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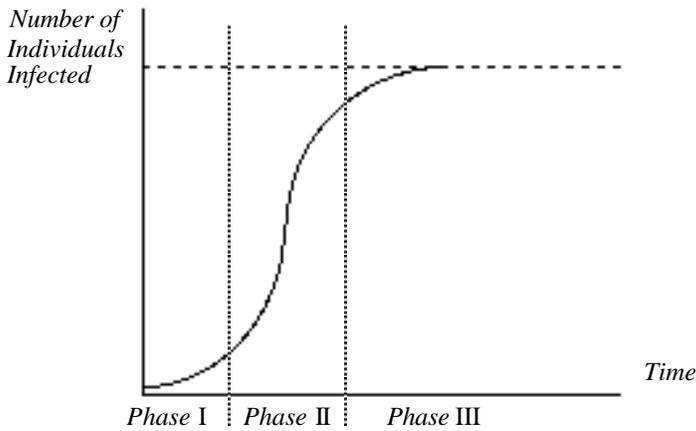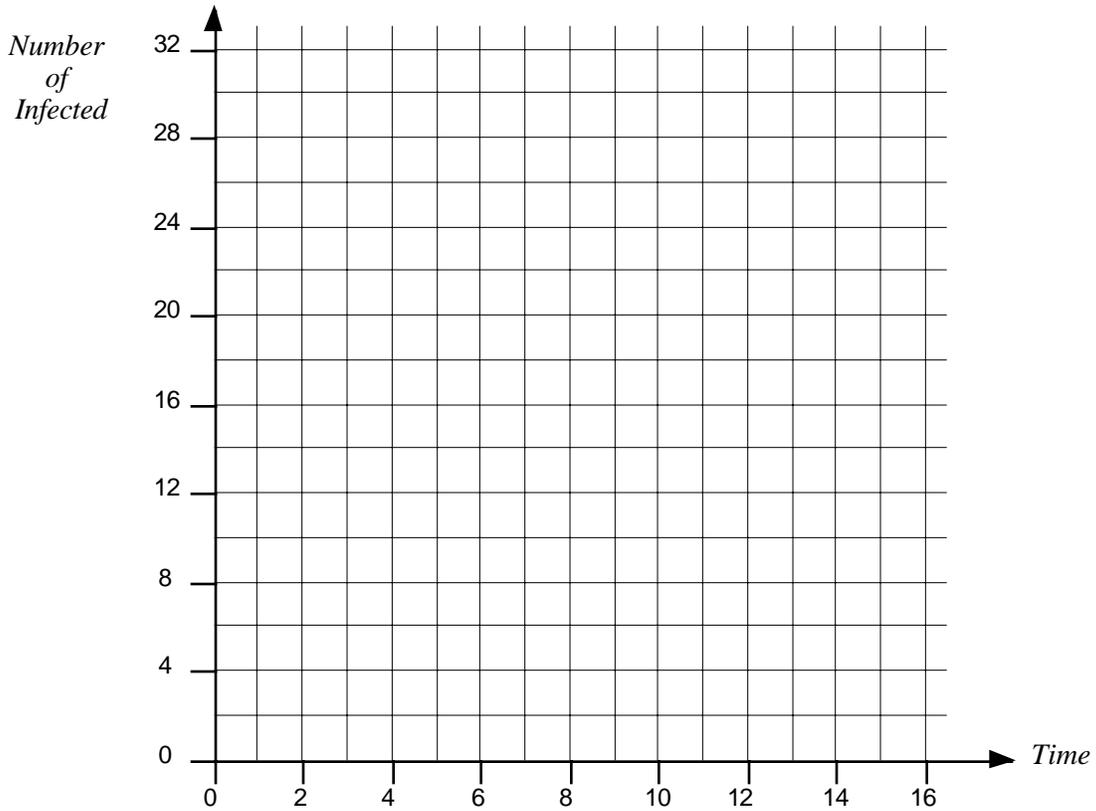
The objective of this activity is to learn what patterns "Logistic Growth" follows, and how to describe logistic growth using rates of change.

