Day 47	A Level Maths: S Tier 10-a-day
1 A colony of 200 cells grows by 12% each day. Find the least whole number of days for the colony to exceed 1000 cells.	
2 A stone is thrown vertically upwards with speed 10 m s^{-1} from the top of a cliff. The top of the cliff is 14.1 m above the sea. Find (a) the time taken for the stone to reach the sea, (b) the total distance travelled by the stone, to 3 s.f. Take g = 9.8 m s^{-2}.	
3 Find the set of values of x for which both $x^2 - 3x - 4 \geq 0$ and $x - 1 > -6$.	
4 A drink cools according to $\theta = 10 + Ae^{-kt}$, where θ °C is the temperature after t minutes. Initially $\theta = 100$, and after 6 minutes $\theta = 70$. Find A and k, then find when $\theta = 31$ (3 s.f.).	
5 A particle P moves with constant acceleration. At t = 0 seconds P is at (3**i**) m with velocity (10**i** + 10**j**) m s^{-1}. At t = 8, P has velocity (−14**i** − 14**j**) m s^{-1}. Find (a) the acceleration of P, (b) the time at which P moves parallel to (**i** + **j**), (c) the position vector of P at that time.	

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6 The fill volume of a bottle is N(μ, 25) with known variance 25. The mean was claimed to be 37 ml. A random sample of 36 has mean 34.75. Test at the 5% level whether the mean is different from 37.	
7 Find the binomial expansion of $(3 + 5x)^{-1}$ in ascending powers of x up to and including the term in x^3. State the values of x for which it is valid.	
8 X ~ B(60, 0.25). (a) State why a normal approximation is suitable for X. (b) Use a normal approximation to estimate P(X ≥ 16), to 3 significant figures.	
9 (a) Show that $\frac{x^2 + 14x + 28}{(x + 1)(x + 4)} \equiv 1 + \frac{A}{x + 1} + \frac{B}{x + 4}$. (b) Hence find the exact value of $\int_0^1 \frac{x^2 + 14x + 28}{(x + 1)(x + 4)}\,dx$.	
10 A curve has parametric equations $x = 3(t + \frac{1}{t})$, $y = 2(t - \frac{1}{t})$, $t \neq 0$. Find a Cartesian equation of the curve.	