About the Mathematics

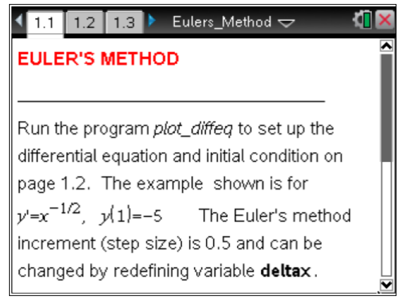
The Euler's Method document provides a graphical tool for visualizing an approximate solution to differential equations. Euler's method is motivated by the idea of "local linearity"—a differentiable function behaves very much like a linear function on small intervals. Using that idea, if you know the value of the derivative of a function at a single point, then you can approximate a small portion of its graph with a straight line segment at that point, having the required slope. Given a differential equation and an initial condition, you have the information needed to approximate a small part of the graph. If ($x0$, $y0$) is the initial condition, then you can approximate a y-value $y1$ on the solution curve corresponding to $x1 = x0 + \Delta x$. Now you can repeat this strategy, treating ($x1$, $y1$) as a new point on the solution curve. Repeating this process over and over again yields Euler's method.

Math Objective

- Students will have the opportunity to see a dynamic graphical representation of Euler's method that can be plotted one step at a time.
- Students will look for and make use of structure. (CCSS Mathematical Practice)
- Students will reason abstractly and quantitatively. (CCSS Mathematical Practice)

Using the Document

Page 1.1 provides the instructions. On page 1.2, use the command *plot_diffeq*($y' = \mathbf{g}(x, y)$,{$x0$, $y0$}) to specify the differential equation and initial condition. The example $\frac{dy}{dx} = \mathbf{g}(x, y) = x^{-\frac{1}{2}}$ and ($x0$, $y0$) = (1, –5) is provided. The spreadsheet on page 1.3 displays the initial point and 40 points generated by Euler's Method. The initial condition {x0, y0} and the Euler increment **deltax** determine Xmin and Xmax for the graphing window on page 1.4, Click the up arrow repeatedly to plot the 40 points generated by Euler's Method.
(Ymin and Ymax are set by the user.)



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Enter a command and its arguments on a Calculator page
- Click on a minimized slider

Tech Tips:

- Make sure the font size on your TI-Nspire handheld is set to Medium.
- In *Graphs*, you can hide or bring up the function entry line by pressing ctrl G.

Lesson Materials:
Eulers_Method.tns