Day 245	A Level Maths: S Tier 10-a-day
1 Solve $5^{2x} - 27 \times 5^{x} + 50 = 0$, giving each answer exactly and, where not an integer, to 3 s.f.	
2 Car P passes a point O travelling at a constant speed of 16 m s^{-1}. 5 s later, car Q leaves O from rest with constant acceleration 2 m s^{-2}, travelling in the same direction. Q overtakes P at the point X. Find (a) the time Q takes to reach X, (b) the distance OX, (c) the speed of Q at X.	
3 Express $\frac{x^3 - 2x^2 - 9x + 16}{(x - 4)(x - 2)}$ in the form $ax + b + \frac{C}{(x - 4)} + \frac{D}{(x - 2)}$.	
4 $f(x) = x^3 + x^2 - 6x - 4$. (a) Show that $f(x) = 0$ has a root α with $-1 < \alpha < 0$. (b) Use Newton-Raphson with $x_0 = 0$ to find x_1 and x_2 to 4 decimal places.	
5 For 12 pairs of values, $S_{xx} = 324$, $S_{yy} = 144$ and $S_{xy} = -131$. (a) Calculate the product moment correlation coefficient r. (b) The critical value for a one-tailed test at the 5% level with n = 12 is 0.4973. Carry out the test of H_0: $\rho = 0$ against H_1: $\rho < 0$.	

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6 The tangent to $y = \frac{18}{x^2 + 5}$ at the point where $x = 2$ meets the axes at A and B. Find the exact area of triangle OAB, where O is the origin.	
7 $f(x) = \frac{6}{2x^2 - 4x + 6}$ for all real x. Find the greatest value of f(x), the value of x at which it occurs, and the range of f.	
8 A particle P moves on a line. Its displacement from a fixed point O at time t seconds is s metres, where $s = 5 \sin \frac{t}{2} + 12 \cos \frac{t}{2}$. Find (a) the greatest distance of P from O, (b) the greatest speed of P, (c) the first time P is at its greatest distance from O (3 s.f.).	
9 A student's time on a task, in minutes, is $N(39, 12^2)$. Given that it exceeds 27, find the probability that it exceeds 36.	
10 In the diagram, line l_1 passes through A and B. Line l_2 is perpendicular to l_1 at B and meets the x-axis at C. Find the coordinates of C and the area of triangle ABC. 	