Day 162	A Level Maths: A Tier 10-a-day
1 $X \sim B(39, p)$. 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 $p = 0.5$ (3 s.f.).	
2 $f(x) = x^2 + 3$ and $g(x) = 3x - 2$. Solve $fg(x) = gf(x)$.	
3 $X \sim N(\mu, \sigma^2)$, with $P(X < 82) = 0.3085$ and $P(X > 94) = 0.0668$. Find μ and σ.	
4 The equation $x^2 = 5x + 1$ has a root α. Use the iteration $x_{n+1} = \sqrt{5x + 1}$ with $x_0 = 2$ to find x_1, x_2 and x_3 to 4 d.p., and hence the value of α to 2 d.p. (continue until the 2 d.p. value is settled).	
5 Expand $(4 - x)^{\frac{1}{2}}$ in ascending powers of x, up to and including x^2. State the range of x for which the expansion is valid.	

Day 162	A Level Maths: A Tier 10-a-day
6 A particle slides from rest down a rough plane inclined at α to the horizontal, where $\tan\alpha = \frac{3}{4}$. It moves 39.2 m in 5 s. Find (a) the coefficient of friction, (b) the speed after 5 s. Take g = 9.8.	
7 Find the coordinates of the stationary points of $y = \frac{x}{x^2 + 4}$.	
8 A 3 kg particle is in equilibrium on a rough plane inclined at α, $\tan\alpha = \frac{8}{15}$, μ = 0.5. A horizontal force of P N, in the vertical plane through a line of greatest slope, pushes it towards the plane. Find the least and greatest values of P. Take g = 9.8. Give answers to 3 s.f. if not exact.	
9 The line l has equation $\mathbf{r} = \begin{pmatrix} -1 \\ -4 \\ -6 \end{pmatrix} + t\begin{pmatrix} -3 \\ -3 \\ -3 \end{pmatrix}$. Find the coordinates of the foot of the perpendicular from P(0, 2, −4) to l, and the exact distance from P to l.	
10 In the expansion of $(1 + kx)^n$, where n is a positive integer, the coefficient of x is 6 and the coefficient of x^2 is 15. Find n and k.	