Day 225	A Level Maths: A Tier 10-a-day
1 A systematic sample is taken from a numbered list of 240 items. The 4th item chosen is number 22 and the 5th item chosen is number 28. Find the sampling interval, the number of the first item chosen and the size of the sample.	
2 $f(x) = 3x^2 + 12x + 10$. (a) Write f(x) in the form $a(x + p)^2 + q$. (b) State the minimum value of f(x) and the value of x at which it occurs. (c) Solve f(x) = 0, giving surds in simplest form.	
3 A data set has mean 52 and standard deviation 3. A value is treated as an outlier if it is more than 3 standard deviations from the mean. Which of 39, 45, 64, 70 are outliers?	
4 Express $\frac{1}{(x + 1)} - \frac{2}{(x + 3)}$ as a single fraction in its simplest form.	
5 For small θ (in radians), use the small angle approximations to find the value that $\frac{\sin 2\theta \tan \theta}{1 - \cos 3\theta}$ approaches as $\theta \to 0$.	

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6 A non-uniform rod AB (length 6 m, mass 12 kg) has its centre of mass at G, AG = 1 m. It hangs horizontally from vertical strings at A and B. A particle of mass m kg is fixed at P, AP = 5.5 m, making the tensions equal. Find (a) m, (b) the tension. Take g = 9.8.	
7 The region bounded by the curve $y = e^{2x}$, the x-axis, x = 0 and x = 2 is rotated through 360° about the x-axis. Find the exact volume of the solid formed.	
8 The curve y = f(x), where $f(x) = \frac{3}{x+2} - 2$, is translated by $\begin{pmatrix} 3 \\ -1 \end{pmatrix}$. Write down the equations of the asymptotes of the new curve, and find where it crosses the x-axis.	
9 Find the exact value of $\int_0^{\frac{\pi}{2}} (2\sin 2x + 6\cos x)\, dx$.	
10 A ball is projected from a point O on horizontal ground at angle α above the horizontal, $\tan\alpha = \frac{4}{3}$, and passes through A, 30 m horizontally from O and 20.4 m above the ground. Find the speed of projection. Take g = 9.8.	