**Day 359** **A Level Maths: C Tier 10-a-day: Model Solutions**

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

Expand and simplify $(7 - \sqrt{2})^2$.

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

$= 49 - 14\sqrt{2} + 2$

**Answer: $51 - 14\sqrt{2}$**

## 2 Normal distribution: diagram and symmetry (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows the density of $X \sim N(60, 2^2)$.
a and b are equal distances from the mean. The shaded area is 0.48.
Find $P(X > b)$.

Unshaded area $= 1 - 0.48 = 0.52$

The two tails are equal by symmetry, so $P(X > b) = 0.52 \div 2$

**Answer: 0.26**

## 3 Integrate standard functions (All boards)

Find

(a) $\int (5\,e^x + \frac{2}{x})\,dx$

(b) $\int 10\,e^{2x}\,dx$

Use the standard integrals and divide by the coefficient of x where needed.

(a) $= 5\,e^x + 2 \ln|x| + c$

(b) $= 5\,e^{2x} + c$

**Answer: (a) $5\,e^x + 2 \ln|x| + c$ (b) $5\,e^{2x} + c$**

## 4 Selection without replacement (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A bag has 6 red and 2 blue sweets. Two are taken at random without replacement.
Find the probability that they are both the same colour.

$P(RR) = \frac{6}{8} \times \frac{5}{7}$, $P(BB) = \frac{2}{8} \times \frac{1}{7}$

Add: $\frac{15}{28} + \frac{1}{28}$

**Answer: $\frac{4}{7}$**

## 5 Exponential graph through two points (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows the curve $y = ab^x$, where $b > 0$.
Find the values of a and b.

Through (0, 4): $a \times b^0 = 4$, so $a = 4$.

Through (2, 64): $4\,b^2 = 64$

$b^2 = 16$, so $b = 4$ $(b > 0)$

**Answer: $a = 4$, $b = 4$**

## 6 Constant acceleration: distance from average speed (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A car moving in a straight line with constant acceleration increases its speed from 1 m $s^{-1}$ to 7 m $s^{-1}$ in 4 s.
Find the distance it travels in this time.

$s = \frac{(u + v)}{2}\,t$

$s = \frac{(1 + 7)}{2} \times 4$

**Answer: 16 m**

**Day 359** **A Level Maths: C Tier 10-a-day: Model Solutions**

## 7 Integrate using partial fractions (All boards)

$\frac{6x + 14}{(x + 3)(x + 2)} \equiv \frac{A}{x + 3} + \frac{B}{x + 2}$.

Find A and B, and hence find $\int \frac{6x + 14}{(x + 3)(x + 2)}\,dx$.

$6x + 14 \equiv A(x + 2) + B(x + 3)$
$x = -3$ gives $A = 4$; $x = -2$ gives $B = 2$
$\int \left(\frac{4}{x + 3} + \frac{2}{x + 2}\right) dx = 4 \ln|x + 3| + 2 \ln|x + 2| + c$
**Answer: A = 4, B = 2; $4 \ln|x + 3| + 2 \ln|x + 2| + c$**

## 8 Rationalising the denominator (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Rationalise the denominator of $\frac{6}{2 - \sqrt{10}}$.

Write your answer in the form $p + q\sqrt{10}$.

Multiply top and bottom by $2 + \sqrt{10}$:
$\frac{6(2 + \sqrt{10})}{(2)^2 - (\sqrt{10})^2} = \frac{6(2 + \sqrt{10})}{-6}$
**Answer: $-2 - \sqrt{10}$**

## 9 Particle held by a string and a horizontal force (All boards)

A ball of weight 20 N hangs from a light string, pulled aside by a horizontal force P N so that the string makes an angle $\theta$ with the vertical, where $\tan\theta = \frac{3}{4}$. Find P and the tension T N.

Vertically: $T\cos\theta = 20$
Horizontally: $T\sin\theta = P$
Dividing: $P = 20\tan\theta$; $T = \sqrt{20^2 + P^2}$
**Answer: P = 15, T = 25**

## 10 Optimisation (algebraic set-up) (All boards)

A farmer has 80 m of fencing for three sides of a rectangular pen; the fourth side is a wall.
Find the maximum area of the pen.

Two sides of length x m: $A = x(80 - 2x) = 80x - 2x^2$
$dA/dx = 80 - 4x = 0$, so $x = 20$
$d^2A/dx^2 = -4 < 0$ (maximum); $A = 20 \times 40$
**Answer: 800 m²**