Day 298 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Velocity-time graph: acceleration from two stages (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The graph shows the velocity of a runner.
(a) Find the acceleration in the first 2 s.
(b) Find the deceleration in the last 2 s.
(c) Find the total distance travelled.

(a) $a = \frac{6 - 2}{2}$

(b) $a = \frac{6 - 0}{2}$, a deceleration of 3

(c) area $= \frac{1}{2}(2 + 6) \times 2 + 6 \times 12 + \frac{1}{2} \times 2 \times 6$

Answer: (a) 2 m s^{-2} (b) 3 m s^{-2} (c) 86 m

2 Simplifying algebraic indices (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Simplify $(4x^3)^2 \div 8x^4$.

$(4x^3)^2 = 16x^6$

$16x^6 \div 8x^4$: divide the numbers and subtract the powers

$= 2x^2$

Answer: $2x^2$

3 Coding (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The values x are coded using $y = (x - 100) \div 10$.

The coded values have mean $\bar{y} = 2$ and standard deviation 1.5.

Find the mean and standard deviation of x.

$x = 100 + 10y$

Mean: $100 + 10 \times 2 = 120$

Standard deviation: $10 \times 1.5 = 15$ (adding 100 has no effect)

Answer: mean = 120, standard deviation = 15

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

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

$= 6^2 - (\sqrt{7})^2$

$= 36 - 7$

Answer: 29

5 Binomial: cumulative probabilities (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

$X \sim B(13, 0.5)$. Find $P(5 \leq X \leq 8)$, giving your answer to 3 s.f.

$P(5 \leq X \leq 8) = P(X \leq 8) - P(X \leq 4)$

$= 0.8666 - 0.1334$

Answer: 0.733

6 Partial fractions: find the constants (All boards)

Express $\frac{7x + 20}{(x + 2)(x + 4)}$ in the form $\frac{A}{x + 2} + \frac{B}{x + 4}$.

Find the values of A and B.

$7x + 20 \equiv A(x + 4) + B(x + 2)$

$x = -2$: $6 = A(2)$, so $A = 3$

$x = -4$: $-8 = B(-2)$, so $B = 4$

Answer: A = 3, B = 4

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7 Finding a quadratic from its turning point (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows a sketch of a quadratic curve.

Find its equation in the form $y = a(x - p)^2 + q$.

The turning point is $(-2, -4)$, so $y = a(x + 2)^2 - 4$.

The curve passes through $(0, 8)$:

$8 = a(2)^2 - 4$, so $12 = 4a$

$a = 3$

Answer: $y = 3(x + 2)^2 - 4$

8 Solve a^x = b using logarithms (All boards)

Solve $7^{2x} = 10$.

Give your answer to 3 significant figures.

Take logs: $2x \log 7 = \log 10$

$x = \frac{\log 10}{2 \log 7} = 0.592$

Answer: $x = 0.592$

9 Differentiating velocity to find acceleration (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A particle moves in a straight line. Its velocity at time t seconds is v m s^{-1}, where $v = t^2 - 4t + 5$.

(a) Find its acceleration when t = 1.

(b) Find the time when its acceleration is zero.

$a = \frac{dv}{dt} = 2t - 4$

(a) $t = 1$: $a = 2 \times 1 - 4$

(b) $2t - 4 = 0$, so $t = \frac{4}{2}$

Answer: (a) -2 m s^{-2} (b) 2 s

10 Straight line from logarithmic graph (All boards)

Variables x and y satisfy $y = ax^n$. A graph of $\log_{10} y$ against $\log_{10} x$ is a straight line with gradient $\frac{1}{2}$ and intercept 0.8.

Find n and a, giving a to 3 significant figures.

$\log y = \log a + n \log x$

Gradient $n = \frac{1}{2}$

$\log a = 0.8$ so $a = 10^{0.8} = 6.31$

Answer: $n = \frac{1}{2}$, $a = 6.31$