Day 183	A Level Maths: S Tier 10-a-day
1 Solve $\cos 2\theta + 3\cos\theta - 1 = 0$ for $0 \leq \theta < 2\pi$, giving answers in terms of π.	
2 The number of customers arriving at a shop in one hour is Po(45). Use a suitable approximation to find $P(X \geq 65)$, to 3 significant figures.	
3 A ball is thrown vertically upwards from ground level. It is more than 235.2 m above the ground for 2 s. Find the speed of projection and the greatest height reached. Take $g = 9.8$ m s^{-2}.	
4 20 recorded masses (grams) have mean 25 and standard deviation 2. One value was recorded as 23 but should have been 25. Find the correct mean and the correct standard deviation.	
5 A particle P moves on a straight line. At time t seconds its velocity is v m s^{-1}, where $v = 3t^2 - 18t + 15$ for $0 \leq t \leq 6$ Find (a) the times at which P is at instantaneous rest, (b) the total distance travelled by P in the first 6 seconds.	

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6 The curve C has equation $x^2y + xy^2 = 6$. Find the equation of the normal to C at the point $(-3, 1)$, in the form $ax + by + c = 0$ with integers a, b, c.	
7 $g(x) = x^2 + 1$. Also $fg(x) = -2x^2 + 5$, where f is a linear function. (a) Find f(x). (b) Solve $gf(x) = 82$.	
8 Solve $\|x - 6\| < -3x - 6$.	
9 Two boats P and Q move so that, t hours after noon, their position vectors in km are $\mathbf{r}_P = \begin{pmatrix} 4 \\ -3 \end{pmatrix} + t\begin{pmatrix} -1 \\ 3 \end{pmatrix}$ and $\mathbf{r}_Q = \begin{pmatrix} 0 \\ 0 \end{pmatrix} + t\begin{pmatrix} 0 \\ 1 \end{pmatrix}$. Find the time at which they are closest and the exact minimum distance between them.	
10 $f(x) = \frac{-5x + 5}{(1 + 2x)(1 - 3x)}$. (a) Express f(x) in partial fractions. (b) Hence expand f(x) in ascending powers of x up to x^3, stating the range of validity.	