**Day 132** **A Level Maths: C Tier 10-a-day: Model Solutions**

## 1 Solve a logarithmic equation (one log) (All boards)

Solve $\log_5 x = 2$.

$x = 5^2$

**Answer: $x = 25$**

## 2 Binomial: mean and variance (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

X ~ B(20, 0.3). Find E(X) and Var(X).

$E(X) = np = 20 \times 0.3 = 6$

$Var(X) = npq = 20 \times 0.3 \times 0.7$

**Answer: E(X) = 6, Var(X) = 4.2**

## 3 Car towing a caravan (All boards)

A car of mass 1200 kg tows a caravan of mass 500 kg on a level road with acceleration 0.75 m $s^{-2}$. Resistances: 300 N on the car, 150 N on the caravan. Find the driving force and the tow bar tension.

Whole system: $D - 300 - 150 = 1700 \times 0.75$

Caravan: $T - 150 = 500 \times 0.75$

**Answer: D = 1725 N, T = 525 N**

## 4 Parametric equations: finding points (Edexcel, OCR, MEI, CIE, AQA, Eduqas)

A curve has parametric equations

$x = 4t - 4$, $y = 2t^2 - 5$.

Find the coordinates of the point where $t = 1$.

$x = 4 \times 1 - 4 = 0$

$y = 2 \times 1^2 - 5 = -3$

**Answer: (0, −3)**

## 5 Combined mean (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The mean of 15 ages of the men is 34. The mean of 30 ages of the women is 37.

Find the mean of all 45 values.

Total of first group = $15 \times 34 = 510$

Total of second group = $30 \times 37 = 1110$

Mean = $1620 \div 45$

**Answer: 36**

## 6 Vector geometry with a diagram (OAB) (All boards)

In the diagram, OA = $\mathbf{a}$, OB = $\mathbf{b}$, and P lies on AB with AP : PB = 1 : 4.

Find AB and OP in terms of $\mathbf{a}$ and $\mathbf{b}$.

$AB = OB - OA = \mathbf{b} - \mathbf{a}$

$AP = \frac{1}{5} AB = \frac{1}{5}(\mathbf{b} - \mathbf{a})$

$OP = OA + AP = \mathbf{a} + \frac{1}{5}(\mathbf{b} - \mathbf{a})$

$= \frac{4}{5}\mathbf{a} + \frac{1}{5}\mathbf{b}$

**Answer: $AB = \mathbf{b} - \mathbf{a}$; $OP = \frac{4}{5}\mathbf{a} + \frac{1}{5}\mathbf{b}$**

## 7 Modulus equations (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $|x + 5| = 7$.

$x + 5 = 7$ or $x + 5 = -7$

$x = 2$ or $x = -12$

**Answer: $x = 2$ or $x = -12$**

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## 8 Moments: reactions on a uniform beam (AQA, Edexcel, OCR, MEI)

A uniform beam AB of mass 20 kg and length 6 m rests horizontally on supports at A and B. A load of mass 20 kg is placed on the beam 4.5 m from A. Take g = 9.8 m $s^{-2}$. Find the reaction at B.

Moments about A:

$R_B \times 6 = 20 \times 9.8 \times 3 + 20 \times 9.8 \times 4.5$

$R_B \times 6 = 1470$

**Answer: 245 N**

## 9 Proof by contradiction (AQA, Edexcel, OCR, MEI, Eduqas)

Prove by contradiction that if 3n + 2 is even, then n is even, where n is an integer.

Assume n is odd, so n = 2k + 1 for an integer k.

3n + 2 = 6k + 3 + 2 = 2(3k + 2) + 1

This is odd, which contradicts 3n + 2 being even.

So the assumption is false: n must be even.

**Answer: Proved**

## 10 Integrate using partial fractions (All boards)

$\frac{2x}{(x+3)(x+1)} \equiv \frac{A}{x+3} + \frac{B}{x+1}$.

Find A and B, and hence find $\int \frac{2x}{(x+3)(x+1)}\,dx$.

$2x \equiv A(x+1) + B(x+3)$

$x = -3$ gives $A = 3$; $x = -1$ gives $B = -1$

$\int \left(\frac{3}{x+3} + \frac{-1}{x+1}\right) dx = 3 \ln|x+3| + -1 \ln|x+1| + c$

**Answer: A = 3, B = −1; 3 ln |x + 3| − ln |x + 1| + c**