Day 109	A Level Maths: S Tier 10-a-day
1 A binomial random variable X has mean 31.5 and variance 7.875. (a) Find n and p. (b) Find P(X = 34), correct to 3 significant figures.	
2 A circle has its centre in the first quadrant and touches both the x-axis and the y-axis. It passes through the point (4, 2). Find the two possible equations of the circle.	
3 A shell is projected from a point O on horizontal ground with speed 49 m s^{-1} at an angle θ above the horizontal, where $\tan\theta = \frac{3}{4}$. Find (a) the time of flight, (b) the range, (c) the greatest height. Take g = 9.8 m s^{-2}.	
4 Find the exact value of $\tan(\tan^{-1}(\frac{4}{7}) + \tan^{-1}(1))$.	
5 A train accelerates uniformly from rest at 0.8 m s^{-2} to a speed of V m s^{-1}, travels at this speed, then decelerates uniformly at 1.5 m s^{-2} to rest. The journey takes 68 s and covers 678 m. Find V and the time spent at constant speed.	

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6 Describe a sequence of two transformations that maps the curve $y = x^2$ onto the curve $y = 4x^2 + 16x + 13$.	
7 Find the coordinates of the stationary points of $y = 2\cos 2x + 4\cos x$ for $0 < x < 2\pi$, and determine their nature.	
8 $X \sim B(200, 0.01)$. (a) Explain why a Poisson approximation is suitable and state its distribution. (b) Use it to estimate $P(X > 3)$, to 4 s.f. (c) Find the exact value of $P(X > 3)$, to 4 s.f.	
9 $f(x) = \frac{8}{x^2 + 2x + 5}$ for all real x. Find the greatest value of f(x), the value of x at which it occurs, and the range of f.	
10 The line l has equation $\mathbf{r} = \begin{pmatrix} 6 \\ 1 \\ 1 \end{pmatrix} + t\begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix}$. The point P has coordinates $(6, 6, -2)$. Find the coordinates of the foot F of the perpendicular from P to l, and the exact distance PF.	