# *In Class Exercises (ICE)*

***To complete this activity, you will need:***

- ***something to simulate spreading disease (e.g. candy)***
- ***the tables included on this activity sheet.***

***This activity simulates the spread of a disease or rumor through a group of people. It is also a simulation of a kind of population growth called "Logistic Growth."***

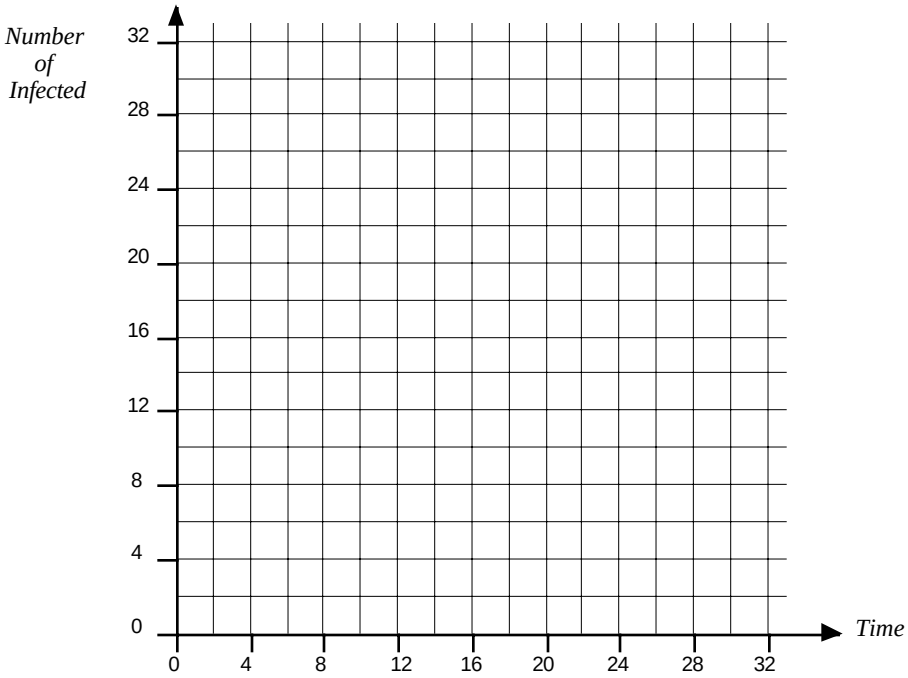
***The objective of this activity is to learn what patterns "Logistic Growth" follows, and how to describe logistic growth using rates of change.***

***To carry out this activity, we'll walk around in a big circle. One person will have a bag of "disease," and every now and again they will spread the disease (or rumor) to others.***

***We'll record the number of "diseased" people in a table.***

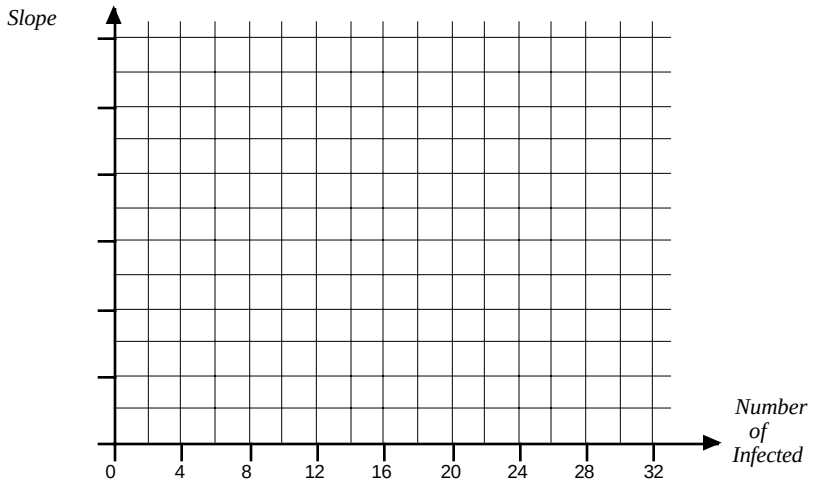
| *Time* | *Number Infected* | *Time* | *Number Infected* |
|---|---|---|---|
| 0 | | 15 | |
| 1 | | 16 | |
| 2 | | 17 | |
| 3 | | 18 | |
| 4 | | 19 | |
| 5 | | 20 | |
| 6 | | 21 | |
| 7 | | 22 | |
| 8 | | 23 | |
| 9 | | 24 | |
| 10 | | 25 | |
| 11 | | 26 | |
| 12 | | 27 | |
| 13 | | 28 | |
| 14 | | 29 | |

