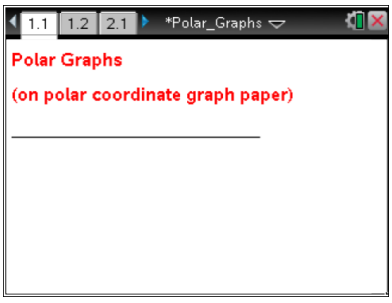
About the Mathematics

Many students' first introduction to polar coordinates comes in their study of calculus. Rectangular graph paper has grid lines that are associated with constant values of x or y, or the rectangular coordinates (x, y). Polar graph paper has grid lines that are associated with constant values of r or θ, or the polar coordinates (r, θ).



Math Objective

- Students will have the opportunity to relate polar coordinates to rectangular coordinates and to plot polar functions having the form $r = f(\theta)$ with background polar "graph paper" on screen.
- Students will look for and make use of structure. (CCSS Mathematical Practice)
- Students will reason abstractly and quantitatively. (CCSS Mathematical Practice)

TI-Nspire™ Navigator™ System

- Send out the *Polar_Graphs.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

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:

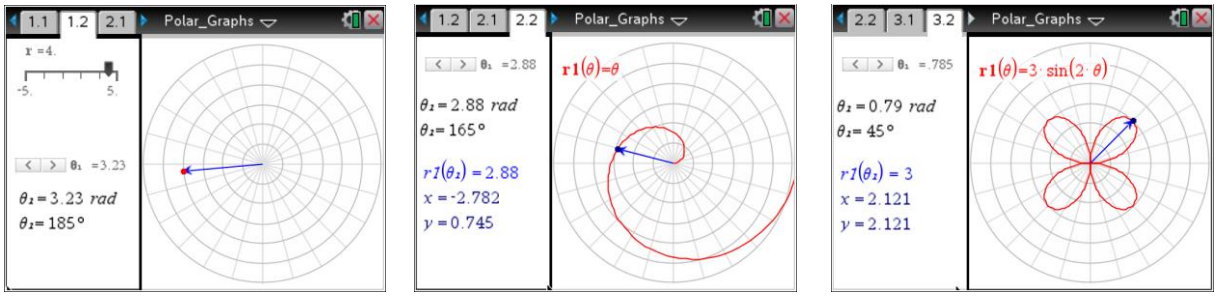
- Polar_Graphs.tns

Recommended Related Activity

- Polar Necessities – Learn necessary knowledge to be successful with polar graph. Also included are calculus topics of finding the slope of a polar graph and the area of an included region.
- Rose Curve – This interactive activity uses sliders to change the number of pedals of a polar rose. On the next page as a point is dragged along a sinusoidal function, the corresponding polar equation is formed. Compare the equations of the function and the rose curve, and make generalizations about the relationship between the two equations.

Using the Document

Page 1.2 provides an introduction to polar coordinates. The slider bar allows the user to easily change the radius *r*, while the slider arrows allow the user to change the angle *θ* (in both radians and degrees). A dynamic vector points to the location determined by the corresponding polar coordinates.



Pages 2.2 and 3.2 provide the user with two examples of polar functions, the classic "Archimedes' spiral" ($r = \theta$) on page 2.2 and a "four-leaf clover" ($r = 3\sin(2\theta)$) on page 3.2. A vector arrow points to a "trace point" on the graph.

Possible Application

Unlike rectangular coordinates, polar coordinates are not uniquely determined by location for a point in the plane. (For the same nonzero radius *r*, two angle values that differ by 2π will specify the same location, and for the opposite value $-r$, an angle that differs by an odd multiple of π will specify the same location; in the extreme case $r = 0$, the origin is the location regardless of the angle.)

Note: You may want to keep page 2.2 always with the Archimedean spiral for illustration and have students edit function *r1*(*θ*) on page 3.2.

Tech Tip: On a graph page, show the function entry line to plot a function by pressing ctrl G. Change the entry to line plot polar by pressing menu > Graph Entry/Edit > Polar.

iPad Tech Tip: On a graph page, show the entry line by tapping on white space. Change the entry line to plot polar by selecting > Graph Entry/Edit > Polar.