Day 223 **A Tier 10-a-day: Model Solutions**

1 Area of parallelograms and kites

The area of this parallelogram is 180 cm^2.
Work out the value of h.
The diagram is not drawn accurately.

$18 \times h = 180$
$h = 180 \div 18 = 10$
Answer: h = 10

2 Finding a percentage change

The population of a village was 100 and is now 88.
Work out the percentage decrease.

Change = $100 - 88 = 12$
Percentage decrease = $\frac{12}{100} \times 100 = 12\%$
Answer: 12% decrease

3 Straight line graphs

A straight line has equation $6x - 2y = 18$
(a) Find the gradient of the line.
(b) Find the coordinates of the point where the line crosses the x-axis.

(a) Rearrange into y = mx + c: $-2y = -6x + 18$
$y = 3x - 9$
The gradient is 3
(b) On the x-axis, y = 0: $6x = 18$, so $x = 3$
Answer: (a) 3 (b) (3, 0)

4 Reverse fractions

Zara reads $\frac{7}{10}$ of a book and has now read 105 pages.
How many pages does the whole book have?

$\frac{7}{10}$ of the total = 105
$\frac{1}{10}$ of the total = $105 \div 7 = 15$
Whole = $15 \times 10 = 150$
Answer: 150

5 Direct proportion formulae

y is directly proportional to the square root of x.
When x = 9, y = 24.
(a) Find a formula for y in terms of x.
(b) Work out the positive value of x when y = 64.

(a) $y = k\sqrt{x}$. Substitute: $24 = k \times 3$, so $k = 8$
$y = 8\sqrt{x}$
(b) $64 = 8\sqrt{x}$, so $\sqrt{x} = 64 \div 8 = 8$, so $x = 8^2 = 64$
Answer: (a) $y = 8\sqrt{x}$ (b) x = 64

6 Circle theorems: angle at the centre

X, Y and Z are points on a circle with centre O.
Angle XOY = 80°.
Work out the size of angle x.
Give a reason for your answer.

The angle at the centre is twice the angle at the circumference
$x = 80 \div 2 = 40$
Answer: x = 40°

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7 Composite functions

f(x) = 4x + 3
g(x) = $x^2 - 2$
Solve gf(x) = 7

gf(x) = $(4x + 3)^2 - 2$
$(4x + 3)^2 - 2 = 7$, so $(4x + 3)^2 = 9$
$4x + 3 = \pm 3$
$4x + 3 = 3$ or $4x + 3 = -3$
$x = 0$ or $x = -\frac{3}{2}$

Answer: $x = 0$ or $x = -\frac{3}{2}$

8 Reading a histogram

The histogram shows information about the time of some items.
(a) Work out the number of items with a time in the class 0 to 10 minutes.
(b) Work out an estimate for the number with a time greater than 25 minutes.

(a) Frequency = frequency density × class width
1 × 10 = 10
(b) 25 to 40: 1.8 × 15 = 27
Class 40 to 70: 1.4 × 30 = 42
Class 70 to 90: 0.6 × 20 = 12
Total = 27 + 42 + 12 = 81
Answer: (a) 10 (b) 81

9 Equations with algebraic fractions

Solve $\frac{6}{(x + 5)} + \frac{4}{(x + 1)} = 1$

Multiply every term by $(x + 5)(x + 1)$
$6(x + 1) + 4(x + 5) = (x + 5)(x + 1)$
$10x + 26 = x^2 + 6x + 5$
$x^2 - 4x - 21 = 0$
$(x + 3)(x - 7) = 0$
$x = -3$ or $x = 7$
Answer: $x = -3$ or $x = 7$

10 Average speed

A coach travels for 1 hour 30 minutes at 35 km/h,
then for 1 hour at 65 km/h.
Work out the average speed for the whole journey.

Distance 1 = 35 × 1.5 = 52.5 km
Distance 2 = 65 × 1 = 65 km
Total distance = 117.5 km and total time = 2.5 hours
Average speed = 117.5 ÷ 2.5 = 47 km/h
Answer: 47 km/h