Day 39 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 F = ma: find the force or the mass (All boards)

A particle of mass 5 kg has acceleration 1.5 m s^{-2}. Find the magnitude of the resultant force acting on it.

$F = ma$

$F = 5 \times 1.5$

Answer: 7.5 N

2 Comparing distributions (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The test marks for two groups: School A has mean 60, standard deviation 7; School B has mean 72, standard deviation 6. Compare the two sets of data.

The mean measures the average: School B has the higher mean.

The standard deviation measures spread: School B has the smaller standard deviation, so it is more consistent.

Answer: School B has the higher mean; School B is more consistent

3 Vertical motion under gravity: thrown upwards (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A marble is thrown vertically upwards with speed 9.8 m s^{-1}. Take $g = 9.8$ m s^{-2}.

(a) Find the time taken to reach its greatest height.

(b) Find the greatest height reached.

(a) $v = u + at$: $0 = 9.8 - 9.8t$, so $t = 1$

(b) $v^2 = u^2 + 2as$: $0 = 9.8^2 - 2 \times 9.8 \times s$

$s = \frac{96.04}{19.6}$

Answer: (a) 1 s (b) 4.9 m

4 Proof by deduction (AQA, Edexcel, OCR, MEI, Eduqas)

Prove that $(n + 6)^2 - (n - 6)^2$ is a multiple of 4 for every integer n.

$(n + 6)^2 - (n - 6)^2 = (n^2 + 12n + 36) - (n^2 - 12n + 36)$

$= 24n = 4 \times 6n$

6n is an integer, so the expression is a multiple of 4.

Answer: Shown

5 Solve a logarithmic equation (two logs) (All boards)

Solve $\ln(x + 2) - \ln x = \ln 2$.

$\ln \frac{x + 2}{x} = \ln 2$, so $\frac{x + 2}{x} = 2$

$x + 2 = 2x$, so $2 = 1x$

$x = 2$

Answer: x = 2

6 Equation of a reciprocal graph from asymptotes (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows the graph of $y = \frac{k}{x - a} + c$ with its asymptotes. Find the values of a, c and k.

The asymptotes are $x = -1$ and $y = -2$, so $a = -1$ and $c = -2$.

Through (0, 1): $1 = \frac{k}{0 - (-1)} + -2$

$\frac{k}{1} = 3$, so $k = 3$

Answer: a = −1, c = −2, k = 3

7 Solve a^x = b using logarithms (All boards)

Solve $5^{2x} = 100$.
Give your answer to 3 significant figures.

Take logs: $2x \log 5 = \log 100$

$x = \frac{\log 100}{2 \log 5} = 1.43$

Answer: x = 1.43

8 Evaluating fractional and negative indices (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Evaluate $9^{\frac{1}{2}}$.

$9^{\frac{1}{2}} = (9^{\frac{1}{2}})^1$

$9^{\frac{1}{2}} = 3$

$(3)^1 = 3$

Answer: 3

9 Conditional probability (Bayes) (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The probability that it rains is 0.2. If so, the probability that Sam is late is 0.5; otherwise it is 0.4.
Given that Sam is late, find the probability that it rains.

P(both) = 0.2 × 0.5 = 0.1; P(not first and second) = 0.8 × 0.4 = 0.32
P(second) = 0.1 + 0.32 = 0.42
P = 0.1 ÷ 0.42

Answer: $\frac{5}{21}$ = 0.238

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

Solve $-4\sin^2 x + 2\cos x + 4 = 0$
for $0° \leq x \leq 360°$.

Use $\sin^2 x = 1 - \cos^2 x$: $4\cos^2 x + 2\cos x = 0$

Factorise and solve: $\cos x = 0$ or $\cos x = -\frac{1}{2}$

x = 90°, 120°, 240°, 270°

Answer: x = 90°, 120°, 240°, 270°