IDE Worksheet #1

Name: ______________________ Last five digits of ID Number: __________

Date: __________ Start Time: ________ End Time: ________ Monitor: ________

Goals: Study effects of parameters on solutions to the logistic differential equation. Study Euler's method. Locate the Mac Lab.

1. The `Logistic Growth` tool:

   (a) This tool has three sliders. Which sliders correspond to parameters? What does the other slider represent?

   (b) Briefly describe the effect that each parameter has on the solution.

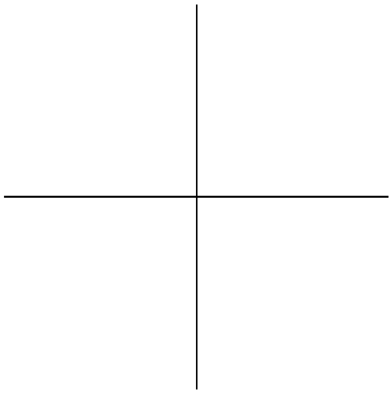
   (c) Do the solutions always reach the value K?

   (d) How do you think that the author of this tool came up with the formula for the solution that you see at the bottom of the screen? Is the formula correct? How do you know?

2. The `Slope Fields` tool:

(a) Consider the differential equation $\dot{x} = x$ ($\dot{x}$ is just different notation for dx/dt). Use the tool (in vector drawing mode) with $\Delta t = 0.5$ to perform Euler's method graphically for the initial condition $x(-1) = 0.1$. Complete the following table. Do your best to be accurate, but it is difficult to be extremely accurate using this tool.

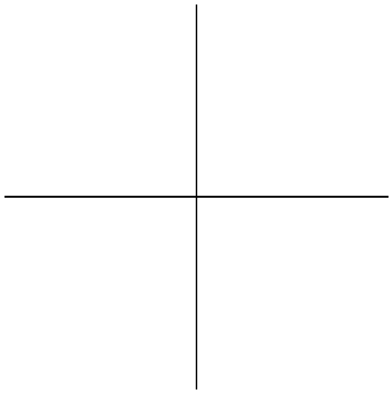
k	t_k	x_k
0	-1	0.1
1		
2		
3		
4		
5		
6		



On the axes above, plot the corresponding points along with the graph of the (RK4 $\Delta t = 0.01$) solution. To get this solution, change the drawing mode of the tool back to solutions mode.

What is an analytic representation of the solution to this initial-value problem? How accurate is Euler's method in this case?

Plot several solutions to this differential equation and sketch your results below. Do enough solutions so that you get a general impression of the behavior of all solutions with initial conditions in the given window.



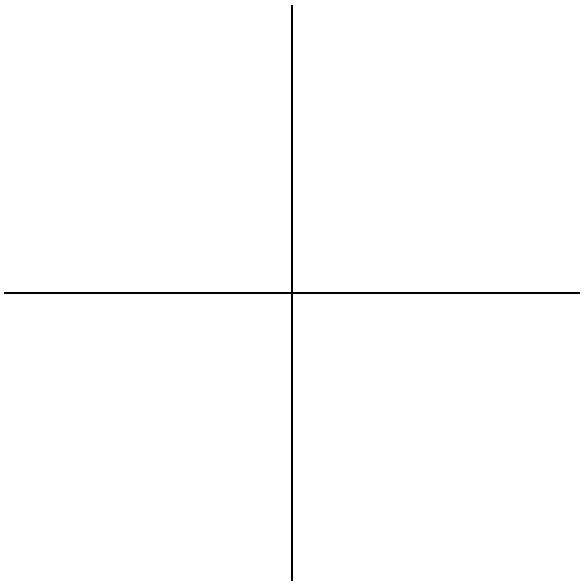
(b) Consider the differential equation $\dot{x} = x - t$. Use the tool with $\Delta t = 0.5$ to perform Euler's method graphically for the initial condition $x(-2) = -1.1$. Complete the following table:

k	t_k	x_k
0		
1		
2		
3		
4		
5		
6		
7		
8		

On the axes above, plot the corresponding points along with the graph of the (RK4 $\Delta t = 0.01$) solution.

Plot several solutions to this differential equation and sketch your results below. Do enough solutions so that you get a general impression of the behavior of all solutions with initial conditions in the given window.

(c) Consider the differential equation $\dot{x} = x^2 - t^2$. Plot several solutions to this differential equation and sketch your results below. Do enough solutions so that you get a general impression of the behavior of all solutions with initial conditions in the given window.



3. If you have time, you may enjoy playing around with some of the other tools in IDE. Two of my favorite tools are the `Pendulums` tool and `The Glider` tool. We will be discussing many of these tools as the semester progresses.