**Day 115** **A Level Maths: C Tier 10-a-day: Model Solutions**

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

The mean of 30 ages of the men is 58. The mean of 45 ages of the women is 64.
Find the mean of all 75 values.

Total of first group = 30 × 58 = 1740
Total of second group = 45 × 64 = 2880
Mean = 4620 ÷ 75
**Answer: 61.6**

## 2 Transforming a graph with a labelled turning point (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows the curve y = f(x). The maximum point is shown. Write down the coordinates of the maximum point on the curve with equation
(a) y = f(2x) (b) y = f(x) + 1

(a) y = f(2x): the maximum point moves to (2, 3).
(b) y = f(x) + 1: the maximum point moves to (4, 4).
**Answer: (a) (2, 3) (b) (4, 4)**

## 3 Trapezium rule: strips shown (diagram) (AQA, Edexcel, OCR, MEI, Eduqas)

The diagram shows the curve $y = e^x$ from x = 0 to x = 2 divided into 4 strips of equal width.
Use the trapezium rule with these strips to estimate the shaded area to 3 s.f.

h = 0.5; y values: 1.000, 1.649, 2.718, 4.482, 7.389

Area $\approx \frac{0.5}{2}[1.000 + 7.389 + 2(8.849)]$

= 6.52
**Answer: 6.52**

## 4 Velocity at time t with constant acceleration (vectors) (AQA, Edexcel, OCR, MEI, Eduqas)

A particle has initial velocity $(\mathbf{i} - 4\mathbf{j})$ m s$^{-1}$ and constant acceleration $(-\mathbf{i} - \mathbf{j})$ m s$^{-2}$.
Find its velocity after 2 s.

v = u + at
$\mathbf{v} = (\mathbf{i} - 4\mathbf{j}) + 2(-\mathbf{i} - \mathbf{j})$
$= (\mathbf{i} - 4\mathbf{j}) + (-2\mathbf{i} - 2\mathbf{j})$
**Answer: $(-\mathbf{i} - 6\mathbf{j})$ m s$^{-1}$**

## 5 Equation of a tangent or normal (All boards)

Find the equation of the normal to the curve
y = 4 ln x + x at the point where x = 1.

dy/dx = 1 + 4/x, so the gradient of the curve at x = 1 is 5
At x = 1, y = 1

Gradient of normal = $-\frac{1}{5}$

$y - 1 = (-\frac{1}{5})(x - 1)$

**Answer: $y = -\frac{1}{5}x + \frac{6}{5}$**

## 6 Two-stage motion: acceleration then constant speed (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A train starts from rest and accelerates uniformly at 4 m s$^{-2}$ for 8 s, then travels at constant speed for a further 30 s. Find the total distance travelled.

Speed reached: v = 4 × 8 = 32 m s$^{-1}$

Stage 1: $s = \frac{1}{2} \times 32 \times 8 = 128$

Stage 2: s = 32 × 30 = 960
**Answer: 1088 m**

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

Solve $|x + 9| = 9$.

$x + 9 = 9$ or $x + 9 = -9$

$x = 0$ or $x = -18$

**Answer: $x = 0$ or $x = -18$**

## 8 Small angle approximations (AQA, Edexcel, OCR, MEI, Eduqas)

$\theta$ is small and measured in radians.

Use the small angle approximations to find an approximation for $\sin 2\theta \tan \theta$.

$\sin 2\theta \approx 2\theta$ and $\tan \theta \approx \theta$

So $\sin 2\theta \tan \theta \approx 2\theta^2$

**Answer: $2\theta^2$**

## 9 Solving equations with indices (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Solve $x^{\frac{4}{3}} = 81$.

Raise both sides to the power $\frac{3}{4}$:

$x = 81^{\frac{3}{4}} = (81^{\frac{1}{4}})^3$

$= 3^3 = 27$

**Answer: $x = 27$**

## 10 Continuous random variable: probability and mean (CIE)

X has probability density function $f(x) = \frac{3}{8}x^2$ for $0 \leq x \leq 2$, and 0 otherwise.

Find E(X).

$E(X) = \int$ from 0 to 2 of $x\, f(x)\, dx = \int$ from 0 to 2 of $\frac{3}{8}x^3\, dx$

$= \frac{3}{8} \times \frac{2^4}{4}$

**Answer: $\frac{3}{2}$**