Day 82	A Level Maths: S Tier 10-a-day
1 (a) Express $4\cos\theta - 3\sin\theta$ in the form $R\cos(\theta + \alpha)$, where $R > 0$ and $0 < \alpha < 90°$. Give α to 1 d.p. (b) Hence solve $4\cos\theta - 3\sin\theta = -1$ for $0 \leq \theta < 360°$, giving answers to 1 d.p.	
2 A stone is thrown vertically upwards with speed 12 m s^{-1} from the top of a cliff. The top of the cliff is 8.1 m above the sea. Find (a) the time taken for the stone to reach the sea, (b) the total distance travelled by the stone, to 3 s.f. Take g = 9.8 m s^{-2}.	
3 A data set has lower quartile 16 and upper quartile 22. An outlier is a value more than 2 × IQR beyond the nearest quartile. (a) Find the range of values that are not outliers. (b) 8 observations have mean 16. The largest is 37, an outlier, and it is removed. Find the new mean.	
4 (a) Expand $(16 + x)^{\frac{1}{2}}$ up to and including the term in x^2. (b) Use $x = 0.02$ to estimate $\sqrt{16.02}$ to 5 decimal places.	
5 $X \sim B(8, p)$. It is given that $P(X = 2) = \frac{7}{4} \times P(X = 1)$. (a) Find the value of p. (b) Find $P(X = 0)$, correct to 3 significant figures.	

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6 A uniform plank AB of length 10 m and mass 30 kg rests on supports at C and D, where AC = 3 m and DB = 2 m. A girl of mass 50 kg stands on it at distance x m from A. Find the range of x for which the plank stays in equilibrium on both supports.	
7 The curve C has equation $x e^y + 3y = 1$. Find the equation of the tangent to C at the point (1, 0), in the form $ax + by + c = 0$ with integers a, b, c.	
8 Solve simultaneously, giving integer x and y: $8^x \times 2^y = 1024$ $9^x \div 3^y = 243$	
9 Find the coordinates of the points of inflection of $y = \frac{6}{x^2 + 27}$.	
10 Prove by contradiction that $\log_{10} 5$ is irrational.	