Day 312 **A Tier 10-a-day: Model Solutions**

1 Algebraic formulae in context

A gym charges a joining fee of £20 and then £20 each month.
(a) Write a formula for the total cost, £C, after n months.
(b) Omar pays £320 in total. Work out the number of months.

(a) C = 20 + 20n
(b) 20 + 20n = 320
20n = 300
n = 15
Answer: (a) C = 20 + 20n (b) 15

2 Exchange rates

£1 = €1.12.
(a) Change £80 to euros.
(b) Change €201.6 to pounds.

(a) 80 × 1.12 = 89.6
(b) 201.6 ÷ 1.12 = 180
Answer: (a) €89.6 (b) £180

3 Recurring decimals to fractions

Write the recurring decimal $0.\dot{7}\dot{4}$ as a fraction in its simplest form.

Let x = 0.747474...
Multiply by 100: 100x = 74.7474...
Subtract: 99x = 74
$x = \frac{74}{99}$

Answer: $\frac{74}{99}$

4 nth term of a linear sequence

Here are the first four terms of a sequence.
0, 2, 4, 6
(a) Find an expression for the nth term.
(b) Find the first term in the sequence that is greater than 150.

The terms go up by 2 each time, so the nth term starts with 2n
0 − 2 = −2, so the nth term is 2n − 2
(b) 2n − 2 > 150
2n > 152
n > 76
The smallest whole number is n = 77, and the term is 152
Answer: (a) 2n − 2 (b) 152

5 Profit and loss

Isla buys a bike for £40 and sells it making a profit of 25%.
Work out the selling price.

Selling price = 125% of the cost price
£40 × 1.25 = £50
Answer: £50

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6 Probability without replacement

A bag contains 4 red, 4 blue and 2 green counters.
Two counters are taken at random without replacement.
Work out the probability that exactly one of the two counters is red.

P(red then not red) = $\frac{4}{10} \times \frac{6}{9} = \frac{24}{90}$

P(not red then red) = $\frac{6}{10} \times \frac{4}{9} = \frac{24}{90}$

Add: $\frac{24}{90} + \frac{24}{90} = \frac{8}{15}$

Answer: $\mathbf{\frac{8}{15}}$

7 Transformations of graphs

The graph of y = f(x) has a maximum point at (3, 3).
Write down the coordinates of the turning point of the graph of
(a) y = f(−x)
(b) y = f(x + 1)

(a) The graph is reflected in the y-axis, so the x-coordinate changes sign
The maximum point is (−3, 3)
(b) Replacing x by (x + 1) moves the graph 1 unit left
The maximum point is (2, 3)
Answer: (a) (−3, 3) (b) (2, 3)

8 Trigonometry: finding an angle

Work out the size of angle x. (Calculator)
Give your answer to 1 decimal place.
The diagram is not drawn accurately.

The sides given are the opposite (5) and the adjacent (8), so use tan

$\tan x = \frac{5}{8}$

$x = \tan^{-1}(\frac{5}{8})$

$x = 32.0°$

Answer: x = 32.0°

9 Compound interest

Leah invests £6,500 in an investment bond. (Calculator)
The account pays compound interest at 2% per year.
Work out the value of the investment after 3 years.

Multiplier = 1 + 2 ÷ 100 = 1.02

£6,500 × 1.02^3 = £6,897.85

Answer: £6,897.85

10 Pythagoras in three dimensions

The diagram shows a cuboid.
Work out the length of the diagonal AG. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

$AG^2 = 7^2 + 12^2 + 9^2$
$= 49 + 144 + 81 = 274$
$AG = \sqrt{274} = 16.6$
Answer: 16.6 cm