Day 78	A Level Maths: A Tier 10-a-day
1 A uniform rod AB (10 kg, 4 m) is smoothly hinged at A to a vertical wall, with a 4 kg particle at B. A light string from B to the wall above A holds the rod horizontal, at angle θ to it, $\tan\theta = \frac{5}{12}$. Find (a) the tension, (b) the magnitude of the hinge force. Take g = 9.8. Give answers to 3 s.f. if not exact.	
2 For small x (in radians), use the small angle approximations to find the value that $\frac{1 - \cos 5x}{x \sin 4x}$ approaches as $x \to 0$.	
3 A 5 kg particle rests on a rough plane inclined at α, $\tan\alpha = \frac{7}{24}$, $\mu = 0.2$. A force of P N acts up a line of greatest slope and the particle stays at rest. Find the range of values of P. Take g = 9.8. Give answers to 3 s.f. if not exact.	
4 $y = (6x - 3)e^{-2x}$. Find the exact coordinates of the stationary point and determine its nature.	
5 Faults are reported at random at an average of 10 per hour. Find the probability that in a 90-minute period there are (a) zero events (b) at least 2. (c) Find the probability that at least one occurs in each of two separate 90-minute periods.	

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6 The sum of the first n terms of an arithmetic series is $S_n = 4n^2 + 2n$. (a) Find the first term and the common difference. (b) Find u_{30}.	
7 Solve $4\text{cosec}^2 x - 14\cot x + 2 = 0$ for $0° < x < 180°$. Give answers to 1 d.p.	
8 The line $y = k - 5x$ is a tangent to the curve $y = \frac{5}{x}$. Find the possible values of k.	
9 Prove by contradiction that there are no integers x and y such that $x^2 - y^2 = 14$.	
10 $X \sim N(51, 6^2)$. Find $P(X > 56 \mid X > 53)$ to 3 significant figures.	