Day 275 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 F = ma: find the acceleration (All boards)

A horizontal force of 85 N acts on a sledge of mass 50 kg on a smooth horizontal surface.
Find the acceleration.

F = ma
85 = 50 a
Answer: 1.7 m s^{-2}

2 Simplifying surds (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Simplify $\sqrt{150} + \sqrt{54}$, giving your answer in the form $p\sqrt{6}$.

$\sqrt{150} = 5\sqrt{6}$ and $\sqrt{54} = 3\sqrt{6}$
Sum = $(5 + 3)\sqrt{6}$
Answer: $8\sqrt{6}$

3 Equation of a tangent or normal (All boards)

Find the equation of the tangent to the curve
$y = 2x^3 + 3x^2 + 1$ at the point where x = 2.

dy/dx = 6x^2 + 6x, so the gradient of the curve at x = 2 is 36
At x = 2, y = 29
$y - 29 = 36(x - 2)$
Answer: y = 36x − 43

4 Moments: balancing a plank (AQA, Edexcel, OCR, MEI)

A light plank rests on a pivot. A child of mass 45 kg sits 2.5 m from the pivot on one side. Where must a child of mass 15 kg sit on the other side for the plank to balance horizontally?

Moments about the pivot:
45 g × 2.5 = 15 g × d
$d = \frac{45 \times 2.5}{15}$
Answer: 7.5 m from the pivot

5 Solve trig equation in radians (calculator) (All boards)

Solve 4 sin x = −1 for $0 \leq x \leq 2\pi$.
Give your answers to 3 significant figures.

$\sin x = -\frac{1}{4}$

Reference angle = $\sin^{-1}(0.2500) = 0.2527$ radians
sin is negative in the third and fourth quadrants.
x = 3.39, 6.03
Answer: x = 3.39, 6.03

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

The table shows grouped data.
Class: $0 \leq x < 5$; $5 \leq x < 10$; $10 \leq x < 15$; $15 \leq x < 20$
Frequency: 11, 7, 3, 13
Estimate the median, to 3 s.f.

n = 34, so the median is the 17 th value, in class $5 \leq x < 10$
Cumulative frequency before this class = 11

Median $\approx 5 + \frac{(17 - 11)}{7} \times 5$

Answer: 9.29

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7 Solving equations with indices (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $25^x = 125$.

$25 = 5^2$ and $125 = 5^3$

$5^{2x} = 5^3$, so $2x = 3$

Answer: $x = \frac{3}{2}$

8 Integrate using double angle formulae (All boards)

Use a double angle formula to find
$\int \sin 3x \cos 3x \, dx$.

$\sin 2\theta = 2 \sin \theta \cos \theta$, so $\sin 3x \cos 3x = \frac{1}{2} \sin 6x$

Integrate term by term

Answer: $-\frac{\cos 6x}{12} + c$

9 Selection without replacement (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A bag has 4 red and 4 blue marbles. Two are taken at random without replacement.
Find the probability that they are different colours.

$P(RB) = \frac{4}{8} \times \frac{4}{7}$, $P(BR) = \frac{4}{8} \times \frac{4}{7}$

Add: $\frac{2}{7} + \frac{2}{7}$

Answer: $\frac{4}{7}$

10 Exponential graph through two points (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows the curve $y = ab^x$, where $b > 0$.
Find the values of a and b.

Through (0, 1): $a \times b^0 = 1$, so $a = 1$.

Through (2, 4): $1 \, b^2 = 4$

$b^2 = 4$, so $b = 2$ ($b > 0$)

Answer: $a = 1$, $b = 2$