Day 131	A Level Maths: S Tier 10-a-day
1 Solve $\sin(2\theta + 10°) = -\frac{\sqrt{3}}{2}$ for $0° \leq \theta \leq 180°$.	
2 Calls arrive at a switchboard at an average rate of 6 per hour, independently and at random. (a) Find the probability of at least 2 in a 30-minute period. (b) Find the probability that, of 6 separate 30-minute periods, exactly 2 have no arrivals.	
3 Sam claims that $n^2 + 3n + 19$ is prime for every positive integer n. Show that Sam is wrong by finding the smallest value of n that is a counter-example.	
4 Three forces $(-4\mathbf{i} - 6\mathbf{j})$ N, $(7\mathbf{i} + k\mathbf{j})$ N and $(2\mathbf{i} + \mathbf{j})$ N act on a particle of mass 4 kg. The resultant is parallel to $(5\mathbf{i} - 11\mathbf{j})$. Find (a) the value of k, (b) the magnitude of the acceleration of the particle, to 3 s.f.	
5 (a) Show that $\frac{\sin 2\theta}{1 + \cos 2\theta} \equiv \tan\theta$. (b) Hence solve $\frac{\sin 2\theta}{1 + \cos 2\theta} = -\frac{1}{2}$ for $0 \leq \theta < 360°$ (1 d.p.).	

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6 Each year Jo pays £600 into an account on 1 January. Interest of 2% is added each 31 December. Find the first year-end at which the balance exceeds £8,000.	
7 A car of mass 800 kg, with engine power 34.6 kW, climbs a straight road with $\sin\alpha = \frac{1}{10}$ against a constant resistance of 600 N. Find (a) the greatest steady speed up the hill, (b) the acceleration at 6.25 m s^{-1}. Take g = 9.8 m s^{-2}.	
8 A curve has parametric equations x = 2 sin t, y = 2 cos t, for $0 \leq t \leq \frac{\pi}{2}$. Find the exact area bounded by the curve and the coordinate axes.	
9 A biased coin lands on 'win' with the same unknown probability p each time. It is used 5 times in round 1 and 7 times in round 2. Given that exactly 8 wins occur altogether, find the probability that exactly 5 of them were in round 1.	
10 The curve C has parametric equations x = 3t, $y = 4t^2$. The line $y = \frac{4}{3}x + 8$ meets C at A and B. Find the exact length AB.	