Day 333 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Exact trigonometric values (All boards)

Write down the exact value of sin 330°.

sin 330° has the same size as sin 30°, and the sign comes from the quadrant (CAST).

sin 30° = $\frac{1}{2}$, so sin 330° = $-\frac{1}{2}$

Answer: $-\frac{1}{2}$

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

Solve $x^2 - 10x - 1 = 0$, giving your answers in the form $p \pm \sqrt{q}$.

Complete the square: $(x - 5)^2 - 25 - 1 = 0$

$(x - 5)^2 = 26$

$x - 5 = \pm\sqrt{26}$

Answer: $x = 5 \pm \sqrt{26}$

3 Standard deviation from raw data (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Here are 6 values: 17, 20, 18, 4, 4, 16

Find the mean and the standard deviation, to 3 s.f.

$\Sigma x = 79$, $\Sigma x^2 = 1301$, $n = 6$

Mean = 79 ÷ 6 = 13.17

Variance = $\frac{1301}{6} - (13.17)^2 = 43.47$

Standard deviation = $\sqrt{43.47}$

Answer: mean = 13.2, standard deviation = 6.59

4 Compound growth: find n (All boards)

£5000 invested at 4% compound interest per year.

After how many whole years will it first exceed £15000?

$5000 \times 1.04^n > 15000$, so $1.04^n > 3$

$n > \frac{\log 3}{\log 1.04} = 28.01$

The least whole number of years is 29

Answer: 29 years

5 Horizontal projection from a cliff (AQA, Edexcel, OCR, MEI)

A ball is thrown horizontally at 13 m s^{-1} from the top of a vertical cliff of height 19.6 m above the sea. Take g = 9.8 m s^{-2}.

Find (a) the time taken to reach the sea, (b) the horizontal distance of the landing point from the cliff.

(a) Vertically: $u = 0$, $s = 19.6$, $a = 9.8$

$19.6 = \frac{1}{2} \times 9.8 \times t^2$, so $t^2 = 4$

(b) Horizontal distance = speed × time = 13 × 2

Answer: (a) 2 s (b) 26 m

6 Modulus equations (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $|x - 1| > 1$.

$x - 1 > 1$ or $x - 1 < -1$

Add 1 to each side.

Answer: $x < 0$ or $x > 2$

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7 Grouped data: estimated mean (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The table shows grouped data.
Class: $20 \le x < 30$; $30 \le x < 40$; $40 \le x < 50$; $50 \le x < 60$
Frequency: 11, 2, 9, 8
Estimate the mean, to 3 s.f.

Midpoints: 25, 35, 45, 55
$\Sigma fx = 11\times25 + 2\times35 + 9\times45 + 8\times55 = 1190$
Mean $\approx 1190 \div 30$
Answer: 39.7

8 Combining two inequalities (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Find the set of values of x satisfying both
$2x - 4 > 6$ and $x^2 - 6x < 0$.

$2x - 4 > 6$ gives $x > 5$.
$x^2 - 6x < 0$: $(x + 0)(x - 6) < 0$, so $0 < x < 6$.
Both are true where the two ranges overlap.
Answer: $5 < x < 6$

9 Connected rates of change (All boards)

The side x cm of a cube increases at 0.25 cm/s.
Find the rate of increase of the volume when x = 4.

$V = x^3$, so $\frac{dV}{dx} = 3x^2$
$\frac{dV}{dt} = \frac{dV}{dx} \times \frac{dx}{dt} = 3 \times 4^2 \times 0.25$
Answer: 12 cm^3/s

10 Friction: acceleration along rough ground (All boards)

A block of mass 10 kg is pulled along rough horizontal ground by a horizontal force of 44.5 N.
The coefficient of friction is 0.25. Take g = 9.8 m s^{-2}. Find the acceleration.

$R = 10 \times 9.8 = 98$
$F = \mu R = 0.25 \times 98 = 24.5$
$P - F = ma$: $44.5 - 24.5 = 10\,a$
Answer: 2 m s^{-2}