Day 329 **A Tier 10-a-day: Model Solutions**

1 Algebraic formulae in context

A mechanic charges £35 plus £40 for each hour of work.
(a) Write a formula for the total cost, £C, after t hours.
(b) Raj pays £475 in total. Work out the number of hours.

(a) C = 35 + 40t
(b) 35 + 40t = 475
40t = 440
t = 11
Answer: (a) C = 35 + 40t (b) 11

2 Median from a frequency table

Here are the results for 29 students.
(a) Find the median.
(b) Work out the range.

(a) The median is the 15th value (29 + 1) ÷ 2 = 15
Cumulative frequencies: 2, 11, 16, 22, 29
The 15th value is 5
(b) Range = 7 − 3 = 4
Answer: (a) 5 (b) 4

3 Simultaneous equations

Solve the simultaneous equations
2x − 4y = −18
3x + 4y = 33

The y terms have opposite signs, so add the equations
5x = 15, so x = 3
Substitute x = 3 into equation (1) to find y = 6
Answer: x = 3, y = 6

4 Stem and leaf diagrams

The stem and leaf diagram shows the ages of 15 people.
Key: 2 | 0 represents 20 years
(a) Work out the median age.
(b) Work out the interquartile range.

(a) 15 values, so the median is the 8th value
Counting along the leaves gives 40
(b) LQ is the middle of the lower 7 values = 33
UQ is the middle of the upper 7 values = 51
IQR = 51 − 33 = 18
Answer: (a) 40 years (b) 18 years

5 Quadratic sequences

Here are the first five terms of a quadratic sequence.
2, 5, 6, 5, 2
(a) Find an expression for the nth term.
(b) Work out the 10th term.

First differences: 3, 1, −1
Second differences: −2, −2, so a = −2 ÷ 2 = −1
Subtract $-n^2$ from each term (−1, −4, −9, −16): 3, 9, 15, 21
This is linear: 6n − 3
nth term = $-n^2 + 6n - 3$
(b) Substitute n = 10: $-1 \times 10^2 + 6 \times 10 - 3 = -43$
Answer: (a) $-n^2 + 6n - 3$ (b) −43

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6 Index equations

Solve $4^x = \frac{1}{4}$

Write both sides as powers of 2: $4 = 2^2$, so $4^x = 2^{2x}$

$\frac{1}{4} = 2^{-2}$, so $2x = -2$

$x = -1$

Answer: $x = -1$

7 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 adjacent (3) and the hypotenuse (9), so use cos

$\cos x = \frac{3}{9}$

$x = \cos^{-1}(\frac{3}{9})$

$x = 70.5°$

Answer: $x = 70.5°$

8 Reverse compound change

The value of a car falls by 20% each year. (Calculator)
After 3 years it is worth £19,712.
Work out its value at the start.

Yearly multiplier = 0.8

Overall multiplier = $0.8^3 = 0.512$

Original value = £19,712 ÷ 0.512 = £38,500

Answer: £38,500

9 The cosine rule: finding an angle

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

$\cos x = \frac{14^2 + 10^2 - 16^2}{2 \times 14 \times 10}$

$\cos x = \frac{40}{280}$

$x = \cos^{-1}(0.1429)$

$x = 81.8°$

Answer: $x = 81.8°$

10 Percentages in context

A television costs £500 plus VAT at 20%.
In a sale, the price including VAT is reduced by 25%.
Work out the sale price of the television.

VAT = 20% of £500 = £100, so the price with VAT is £600

Reduction = 25% of £600 = £150

Sale price = £600 − £150 = £450

Answer: £450