Day 300	A Level Maths: S Tier 10-a-day
1 The curve C has equation $y = \frac{x + 7}{x + 3}$. (a) Write down the equations of the asymptotes of C. (b) The line $y = -x + k$ is a tangent to C. Find the possible values of k.	
2 A ball is thrown vertically upwards from ground level. It is more than 196 m above the ground for 6 s. Find the speed of projection and the greatest height reached. Take $g = 9.8$ m s^{-2}.	
3 Use the trapezium rule with 5 strips to estimate $\int_0^2 \sqrt{4 - x^2}\, dx$, to 4 s.f. Is it an overestimate or an underestimate? Explain.	
4 A data set has lower quartile 13 and upper quartile 23. An outlier is a value more than 1.5 × IQR beyond the nearest quartile. (a) Find the range of values that are not outliers. (b) 12 observations have mean 23. The largest is 45, an outlier, and it is removed. Find the new mean.	
5 Prove by contradiction that $\log_9 10$ is irrational.	

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6 Large Data Set, daily mean air temperature (°C), Heathrow, October 2015 (n = 92): mean 11.1, sd 3.2. (F = 1.8C + 32) (a) Find the mean and sd in °F. (b) Is a reading of 16.9 more than 2 sd above the mean?	
7 The curve C has equation $x^3 + xy^2 = 5$. Find the equation of the normal to C at the point $(1, -2)$, in the form $ax + by + c = 0$ with integers a, b, c.	
8 A sequence is defined by $u_1 = -3$ and $u_{n+1} = \frac{1}{1 - u_n}$. Show that the sequence is periodic and find $\sum_{r=1}^{75} u_r$.	
9 A ball is projected from level ground with horizontal and vertical velocity components 14.7 and 34.3 m s^{-1}. Find (a) the two times at which it moves at 45° to the horizontal, (b) the horizontal distance between those two points. Take g = 9.8 m s^{-2}.	
10 $f(\theta) = \frac{2}{32 + 7\sin\theta + 24\cos\theta}$ (a) Write $7\sin\theta + 24\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$. (b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.	