Day 4 **A Tier 10-a-day: Model Solutions**

1 Median from a frequency table

The frequency table shows data for 33 matches.
(a) Find the median.
(b) Work out the range.

(a) The median is the 17th value (33 + 1) ÷ 2 = 17
Cumulative frequencies: 5, 13, 20, 24, 33
The 17th value is 2
(b) Range = 4 − 0 = 4
Answer: (a) 2 (b) 4

2 Difference of two squares

(a) Factorise $25y^2 - 4z^2$
(b) Use the same idea to work out $185^2 - 15^2$ without a calculator.

(a) $25y^2 - 4z^2 = (5y)^2 - (2z)^2$
$(5y - 2z)(5y + 2z)$
(b) $a^2 - b^2 = (a + b)(a - b)$, so $185^2 - 15^2 = (185 + 15)(185 - 15)$
$= 200 \times 170 = 34000$
Answer: (a) (5y − 2z)(5y + 2z) (b) 34000

3 Percentages in context

Owen earns £29000 a year.
She pays no tax on the first £15000.
She pays 25% tax on the rest.
Work out how much tax she pays in a year.

Taxable amount = £29000 − £15000 = £14000
Tax = 25% of £14000 = £3500
Answer: £3500

4 Reverse percentages

Ryan's salary increases by 10%. (Calculator)
Her new salary is £242.
Work out her salary before the increase.

The new salary is 110% of the old salary.
110% = £242, so 1% = £242 ÷ 110 = £2.20
100% = £2.20 × 100 = £220
Answer: £220

5 Scatter graphs

The scatter graph shows the temperature and the number of hot drinks sold on some days.
A line of best fit is drawn.
(a) Describe the correlation.
(b) Estimate the number of hot drinks sold on a day when the temperature is 4 °C.

(a) As temperature increases, hot drinks sold decreases, so there is negative correlation
(b) Draw a line up from 4 on the horizontal axis to the line of best fit, then across to the vertical axis
The line gives a value of 34
Answer: (a) Negative correlation (b) 34

6 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 (8) and the adjacent (3), so use tan

$\tan x = \frac{8}{3}$

$x = \tan^{-1}(\frac{8}{3})$

$x = 69.4°$

Answer: x = 69.4°

7 Surd fractions

Show that $\frac{\sqrt{27} + \sqrt{12}}{\sqrt{3}}$ is an integer, and find its value.

$\sqrt{27} = 3\sqrt{3}$ and $\sqrt{12} = 2\sqrt{3}$

Numerator = $3\sqrt{3} + 2\sqrt{3} = 5\sqrt{3}$

$\frac{5\sqrt{3}}{\sqrt{3}} = 5$

Answer: 5

8 Volume of composite solids

A solid is made from a cylinder and a hemisphere.
The cylinder has radius 9 cm and height 10 cm.
The hemisphere has the same radius as the cylinder and sits on top of it.
Work out the total volume. Give your answer in terms of π.

Cylinder = $\pi \times 9^2 \times 10 = 810\pi$

Hemisphere = $\frac{2}{3} \times \pi \times 9^3 = 486\pi$

Total = $810\pi + 486\pi = 1296\pi$

Answer: 1296π cm^3

9 Error intervals

L = 7,300 is rounded to the nearest 100.
Write down the error interval for L.

The rounding unit is 100, so the value could be up to half of this, 50, either side.
Lower bound = 7,300 − 50 = 7,250, upper bound = 7,300 + 50 = 7,350

Answer: 7,250 ≤ L < 7,350

10 Simultaneous equations (one quadratic)

Solve the simultaneous equations
$x^2 + y^2 = 169$
$y = -x + 17$

Substitute $y = -x + 17$ into $x^2 + y^2 = 169$

$x^2 + (-x + 17)^2 = 169$

$2x^2 - 34x + 120 = 0$

Divide by 2: $x^2 - 17x + 60 = 0$

$(x - 5)(x - 12) = 0$

$x = 5$ or $x = 12$

Use $y = -x + 17$ to find y: when x = 5, y = 12; when x = 12, y = 5

Answer: x = 5, y = 12 and x = 12, y = 5