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.**

Number of Infected (y-axis, values 0, 4, 8, 12, 16, 20, 24, 28, 32)
Time (x-axis, values 0, 2, 4, 6, 8, 10, 12, 14, 16)

Number of Individuals Infected

Time

Phase I *Phase* II *Phase* III

Figure 1: Growth of the number of infected individuals.

The rate at which the infection spreads is not constant. Your graph probably shows three phases of growth in the number of infected individuals. (See Figure 1).

- **Explain why the rate of change is low or high during each phase.**

In the next part of this ICE, you will explore the relationship between the rate at which the infection spreads and the number of infected individuals.

- **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

Slope

Number of Infected

0   4   8   12   16   20   24   28   32
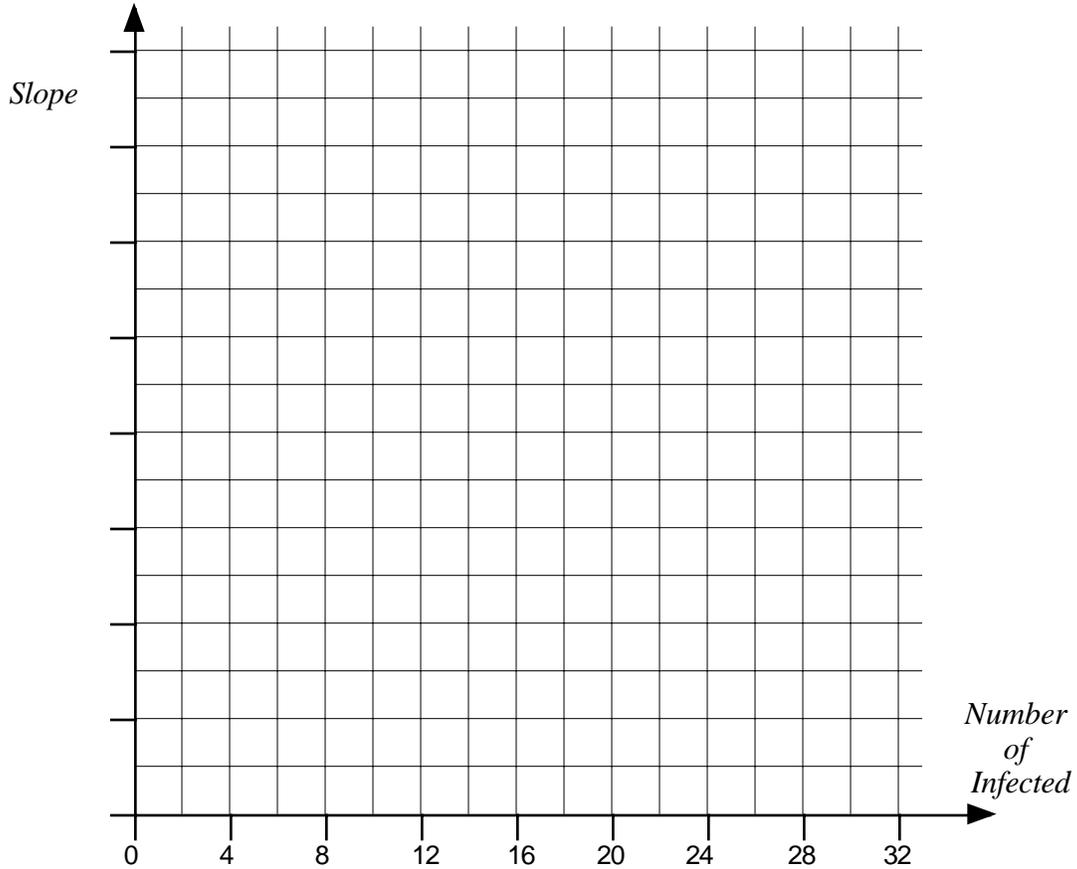
- **What kind of function would do a good job of representing the pattern in the graph of slope versus number of infected? Try to find an equation that gives slope as a function of the number of infected people.**

- **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: $\dfrac{dy}{dx} = \dfrac{-x}{y}$ | 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 $\dfrac{dy}{dx} = \dfrac{-x}{y}$

