Slope Fields

TEACHER NOTES

About the Mathematics

The *Slope_Fields.tns* file provides a graphical tool for visualizing antiderivatives and, more generally, solutions to differential equations. Slope fields are 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 centered at that point, having the required slope. If you know the derivative value at every point, then you could choose a large sample of points (for example, a rectangular lattice of grid points) and plot a small slope segment at each one, creating a slope "field" (much like a direction field for vector plots). The result provides a powerful way to visualize solution curves (graphs of solution functions), even for differential equations that would defy paper-and-pencil techniques or the use of a computer algebra system.

Math Objective

- Students will have the opportunity to use a visual representation of the family of solutions to a differential equation.

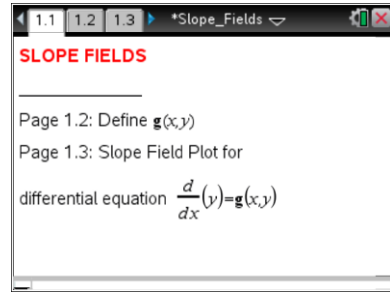## TI-Nspire™ Navigator™ System

- Send out the *Slope_Fields.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies: 📱 TI-Nspire™ CX Handhelds, 📲 TI-Nspire™ Apps for iPad®, 💻 TI-Nspire™ Software

SLOPE FIELDS

Page 1.2: Define $\mathbf{g}(x,y)$

Page 1.3: Slope Field Plot for

differential equation $\frac{d}{dx}(y) = \mathbf{g}(x,y)$

Tech Tips:

- This activity includes class captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/ calculators/pd/US/Online-Learning/Tutorials

Lesson Files:
- Slope_Fields.tns

Recommended Related Activity

- Slope Fields Forever.tns –This exploration hands-on activity also equips students to use the built-in capabilities of the TI-Nspire to graph slope fields. It includes a match the slope field handout and a CAS extension.
- Slope Fields Introduction – This activity uses this tns file and includes a matching activity. The link also includes a Tech Tip video for how to use the deSolve command on a TI-Nspire CAS.

Using the Document

Page 1.1 provides the simple instructions. Any differential equation of the form $\frac{dy}{dx} = g(x, y)$ may be studied (where **g**(x, y) is any expression in terms of x and y). On page 1.2, define **g**(x, y). The example $\frac{dy}{dx} = g(x, y) = -\frac{x}{y}$ is provided. On page 1.3, the corresponding slope field is shown.
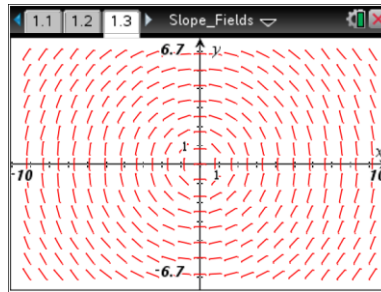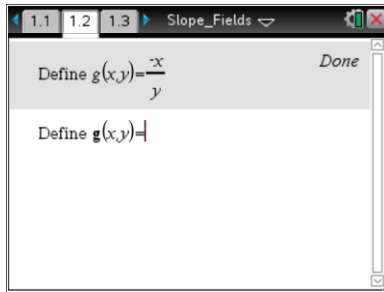
Students can plot a function graph on top of the slope field to check the reasonableness of potential analytic solutions.

> **Tech Tip:** On page 1.3, show the function entry line to plot a function by pressing ⌃ ctrl ⌃ G . You can also use ⌃ ctrl ⌃ G to hide the entry line.
>
> **iPad Tip:** On page 1.3, show the entry line by tapping on white space. To hide the function entry line tap white space.