Day 362 **A Tier 10-a-day: Model Solutions**

1 Time

(a) A train leaves London at 1015. The journey takes 3 hours 13 minutes. Work out the time it ends.
(b) Change 2.2 hours into hours and minutes.

(a) 1015 + 3 hours = 1315, then + 13 minutes = 1328
(b) 0.2 hours = 0.2 × 60 = 12 minutes, so 2.2 hours = 2 hours 12 minutes
Answer: (a) 1328 (b) 2 hours 12 minutes

2 Area of parallelograms and kites

The diagram shows a parallelogram.
Work out its area.
The diagram is not drawn accurately.

Area = base × perpendicular height
= 19 × 8 = 152
(the slanted side, 12 cm, is not used)
Answer: 152 cm^2

3 Probability with three selections

A bag contains 7 black pens and 2 blue pens.
Three pens are taken at random without replacement.
Work out the probability that exactly one of the three pens is blue.

One order, for example blue, black, black: $\frac{2}{9} \times \frac{7}{8} \times \frac{6}{7} = \frac{1}{6}$
There are 3 possible orders, each with the same probability
$3 \times \frac{1}{6} = \frac{1}{2}$
Answer: $\frac{1}{2}$

4 Converting units

(a) Change 8 cm^2 to mm^2.
(b) Change 3,500,000 cm^3 to m^3.

(a) 8 cm^2 × 100 = 800 mm^2
(b) 3,500,000 cm^3 ÷ 1 000 000 = 3.5 m^3
Answer: (a) 800 mm^2 (b) 3.5 m^3

5 Volume of a prism

The diagram shows a prism.
The cross-section of the prism is a right-angled triangle.
Work out the volume of the prism.
The diagram is not drawn accurately.

Area of cross-section = $\frac{1}{2} \times 4 \times 5 = 10$
Volume = area of cross-section × length
= 10 × 6
= 60
Answer: 60 cm^3

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6 Quadratic graphs

The curve C has equation $y = x^2 - 4x + 3$
(a) Find the coordinates of the points where C crosses the x-axis.
(b) Find the coordinates of the turning point of C.

(a) Set $y = 0$: $x^2 - 4x + 3 = 0$
$(x - 1)(x - 3) = 0$
$x = 1$ or $x = 3$, so the graph crosses the x-axis at (1, 0) and (3, 0)
(b) The turning point is halfway between the roots: $x = (1 + 3) \div 2 = 2$
$y = -1$, so the minimum point is $(2, -1)$
Answer: (a) (1, 0) and (3, 0) (b) (2, −1)

7 Changing a ratio

A bag contains red counters and blue counters in the ratio 5 : 6.
11 more red counters are added to the bag.
The ratio of red counters to blue counters is now 6 : 5.
How many counters were in the bag at the start?

Let red = 5x and blue = 6x. After adding: $(5x + 11) : 6x = 6 : 5$
$\frac{5x + 11}{6x} = \frac{6}{5}$, so $5(5x + 11) = 6 \times 6x$
$25x + 55 = 36x$, so $11x = 55$, $x = 5$
Start: $5x + 6x = 11 \times 5 = 55$ counters
Answer: 55

8 Reverse compound change

The value of a car falls by 2% each year. (Calculator)
After 2 years it is worth £33,614.
Work out its value at the start.

Yearly multiplier = 0.98
Overall multiplier = $0.98^2 = 0.9604$
Original value = £33,614 ÷ 0.9604 = £35,000
Answer: £35,000

9 Finding an interest rate

Leah invests £8000 in a savings account. (Calculator)
The account pays compound interest at a fixed rate each year.
After 2 years there is £8988.80 in the account.
Work out the annual rate of interest.

Let the yearly multiplier be m. Then $8000 \times m^2 = 8988.8$
$m^2 = 8988.8 \div 8000 = 1.1236$
$m = \sqrt{1.1236} = 1.06$
Rate = $(1.06 - 1) \times 100 = 6\%$
Answer: 6%

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$y = x^2 - 3x + 4$
$y = -2x + 6$

Set the y values equal: $x^2 - 3x + 4 = -2x + 6$
$x^2 - x - 2 = 0$
$(x + 1)(x - 2) = 0$
$x = -1$ or $x = 2$
Substitute into $y = -2x + 6$: $y = 8$ and $y = 2$
Answer: x = −1, y = 8 and x = 2, y = 2