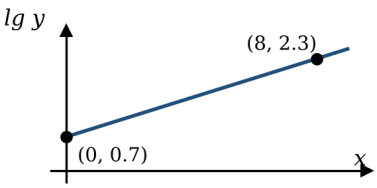
Day 38	A Level Maths: S Tier 10-a-day

1 A cone with its vertex downwards and semi-vertical angle α, where $\tan\alpha = \frac{1}{2}$, is filled at 6π cm^{3}s^{-1}. Find the rate at which the depth h is rising when h = 4 cm. ($V = \frac{1}{3}\pi r^2 h$)

2 $y = ab^x$. The graph of lg y against x is the straight line shown.
Find a and b to 3 significant figures.



3 A sequence is defined by $u_1 = -1$ and $u_{n+1} = \frac{1}{1 - u_n}$.
Show that the sequence is periodic and find $\sum_{r=1}^{101} u_r$.

4 A train accelerates uniformly from rest at 2.2 m s^{-2} to a speed of V m s^{-1}, travels at this speed, then decelerates uniformly at 2 m s^{-2} to rest. The journey takes 71 s and covers 1331 m. Find V and the time spent at constant speed.

5 Use the substitution $u = x^2 + 3$ to find the exact value of $\int_0^1 x(x^2 + 3)^2\,dx$

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6 Express $\sqrt{42 - 12\sqrt{6}}$ in the form $a - b\sqrt{6}$, where a and b are positive integers.	
7 A golf ball is hit from a point O on horizontal ground. It lands 48 m from O, and reaches a maximum height of 9 m above the ground. Find the angle of projection and the speed of projection, to 3 s.f. Take g = 9.8 m s^{-2}.	
8 Solve $x^3 + 3x^2 - 10x - 24 > 0$.	
9 $y = e^{-3x} \cos 2x$. Show that $dy/dx = e^{-3x}(-3 \cos 2x - 2 \sin 2x)$. Find the x coordinate of the stationary point with the smallest positive x (3 s.f.), and its nature.	
10 X ~ B(80, 0.4). (a) State why a normal approximation is suitable for X. (b) Use a normal approximation to estimate $P(24 \leq X \leq 36)$, to 3 significant figures.	