Day 243	A Level Maths: S Tier 10-a-day
1 A tennis ball is projected from a point O on horizontal ground with speed 63.7 m s^{-1} at an angle α above the horizontal, where $\tan\alpha = \frac{12}{5}$. Find (a) the time of flight, (b) the range, (c) the greatest height. Take g = 9.8 m s^{-2}.	
2 Faults in a cable occur at random at a mean rate of 4 per hour. After a modification, 19 faults are found in 2 hours. Test at the 10% level whether the rate of faults has increased.	
3 A particle is projected at 16 m s^{-1} up a line of greatest slope of a rough plane inclined at α to the horizontal, where $\sin\alpha = \frac{4}{5}$ and $\mu = 0.8$. Find (a) the distance it travels up the plane, to 3 s.f., (b) its speed on returning to its starting point. Take g = 9.8 m s^{-2}.	
4 Find the exact value of $\tan(\tan^{-1}(\frac{2}{9}) + \tan^{-1}(\frac{1}{2}))$.	
5 (a) Expand $(16 + x)^{\frac{1}{2}}$ up to and including the term in x^2. (b) Use x = 0.03 to estimate $\sqrt{16.03}$ to 5 decimal places.	

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6 A curve has parametric equations $x = 4\cos t$, $y = 4\sin t$. Find a cartesian equation of the curve, with no fractions.	
7 X and Y are independent, X ~ Po(2) and Y ~ Po(2). (a) State the distribution of X + Y. (b) Given that X + Y = 4, find the probability that X = 1.	
8 Find the sum of all the integers from 1 to 407 inclusive that are divisible by 5 or by 7, but not by both.	
9 The curve C has equation $x^2 - xy + 2y^2 = 28$. Find the coordinates of the points on C where the tangent is parallel to the x-axis.	
10 $f(x) = \frac{4x - 4}{(1 + 2x)(1 - 2x)}$. (a) Express f(x) in partial fractions. (b) Hence expand f(x) in ascending powers of x up to x^3, stating the range of validity.	