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

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

2 Sketch a line with that slope.

3 Repeat at other points.

4 Sketch some solution curves.

Number of Infected

Time
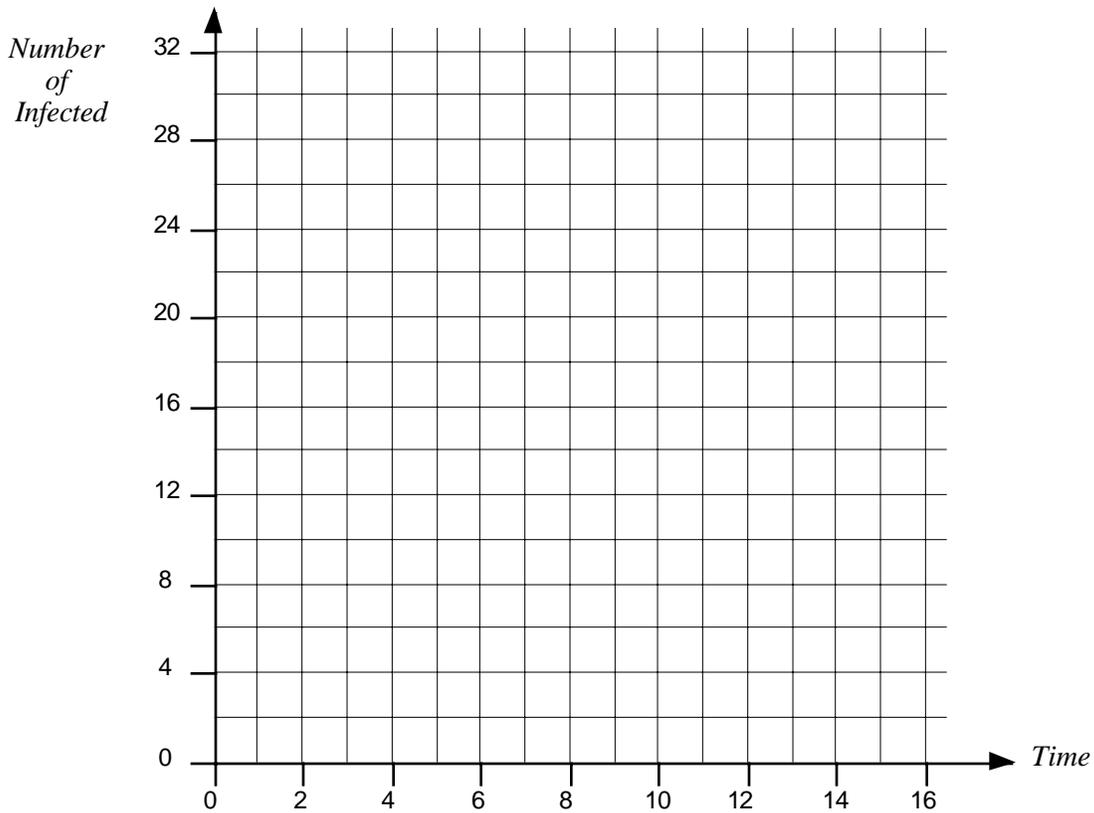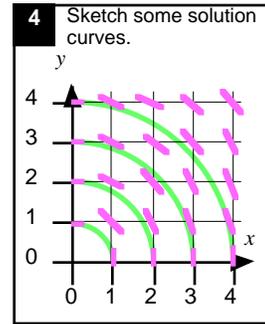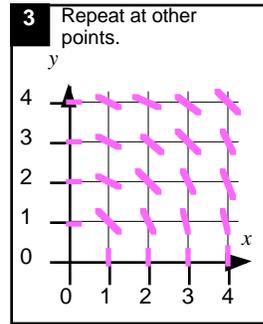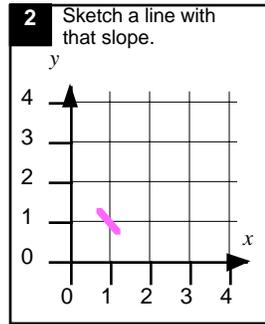
- **How is the appearance of this slope field related to the appearance of the graph that you plotted earlier?**