Day 151	A Level Maths: A Tier 10-a-day
1 A 4 kg particle rests on a smooth plane inclined at α, $\tan\alpha = \frac{3}{4}$, held by a string in the vertical plane through a line of greatest slope, at angle θ above the slope, $\tan\theta = \frac{3}{4}$. Find the tension and the normal reaction. Take g = 9.8.	
2 $f(x) = 2x - 1$ and $g(x) = x^2 - 4$. Solve $gf(x) = 0$.	
3 Prove the identity $(\cos A + \sin A)^2 \equiv 1 + \sin 2A$	
4 $X \sim B(36, 0.5)$. Find the largest value of c such that $P(X \leq c) < 0.01$.	
5 A particle of mass 3 kg is acted on by forces $F_1 = (9\mathbf{i} - \mathbf{j})$ N and F_2. Its acceleration is $(-2\mathbf{i} - 3\mathbf{j})$ m s^{-2}. Find (a) F_2, (b) the angle between F_2 and $\mathbf{i}$, to 1 d.p.	

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6 A, B and C have position vectors $\begin{pmatrix} -1 \\ 1 \\ -2 \end{pmatrix}$, $\begin{pmatrix} -1 \\ 4 \\ 0 \end{pmatrix}$ and $\begin{pmatrix} -1 \\ 10 \\ k \end{pmatrix}$ relative to O, where k is a constant. Given that A, B and C are collinear, find k and the ratio AB : BC.

7 $f(x) = x^2 - 6x + 13$, $x \in \mathbb{R}$, and $g(x) = \frac{1}{x+1}$, $x > -1$.
(a) Find the range of f.
(b) Show that gf is defined and find its range.

8 Solve $\text{cosec}^2 x + \cot x - 3 = 0$
for $0° < x < 360°$. Give answers to 1 d.p.

9 A curve has parametric equations $x = 2t^2 - 2$, $y = -t(t^2 - 16)$.
Find the coordinates of the points where the curve meets the x-axis.

10 $X \sim N(55, 4^2)$. Find $P(X > 59 \mid X > 55)$ to 3 significant figures.