Day 200 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Composite functions (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

f(x) = 5x − 2 and g(x) = 2x + 2.
Find the value of gf(0).

f(0) = −2
g(−2) = −2
Answer: −2

2 Equilibrium of forces given as vectors (AQA, Edexcel, OCR, MEI, Eduqas)

Three forces $(2\mathbf{i} + 4\mathbf{j})$ N, $(-3\mathbf{i} + 5\mathbf{j})$ N and $(p\mathbf{i} + q\mathbf{j})$ N act on a particle which is in equilibrium. $\mathbf{i}$ and $\mathbf{j}$ are perpendicular unit vectors. Find the values of p and q.

Sum of forces = 0:
i components: p + (2) + (−3) = 0
j components: q + (4) + (5) = 0
Answer: p = 1, q = −9

3 Partial fractions: find the constants (All boards)

Express $\frac{5x + 11}{(x + 3)(x + 2)}$ in the form $\frac{A}{x + 3} + \frac{B}{x + 2}$.
Find the values of A and B.

5x + 11 ≡ A(x + 2) + B(x + 3)
x = −3: −4 = A(−1), so A = 4
x = −2: 1 = B(1), so B = 1
Answer: A = 4, B = 1

4 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: $(x + 5)^2 - 25 + 1 = 0$
$(x + 5)^2 = 24$
$x + 5 = \pm\sqrt{24}$
Answer: $x = -5 \pm 2\sqrt{6}$

5 Geometric distribution (CIE)

A fair die is rolled until a six appears. X is the number of rolls.
Find P(X ≤ 3), to 3 s.f.

$P(X \leq 3) = 1 - P(X > 3) = 1 - (\frac{5}{6})^3$

Answer: 0.421

6 Separable differential equations (All boards)

Given that $dy/dx = \frac{x}{y}$ and y = 4 when x = 0,

find y^2 in terms of x.

$y\,dy = x\,dx$, so $\frac{y^2}{2} = \frac{x^2}{2} + c$

$x = 0, y = 4$: $c = \frac{16}{2}$

$y^2 = x^2 + 16$
Answer: $y^2 = x^2 + 16$

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

Find the set of values of x satisfying both
$3x - 1 < -13$ and $x^2 + 7x + 10 < 0$.

$3x - 1 < -13$ gives $x < -4$.
$x^2 + 7x + 10 < 0$: $(x + 5)(x + 2) < 0$, so $-5 < x < -2$.
Both are true where the two ranges overlap.
Answer: $-5 < x < -4$

8 Area enclosed by a parabola (diagram) (All boards)

The diagram shows the curve $y = x(2 - x)$.
Find the area of the shaded region, between the curve and the x-axis.

The curve meets the x-axis where x = 0 and x = 2
Area = $\int_0^2 2x - x^2 \, dx = [\frac{2x^2}{2} - \frac{x^3}{3}]$ from 0 to 2
$= \frac{2^3}{2} - \frac{2^3}{3}$
$= \frac{4}{3}$
Answer: $\frac{4}{3}$

9 Interpreting the PMCC (AQA, Edexcel, OCR, MEI, Eduqas)

For data set A, $r = -0.44$. For data set B, $r = -0.91$.
Which data set has the stronger linear correlation? Give a reason.

Strength depends on the size of r, ignoring the sign.
$|-0.44| = 0.44$ and $|-0.91| = 0.91$.
Answer: data set B, as |r| is larger

10 Particle held by a string and a horizontal force (All boards)

A particle of weight 24 N hangs from a light string, pulled aside by a horizontal force P N so that the string makes an angle θ with the vertical, where $\tan\theta = \frac{5}{12}$. Find P and the tension T N.

Vertically: $T\cos\theta = 24$
Horizontally: $T\sin\theta = P$
Dividing: $P = 24\tan\theta$; $T = \sqrt{24^2 + P^2}$
Answer: P = 10, T = 26