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MATH 130

Project #1 (2.1-2.3): Applications of exponential functions to biology

1. Many bacteria reproduce by binary fission, in which a single-celled bacterium divides into two bacteria, which each have identical genetic information. Write an equation describing reproduction in a bacterium that can reproduce itself by binary fission.

Using this equation, calculate how many bacteria there would be after **3 hours** and after **10 hours**, if the bacteria could reproduce itself by binary fission every 30 minutes.

What does this equation assume about the bacteria?

2. Consider the exponential equation of population growth: $N(t) = N_0 e^{rt}$

N(t) = number of individuals in population at time t
N_0 = initial population (number of individuals in population at time 0)
r = intrinsic rate of population growth
t = time

Write an equation using the same variables to describe linear population growth.

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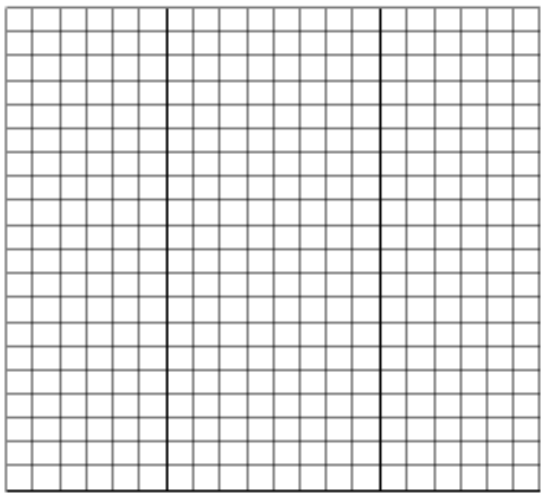
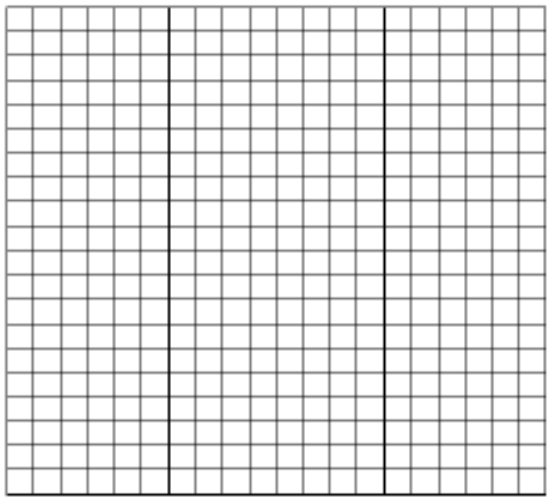
For what values of the intrinsic growth rate **r** will the exponential growth equation overtake the linear growth equation over time?

Give an example of a situation where you would expect exponential population growth. Why would this population not experience linear population growth?

3. A male and a female rabbit are introduced to an island. Graph the estimated island rabbit population over 5 years for each of the following intrinsic population growth rates: r = 0.5 and r = 2. Remember to include your axes and labels.





What does the different r value imply for the rabbit population?