Homefun 14
Take It to the Limit One More Time

MATH 150
10 points

Directions: Work in groups of 2 to 4 in class and then finish outside of class as necessary. Each group should submit **ONE** solution page for the group. (Be sure everyone's name is on it!)

Population growth tends to appear exponential in the early growth stages, but it slows down as the population approaches the **carrying capacity** of the environment.

For a growth rate of r, an initial population of P_0, and a carrying capacity of K, the population $P(t)$ at time t (since the population was P_0) is given by[1]

$$P(t) = \frac{KP_0}{P_0 + (K - P_0)e^{-rt}}.$$

1. Find $\lim_{t\to\infty} P(t)$. Does the answer make sense?

2. By some estimates, Earth's carrying capacity is about 10 billion people. Using a 1% annual growth rate and the current population of around 7 billion, when does this model predict Earth will reach a (human) population of 9 billion?

3. Graph $P(t)$ in Desmos using the Earth data above. The graph is known as a **logistic curve**.

[1] `https://math.usu.edu/~powell/biomath/mlab3-02/node3.html`