Day 280	A Level Maths: S Tier 10-a-day
1 A colony of 500 cells grows by 8% each day. Find the least whole number of days for the colony to exceed 2500 cells.	
2 Data satisfy $y = ab^x$. The line of best fit for lg y against x is lg y = 0.4 + 0.6x. (a) Find a and b to 3 significant figures. (b) Estimate y when x = 14, to 3 significant figures. (c) Interpret the value of b.	
3 The curve $y = 5^x - 2x$ has one stationary point. Find its coordinates to 3 s.f. and show that it is a minimum.	
4 $f(x) = 2x^3 + ax^2 + bx + 16$, where a and b are constants. (x + 1) is a factor of f(x), and f(x) leaves remainder 144 when divided by (x − 2). Find a and b, and hence solve f(x) = 0.	
5 A chord AB of a circle, centre O and radius 3 cm, subtends an angle of $\frac{\pi}{2}$ at O. Find the exact area and the exact perimeter of the minor segment cut off by AB.	

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6 Each component is faulty with probability 0.1, independently. Find the least number n of components that must be tested so that the probability of finding at least one faulty is greater than 0.99.	
7 Evaluate $\sum_{r=5}^{13}(3 \times 2^r + 1r)$.	
8 A particle P moves on a straight line. At time t seconds its velocity is v m s^{-1}, where $v = 6\cos(\frac{\pi t}{6})$ for $t \geq 0$. Find (a) the greatest magnitude of the acceleration of P, (b) the distance P travels before it first comes to instantaneous rest. Give (b) to 3 s.f.	
9 The line $8y = 6x + k$ is a tangent to the circle $(x + 0)^2 + (y + 2)^2 = 16$. Find the two possible values of k.	
10 A plank of mass 2 kg lies on a smooth horizontal table, with a block of mass 6 kg on it ($\mu = 0.2$ between them). A horizontal force P N acts on the block. (a) Find the greatest P for which the block does not slip. (b) Find the accelerations of block and plank when P = 117.6. Take g = 9.8 m s^{-2}.	