Day 349 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Degrees and radians (All boards)

(a) Convert $\frac{7\pi}{6}$ radians to degrees.

(b) Convert 40° to radians, giving your answer in terms of π.

(a) $\frac{7\pi}{6} \times \frac{180}{\pi} = 210°$

(b) $40 \times \frac{\pi}{180} = \frac{2\pi}{9}$

Answer: (a) 210° (b) $\frac{2\pi}{9}$ radians

2 Simplifying algebraic indices (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Simplify $(3x^4)^3 \div 9x^4$.

$(3x^4)^3 = 27x^{12}$

$27x^{12} \div 9x^4$: divide the numbers and subtract the powers

$= 3x^8$

Answer: $3x^8$

3 Integrate (ax + b)^n and related (All boards)

Find $\int e^{4x+1}\,dx$.

$\int e^{ax+b}\,dx = \frac{1}{a} e^{ax+b}$

Here $a = 4$

Answer: $\frac{1}{4} e^{4x+1} + c$

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

A resultant force of 32 N gives a body an acceleration of 4 m s^{-2}. Find the mass of the body.

$F = ma$

$32 = m \times 4$

Answer: 8 kg

5 Transforming a graph with a labelled turning point (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows the curve y = f(x). The maximum point is shown. Write down the coordinates of the maximum point on the curve with equation

(a) $y = f(x) - 2$ (b) $y = f(2x)$

(a) $y = f(x) - 2$: the maximum point moves to (2, 3).

(b) $y = f(2x)$: the maximum point moves to (1, 5).

Answer: (a) (2, 3) (b) (1, 5)

6 Grouped data: estimated median (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The table shows grouped data.

Class: $0 \le x < 10$; $10 \le x < 20$; $20 \le x < 30$; $30 \le x < 40$

Frequency: 15, 4, 14, 7

Estimate the median, to 3 s.f.

n = 40, so the median is the 20 th value, in class $20 \le x < 30$

Cumulative frequency before this class = 19

Median $\approx 20 + \frac{(20 - 19)}{14} \times 10$

Answer: 20.7

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7 Finding an unknown using the factor theorem (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

When $x^3 + kx^2 + 5x - 8$ is divided by $(x - 3)$, the remainder is -2. Find the value of k.

$f(3) = -2$
$27 + 9k + 7 = -2$
$9k = -36$
Answer: $k = -4$

8 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 0 and 5 minutes.

Frequency = frequency density × class width
$0 \leq t < 5$: $1 \times 5 = 5$
Answer: 5

9 Solve trig equation in radians (exact) (All boards)

Solve $\tan x = \frac{\sqrt{3}}{3}$ for $0 \leq x \leq 2\pi$.

Give your answers in terms of π.

Reference angle: $\frac{\pi}{6}$

tan is positive in the first and third quadrants.

$x = \frac{\pi}{6}, \frac{7\pi}{6}$

Answer: $x = \frac{\pi}{6}, \frac{7\pi}{6}$

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

A particle moves in a straight line with velocity $v = (9t^2 + 2t + 8)$ m s^{-1} at time t seconds.
Find the distance travelled between t = 3 and t = 4 (the particle does not turn round).

$s = \int v\, dt = 3t^3 + t^2 + 8t$
Distance = $s(4) - s(3)$
$= 240 - 114$
Answer: 126 m