Day 36	A Level Maths: S Tier 10-a-day
1 θ is small and measured in radians. Use small angle approximations to find the value that $\frac{\cos 5\theta - \cos 3\theta}{\theta^2}$ approaches as $\theta \to 0$.	
2 A coin is said to show heads with probability 0.25. In 40 trials it does so 13 times. Test at the 5% level whether the probability is different from 0.25.	
3 Car A passes a point O travelling at a constant speed of 9 m s^{-1}. 8 s later, car B leaves O from rest with constant acceleration 2.5 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.	
4 A sequence is defined by $u_1 = -3$ and $u_{n+1} = \frac{2u_n + 4}{2u_n - 2}$. Show that the sequence is periodic and find $\sum_{r=1}^{100} u_r$.	
5 X ~ B(5, p). It is given that $P(X = 2) = \frac{2}{3} \times P(X = 1)$. (a) Find the value of p. (b) Find P(X = 0), correct to 3 significant figures.	

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6 Find the remainder when x^8 is divided by $(x - 2)(x + 1)$.	
7 Given that $\cos 3\theta \equiv 4\cos^3\theta - 3\cos\theta$, solve $\cos 3\theta = 0$ for $0 < \theta < 2\pi$, in terms of π.	
8 Use the substitution $u = e^x + 2$ to find the exact value of $\int_0^{\ln 2} \frac{e^x}{e^x + 2}\,dx$	
9 A box of weight 195 N is pulled at constant speed up a line of greatest slope of a rough plane ($\tan\alpha = \frac{5}{12}$, $\mu = \frac{3}{4}$) by a force P N at angle β above the plane. (a) Find P when $\tan\beta = \frac{3}{4}$. (b) Find the least possible value of P as β varies.	
10 Solve $\lvert -2x - 6\rvert < -x + 1$.	