Day 11	A Level Maths: S Tier 10-a-day
1 $f(x) = \frac{7x - 1}{(1 - 3x)(1 + x)}$. (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.	
2 A bag has 6 red counters and some black counters, n in total. Two are taken without replacement. P(both red) = $\frac{15}{28}$. Find n.	
3 Find the exact gradient of the curve $y = 2^{2x - 3}$ at the point where x = 3.	
4 Express $\frac{-6 - 2\sqrt{5}}{4 - \sqrt{5}}$ in the form $p + q\sqrt{5}$, where p and q are rational numbers.	
5 The daily output of a machine is N(μ, 36) with known variance 36. The mean was claimed to be 55 units. A random sample of 49 has mean 55.5. Test at the 1% level whether the mean is greater than 55.	

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6 The curve $y = x^2 - 2x + 1$ is translated by $\begin{pmatrix}3\\3\end{pmatrix}$ and then a stretch, scale factor 2, parallel to the x-axis. Find the equation of the resulting curve in the form $y = ax^2 + bx + c$.	
7 (a) Show that $\cos^4\theta - \sin^4\theta \equiv \cos 2\theta$. (b) Hence solve $\cos^4\theta - \sin^4\theta = -\frac{1}{2}$ for $0 \leq \theta < 360°$ (1 d.p.).	
8 Particles A and B are projected from a point O at the same instant, with initial velocities $(32\mathbf{i} + 36\mathbf{j})$ m s^{-1} and $(20\mathbf{i} + 31\mathbf{j})$ m s^{-1} respectively (i horizontal, j vertically upwards). Both are still in flight after 5 s. Find (a) the distance AB at this time, (b) the angle AB makes with the horizontal, to 1 d.p.	
9 $y = e^{-2x} \sin 3x$. Show that $dy/dx = e^{-2x}(-2 \sin 3x + 3 \cos 3x)$. Find the x coordinate of the stationary point with the smallest positive x (3 s.f.), and its nature.	
10 A non-uniform rod AB of length 5 m and mass 4 kg rests on supports at C and D, where AC = 1 m and AD = 4 m, with R_C = 2 R_D. Find (a) the distance of the centre of mass from A. A particle of mass m kg at B puts the rod on the point of tilting about D. (b) Find m.	