Day 277 **A Tier 10-a-day: Model Solutions**

1 Area of parallelograms and kites

The area of this parallelogram is 51 cm^2.
Work out the value of h.
The diagram is not drawn accurately.

17 × h = 51
h = 51 ÷ 17 = 3
Answer: h = 3

2 Converting speeds

A car travels at 90 km/h.
Work out this speed in metres per second.

1 km = 1000 m and 1 hour = 3600 seconds
90 km/h = 90 × 1000 ÷ 3600 m/s
= 90 ÷ 3.6 = 25
Answer: 25 m/s

3 Volume of a cylinder

A cylinder has radius 4 cm. It contains water to a depth of 18 cm. (Calculator)
All the water is poured into an empty tank with a rectangular base 15 cm by 16 cm.
Work out the depth of the water in the tank. Give your answer to 3 significant figures.

Volume of water = $\pi \times 4^2 \times 18 = 288\pi$ cm^3
Depth = volume ÷ base area = 288π ÷ (15 × 16)
= 3.77
Answer: 3.77 cm

4 Calculator and significant figures

Work out $2 \times (1 + 3.8 \div 100)^3$ (Calculator)
Give your answer correct to 3 significant figures.

1 + 3.8 ÷ 100 = 1.038
= 2.23677...
= 2.24 to 3 significant figures
Answer: 2.24

5 Congruent triangles

Triangle ABC: angle B = 90°, AC = 11 cm, AB = 9 cm.
Triangle XYZ: angle Z = 90°, XY = 11 cm, XZ = 9 cm.
Are the two triangles congruent?
Give a reason for your answer.

Both triangles have a right angle
AC and XY are the hypotenuses: both 11 cm
AB = XZ = 9 cm
Right angle, hypotenuse and one other side are equal, so the triangles are congruent (RHS)
Answer: Yes, congruent (RHS)

6 Two-way tables

The table shows information about 64 people.
One person is chosen at random.
(a) Find the probability that the person is in Year 11 and walks to school.
(b) The person travels by bus. Find the probability that they are in Year 10.

(a) Year 11 who walks to school: 6 out of 64 = $\frac{3}{32}$

(b) Bus total = 45, of whom 26 are in the Year 10 row: $\frac{26}{45}$

Answer: (a) $\frac{3}{32}$ (b) $\frac{26}{45}$

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7 Expanding three brackets

Expand and simplify
$(x + 1)(x - 2)(x + 4)$

Expand the first two brackets: $(x + 1)(x - 2) = x^2 - x - 2$
Multiply by the third bracket: $(x^2 - x - 2)(x + 4)$
$= x^3 - x^2 - 2x + 4x^2 - 4x - 8$
$= x^3 + 3x^2 - 6x - 8$
Answer: $x^3 + 3x^2 - 6x - 8$

8 Recurring decimals (mixed)

Write $0.3\dot{8}$ as a fraction in its simplest form.

Let $x = 0.388...$
Multiply by 10: $10x = 3.88...$
Multiply by 100: $100x = 38.88...$
Subtract: $90x = 38 - 3 = 35$
$x = \frac{35}{90} = \frac{7}{18}$
Answer: $\frac{7}{18}$

9 Changing a ratio

A bag contains red counters and blue counters in the ratio 2 : 1.
12 more red counters are added to the bag.
The ratio of red counters to blue counters is now 5 : 1.
How many counters were in the bag at the start?

Let red = 2x and blue = 1x. After adding: $(2x + 12) : 1x = 5 : 1$
$\frac{2x + 12}{1x} = \frac{5}{1}$, so $1(2x + 12) = 5 \times 1x$
$2x + 12 = 5x$, so $3x = 12$, $x = 4$
Start: $2x + 1x = 3 \times 4 = 12$ counters
Answer: 12

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$y = x^2 + 4x - 1$
$y = 4x$

Set the y values equal: $x^2 + 4x - 1 = 4x$
$x^2 - 1 = 0$
$(x + 1)(x - 1) = 0$
$x = -1$ or $x = 1$
Substitute into $y = 4x$: $y = -4$ and $y = 4$
Answer: $x = -1$, $y = -4$ and $x = 1$, $y = 4$