Day 228 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Types of data (AQA, Edexcel, OCR, MEI, Eduqas)

Classify each variable as qualitative, discrete or continuous.
(a) the number of cars in a car park
(b) a person's favourite colour
(c) the mass of a newborn baby

(a) discrete: it is counted, so takes separate values
(b) qualitative: it is described by words, not numbers
(c) continuous: it is measured, so can take any value in a range
Answer: (a) discrete; (b) qualitative; (c) continuous

2 Reciprocal trig functions: exact values (All boards)

Write down the exact values of
(a) sec 315° (b) sec 135°

(a) $\sec 315° = \frac{1}{\cos 315°} = \frac{1}{\frac{\sqrt{2}}{2}} = \sqrt{2}$

(b) $\sec 135° = \frac{1}{\cos 135°} = \frac{1}{-\frac{\sqrt{2}}{2}} = -\sqrt{2}$

Answer: (a) $\sqrt{2}$ (b) $-\sqrt{2}$

3 Expanding brackets with surds (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Expand and simplify $(7 - \sqrt{6})^2$.

$= 7^2 - 2 \times 7 \times \sqrt{6} + (\sqrt{6})^2$
$= 49 - 14\sqrt{6} + 6$
Answer: $55 - 14\sqrt{6}$

4 Vertical motion: greatest height from speed (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A cricket ball is projected vertically upwards with speed 35 m s^{-1} from ground level. Taking g = 9.8 m s^{-2}, find the maximum height it reaches above the ground.

At the top v = 0: $v^2 = u^2 + 2as$
$0 = 35^2 - 2 \times 9.8 \times s$
$s = \frac{1225}{19.6}$
Answer: 62.5 m

5 Equation of a transformed curve (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The curve $y = x^2 - x + 1$ is translated by the vector $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$.

Find the equation of the new curve, giving your answer in the form $y = ax^2 + bx + c$.

Replace x by $(x - 1)$ and add -3:
$y = f(x - 1) - 3$
Expand and collect terms.
Answer: $y = x^2 - 3x$

6 Parallel vectors (All boards)

$\mathbf{a} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -6 \\ -6 \end{pmatrix}$.

Show that a and b are parallel and find the ratio |b| : |a|.

$\mathbf{b} = -2 \times \mathbf{a}$, since $-2 \times 3 = -6$ and $-2 \times 3 = -6$
So a and b are parallel and |b| : |a| = 2 : 1
Answer: b = −2 a, so parallel; ratio 2 : 1

Day 228 **A Level Maths: C Tier 10-a-day: Model Solutions**

7 Sigma notation (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Evaluate $\sum_{r=1}^{20}(3r + 6)$.

This is an arithmetic series with first term 9 and common difference 3.

$S_{20} = \frac{20}{2}[2 \times 9 + 19 \times 3]$

$= 750$

Answer: 750

8 Identity then solve (sin² to cos) (All boards)

Solve $-2\sin^2 x + 3\cos x + 3 = 0$
for $0° \leq x \leq 360°$.

Use $\sin^2 x = 1 - \cos^2 x$: $2\cos^2 x + 3\cos x + 1 = 0$

Factorise and solve: $\cos x = -1$ or $\cos x = -\frac{1}{2}$

$x = 120°, 180°, 240°$

Answer: x = 120°, 180°, 240°

9 Car towing a caravan (All boards)

A car of mass 1500 kg tows a caravan of mass 800 kg on a level road with acceleration 1 m s^{-2}. Resistances: 200 N on the car, 100 N on the caravan. Find the driving force and the tow bar tension.

Whole system: $D - 200 - 100 = 2300 \times 1$
Caravan: $T - 100 = 800 \times 1$
Answer: D = 2600 N, T = 900 N

10 Discrete random variable: E(X) and Var(X) (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The discrete random variable X has this distribution.
x: 0, 3, 6, 8
P(X = x): 0.2, 0.2, 0.3, 0.3
Find E(X) and Var(X).

$E(X) = \Sigma xp = 0\times0.2 + 3\times0.2 + 6\times0.3 + 8\times0.3 = 4.8$

$E(X^2) = \Sigma x^2 p = 31.8$

$Var(X) = 31.8 - 4.8^2$

Answer: E(X) = 4.8, Var(X) = 8.76