Day 142 **A Tier 10-a-day: Model Solutions**

1 Substitution

$E = \frac{1}{2}mv^2$

Work out the value of E when m = 2 and v = −7

$E = \frac{1}{2} \times 2 \times (-7)^2$

$= 1 \times 49$

$= 49$

Answer: 49

2 Circle theorems: isosceles triangles with radii

A, B and C are points on a circle with centre O.
Angle OAB = 31°.
(a) Work out angle AOB.
(b) Work out the size of angle x.
Give reasons for your answers.

(a) OA = OB (radii), so triangle OAB is isosceles and angle OBA = 31°
Angle AOB = 180 − 31 − 31 = 118°
(b) The angle at the centre is twice the angle at the circumference
x = 118 ÷ 2 = 59
Answer: (a) 118° (b) x = 59°

3 Inequalities

Solve $-5x + 8 > -x - 4$

Collect the x terms on the left: $-4x + 8 > -4$
Subtract 8: $-4x > -12$
Divide by −4. Dividing by a negative number reverses the inequality sign
$x < 3$
Answer: x < 3

4 Profit and loss

Nadia sells a games console for £250 and makes a profit of 25%.
Work out how much Nadia paid for the games console.

Selling price = 125% of the cost price
125% = £250, so 1% = £2
100% = £200
Answer: £200

5 Probability without replacement

A bag contains 6 red, 2 blue and 2 green counters.
Two counters are taken at random without replacement.
Work out the probability that the two counters are the same colour.

P(red, red) = $\frac{6}{10} \times \frac{5}{9} = \frac{30}{90}$

P(blue, blue) = $\frac{2}{10} \times \frac{1}{9} = \frac{2}{90}$

P(green, green) = $\frac{2}{10} \times \frac{1}{9} = \frac{2}{90}$

Add: $\frac{30}{90} + \frac{2}{90} + \frac{2}{90} = \frac{17}{45}$

Answer: $\frac{17}{45}$

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6 Volume of a prism

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

Area of cross-section = $\frac{1}{2} \times (6 + 8) \times 3 = 21$

Volume = area of cross-section × length
= 21 × 14
= 294

Answer: 294 cm^3

7 Standard form in context

The population of Region P is 3×10^8.
The population of Region Q is 1.5×10^8.
How many times bigger is the population of Region P than the population of Region Q?

Divide: $(3 \times 10^8) \div (1.5 \times 10^8)$
$= 3 \div 1.5 \times 10^0 = 2$

Answer: 2 times

8 Combined means

The mean of 10 numbers is 59.
Another number is added. The mean of the 11 numbers is now 56.
Work out the number that was added.

Total of the first 10 numbers = 10 × 59 = 590
Total of the 11 numbers = 11 × 56 = 616
Number added = 616 − 590 = 26

Answer: 26

9 Standard form notation

(a) Write 0.00011 in standard form.
(b) Write 5.07×10^3 as an ordinary number.

(a) Move the decimal point 4 places to get 1.1: 1.1×10^{-4}
(b) Move the decimal point 3 places to the right: 5,070

Answer: (a) 1.1×10^{-4} (b) 5,070

10 Distance-time graphs

The graph shows the distance travelled by a runner.
(a) For how many minutes did the runner stop?
(b) Work out the speed during the first part of the journey. Give your answer in km/h.

(a) The graph is horizontal from 40 to 70 minutes, so the stop is 70 − 40 = 30 minutes
(b) First part: distance 8 km in 40 minutes

Speed = distance ÷ time = $8 \div \frac{40}{60}$ = 12 km/h

Answer: (a) 30 minutes (b) 12 km/h