- ***Use the axes given below to plot the number of infected people as a function of time. Describe the spread of the disease as a function of time.***




- ***At several places on your graph, draw tangent lines, and estimate the slopes of these tangent lines. Record your results in the table given below, and plot the points using the axes given.***

| Number Infected | Slope | Number Infected | Slope | Number Infected | Slope |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |



- ***What kind of function would do a good job of representing the pattern in the graph of slope versus number of infected? Try to find an equation that gives slope as a function of the number of infected people.***

- ***Below is a short tutorial on sketching slope fields. Use the equation that you found for slope as a function of number infected to draw a slope field in the space provided.***

**To calculate the slope field:** $\frac{dy}{dx} = \frac{-x}{y}$

**1. Evaluate the derivative at a point** **2. Sketch a line with that slope**

**3. Repeat at other points** **4. Sketch some solution curves**

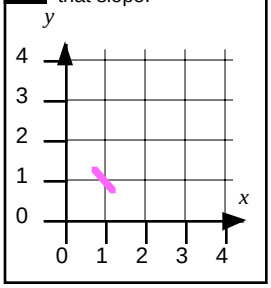
**1** Evaluate the derivative at a point.

Evaluate $\frac{dy}{dx} = \frac{-x}{y}$

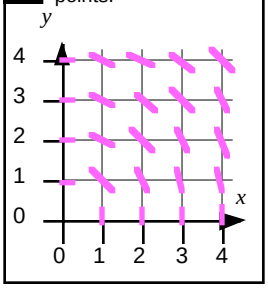
at the point $(x, y) = (1, 1)$

$$\frac{dy}{dx} = \frac{-x}{y} = \frac{-1}{1} = -1$$

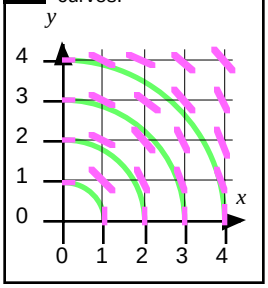
**2** Sketch a line with that slope.

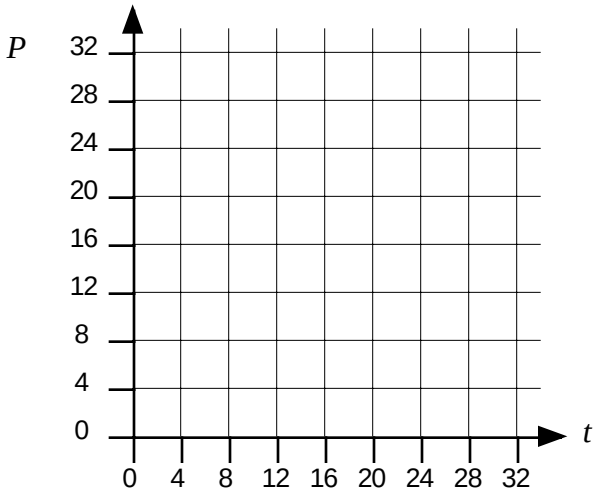



**3** Repeat at other points.




**4** Sketch some solution curves.




- ***How is the appearance of the slope field related to the graph that you plotted of number infected as a function of time?***

***Figure 1 shows a colony of coral commonly known as green star polyps. (Scientific name: Clavularia viridus.)***

***This coral grows rapidly when conditions are favorable, quickly covering all available space on the reef.***

Figure 1: A colony of green star polyps ( *Clavularia viridus* ).

- ***When the star polyps encounter another coral, their growth is restricted, as other corals sting[1] the star polyps. What pattern of growth would you expect a colony of green star polyps to exhibit? What similarities exist between this situation and the spread of a disease that you considered earlier?***

[1] Many corals produce tentacles covered in stinging cells (called sweeper tentacles) to deter other corals from growing too close. (Source: www.reeftank.com)