Day 281	A Level Maths: A Tier 10-a-day
1 A particle is projected at 4.2 m s^{-1} up a line of greatest slope of a rough plane inclined at α, where $\tan\alpha = \frac{3}{4}$. The coefficient of friction is 0.5. 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 X, the score (marks), is normally distributed with mean 58 and standard deviation 12. Find (a) P(X > 85.6) (b) P(85.6 < X < 103.6), each to 3 s.f.	
3 A ball is projected from a point O on horizontal ground at 37 m s^{-1} at angle α above the horizontal, $\tan\alpha = \frac{12}{5}$, and lands at A. Find (a) the time of flight, (b) the greatest height, (c) OA. Take g = 9.8. Give answers to 3 s.f. if not exact.	
4 Solve $\lvert x - 7\rvert > \lvert 3x + 1\rvert$.	
5 Solve $3\sec^2\theta - 15\tan\theta + 9 = 0$ for $0° \leq \theta \leq 180°$. Give answers to 1 d.p.	

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6 Expand $(1 + 4x)^{-2}$ in ascending powers of x up to and including the term in x^3. State the range of values of x for which the expansion is valid.	
7 $y = e^{2x} - 10e^x + 12x$. Show that the stationary points occur where $e^x = 2$ and $e^x = 3$, and find the exact y-coordinate of each, with its nature.	
8 Buses arrive at a stop at random at an average of 6 per hour. Find the probability that in a 30-minute period there are (a) zero events (b) at least 3. (c) Find the probability that at least one occurs in each of two separate 30-minute periods.	
9 $u_1 = 0$ and $u_{n+1} = -\frac{1}{2} u_n + 30$. (a) Find the limit L of the sequence as $n \to \infty$. (b) Find the least n for which $\lvert u_n - L \rvert < 0.01$.	
10 Water drains from a tank so that the depth h metres falls at a rate proportional to $\sqrt{h}$. Initially $h = 36$, and after 6 hours $h = 25$. Form and solve a differential equation to find how long, in total, the tank takes to empty.	