Day 61 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Addition rule (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

For events A and B, P(A) = 0.15, P(B) = 0.55 and P(A ∪ B) = 0.6.
(a) Find P(A ∩ B).
(b) Find P(A′ ∩ B′).

(a) P(A ∩ B) = P(A) + P(B) − P(A ∪ B) = 0.15 + 0.55 − 0.6 = 0.1
(b) A′ ∩ B′ is outside both, so P = 1 − P(A ∪ B) = 1 − 0.6
Answer: (a) 0.1 (b) 0.4

2 Exact trigonometric values (All boards)

Write down the exact value of cos 210°.

cos 210° has the same size as cos 30°, and the sign comes from the quadrant (CAST).
cos 30° = $\frac{\sqrt{3}}{2}$, so cos 210° = $-\frac{\sqrt{3}}{2}$
Answer: $-\frac{\sqrt{3}}{2}$

3 Arithmetic series: sum of terms (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

An arithmetic series has first term 6, last term 146 and 29 terms. Find the sum of the series.

$S_n = \frac{n}{2}(a + l) = \frac{29}{2}(6 + 146)$
= 2204
Answer: 2204

4 Histograms (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The histogram shows the times, t minutes, taken by some people to complete a puzzle.
Find the number of people who took between 20 and 45 minutes.

Frequency = frequency density × class width
20 ≤ t < 30: 3 × 10 = 30
30 ≤ t < 45: 3 × 15 = 45
Total = 30 + 45
Answer: 75

5 Small angle approximations (AQA, Edexcel, OCR, MEI, Eduqas)

θ is small and measured in radians.
Use the small angle approximations to find an approximation for 1 − cos 5θ.

Use $\cos 5\theta \approx 1 - \frac{5^2\theta^2}{2}$
So $1 - \cos 5\theta \approx \frac{25\,\theta^2}{2}$
Answer: $\frac{25\,\boldsymbol{\theta}^2}{2}$

6 Exponential graphs (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Sketch $y = 3^x - 9$.
Write down the equation of the asymptote and the coordinates where the curve meets the axes.

As x → −∞, $3^x \to 0$, so y → −9: asymptote y = −9.
x = 0: $y = 3^0 - 9 = -8$
y = 0: $3^x = 9$, so $3^x = 9$ and x = 2
Answer: y = −9 ; (0, −8), (2, 0)

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7 Integrating velocity to find displacement (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A particle moves in a straight line with velocity $v = (6t^2 + 5)$ m s^{-1} at time t seconds.
Find the distance travelled between t = 3 and t = 6 (the particle does not turn round).

$s = \int v\,dt = 2t^3 + 5t$
Distance = $s(6) - s(3)$
$= 462 - 69$
Answer: 393 m

8 Definite integrals (exact) (All boards)

Evaluate

$\int_0^2 (x^2 + 2)\,dx$.

$[\frac{x^3}{3} + 2x]$ from 0 to 2
$= \frac{8}{3} + 4 = \frac{20}{3}$
Answer: $\frac{20}{3}$

9 Differentiating displacement to find velocity (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A body moves in a straight line. Its displacement from O at time t seconds is s metres, where $s = 2t^3 + 4t^2$.
Find its velocity when t = 1.

$v = \frac{ds}{dt} = 6t^2 + 8t$
When t = 1: $v = 6 \times 1^2 + 8 \times 1 + 0$
Answer: 14 m s^{-1}

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

The curve C has equation $y = x^3 + 3x^2 + 3x + 2$.
C is reflected in the y-axis. Find the equation of the image.

Reflection in the y-axis: replace x by $-x$.
$y = -x^3 + 3x^2 - 3x + 2$
Answer: $y = -x^3 + 3x^2 - 3x + 2$