Day 48	A Level Maths: S Tier 10-a-day
1 Solve $\sqrt{2x + 1} = x - 7$.	
2 A particle P of mass 4 kg moves under a single force F N, where $F = (32t - 12)\mathbf{i} + (24t^2 - 16)\mathbf{j}$ and t is the time in seconds. At t = 0, P is at the origin with velocity $(-3\mathbf{i} + 4\mathbf{j})$ m s^{-1}. Find (a) the velocity of P at t = 3, (b) the position vector of P at t = 3.	
3 The heights of plants, in cm are normally distributed. 35% are less than 47 and 35% are greater than 54. Find the mean and standard deviation, each correct to 3 significant figures.	
4 Express $\sqrt{76 + 42\sqrt{3}}$ in the form $a + b\sqrt{3}$, where a and b are positive integers.	
5 (a) Show that $\tan\theta + \cot\theta \equiv 2\operatorname{cosec} 2\theta$. (b) Hence solve $\tan\theta + \cot\theta = 3$ for $0 \leq \theta < 360°$ (1 d.p.).	

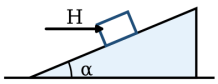
Day 48 **A Level Maths: S Tier 10-a-day**

6 Class P has 20 students with mean mark 77 and standard deviation 6. Class R has 30 students with mean mark 68 and standard deviation 7.
(a) Find the mean mark of all 50 students.
(b) Find the standard deviation of all 50 students.

7 $f(x) = \frac{kx - 3}{x - 3}$ for $x \neq 3$. Given that f is self-inverse, find k, and hence solve $f(x) = x$.

8 The region bounded by $y = \sqrt{x}e^x$, the x-axis and the lines
$x = 0$ and $x = 2$ is rotated through 2π about the x-axis.
Find the exact volume of the solid formed.

9 A particle of weight 110 N rests on a rough plane inclined at α to the horizontal, where $\tan\alpha = \frac{5}{12}$ and $\mu = 0.2$.
A horizontal force H N, in the vertical plane through a line of greatest slope, holds it in equilibrium. Find the range of possible values of H.



10 Two drones P and Q move so that, t seconds after launch, their position vectors in metres are
$\mathbf{r}_P = \begin{pmatrix} -4 \\ 2 \\ -5 \end{pmatrix} + t\begin{pmatrix} -2 \\ 2 \\ -1 \end{pmatrix}$ and $\mathbf{r}_Q = \begin{pmatrix} -8 \\ 1 \\ -2 \end{pmatrix} + t\begin{pmatrix} -1 \\ 2 \\ -3 \end{pmatrix}$.
Find the time at which they are closest and the exact minimum distance between them.