Day 122 **A Level Maths: C Tier 10-a-day: Model Solutions**

1 Comparing distributions (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The heights in cm for two groups: Group A has mean 56, standard deviation 7; Group B has mean 62, standard deviation 4.
Compare the two sets of data.

The mean measures the average: Group B has the higher mean.
The standard deviation measures spread: Group B has the smaller standard deviation, so it is more consistent.
Answer: Group B has the higher mean; Group B is more consistent

2 Integrating velocity to find displacement (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

A particle moves in a straight line with velocity $v = (9t^2 - 2t + 8)$ m s^{-1} at time t seconds.
Find the distance travelled between t = 3 and t = 6 (the particle does not turn round).

$s = \int v\,dt = 3t^3 - t^2 + 8t$
Distance = $s(6) - s(3)$
$= 660 - 96$
Answer: 564 m

3 Line through two axis intercepts (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The diagram shows a line meeting the axes at A and B.
Find (a) the equation of AB in the form px + qy = r with integers p, q and r, (b) the length AB.

Gradient $= \frac{-6 - 0}{0 - (-2)} = -3$
Using y = mx + c with c = −6: y = −3x − 6, so 3x + y = −6
$AB^2 = 2^2 + 6^2 = 40$
Answer: (a) 3x + y = −6 (b) $2\sqrt{10}$

4 Find a and b in y = ab^x (All boards)

The curve $y = ab^x$ passes through (0, 3) and (2, 48).
Find the values of a and b.

x = 0: $y = a \times b^0 = a$, so a = 3
x = 2: $3 \times b^2 = 48$, so $b^2 = 16$
b = 4
Answer: a = 3, b = 4

5 Large data set: handling readings (AQA, Edexcel, OCR, MEI, Eduqas)

Seven daily rainfall readings (mm) from the Large Data Set are: 0.6, tr, 2.2, 2.8, 1.2, 3.2, tr.
Here 'tr' means a trace, which is treated as 0.
Find the mean daily rainfall to 3 s.f.

Replace each 'tr' by 0
Total = 10
Mean = 10 ÷ 7
Answer: 1.43 mm

6 Binomial expansion: positive integer powers (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

Find the coefficient of x^2 in the expansion of
$(3 - 3x)^8$.

Term in x^2: ${}^8C_2 \times 3^6 \times (-3x)^2$
$= 28 \times 729 \times 9$
Answer: 183708

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7 Identity then solve (sin² to cos) (All boards)

Solve $-6\sin^2 x + 3\cos x + 6 = 0$
for $0° \le x \le 360°$.

Use $\sin^2 x = 1 - \cos^2 x$: $6\cos^2 x + 3\cos x = 0$

Factorise and solve: $\cos x = -\frac{1}{2}$ or $\cos x = 0$

$x = 90°, 120°, 240°, 270°$

Answer: $x = 90°, 120°, 240°, 270°$

8 Gradient of a tangent to a circle (AQA, Edexcel, OCR, MEI, Eduqas, CIE)

The circle $(x - 2)^2 + y^2 = 25$ passes through $P(5, -4)$.
Find the gradient of the tangent to the circle at P.

Centre $C(2, 0)$.

Gradient of $CP = \frac{-4 - 0}{5 - 2} = -\frac{4}{3}$

The tangent is perpendicular to CP: gradient $= -1 \div (-\frac{4}{3})$

Answer: $\frac{3}{4}$

9 Find the angle of a sector (All boards)

A sector has radius 6 cm and arc length 3.00 cm.
Find the angle of the sector in radians and the area of the sector.

$\theta = \frac{\text{arc length}}{r} = \frac{3.00}{6} = 0.5$

Area $= \frac{1}{2}r^2\theta = \frac{1}{2} \times 6^2 \times 0.5 = 9.00\ \text{cm}^2$

Answer: $\theta = 0.5$ radians; area $9.00\ \text{cm}^2$

10 Equilibrium of a particle under three forces (diagram) (All boards)

A particle is in equilibrium under the three forces shown. $\cos\alpha = \frac{5}{13}$. Find P and Q.

Horizontally: $P = 65\cos\alpha = 65 \times \frac{5}{13}$

Vertically: $Q = 65\sin\alpha = 65 \times \frac{12}{13}$

Answer: $P = 25$, $Q = 60$