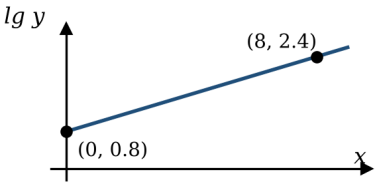
Day 182	A Level Maths: S Tier 10-a-day
1 $f(x) = x^3 - 6x^2 + 17x - 24$. Show that $(x - 3)$ is a factor of $f(x)$, and that the equation $f(x) = 0$ has exactly one real root.	
2 A tennis ball is projected from a point O on horizontal ground with speed 49 m s^{-1} at an angle α above the horizontal, where $\tan\alpha = \frac{4}{3}$. Find the horizontal distance between the two points at which the tennis ball is 73.5 m above the ground. Take g = 9.8 m s^{-2}.	
3 $f(\theta) = \frac{1}{20 + 12\sin\theta + 5\cos\theta}$ (a) Write $12\sin\theta + 5\cos\theta$ as $R\sin(\theta + \alpha)$, $R > 0$, $0 < \alpha < 90°$. (b) Find the greatest and least values of $f(\theta)$, and the smallest positive θ at which the greatest value occurs, to 1 d.p.	
4 Prove that $n^2 + 2$ is never a multiple of 4, for any integer n.	
5 A drink cools according to $\theta = 10 + Ae^{-kt}$, where θ °C is the temperature after t minutes. Initially $\theta = 100$, and after 6 minutes $\theta = 64$. Find A and k, then find when $\theta = 44$ (3 s.f.).	

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6 $X \sim N(43, 49^2)$. Find the value k such that $P(43 - k < X < 43 + k) = 0.70$.
Give k to 3 significant figures.

7 $u_{n+1} = u_n + n - 4$, $u_1 = 7$.
(a) Show that $u_n = an^2 + bn + c$ and find a, b, c.
(b) Find the least n for which $u_n > 533$.

8 $y = ab^x$. The graph of lg y against x is the straight line shown.
Find a and b to 3 significant figures.



9 Line l_1: $\mathbf{r} = \begin{pmatrix} -8 \\ -4 \\ -1 \end{pmatrix} + s\begin{pmatrix} 3 \\ 3 \\ 1 \end{pmatrix}$,
line l_2: $\mathbf{r} = \begin{pmatrix} 1 \\ -1 \\ 9 \end{pmatrix} + t\begin{pmatrix} 0 \\ -3 \\ 3 \end{pmatrix}$.
Show whether the lines meet, giving the point of intersection if they do, and find the acute angle between them to 1 d.p.

10 A plank of mass 5 kg lies on a smooth horizontal table, with a block of mass 3 kg on it ($\mu = 0.3$ between them). A horizontal force P N acts on the plank.
(a) Find the greatest P for which the block does not slip. (b) Find the accelerations of block and plank when P = 47.04. Take g = 9.8 m s^{-2}.