Day 168	A Level Maths: S Tier 10-a-day
1 Prove by contradiction that $\log_2 7$ is irrational.	
2 For 50 observations x, $\Sigma(x - 20) = 20$ and $\Sigma(x - 20)^2 = 908$. (a) Find the mean of x. (b) Find the standard deviation of x. (c) Find the value of Σx^2.	
3 The curve C has parametric equations $x = t$, $y = t^2$. The line $y = 7x - 12$ meets C at A and B. Find the exact length AB.	
4 $f(x) = e^x + 2x - 3$. (a) Show that $f(x) = 0$ has a root α with $0 < \alpha < 1$. (b) Use Newton-Raphson with $x_0 = 1$ to find x_1 and x_2 to 4 decimal places.	
5 The first row of a theatre has 23 seats. Each row has 3 more seats than the row in front. Find (a) the number of seats in row 32, (b) the least number of rows for at least 1632 seats.	

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6 A curve has parametric equations $x = t^2$, $y = 2t^3 - 18t$. Find the coordinates of the points on the curve where the gradient is 6.	
7 A particle P of mass 5 kg moves under a single force F N, where $F = (40t + 25)\mathbf{i} + (30t^2)\mathbf{j}$ and t is the time in seconds. At t = 0, P is at the origin with velocity $(-4\mathbf{i} + 4\mathbf{j})$ m s^{-1}. Find (a) the velocity of P at t = 3, (b) the position vector of P at t = 3.	
8 A non-uniform rod AB of length 6 m and mass 10 kg rests on supports at C and D, where AC = 1 m and AD = 4 m, with R_C = 3 R_D. Find (a) the distance of the centre of mass from A. A particle of mass m kg at B puts the rod on the point of tilting about D. (b) Find m.	
9 The region bounded by $y = \frac{2}{x + 1}$, 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.	
10 A test of H_0: p = 0.25 against H_1: p > 0.25 uses a sample of 50 at the 5% level. (a) Find the critical region for X, the number of successes. (b) Find the actual significance level. (c) Find P(Type II error) when in fact p = 0.45.	