## Logistic Growth

## Goal:

- Can build differential equations that reflect logistic growth

Terminology:

- Logistic

Discussion question: Consider the situation we are currently in. COVID-19 is currently spreading exponentially (i.e. proportional to the amount of people who have the virus), but it can't go on forever. Eventually, either a vaccine will be developed or it burns itself out and everyone on Earth gets it but we cannot say that as $t \rightarrow \infty$ that the number of COVID-19 cases, $n \rightarrow \infty$. Write a differential equation that could be used to describe the how the number of cases changes over time.

We will NOT be solving this differential equation (although it does have a solution). Instead we can use technology to predict the solution curve.

Example: A new meme is kind of like a virus. It will get shared and shared until everyone has either seen it or a person was never aware the meme existed. Write a differential equation for the number of people who have seen the following meme. Three years after "I can has cheezburger?" was created 16 million people had seen it. Today 20 million people know it (assume this is the limit). Use technology to predict $k$.

Practice: A chemical reaction procceds as follows:

$$
A+B \rightarrow C+g
$$

Where chemical $A$ and $B$ react to form chemicals $C$ and $g$ where $g$ is a gas. The important thing is that mass of the system does not stay fixed as the chemical $g$ will leave the system. Before anything happens the mass of $A+B$ is 500 g and once the reaction is complete (and $A, B$ have disapeared) the mass of $C$ is 300 g . The rate of the reaction is proportional to how much has reacted and how much there is left to react.
a. Make a differential equation that describes the change in the mass of the system
b. After 20 minutes the mass of the system is 480 g and after 60 minutes the mass of the system is 340 g . Use technology to predict $k$ and the point where the reaction is half way done.

Practice: Follow the link given on Teams that has data of the number of confirmed cases in BC of COVID-19 over the past 90 days. Write the differential equation for the change in the number of confirmed cases. There are three variable that are unknown. In your group come to an agreement on the best choice of $C, k, M$ (and $M$ is obviouly the value everyone wants to know).

