Day 149 **A Tier 10-a-day: Model Solutions**

1 Circle area and circumference

The area of a circle is 36π cm^2.
(a) Work out the radius of the circle.
(b) Work out the circumference. Give your answer in terms of π.

(a) $\pi r^2 = 36\pi$, so $r^2 = 36$
$r = 6$
(b) Circumference $= 2\pi r = 2 \times \pi \times 6 = 12\pi$
Answer: (a) 6 cm (b) 12π cm

2 Algebraic formulae in context

A gym charges a joining fee of £40 and then £18 each month.
(a) Write a formula for the total cost, £C, after n months.
(b) Leo pays £292 in total. Work out the number of months.

(a) $C = 40 + 18n$
(b) $40 + 18n = 292$
$18n = 252$
$n = 14$
Answer: (a) $C = 40 + 18n$ (b) 14

3 Stem and leaf diagrams

The stem and leaf diagram shows the ages of 11 people.
Key: 2 | 8 represents 28 years
(a) Work out the median age.
(b) Work out the interquartile range.

(a) 11 values, so the median is the 6th value
Counting along the leaves gives 37
(b) LQ is the middle of the lower 5 values = 33
UQ is the middle of the upper 5 values = 51
IQR = 51 − 33 = 18
Answer: (a) 37 years (b) 18 years

4 Counting

A shop sells 5 different shirts, 5 different pairs of trousers and 2 different hats.
How many different outfits, made of one shirt, one pair of trousers and one hat, are possible?

Multiply the number of choices: $5 \times 5 \times 2 = 50$
Answer: 50

5 Trigonometry: finding a side

Work out the value of x. (Calculator)
Give your answer to 3 significant figures.
The diagram is not drawn accurately.

x is the adjacent and 10 m is the hypotenuse, so use cos

$\cos 63° = \frac{x}{10}$

$x = 10 \times \cos 63°$
$x = 4.54$
Answer: $x = 4.54$ m

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6 Distance-time graphs

The distance-time graph shows a journey made by a cyclist.
(a) For how many minutes did the cyclist 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 20 to 50 minutes, so the stop is 50 − 20 = 30 minutes
(b) First part: distance 6 km in 20 minutes

Speed = distance ÷ time = $6 \div \frac{20}{60}$ = 18 km/h

Answer: (a) 30 minutes (b) 18 km/h

7 Time

(a) A flight takes off at 1145. The journey takes 2 hours 13 minutes. Work out the time it ends.
(b) Change 210 minutes into hours. Give your answer as a decimal.

(a) 1145 + 2 hours 13 minutes = 1358
(b) 210 ÷ 60 = 3.5 hours
Answer: (a) 1358 (b) 3.5 hours

8 Equations with algebraic fractions

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

Multiply every term by (x − 1)(x + 1)
5(x + 1) + 6(x − 1) = (x − 1)(x + 1)
$11x - 1 = x^2 - 1$
$x^2 - 11x = 0$
x(x − 11) = 0
x = 0 or x = 11
Answer: x = 0 or x = 11

9 Estimation

By rounding each number to 1 significant figure, estimate the value of

$\frac{65.5 + 5.8}{0.99}$

Round each number to 1 significant figure: 70, 6, 1.0

$\frac{70 + 6}{1.0} = 76$

Answer: 76

10 Quadratic sequences

Here are the first five terms of a quadratic sequence.
5, 6, 9, 14, 21
(a) Find an expression for the nth term.
(b) Work out the 10th term.

First differences: 1, 3, 5
Second differences: 2, 2, so a = 2 ÷ 2 = 1
Subtract n^2 from each term (1, 4, 9, 16): 4, 2, 0, −2
This is linear: −2n + 6
nth term = $n^2 - 2n + 6$
(b) Substitute n = 10: $1 \times 10^2 - 2 \times 10 + 6 = 86$
Answer: (a) $n^2 - 2n + 6$ (b) 86