Day 283	A Level Maths: S Tier 10-a-day
1 The curve $y = ax^n$ passes through (1, 12) and (2, 96). Find the values of a and n.	
2 A sequence is defined by $u_1 = 5$ and $u_{n+1} = \frac{u_n + 4}{3u_n - 1}$. Show that the sequence is periodic and find $\sum_{r=1}^{101} u_r$.	
3 A bag has 3 red, 6 blue and 3 green counters. A player takes two without replacement. Two reds win £3, two blues win £6, anything else wins nothing. (a) Find the expected winnings. (b) The player pays £1 to play. Find the expected profit.	
4 Car A passes a point O travelling at a constant speed of 13.5 m s^{-1}. 6 s later, car B leaves O from rest with constant acceleration 2 m s^{-2}, travelling in the same direction. B overtakes A at the point X. Find (a) the time B takes to reach X, (b) the distance OX, (c) the speed of B at X.	
5 Find the set of values of x for which both $x^2 - 2x - 35 \leq 0$ and $3x - 3 > 10$.	

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6 For 10 pairs of values, $S_{xx} = 49$, $S_{yy} = 256$ and $S_{xy} = 58$. (a) Calculate the product moment correlation coefficient r. (b) The critical value for a two-tailed test at the 5% level with n = 10 is 0.6319. Carry out the test of H_0: $\rho = 0$ against H_1: $\rho \neq 0$.	
7 The curve C has equation $x^2 - xy + 5y^2 = 19$. Find the coordinates of the points on C where the tangent is parallel to the x-axis.	
8 The curve C has equation $y = \frac{-x - 1}{x + 3}$. (a) Write down the equations of the asymptotes of C. (b) The line $y = -2x + k$ is a tangent to C. Find the possible values of k.	
9 $y = e^{-2x} \sin 2x$. Show that $dy/dx = e^{-2x}(-2 \sin 2x + 2 \cos 2x)$. Find the x coordinate of the stationary point with the smallest positive x (3 s.f.), and its nature.	
10 A non-uniform rod AB of length 6 m and mass 4 kg rests on supports at C and D, where AC = 2 m and AD = 4 m, with R_C = 3 R_D. Find (a) the distance of the centre of mass from A. A particle of mass m kg at B puts the rod on the point of tilting about D. (b) Find m.	