

Name: Solutions

Collaborator(s): _____

Please take your time and answer each question clearly and carefully. You may work with other students, but please be sure to write your own version of your solutions, in your own words, on this sheet. Please note your collaborators above. Collaboration is optional, but please spend your time constructively.

1. Recall our population model $P(t) = \frac{KP_0e^{rt}}{K+P_0(e^{rt}-1)}$. In full sentences, using your own words, describe the following quantities. One is a function, one is a variable, and the rest are parameters – clearly indicate which is which in your description.

(a) P_0

This represents the starting value of $P(t)$, meaning at $t=0$, $P(0) = P_0$. This is probably something we consider fixed or known, or else a parameter.

(b) $P(t)$

This is the function that represents the population over time.

(c) r

This is the parameter that represents the growth rate of the population. It may be known or unknown, but it might be possible to measure or estimate.

(d) K

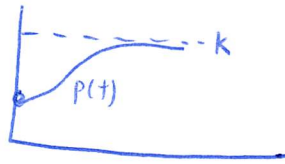
This is the ("carrying") capacity of the system, or the stable value of $P(t)$. It is a parameter.

(e) t

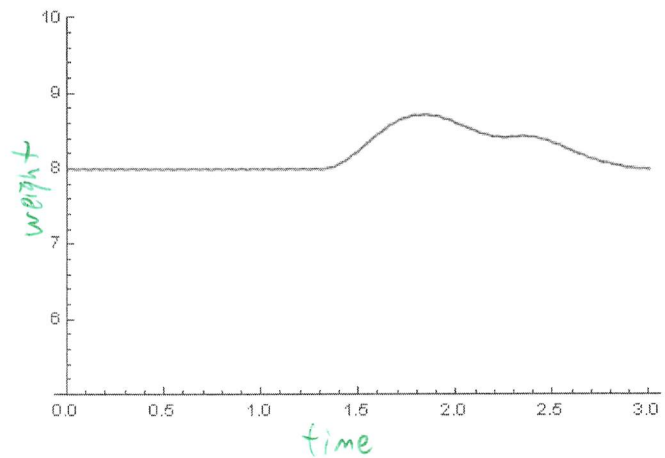
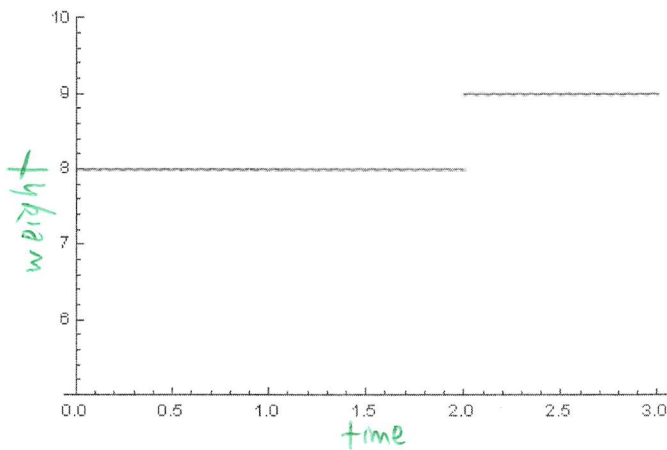
This is the (independent) variable, time. It may be important to know the units of t (and r).

2. Which quantity in the previous question is equal to $\lim_{t \rightarrow \infty} P(t)$? (You do not need to show the mathematical justification, just explain which one this is and why.)

This is K . The function $P(t)$ should approach K , something like:



3. The two graphs below show two different phenomena related to the weight of cat.



The two phenomena are as follows:

- My cat broke its leg and was fitted with a heavy metal rod to fix the bone.
- My cat had a mid-life crisis (life # 4 for cats) and gained some weight.

Which of these graphs shows which phenomenon? How do you know?

The left is the break because the weight of the cat over time jumps up the moment the rod is installed. The right shows a steady increase, then some decrease, as if weight is being gained over time.

Note: The labels in green were provided in class.

Which of these functions is continuous? One? Both? Neither?

The function on the right seems to be. There are no jumps or breaks in the function.

Note: This is fictional. Neither of these things happened to my cat.