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Math 2605: Calculus III

Euler's Method

Report

For this project, I chose to use a particular function parsing package that allowed for variables to be set as well as for functions to be defined as "expressions". The package provides useful classes that all relate to evaluating a parsed function. One such example is the SyntaxException class that checks to see if the input function meets certain syntax requirements before actually performing any calculations. The Parser class examines a string and allows for that string to be defined as an expression in the Expr class. The graph of the functions simply relies on the applet classes and methods in order to do the painting.

In order to implement Euler's method properly, it was necessary to include a text field for each of the inputs required, namely the two functions f and g, the time step value h, the values of x0 and y0 and finally the maximum time interval T. When inputs are entered, the program performs various checks that determine the legality of the inputs. One such check determines whether or not T is positive since it must be a positive time value. To perform Euler's method, the program first graphs x0, y0. Next, the program evaluates the functions at x0, y0 and then multiplies the resulting vector by a factor of h. The new vector is added to the old vector x0, y0 and is then graphed. A line is then drawn connecting the vectors. This iteration runs as many times as have been specified by the value T.

Results

1.) For the unit circle, a value h = 1 * 10^-2 is enough to show the graph in fact produces a picture of the unit circle. In other words, if h is about 1/100 then the graph is close enough to be accurate. Assuming h = 1 * 10^-1, the graphs do not quite meet. At this point, a circle is viewable, albeit distorted.
2.) For the next graph, the curve begins at the x-axis and decreases rapidly but levels out at point [4, -2]. h = 1* 10^-3 is enough to show the curve tends to [4, -2].
3.) For the next graph, the curve shoots upward at an asymptote. This unstable curve is more clearly defined at h = 1* 10^-2 than the stable curve before. That is to say h does not need to be as small for the graph to be as accurate.