Day 209 **A Tier 10-a-day: Model Solutions**

1 Substitution

Work out the value of $4x^2 + 5x - 3$ when $x = -2$

Substitute $x = -2$: $4 \times (-2)^2 + 5 \times (-2) - 3$
$= 16 - 10 - 3$
$= 3$
Answer: 3

2 Median from a frequency table

Here are the results for 19 matches.
(a) Find the median.
(b) Work out the range.

(a) The median is the 10th value $(19 + 1) \div 2 = 10$
Cumulative frequencies: 2, 3, 6, 10, 19
The 10th value is 3
(b) Range $= 4 - 0 = 4$
Answer: (a) 3 (b) 4

3 nth term of a linear sequence

Here are the first four terms of a sequence.
6, 4, 2, 0
(a) Find an expression for the nth term.
(b) Is -22 a term of this sequence? You must show your working.

The terms change by -2 each time, so the nth term starts with $-2n$
$6 - (-2) = 8$, so the nth term is $-2n + 8$
(b) $-2n + 8 = -22$
$-2n = -30$, so $n = 15$
n is a whole number, so -22 is a term of the sequence
Answer: (a) $-2n + 8$ (b) Yes ($n = 15$)

4 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 opposite and 6 cm is the adjacent, so use tan

$\tan 40° = \frac{x}{6}$

$x = 6 \times \tan 40°$
$x = 5.03$
Answer: x = 5.03 cm

5 Growth and decay

A culture starts with 2500 bacteria. (Calculator)
The number of bacteria increases by 10% every hour.
Work out the number of bacteria after 2 hours.
Give your answer to the nearest whole number.

Multiplier = 100% + 10% = 1.1
$2500 \times 1.1^2 = 3025.00$
= 3025 to the nearest whole number
Answer: 3025

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6 Adding and subtracting in standard form

Work out $(2.5 \times 10^2) - (8.5 \times 10^1)$
Give your answer in standard form.

Write both numbers using 10^1: $2.5 \times 10^2 = 25 \times 10^1$
$(25 - 8.5) \times 10^1 = 16.5 \times 10^1$
In standard form: 1.65×10^2
Answer: 1.65×10^2

7 Transformations of graphs

The graph of y = f(x) has a minimum point at (4, 0).
Write down the coordinates of the turning point of the graph of
(a) y = f(x) + 2
(b) y = f(−x)

(a) Adding 2 to f(x) moves the graph 2 units up
The minimum point is (4, 2)
(b) The graph is reflected in the y-axis, so the x-coordinate changes sign
The minimum point is (−4, 0)
Answer: (a) (4, 2) (b) (−4, 0)

8 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.

$$\cos x = \frac{19^2 + 18^2 - 16^2}{2 \times 19 \times 18}$$

$$\cos x = \frac{429}{684}$$

$x = \cos^{-1}(0.6272)$
$x = 51.2°$
Answer: x = 51.2°

9 Probability with three selections

A bag contains 6 red counters and 2 blue counters.
Three counters are taken at random without replacement.
Work out the probability that at least one of the three counters is blue.

$$\text{P(none is blue)} = \text{P(all red)} = \frac{6}{8} \times \frac{5}{7} \times \frac{4}{6} = \frac{5}{14}$$

$$\text{P(at least one blue)} = 1 - \frac{5}{14} = \frac{9}{14}$$

Answer: $\frac{9}{14}$

10 Finding a rate of compound change

Mo invests £11,000 in a savings account. (Calculator)
Compound interest is paid at a fixed rate each year.
After 2 years the investment is worth £12,830.40.
Work out the annual rate of interest.

Overall multiplier = £12,830.40 ÷ £11,000 = 1.1664
Take the square root: $\sqrt{1.1664} = 1.08$
Rate = (1.08 − 1) × 100 = 8%
Answer: 8%