Day 49	A Level Maths: A Tier 10-a-day
1 By writing 105° as 60° + 45°, find the exact value of cos 105°, in the form $\frac{\sqrt{a} \pm \sqrt{b}}{c}$.	
2 Particles A (2 kg) and B (7 kg) move in the same direction on a smooth horizontal line at 5 m s^{-1} and 5 m s^{-1}. They collide and coalesce. Find (a) the speed of the combined particle, (b) the kinetic energy lost in the collision.	
3 Solve $3^{3x} = 7^{3x+3}$. Give your answer to 3 significant figures.	
4 X has a binomial distribution with mean 12 and variance 4.8. (a) Find n and p. (b) Find P(X = 11) to 3 significant figures.	
5 Solve $\|2x + 3\| < \|x - 4\|$.	

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6 A 15 kg box is pulled from rest along rough horizontal ground by a horizontal force of 53.1 N and moves 10.8 m in 6 s. Find (a) the coefficient of friction. The force is then removed; (b) find the further distance moved. Take g = 9.8. Give answers to 3 s.f. if not exact.	
7 Water drains from a tank so that the depth h metres falls at a rate proportional to $\sqrt{h}$. Initially h = 9, and after 6 hours h = 4. Form and solve a differential equation to find how long, in total, the tank takes to empty.	
8 The 2nd term of a geometric sequence is −12 and the 4th term is −108. Find the common ratio and the first term. Find the sum of the first 8 terms.	
9 $u_1 = 8$ and $u_{n+1} = \frac{1}{4} u_n + 3$. (a) Find the limit L of the sequence as $n \to \infty$. (b) Find the least n for which $\lvert u_n - L \rvert < 0.1$.	
10 X ~ B(26, 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 = 0.6 (3 s.f.).	