Day 275	A Level Maths: S Tier 10-a-day
1 A particle P moves on a straight line. At time t seconds its velocity is v m s^{-1}, where v = 3 $\cos(\frac{\pi t}{2})$ for $t \geq 0$. Find (a) the greatest magnitude of the acceleration of P, (b) the distance P travels before it first comes to instantaneous rest. Give (b) to 3 s.f.	
2 £5000 is invested at 6% per year compound interest. Find the least whole number of years for the investment to exceed £15000.	
3 Data satisfy $y = ax^n$. The line of best fit for lg y against lg x is lg y = 0.9 + 0.5 lg x. (a) Find a and n, giving a to 3 significant figures. (b) Estimate y when x = 100, to 3 significant figures.	
4 Prove by contradiction that $\sqrt{13}$ is irrational.	
5 θ is small and measured in radians. Use small angle approximations to find the value that $\frac{\theta \sin 1\theta}{1 - \cos 2\theta}$ approaches as $\theta \to 0$.	

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6 X and Y are independent, X ~ Po(3) and Y ~ Po(2). (a) State the distribution of X + Y. (b) Given that X + Y = 4, find the probability that X = 2.	
7 Solve $\sqrt{5x - 6} = x - 4$.	
8 A particle P moves on a line. Its displacement from a fixed point O at time t seconds is s metres, where s = 12 sin 2t + 5 cos 2t. 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 ball is dropped from a height of 2 m. After each bounce it rises to $\frac{3}{5}$ of its previous height. (a) Find the total distance it travels before it stops. (b) After how many bounces does it rise less than 0.01 m?	
10 $y = e^x \sin 2x$. Show that $dy/dx = e^x(\sin 2x + 2 \cos 2x)$. Find the x coordinate of the stationary point with the smallest positive x (3 s.f.), and its nature.	