Day 318 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Linear inequalities (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $-5x + 1 > -4$.

$-5x > -5$

Divide by -5 and reverse the inequality:

$x < 1$

Answer: $x < 1$

2 Braking: deceleration and time (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A cyclist travelling at 25 m s^{-1} brakes uniformly and comes to rest after travelling 100 m.
(a) Find the deceleration.
(b) Find the time taken to stop.

(a) $v^2 = u^2 + 2as$: $0 = 25^2 + 2 \times a \times 100$

so $a = -3.125$, a deceleration of 3.125

(b) $s = \frac{(u + v)}{2} t$: $100 = 12.5\ t$

Answer: (a) 3.125 m s^{-2} (b) 8 s

3 Solve a logarithmic equation (one log) (All boards)

Solve $\log_3 x = 4$.

$x = 3^4$

Answer: $x = 81$

4 Transforming a point on a graph (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The point P(−4, 3) lies on the curve y = f(x).
Write down the coordinates of the image of P on
(a) y = f(2x) (b) y = f(x − 4)

(a) y = f(2x) divides x by 2, so P maps to (−2, 3).
(b) y = f(x − 4) adds 4 to x, so P maps to (0, 3).
Answer: (a) (−2, 3) (b) (0, 3)

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

A particle moving in a straight line with constant acceleration 3 m s^{-2} travels 25.5 m in 3 s.
Find its initial speed.

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

$25.5 = 3u + \frac{1}{2} \times 3 \times 3^2$

$3u = 12$

Answer: 4 m s^{-1}

6 The remainder theorem (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Find the remainder when $2x^3 - 3x^2 + 3x - 6$ is divided by $(3x - 1)$.

Put $3x - 1 = 0$: $x = \frac{1}{3}$

Remainder = $f(\frac{1}{3}) = \frac{2}{27} + (-\frac{1}{3}) + 1 + (-6)$

$= -\frac{142}{27}$

Answer: $-\frac{142}{27}$

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7 Parametric differentiation (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A curve has parametric equations

$x = 1t$, $y = 4t^2 + 1$.

Find the gradient at the point where $t = 3$.

$dx/dt = 1$, $dy/dt = 8t$

$dy/dx = \frac{8t}{1}$

At $t = 3$: $dy/dx = 24$

Answer: 24

8 Binomial: finding parameters (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

$X \sim B(60, p)$ and $E(X) = 6$.

Find p and $Var(X)$.

$np = 6$, so $p = 6 \div 60 = 0.1$

$Var(X) = npq = 6 \times 0.9$

Answer: $p = 0.1$, $Var(X) = 5.4$

9 2D vectors: magnitude and direction (All boards)

The vector $\mathbf{p} = 12\mathbf{i} + 5\mathbf{j}$.

Find (a) $|\mathbf{p}|$, (b) the angle $\mathbf{p}$ makes with the positive x-axis, measured anticlockwise (1 d.p.).

(a) $|\mathbf{p}| = \sqrt{12^2 + 5^2} = 13$

(b) Acute angle $= \tan^{-1}(\frac{5}{12}) = 22.6°$

$\mathbf{p}$ is in the first quadrant, so the angle is 22.6°

Answer: (a) 13 (b) 22.6°

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

$X \sim B(12, 0.2)$. Find $P(X \leq 2)$, giving your answer to 3 s.f.

Using the cumulative binomial function (or adding $P(X = 0)$ up to $P(X = 2)$)

Answer: 0.558