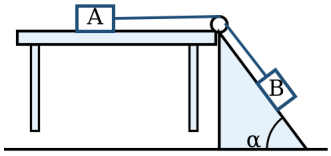
Day 246	A Level Maths: S Tier 10-a-day
1 Prove by contradiction that $\log_3 10$ is irrational.	
2 A population of bacteria is modelled by $P = P_0e^{kt}$, t in hours. Initially P = 50 and after 4 hours $P = \frac{125}{2}$. Find k, and the time for the population to reach 500, to 3 s.f.	
3 25 recorded times (seconds) have mean 39 and standard deviation 5. One value was recorded as 36 but should have been 21. Find the correct mean and the correct standard deviation.	
4 A pile of logs has 17 logs in its bottom row. Each row above has 1 fewer logs than the row below, and the pile has as many rows as possible, each with at least one log. Find the number of rows and the total number of logs.	
5 A particle P moves on a straight line. At time t seconds its velocity is v m s^{-1}, where $v = t^2 - 4t + 3$ for $0 \leq t \leq 4$ Find (a) the times at which P is at instantaneous rest, (b) the total distance travelled by P in the first 4 seconds.	

Day 246 **A Level Maths: S Tier 10-a-day**

6 Data satisfy $y = ax^n$. The line of best fit for lg y against lg x is lg y = 0.25 − 0.5 lg x.
(a) Find a and n, giving a to 3 significant figures.
(b) Estimate y when x = 100, to 3 significant figures.

7 Particle A (10 kg) lies on a rough table with $\mu = 0.25$, and is joined by a light string over a smooth pulley (see diagram) to particle B (10 kg) on a smooth slope, $\sin\alpha = \frac{4}{5}$.
Released from rest, the string is cut when B has moved 1.5 m. Find the further distance A slides before stopping.



8 The curve C has equation $x^2 + xy + 4y^2 = 135$.
Find the coordinates of the points on C where the
tangent is parallel to the x-axis.

9 A curve has parametric equations
$x = -3 + 4\cos t$, $y = 1 + 4\sin t$.
Find its Cartesian equation.

10 Line l_1: $\mathbf{r} = \begin{pmatrix} -1 \\ 7 \\ -3 \end{pmatrix} + s\begin{pmatrix} -1 \\ 3 \\ -3 \end{pmatrix}$,
line l_2: $\mathbf{r} = \begin{pmatrix} -1 \\ -1 \\ 6 \end{pmatrix} + t\begin{pmatrix} 2 \\ 2 \\ -3 \end{pmatrix}$.
Show whether the lines meet, giving the point of intersection if they do, and find the acute angle between them to 1 d.p.