Day 280	A Level Maths: B Tier 10-a-day
1 Statement: "If $x^2 > 64$ then $x > 8$." Give a counter-example to show the statement is false.	
2 A box of mass 8 kg rests on a rough horizontal floor, with coefficient of friction 0.6. A horizontal force of 56 N is applied to the box. Take $g = 9.8$ m s^{-2}. Determine whether the box moves. Find the friction force, or the acceleration if it moves.	
3 The vector $\mathbf{a} = \begin{pmatrix} -8 \\ 4 \\ -8 \end{pmatrix}$. Find $\lvert\mathbf{a}\rvert$ and a unit vector in the direction of a.	
4 X ~ Po(4), modelling the number of emails received per hour. Find, to 3 significant figures, (a) $P(X \geq 3)$ (b) $P(X \leq 3)$	
5 The height of the tide in a harbour is modelled by $H = 7 + 4\sin(\frac{\pi t}{6})$, where t is in hours after midnight. Find (a) the greatest and least values, (b) the values of t with $0 \leq t \leq 12$ when it equals 5 m.	

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6 The equation $x^2 + 2kx + (k + 2) = 0$ has real roots.
Find the possible values of k.

7 A population is modelled by $N = N_0e^{kt}$, where t is in hours. Initially N = 1000 and after 5 hours N = 2500.
Find (a) k to 3 s.f., (b) when N reaches 20000, to 3 s.f.

8 The length X cm of a metal rod is normal with mean 500, s.d. 3.
Find k (3 s.f.): (a) $P(X < k) = 0.25$,
(b) $P(X > k) = 0.2$.

9 Express $\frac{3x^2 + 4x - 46}{(x + 5)(x - 4)}$ in the form $P + \frac{Q}{(x + 5)} + \frac{R}{(x - 4)}$.

10 A lift travels between floors in 45 s. The speed-time graph is a trapezium, with the maximum speed V m s^{-1} held from t = 20 to t = 40.
The floors are 650 m apart. Find V, and the deceleration in the final stage.

