Day 174	A Level Maths: S Tier 10-a-day
1 A van costs £30000 and loses 15% of its value each year. Find the least whole number of years after which its value is below £4000.	
2 A stone is thrown vertically upwards with speed 5 m s^{-1} from the top of a cliff. The top of the cliff is 29.1 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 A radioactive sample has mass $m = m_0e^{-kt}$ grams, t in days. Initially m = 100 and after 5 days $m = \frac{200}{3}$. Find k, and the time for the mass to fall to 10 grams, to 3 s.f.	
4 Each battery is faulty with probability 0.05, independently. Find the least number n of batterys that must be tested so that the probability of finding at least one faulty is greater than 0.995.	
5 Solve $2^{2x+2} - 9 \times 2^x + 2 = 0$.	

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6 A particle is projected at 10 m s^{-1} up a line of greatest slope of a rough plane inclined at α to the horizontal, where $\sin\alpha = \frac{4}{5}$ and $\mu = 0.4$. Find (a) the distance it travels up the plane, to 3 s.f., (b) its speed on returning to its starting point. Take g = 9.8 m s^{-2}.	
7 Given that $\sum_{r=1}^{n}(4r - 3) = 1540$, find n.	
8 The curve $y = x^3\sqrt{252 - x}$, for $0 < x < 252$, has one stationary point. Find its exact coordinates and determine its nature.	
9 Show that $\frac{3+\sqrt{11}}{3-\sqrt{11}} - \frac{3-\sqrt{11}}{3+\sqrt{11}}$ can be written in the form $k\sqrt{11}$, and find k.	
10 Faults in a cable occur at random at a mean rate of 2.5 per hour. After a modification, 12 faults are found in 2 hours. Test at the 10% level whether the rate of faults has increased.	