Day 197	A Level Maths: S Tier 10-a-day
1 θ is small and measured in radians. Use small angle approximations to find the value that $\frac{1-\cos 3\theta}{\theta \tan 4\theta}$ approaches as $\theta \to 0$.	
2 A box of weight 25 N is pulled at constant speed along rough horizontal ground ($\mu = \frac{7}{24}$) by a force P N at angle θ above the horizontal. (a) Find P when $\tan\theta = \frac{4}{3}$. (b) Find the least possible value of P as θ varies, and the corresponding θ to 1 d.p.	
3 The curve $y = ab^x$ passes through (0, 3) and (4, 48). Find the exact values of a and b, and the value of y when x = 6.	
4 $f(x) = 3x^3 + ax^2 + bx - 36$, where a and b are constants. (x + 2) is a factor of f(x), and f(x) leaves remainder 0 when divided by (x + 3). Find a and b, and hence solve f(x) = 0.	
5 A box of weight 95 N is pulled at constant speed up a line of greatest slope of a rough plane ($\tan\alpha = \frac{3}{4}$, $\mu = \frac{7}{24}$) by a force P N at angle β above the plane. (a) Find P when $\tan\beta = \frac{7}{24}$. (b) Find the least possible value of P as β varies.	

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6 Express $\frac{6x^2 - 45x + 56}{(x + 3)(x - 4)^2}$ in the form $\frac{A}{(x + 3)} + \frac{B}{(x - 4)} + \frac{C}{(x - 4)^2}$.	
7 $X \sim B(11, \frac{2}{5})$. (a) Show that $P(X = r + 1) \div P(X = r) = \frac{11 - r}{r + 1} \times \frac{2}{3}$. (b) Find the most likely value of X and its probability (3 s.f.).	
8 Find the exact coordinates of the point of inflection of $y = (x + 1)e^{-2x}$, justifying that it is a point of inflection.	
9 The pdf of X is $f(x) = a + bx$ for $0 \leq x \leq 4$, and 0 otherwise, where a and b are constants. $E(X) = \frac{37}{15}$. (a) Find a and b. (b) Find $P(X < 2)$.	
10 A curve has parametric equations $x = -2 + 5\cos t$, $y = -3 + 5\sin t$. Find its Cartesian equation.	