Day 356	A Level Maths: S Tier 10-a-day
1 A car of mass 1000 kg tows a trailer of mass 300 kg along a horizontal road, with driving force 1780 N. Resistances are 500 N on the car and 240 N on the trailer. (a) Find the tension in the tow bar. At 6.4 m s^{-1} the tow bar breaks. (b) Find the distance between car and trailer when the trailer stops.	
2 A radioactive sample has mass $m = m_0e^{-kt}$ grams, t in days. Initially m = 60 and after 3 days m = 45. Find k, and the time for the mass to fall to 3 grams, to 3 s.f.	
3 $u_{n+1} = u_n + 2n + 1$, $u_1 = -5$. (a) Show that $u_n = an^2 + bn + c$ and find a, b, c. (b) Find the least n for which $u_n > 913$.	
4 A game costs £1. Two fair dice are rolled: a total of at least 12 wins £16, a total of at most 3 wins £1, otherwise nothing. (a) Find the expected profit. (b) Find the standard deviation of the profit (3 s.f.). (c) Find the stake that makes the game fair.	
5 Find the sum of all the integers from 1 to 585 inclusive that are divisible by 4 or by 5, but not by both.	

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6 A curve is given by $x = y^3 - 2y$. Find dy/dx and d^2y/dx^2 when $y = 1$.	
7 A ball is projected from a point O on horizontal ground with speed 24.5 m s^{-1} at an angle θ above the horizontal, where $\tan\theta = \frac{4}{3}$. Find (a) the time of flight, (b) the range, (c) the greatest height. Take $g = 9.8$ m s^{-2}.	
8 The points A, B, C have coordinates (3, 3, 5), (−3, 5, −1), (5, −3, 4). Find angle ABC to 1 d.p., and the exact area of triangle ABC.	
9 $X \sim B(18, \frac{1}{3})$. (a) Show that $P(X = r + 1) \div P(X = r) = \frac{18 - r}{r + 1} \times \frac{1}{2}$. (b) Find the most likely value of X and its probability (3 s.f.).	
10 Solve $\lvert -2x + 2\rvert \leq \lvert -4x - 5\rvert$.	