Day 198 **B Tier 10-a-day: Model Solutions**

1 Angles in triangles

A right-angled triangle has one angle of 61°.
Work out the size of the other acute angle.

Angles in a triangle add up to 180°
180 − 90 − 61 = 29
Answer: 29°

2 Order of operations

Work out
(a) 3 × (5 + 19) ÷ 3
(b) (6 + 5) × 7 − 10

(a) Brackets first: 5 + 19 = 24
Multiply: 3 × 24 = 72
Divide: 72 ÷ 3 = 24
(b) Brackets first: 6 + 5 = 11
Multiply: 11 × 7 = 77
Subtract: 77 − 10 = 67
Answer: (a) 24 (b) 67

3 Stem and leaf diagrams

The stem and leaf diagram shows 12 values.
(a) Find the median.
(b) Work out the range.

(a) 12 values, so the median is the mean of the 6th and 7th values
Reading in order: 20, 21, 24, 27, 32, 35, 38, 39, 44, 45, 46, 49
Median = 36.5
(b) Range = 49 − 20 = 29
Answer: (a) 36.5 (b) 29

4 Perimeter with algebra

An equilateral triangle has sides of length (3x + 6) m.
The perimeter of the triangle is 117 m.
Work out the value of x.

3(3x + 6) = 117
3x + 6 = 39
3x = 33
x = 11
Answer: x = 11

5 Laws of indices

Simplify fully
(a) $(x^4)^3$
(b) $4x^6 \times 6x^4$

(a) Multiply the powers: 4 × 3 = 12
(b) Multiply the numbers: 4 × 6 = 24. Add the powers: 6 + 4 = 10
Answer: (a) x^{12} (b) $24x^{10}$

Day 198 **B Tier 10-a-day: Model Solutions**

6 Venn diagram problems

27 adults were asked.
17 of them like tea and 6 of them like coffee.
2 of them did both.
(a) How many did neither?
(b) One is chosen at random. Find the probability that they like tea but do not like coffee.

(a) Union = 17 + 6 − 2 = 21
Neither = 27 − 21 = 6
(b) Only like tea = 17 − 2 = 15
P = 15 out of 27

Answer: (a) 6 (b) $\frac{5}{9}$

7 Tables of values for quadratics

Complete the table of values for $y = x^2 + x - 3$

$x = -2$: $y = (-2)^2 + 1 \times (-2) + (-3) = -1$
$x = -1$: $y = (-1)^2 + 1 \times (-1) + (-3) = -3$
$x = 0$: $y = 0^2 + 1 \times 0 + (-3) = -3$
$x = 2$: $y = 2^2 + 1 \times 2 + (-3) = 3$
Answer: x = −2: −1, x = −1: −3, x = 0: −3, x = 2: 3

8 Standard form

Write each number as an ordinary number.
(a) 2.3×10^4
(b) 9×10^{-5}

(a) Multiply by 10, 4 times: move the decimal point 4 places right
$2.3 \times 10^4 = 23{,}000$
(b) $10^{-5} = 0.00001$, so move the decimal point 5 places left
$9 \times 10^{-5} = 0.00009$
Answer: (a) 23,000 (b) 0.00009

9 Trigonometry in context

A ladder 7 m long leans against a vertical wall. (Calculator)
The foot of the ladder is 1.1 m from the wall on horizontal ground.
Work out the angle between the ladder and the ground.
Give your answer correct to 1 decimal place.

The ladder is the hypotenuse and the distance from the wall is the adjacent side
$\cos\theta = \frac{1.1}{7}$
$\theta = \cos^{-1}(\frac{1.1}{7}) = 80.959...$
$\theta = 81.0°$ (1 d.p.)
Answer: 81.0°

10 Trial and improvement

The equation $x^3 + x = 14$ has a solution between 2 and 3. (Calculator)
Use trial and improvement to find this solution.
Give your answer correct to 1 decimal place.

$x = 2.5$: $2.5^3 + 2.5 = 18.125$ (too big)
$x = 2.2$: $2.2^3 + 2.2 = 12.848$ (too small)
$x = 2.3$: $2.3^3 + 2.3 = 14.467$ (too big)
$x = 2.25$: value = 13.641 (too small), so the solution is above 2.25
So x = 2.3 to 1 decimal place
Answer: x = 2.3