Day 34 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Linear inequalities (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $-5x + 5 \geq 8$.

$-5x \geq 3$

Divide by -5 and reverse the inequality:

$x \leq -\frac{3}{5}$

Answer: $x \leq -\frac{3}{5}$

2 Laws of logarithms: single log (All boards)

Write $2 \log 2 + \log 7 - \log 2$ as a single logarithm, giving it in the form $\log N$ where N is an integer.

$2 \log 2 = \log 2^2 = \log 4$

$\log 4 + \log 7 - \log 2 = \log \frac{4 \times 7}{2} = \log 14$

Answer: log 14

3 Disproof by counter-example (AQA, Edexcel, OCR, MEI, Eduqas)

Show, by a counter-example, that the statement "If n^2 is a multiple of 18 then n is a multiple of 18" is false, where n is a positive integer.

Look for n with n^2 divisible by 18 but n not divisible by 18.

Try $n = 6$: $n^2 = 36 = 18 \times 2$, a multiple of 18.

But 6 is not a multiple of 18, so the statement is false.

Answer: n = 6

4 Reciprocal trig functions: exact values (All boards)

Write down the exact values of

(a) cot 240° (b) sec 300°

(a) $\cot 240° = \frac{1}{\tan 240°} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$

(b) $\sec 300° = \frac{1}{\cos 300°} = \frac{1}{\frac{1}{2}} = 2$

Answer: (a) $\frac{\sqrt{3}}{3}$ (b) 2

5 Binomial: cumulative probabilities (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

$X \sim B(8, 0.4)$. Find $P(X > 5)$, giving your answer to 3 s.f.

$P(X > 5) = 1 - P(X \leq 5)$

$P(X \leq 5) = 0.9502$

Answer: 0.0498

6 Velocity-time graph: acceleration and distance (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The graph shows the velocity of a cyclist over 44 seconds as it moves in a straight line.

(a) Find its acceleration in the first 10 s.

(b) Find the total distance travelled.

(a) acceleration = gradient = $\frac{10}{10}$

(b) distance = area of trapezium

$= \frac{1}{2}(30 + 44) \times 10$

Answer: (a) 1 m s^{-2} (b) 370 m

7 Integrate standard functions (All boards)

Find

(a) $\int 8 \sin 4x \, dx$

(b) $\int (2e^x + \frac{4}{x}) \, dx$

Use the standard integrals and divide by the coefficient of x where needed.

(a) $= -2 \cos 4x + c$

(b) $= 2e^x + 4 \ln |x| + c$

Answer: (a) $-2 \cos 4x + c$ (b) $2e^x + 4 \ln |x| + c$

8 Partial fractions (Edexcel, OCR, MEI, CIE, AQA, Eduqas)

Express $\frac{2x - 4}{(x - 2)^2}$ in the form $\frac{A}{(x - 2)} + \frac{B}{(x - 2)^2}$.

$2x - 4 = A(x - 2) + B$

Coefficient of x: $A = 2$

Constant: $-4 = 4 + B$, so $B = 0$

Answer: $A = 2, B = 0$

9 Critical region (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

$X \sim B(40, p)$. H_0: $p = 0.25$, H_1: $p > 0.25$.

Find the critical region for a test at the 5% significance level.

$P(X \geq 16) = 0.0262 \leq 0.05$

$P(X \geq 15) = 0.0544 > 0.05$

Answer: $X \geq 16$

10 Particle on a smooth table connected to a hanging particle (All boards)

A 6 kg particle on a smooth horizontal table is joined by a light string over a smooth pulley to a hanging 1 kg particle, as shown. The system is released from rest. Take $g = 9.8$ m s^{-2}. Find the tension.

Table particle: $T = 6a$

Hanging particle: $1 \times 9.8 - T = 1a$

Adding: $9.8 = 7a$

Answer: 8.4 N