Day 128	A Level Maths: A Tier 10-a-day
1 For small x (in radians), use the small angle approximations to find the value that $\frac{1 - \cos 3x}{x \sin 4x}$ approaches as $x \to 0$.	
2 Summary statistics for the daily mean visibility (Dm) in the same month are: Camborne: mean 25.5, standard deviation 5.4; Leeming: mean 28, standard deviation 2. Make two comparisons.	
3 $f(x) = \frac{-3x - 1}{x + 4}$, $x \in \mathbb{R}$, $x \neq -4$. Find $f^{-1}(x)$ and state its domain.	
4 $\lvert a \rvert = 4$, $\lvert b \rvert = 5$ and the angle between a and b is 150°. Find the exact values of $a \cdot b$ and $\lvert a + b \rvert$.	
5 A ball is projected from a point O on horizontal ground at 31 m s^{-1} at angle α above the horizontal, $\tan \alpha = \frac{12}{5}$, and lands at A. Find (a) the time of flight, (b) the greatest height, (c) OA. Take $g = 9.8$. Give answers to 3 s.f. if not exact.	

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6 A curve has equation $x^2y + 3y^3 + x = -9$. Find $\frac{dy}{dx}$ in terms of x and y, and the gradient of the normal at $(3, -1)$.	
7 The circle $x^2 + y^2 - 6x + 4y - 87 = 0$ passes through $P(-3, -10)$. (a) Find the equation of the tangent at P, in the form $ax + by = c$. (b) Find the coordinates of the point where this tangent crosses the x-axis.	
8 A ball is projected from a point O on horizontal ground at angle α above the horizontal, $\tan\alpha = \frac{3}{4}$, and passes through A, 8 m horizontally from O and 3.5 m above the ground. Find the speed of projection. Take $g = 9.8$.	
9 Eggs are defective with probability 0.2, independently. A tray of 10 eggs is rejected if it has at least 3 defective. From 6 such trays, find the probability that exactly 2 are rejected (3 s.f.).	
10 Solve $x(\sqrt{6} - 1) = -1 + 2\sqrt{6}$, writing x in the form $p + q\sqrt{6}$.	