Ella.
How much money does Leo get?

Difference in parts: 8 − 1 = 7
7 parts = £56, so 1 part = £8
Leo gets 8 × £8 = £64
Answer: £64

7 LCM problems

Two buses leave a bus station at 09:30.
One bus leaves every 12 minutes.
The other bus leaves every 8 minutes.
At what time do both buses next leave together?

Multiples of 12: 12, 24
Multiples of 8: 8, 16, 24
The first common multiple is 24, so the LCM is 24 minutes
09:30 + 24 minutes = 09:54
Answer: 09:54

8 Trial and improvement

The equation $x^3 - x = 65$ has a solution between 4 and 5. (Calculator)
Use trial and improvement to find this solution.
Give your answer correct to 1 decimal place.

x = 4.5: $4.5^3 - 4.5 = 86.625$ (too big)
x = 4.2: $4.2^3 - 4.2 = 69.888$ (too big)
x = 4.1: $4.1^3 - 4.1 = 64.821$ (too small)
x = 4.15: value = 67.323 (too big), so the solution is below 4.15
So x = 4.1 to 1 decimal place
Answer: x = 4.1

9 Bearings with Pythagoras and trigonometry

A boat sails 7 m on a bearing of 000° from P to Q, then 5 m on a bearing of 090° to R. (Calculator)
(a) Work out the distance PR.
(b) Work out the bearing of R from P.
Give your answers correct to 1 decimal place.

(a) Triangle PQR has a right angle at Q
$PR^2 = 7^2 + 5^2 = 74$
$PR = \sqrt{74} = 8.602...$ m
(b) tan (angle QPR) = $\frac{5}{7}$, so angle QPR = 35.538° (to 3 d.p.)
PQ is on a bearing of 000° and R is 35.5° clockwise from PQ
Bearing = 0 + 35.538 = 35.5°
Answer: (a) 8.6 m (b) 035.5°

10 Similar shapes

The two triangles are similar.
(a) Write down the scale factor of the enlargement from the smaller triangle to the larger triangle.
(b) Work out the value of b.
The diagram is not drawn accurately.

(a) Scale factor = 40 ÷ 10 = 4
(b) b = 8 × 4 = 32
Answer: (a) 4 (b) b = 32 cm