Day 100	A Level Maths: A Tier 10-a-day
1 A particle is projected at 7 m s^{-1} up a line of greatest slope of a rough plane inclined at α, where $\tan\alpha = \frac{12}{5}$. The coefficient of friction is 0.1. Find (a) the greatest distance it moves up the plane, (b) its speed on returning to the start. Take g = 9.8. Give answers to 3 s.f. if not exact.	
2 A curve has parametric equations $x = 3t^2 + 5$, $y = -2t(t^2 - 1)$. Find the coordinates of the points where the curve meets the x-axis.	
3 $y = x\tan(x)$. Find the exact gradient at $x = \frac{\pi}{4}$.	
4 The line $y = -x - 4$ meets the curve $y = x^2 + 2x - 8$ at A and B. (a) Find the coordinates of A and B. (b) Find the exact length AB.	
5 The points A, B and C have coordinates (2, −3, −1), (3, 1, 1) and (−3, −1, −1). Find angle ABC, in degrees to 1 d.p.	

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6 Prove that no square number ends in the digit 2, 3, 7 or 8.	
7 Use integration by parts to find the exact value of $\int_0^1 xe^{3x}\,dx$.	
8 Of 40 students, 14 study Maths (M), 23 Physics (P) and 20 Chemistry (C). 9 study M and P, 7 study M and C, 11 study P and C, and 5 study all three. One student is chosen at random. Given that a student studies Chemistry, find the probability that they study all three.	
9 A particle moves in a straight line with velocity v = $(-3t^2 + 18t)$ m s^{-1} at time t s, $t \geq 0$, starting at O. Find (a) its greatest speed, (b) its distance from O when t = 6, (c) the time at which it returns to O.	
10 X ~ B(35, p). H_0: p = 0.4 is tested against H_1: p < 0.4 using a 5% significance level. (a) Find the critical region. (b) State the probability of a Type I error. (c) Find the probability of a Type II error when p = 0.25 (3 s.f.).	