Day 299	A Level Maths: S Tier 10-a-day
1 A population of bacteria is modelled by $P = P_0e^{kt}$, t in hours. Initially P = 200 and after 2 hours P = 500. Find k, and the time for the population to reach 2000, to 3 s.f.	
2 Find the set of values of x for which both $x^2 - x - 30 \leq 0$ and $-x + 7 \leq 2$.	
3 Three forces $(-8\mathbf{i} + 4\mathbf{j})$ N, $(-4\mathbf{i} + k\mathbf{j})$ N and $(-3\mathbf{i} + 2\mathbf{j})$ N act on a particle of mass 4 kg. The resultant is parallel to $(-5\mathbf{i} + \mathbf{j})$. Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.	
4 (a) Expand $(25 + x)^{-\frac{1}{2}}$ up to and including the term in x^2. (b) Use x = 0.04 to estimate $\frac{1}{\sqrt{25.04}}$ to 5 decimal places.	
5 12 recorded lengths (cm) have mean 56 and standard deviation 8. One value was recorded as 56 but should have been 40. Find the correct mean and the correct standard deviation.	

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6 Find the remainder when x^8 is divided by $(x - 1)(x + 1)$.	
7 Find the exact coordinates of the stationary point of $y = x^4e^{-x}$ for $x > 0$, and determine its nature.	
8 A ball is projected from a point O on horizontal ground at 45° to the horizontal. The ball just passes over the top of a vertical wall of height 6.8 m, at a horizontal distance of 46 m from O. Find (a) the speed of projection, (b) the greatest height of the ball above the ground, to 3 s.f. Take $g = 9.8$ m s^{-2}.	
9 The curve C has equation $x^2 - 2xy + 5y^2 = 144$. Find the coordinates of the points on C where the tangent is parallel to the x-axis.	
10 The mass of a apple is $N(117, 5^2)$ g. A apple is 'heavy' if it exceeds 119. (a) Find the probability that a apple is heavy. (b) 8 apples are chosen at random. Find the probability that at least 3 are heavy.	