Day 11	A Level Maths: A Tier 10-a-day
1 A lift of mass 300 kg carries a person of mass 80 kg. The cable tension is 4028 N and the lift is accelerating. Find (a) the magnitude and direction of the acceleration, (b) the force of the floor on the person. Take g = 9.8.	
2 Solve $27^{x+1} = 3^{2x-1}$.	
3 The random variable X has probability density function f(x) = k(5 − x) for $0 \leq x \leq 5$, and 0 otherwise. (a) Find k. (b) Find E(X). (c) Find $P(X > \frac{10}{3})$.	
4 $y = x^3 e^{-3x}$ for $x > 0$. Find the exact coordinates of the stationary point and determine its nature.	
5 Find the quotient and the remainder when $3x^3 + 6x^2 - 4x + 20$ is divided by (x + 3).	

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6 A regression line of v on w is $v = -2965 + -15w$, where $w = \frac{t - 1990}{10}$. (a) Find the regression line of v on t in the form $v = p + qt$. (b) Estimate v when $t = 2020$.	
7 $u_1 = 1$ and $u_{n+1} = \frac{1}{3} u_n + 6$. (a) Find the limit L of the sequence as $n \to \infty$. (b) Find the least n for which $\lvert u_n - L \rvert < 0.1$.	
8 Solve the differential equation $y\frac{dy}{dx} = x$, given that $y = 1$ when $x = 0$ ($y > 0$). Give y in terms of x.	
9 A 4 kg particle rests on a smooth plane inclined at α, $\tan\alpha = \frac{4}{3}$, held by a string in the vertical plane through a line of greatest slope, at angle θ above the slope, $\tan\theta = \frac{5}{12}$. Find the tension and the normal reaction. Take $g = 9.8$. Give answers to 3 s.f. if not exact.	
10 $y = \tan(2x)$. Find $\frac{dy}{dx}$ and its exact value at $x = \frac{\pi}{6}$.	