Day 264 **A Level Maths: B Tier 10-a-day**

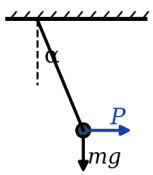
1 Simplify $\frac{(2x)^2 \times 4x^2}{8x^3}$.

2 The vector $\mathbf{a} = \begin{pmatrix} 3 \\ -2 \\ 6 \end{pmatrix}$.
Find $|\mathbf{a}|$ and a unit vector in the direction of $\mathbf{a}$.

3 Express $\frac{10 - 5\sqrt{5}}{\sqrt{5}}$ in the form $p + q\sqrt{5}$, where p and q are integers.

4 The random variable X has E(X) = 10 and Var(X) = 4.
Find (a) E(5X + 1),
(b) Var(5X + 1), (c) $E(X^2)$.

5 A particle of mass 6 kg hangs in equilibrium on a light string inclined at α to the vertical, held by a horizontal force P N, as shown. $\tan\alpha = \frac{5}{12}$.
Take g = 9.8 m s^{-2}.
Find the tension in the string and the value of P.



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6 Line l_1 has equation $4x - y = -20$ and line l_2 has equation $2x + 3y = 4$.
The lines meet at P. Find the area of the triangle formed by l_1, l_2 and the x-axis.

7 9 values of x are coded using $y = \frac{(x - 200)}{10}$.
$\Sigma y = -3$ and $\Sigma y^2 = 191$.
Find the mean and standard deviation of x (3 s.f.).

8 A particle of mass 6 kg is suspended in equilibrium by two light strings attached to a horizontal ceiling. The strings make angles α and β with the ceiling, where $\tan \alpha = \frac{5}{12}$ and $\tan \beta = \frac{4}{3}$.
Take $g = 9.8$ m s^{-2}.
Find the tension in each string.

9 Line l_1: $\mathbf{r} = \begin{pmatrix} -5 \\ -9 \\ 2 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ 3 \\ -1 \end{pmatrix}$.
Line l_2: $\mathbf{r} = \begin{pmatrix} -9 \\ 1 \\ 2 \end{pmatrix} + \mu \begin{pmatrix} 3 \\ -2 \\ -1 \end{pmatrix}$.
Show that l_1 and l_2 intersect and find the point.

10 Find the exact value of
$\int_0^{\ln 4} \frac{e^x}{e^x + 1} \, dx$,
giving your answer in the form a ln b.