Day 124 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Exact trigonometric values (All boards)

Write down the exact value of tan 60°.

Use the special angle values: tan 60° = $\sqrt{3}$

Answer: $\sqrt{3}$

2 Constant acceleration: time to reach a speed (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A car moving in a straight line increases its speed from 4 m s^{-1} to 29 m s^{-1} with constant acceleration 2.5 m s^{-2}. Find the time taken.

$v = u + at$

$29 = 4 + 2.5\,t$

Answer: 10 s

3 Systematic sampling (AQA, Edexcel, OCR, MEI, Eduqas)

A systematic sample of 11 customers is taken from a numbered list of 99.
The first one selected is number 8. Find the number of the 7th one selected.

Interval = 99 ÷ 11 = 9

Number = 8 + 6 × 9

Answer: 62

4 Solve basic trig equation (exact, degrees) (All boards)

Solve $\cos x = \frac{\sqrt{3}}{2}$ for $0° \leq x \leq 360°$.

Reference angle: $\cos 30° = \frac{\sqrt{3}}{2}$

cos is positive in the first and fourth quadrants.

$x = 30°, 330°$

Answer: x = 30°, 330°

5 Proof by exhaustion (AQA, Edexcel, OCR, MEI, Eduqas)

Use proof by exhaustion to show that $n^5 - n$ is divisible by 30 for every integer n with $1 \leq n \leq 4$.

Substitute each value of n:

n = 1: 0 = 30 × 0 ; n = 2: 30 = 30 × 1

n = 3: 240 = 30 × 8 ; n = 4: 1020 = 30 × 34

Every value is a multiple of 30, so the statement is true for $1 \leq n \leq 4$.

Answer: Shown

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

The table shows grouped data.
Class: $10 \leq x < 20$; $20 \leq x < 30$; $30 \leq x < 40$; $40 \leq x < 50$
Frequency: 15, 15, 4, 16
Estimate the median, to 3 s.f.

n = 50, so the median is the 25 th value, in class $20 \leq x < 30$

Cumulative frequency before this class = 15

Median $\approx 20 + \frac{(25 - 15)}{15} \times 10$

Answer: 26.7

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7 Reciprocal graphs and asymptotes (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Sketch $y = \frac{1}{x - 3} + 4$.

Write down the equations of the asymptotes and the coordinates where the curve meets the axes.

Asymptotes: $x = 3$ and $y = 4$.

$y = 0$: $\frac{1}{x - 3} = -4$, so $x = \frac{11}{4}$

$x = 0$: $y = \frac{1}{-3} + 4 = \frac{11}{3}$

Answer: $x = 3$, $y = 4$; $(\frac{11}{4}, 0)$, $(0, \frac{11}{3})$

8 Addition formulae: exact values (All boards)

By writing 75° as 45° + 30°, find the exact value of tan 75°.

$\tan(45° + 30°) = \frac{\tan 45° + \tan 30°}{1 - \tan 45° \tan 30°}$

$= \frac{1 + \frac{\sqrt{3}}{3}}{1 - 1 \times \frac{\sqrt{3}}{3}}$

Simplify and rationalise the denominator: $2 + \sqrt{3}$

Answer: $2 + \sqrt{3}$

9 Solving quadratics: surd answers (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $x^2 - 8x + 2 = 0$, giving your answers in the form $p \pm \sqrt{q}$.

Complete the square: $(x - 4)^2 - 16 + 2 = 0$

$(x - 4)^2 = 14$

$x - 4 = \pm\sqrt{14}$

Answer: $x = 4 \pm \sqrt{14}$

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

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

$s = \int v \, dt = 3t^3 - t^2 + 3t$

Distance $= s(4) - s(2)$

$= 188 - 26$

Answer: 162 m