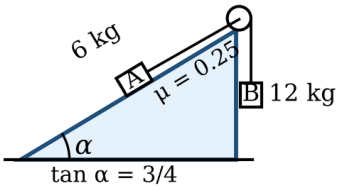
Day 241 **A Level Maths: A Tier 10-a-day**

1 $y = (\ln x)^3$ for $x > 0$.
Find $\frac{dy}{dx}$ and its exact value at $x = e$.

2 The system is released from rest and A moves up the rough plane. Find (a) the acceleration, (b) the tension in the light string. Take $g = 9.8$.



3 The probability that a component is faulty is 0.25. In 21 independent trials, find the probability that this happens
(a) exactly 7 times (b) fewer than 7 times (c) at least 7 times.

4 A particle of mass 3 kg is acted on by forces $\mathbf{F}_1 = (-2\mathbf{i} + 18\mathbf{j})$ N and $\mathbf{F}_2$. Its acceleration is $(2\mathbf{i} + 4\mathbf{j})$ m s^{-2}. Find (a) $\mathbf{F}_2$, (b) the angle between $\mathbf{F}_2$ and $\mathbf{i}$, to 1 d.p.

5 $n = 8$ pairs of (x, y): $\Sigma x = 168$, $\Sigma y = 384$, $\Sigma x^2 = 4128$, $\Sigma xy = 8912$.
(a) Find the equation of the regression line of y on x (3 s.f.).
(b) Estimate y when $x = 9$.

Day 241 **A Level Maths: A Tier 10-a-day**

6 Solve $2 \times 2^{2x} - 6 \times 2^{x} + 4 = 0$.

7 (a) Express $\frac{2x + 9}{(x + 3)^2}$ in the form $\frac{A}{x + 3} + \frac{B}{(x + 3)^2}$.

(b) Hence find the exact value of $\int_0^3 \frac{2x + 9}{(x + 3)^2} dx$.

8 A circle passes through A(2, −9) and B(14, −1).

Its centre lies on the line $y = \frac{1}{2}x + 3$.

Find the equation of the circle.

9 The line l has equation $\mathbf{r} = \begin{pmatrix} 4 \\ -1 \\ 10 \end{pmatrix} + t\begin{pmatrix} 3 \\ -1 \\ 3 \end{pmatrix}$.

Find the coordinates of the foot of the perpendicular from P(0, 4, 3) to l, and the exact distance from P to l.

10 $f(x) = \frac{-5x}{(1 + 3x)(1 + 2x)}$.

(a) Express f(x) in partial fractions.

(b) Hence expand f(x) up to x^2.

(c) State the range of x for which the expansion is valid.