Day 133 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Line through two axis intercepts (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows a line meeting the axes at A and B.
Find (a) the equation of AB in the form px + qy = r with integers p, q and r, (b) the length AB.

Gradient = $\frac{-1-0}{0-(-6)} = -\frac{1}{6}$

Using y = mx + c with c = −1: $y = -\frac{1}{6}x - 1$, so x + 6y = −6

$AB^2 = 6^2 + 1^2 = 37$

Answer: (a) x + 6y = −6 (b) $\sqrt{37}$

2 Modelling assumptions (All boards)

In an exam question, wind is ignored in a model of a falling coin.
State what this assumption means for the motion or forces in the model.

Modelling assumption: wind.
The assumption means: n.o horizontal force acts, so the coin falls vertically
Answer: No horizontal force acts, so the coin falls vertically

3 Expanding brackets with surds (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Expand and simplify $(7 - \sqrt{6})(1 + \sqrt{6})$.

$= 7 + 7\sqrt{6} - 1\sqrt{6} - 6$
$= 1 + 6\sqrt{6}$
Answer: $1 + 6\sqrt{6}$

4 Constant acceleration: finding the initial speed (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A particle moving in a straight line with constant acceleration 4 m s^{-2} travels 42 m in 3 s.
Find its initial speed.

$s = ut + \frac{1}{2}at^2$

$42 = 3u + \frac{1}{2} \times 4 \times 3^2$

3 u = 24
Answer: 8 m s^{-1}

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

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

$\sin x = \frac{1}{2}$

Reference angle = $\sin^{-1}(0.5000) = 0.5236$ radians
sin is positive in the first and second quadrants.
x = 0.524, 2.62
Answer: x = 0.524, 2.62

6 Conditional probability (Bayes) (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The probability that it rains is 0.4. If so, the probability that Sam is late is 0.8; otherwise it is 0.2.
Given that Sam is late, find the probability that it rains.

P(both) = 0.4 × 0.8 = 0.32; P(not first and second) = 0.6 × 0.2 = 0.12
P(second) = 0.32 + 0.12 = 0.44
P = 0.32 ÷ 0.44
Answer: $\frac{8}{11}$ = 0.727

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7 Product rule (All boards)

Use the product rule to differentiate
$y = x^2 \cos 2x$.

$u = x^2$, $v = \cos 2x$
$u' = 2x^1$, $v' = -2 \sin 2x$
$dy/dx = u'v + uv'$, which simplifies to the answer below
Answer: $dy/dx = x^1(2 \cos 2x - 2x \sin 2x)$

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

Solve $|x - 1| \leq 1$.

$-1 \leq x - 1 \leq 1$
Add 1 to each part.
Answer: $0 \leq x \leq 2$

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

For events A and B, P(A) = 0.25, P(B) = 0.4 and $P(A \cup B) = 0.45$.
(a) Find $P(A \cap B)$.
(b) Find $P(A' \cap B')$.

(a) $P(A \cap B) = P(A) + P(B) - P(A \cup B) = 0.25 + 0.4 - 0.45 = 0.2$
(b) $A' \cap B'$ is outside both, so $P = 1 - P(A \cup B) = 1 - 0.45$
Answer: (a) 0.2 (b) 0.55

10 Solve a logarithmic equation (two logs) (All boards)

Solve $\log x + \log (x - 3) = \log 10$, $x > 3$.

$\log [x(x - 3)] = \log 10$, so $x^2 - 3x = 10$
$x^2 - 3x - 10 = 0$, $(x - 5)(x + 2) = 0$
$x = 5$ or $x = -2$; $x > 3$, so $x = 5$
Answer: $x = 5$