1. An exponentially growing yeast culture doubles in 7 days. How long would it take it to quadruple in size?

2. A population of bacteria grows exponentially according to $b(t) = e^{2t}$. Find and illustrate on a graph
   (a) Population at $t = 0$ and $t = 1$.
   (b) The average rate of change between $t = 0$ and $t = 1$.
   (c) The instantaneous rates of change at $t = 0$ and $t = 1$.

3. Find the derivatives of
   (a) $\cos(1 + e^{2x})$
   (b) $\ln(\ln x)$

4. Find the second derivative of the Hill function $x^2/(1 + x^2)$ and use it to describe the curvature of the Hill function's graph.

5. The amount of medication $M_t$ in the bloodstream of a patient on an intravenous drip is governed by the discrete dynamical system $M_{t+1} = M_t - f(M_t)M_t + d$, where $d$ is the rate of delivery through the drip and $f(M_t)$ is the fraction of the medication absorbed by the patient. If $f(M_t) = M_t/(2 + M_t)$ and $d = 1$, find the biologically significant equilibrium and determine its stability.

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