

Calculus II, Quiz 1: 10.1, 10.2

**Name:**

Please answer the following questions in the spaces provided. Don't forget the question on the back. You may not use your textbook, calculator, or notes on this quiz.

1. (3 pts each) Compute the following limits. If they don't exist, say so.

(a)  $\lim_{n \rightarrow \infty} \frac{1}{e^{n!}}$

(b)  $\lim_{n \rightarrow \infty} \frac{\ln(\frac{1}{n})}{n}$

2. (7 pts) Let  $k \geq 2$  be some constant. Classify the sequence  $\{\frac{n^k}{e^n}\}_{n=1}^{\infty}$  as (eventually, if needed) strictly increasing, increasing, strictly decreasing, decreasing, or none of these.

(over)

3. (7 pts) The biologist Robert May has determined that (under certain conditions) the population of a species  $n$  years from now is given by the sequence  $\{x_n\}_{n=1}^{\infty}$  defined by

$$x_{n+1} = rx_n\left(1 - \frac{x_n}{c}\right),$$

where  $x_1$  is the population in the current year,  $r$  is a constant determined by birth and death rates, and  $c$  is a constant determined by the environment in which the species lives. Assuming that the population of the species stabilizes over the course of many years and that the species does not go extinct, to what value will the population stabilize?