

Transitions

ID: 12676

Time Required

15–20 minutes

Activity Overview

Students will explore converting rectangular equations to polar form and vice versa. Familiar trigonometric identities and circle relationships are applied in making the conversions.

Topic: Parametric and Rectangular Equations

- *Converting Between Parametric and Rectangular Equation Forms*
- *Trigonometric Identities*
- *Graphing Polar and Rectangular Equations*

Teacher Preparation and Notes

- *The first problem explores converting a circle equation to polar form. The second problem engages students in the conversion of a linear equation in polar form to rectangular form.*
- *TI-Nspire CAS users will be able to make use of the **Expand** and **Solve** commands for the algebraic work involved in this activity.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter “12676” in the keyword search box.***

Associated Materials

- *Transitions_Student.doc*
- *Transitions.tns*
- *Transitions_Soln.tns*

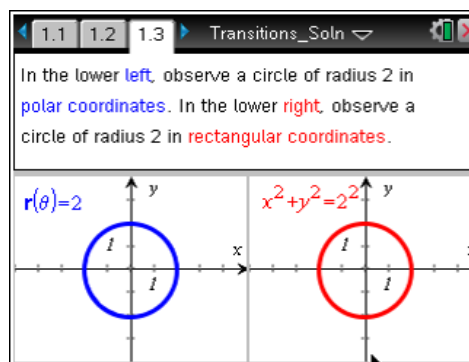
Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Complex Numbers: Plotting and Polar Form (TI-Nspire technology) — 8908*
- *Cardioid Patterns – Discover Using Graphs (TI-Nspire technology) — 10149*
- *Polar Necessities (TI-Nspire technology) — 12559*

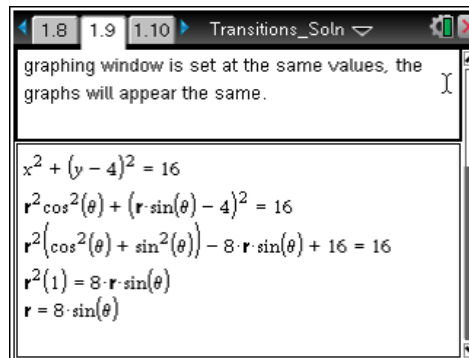
Problem 1 – Rectangular to Polar

Students review some basic relationships relating to the unit circle and apply these relationships in the conversion of a rectangular circle equation to polar form.



On page 1.9, students are asked to convert an equation to polar form. Students can show their work on their worksheets or in the answer box in the TI-Nspire document. Alternatively, students can insert a *Notes* page or *Calculator* page and show their work there.

Once the conversion is completed, students graph the resulting equation and the initial equation and compare the two equations. The polar graph should appear identical to the rectangular equation graph if the work is done correctly.



TI-Nspire Navigator Opportunity: *Screen Capture, Live Presenter, and Quick Poll*

See Note 1 at the end of this lesson.

TI-Nspire CAS users may use the **Expand** and **Solve** commands to simplify the work involved. Remind students that when using the solve command, the variable being solved for must be indicated after a comma inside parentheses as shown in the image to the right.

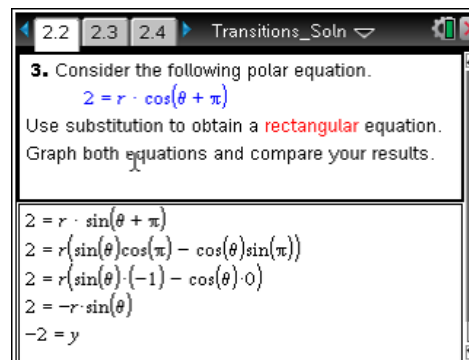
It may be necessary to remind students that when the rectangular circle equation is solved for y , two equations will result and two must be graphed.

Problem 2 – Polar to Rectangular

Next, students convert a polar equation to rectangular form using the angle difference identity for cosine. As in Problem 1, substitution involving familiar identities is useful in making the conversion.

Again, CAS TI-Nspire users will be able to use handheld features to assist them with the algebraic tasks involved.

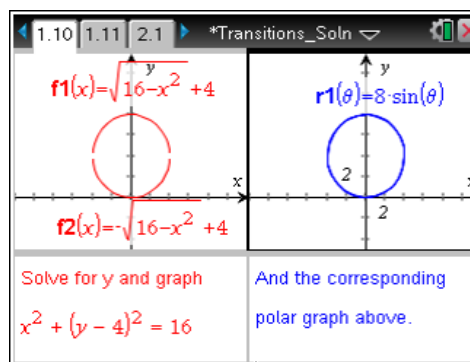
Students will also graph their results to check the accuracy of their solutions.



Student Solutions

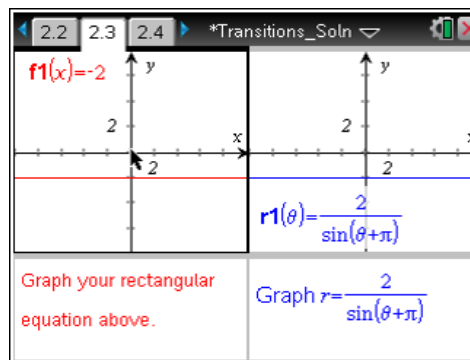
1. $x^2 + y^2 = r^2$, $x = r\cos\theta$, $y = r\sin\theta$
2. $r = 8\sin\theta$

Both graphs should look the same. See screenshot to the right.



3. $y = -2$

Both graphs should look the same. See screenshot to the right.



4. a. $r = 8$ b. $r = 4 \cos\theta$
 c. $r \cdot \cos\theta = -5$ or $r = -5\sec\theta$
 d. $r^2 = \frac{1}{2\cos^2\theta - 1}$ or $r^2 = \frac{1}{1 - 2\sin^2\theta}$
 or $r^2 = \sec(2\theta)$
5. a. $x^2 + y^2 = 9$ b. $x^2 + y^2 = 3y$
 c. $6\sqrt{2} = x + y$ d. $x - \sqrt{3} \cdot y = 6$

TI-Nspire Navigator Opportunity: Collect from Class and Open in Review Workspace
 See Note 2 at the end of this lesson.

TI-Nspire Navigator Opportunities

Note 1

Problem 1, Screen Capture, Live Presenter and Quick Poll

Quick Polls are especially appropriate on pages 1.4, 1.5, and 1.7.

Have a student use *Live Presenter* to show who to change the Graph Type (using menu or the contextual menu from the entry line) from Function to Polar.

Use *Screen Capture* to see that all the students are getting the same graph.

Note 2

Problem 2, Collect from Class and Open in Review Workspace

Collect the file from the class. Optional: Delete the file so the next class is not distracted by the solution. Open in Review Workspace and discuss the answers.