**Day 323** **A Level Maths: C Tier 10-a-day: Model Solutions**

## 1 Midpoint and length of a line segment (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

M(2, 3) is the midpoint of the line segment AB.
A is the point (−2, 2). Find the coordinates of B.

x-coordinate: $\frac{-2 + x_B}{2} = 2$, so $x_B = 6$

y-coordinate: $\frac{2 + y_B}{2} = 3$, so $y_B = 4$

**Answer: B(6, 4)**

## 2 Simplify using identities (All boards)

Simplify $6\sin^2 x + 6\cos^2 x$.

Take out the factor 6: $6(\sin^2 x + \cos^2 x) = 6 \times 1$

**Answer: 6**

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

X ~ B(17, 0.7). Find P(X > 14), giving your answer to 3 s.f.

$P(X > 14) = 1 - P(X \leq 14)$
$P(X \leq 14) = 0.9226$

**Answer: 0.0774**

## 4 Compound growth: find n (All boards)

£1000 invested at 5% compound interest per year.
After how many whole years will it first exceed £2000?

$1000 \times 1.05^n > 2000$, so $1.05^n > 2$

$n > \frac{\log 2}{\log 1.05} = 14.21$

The least whole number of years is 15

**Answer: 15 years**

## 5 Horizontal projection from a cliff (AQA, Edexcel, OCR, MEI)

A ball is thrown horizontally at 14 m $s^{-1}$ from the top of a vertical cliff of height 4.9 m above the sea. Take g = 9.8 m $s^{-2}$.
Find (a) the time taken to reach the sea, (b) the horizontal distance of the landing point from the cliff.

(a) Vertically: u = 0, s = 4.9, a = 9.8

$4.9 = \frac{1}{2} \times 9.8 \times t^2$, so $t^2 = 1$

(b) Horizontal distance = speed × time = 14 × 1

**Answer: (a) 1 s (b) 14 m**

## 6 Perpendicular bisector (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A is (6, −2) and B is (14, −10).
Find the equation of the perpendicular bisector of AB, in the form ax + by = c with integer a, b and c.

Midpoint of AB = (10, −6)

Gradient of AB = $\frac{-8}{8} = -1$, so perpendicular gradient = 1

$y - (-6) = 1(x - 10)$
Multiply out and rearrange.

**Answer: x − y = 16**

## 7 Normal approximation to the binomial (CIE)

X ~ B(80, 0.6). Use a normal approximation to find P(X ≤ 50), to 3 s.f.

np = 48 and npq = 19.2, so use Y ~ N(48, 19.2)
Continuity correction: P(Y < 50.5)

$z = (50.5 - 48) \div \sqrt{19.2}$

**Answer: 0.716**

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## 8 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 = 2 : 1.
Find AB and OP in terms of $\mathbf{a}$ and $\mathbf{b}$.

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

$\text{AP} = \frac{2}{3}\text{AB} = \frac{2}{3}(\mathbf{b} - \mathbf{a})$

$\text{OP} = \text{OA} + \text{AP} = \mathbf{a} + \frac{2}{3}(\mathbf{b} - \mathbf{a})$

$= \frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$

**Answer: $\mathbf{AB} = \mathbf{b} - \mathbf{a}$; $\mathbf{OP} = \frac{1}{3}\mathbf{a} + \frac{2}{3}\mathbf{b}$**

## 9 Constant acceleration: v = u + at (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A car moving in a straight line has initial speed 8 m s$^{-1}$ and constant acceleration 3 m s$^{-2}$.
Find its speed after 11 s.

$v = u + at$
$v = 8 + 3 \times 11$
**Answer: 41 m s$^{-1}$**

## 10 Finding an unknown using the factor theorem (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

When $x^3 + kx^2 - 2x - 6$ is divided by $(x + 3)$, the remainder is $-9$. Find the value of k.

$f(-3) = -9$
$-27 + 9k + 0 = -9$
$9k = 18$
**Answer: $k = 2$**