

## Area of a Circle – ID: 9420

By Lauren Jensen

Time required

30 minutes

## Activity Overview

Students are introduced to capturing data to create a mathematical relationship between the area and radius of a circle. Students will explore the area of a circle numerically, graphically, and algebraically.

## Concepts

- Data representation and interpretation
- Visual transformation of a quadratic function
- Formula for the area of a circle
- Quadratic regression

## Teacher Preparation

This investigation offers opportunities for review and consolidation of key concepts related to the formula for the area of a circle. Begin by reviewing with students the general area formula for a circle  $A = \pi r^2$ .

- This activity is designed to be used in a middle or high school geometry classroom. It offers a suitable introduction to gathering data of the radius and area of a circle as the size changes and exploring functions that model the data and interpretation of graphs.
- The screenshots on pages 2–4 (top) demonstrate expected student results. Refer to the screenshots on page 4 (bottom) for a preview of the student TI-Nspire document (.tns file).
- **To download the student .tns file and student worksheet, go to [education.ti.com/exchange](http://education.ti.com/exchange) and enter “9420” in the quick search box.**

## Classroom Management

- This activity is intended to be **teacher-led** with students in **small groups**. You should seat your students in pairs so they can work cooperatively on their handhelds. You may use the following pages to present the material to the class and encourage discussion. Students will follow along using their handhelds, although the majority of the ideas and concepts are only presented in this document. Be sure to cover all the material necessary for students' total comprehension.
- The student worksheet *GeoAct13\_AreaOfCircle\_worksheet\_EN* is intended as an investigation through the main ideas of the activity. It also serves as a place for students to record their answers. Alternatively, you may wish to have the class record their answers on a separate sheet of paper, or just use the questions posed to engage a class discussion.

TI-Nspire<sup>™</sup> Applications

Calculator, Graphs & Geometry, Lists & Spreadsheet, Notes

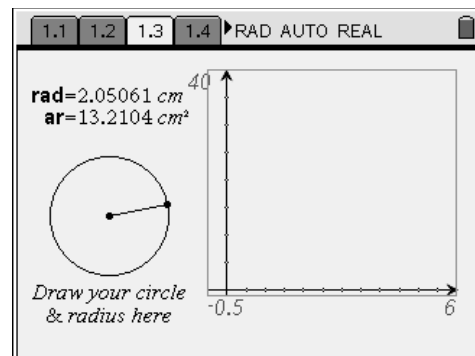
This activity utilizes the automatic data capture of the TI-Nspire handheld to investigate the mathematical relationship between the radius and area of a circle.

### Investigation

On the left side of page 1.3, students are to construct a circle and its radius by using the **Circle** tool from the Shapes menu, followed by the **Segment** tool from the Points & Lines menu.

Next, they should measure the **Area** of the circle and the **Length** of the radius by using the respective tools from the Measurement menu.

These measurements should then be stored as variables. For the radius, click on the measurement, press / + L, select **Store Var**, and then enter **rad** as the name of the variable. Have them repeat the process to store the area measurement as **ar**.

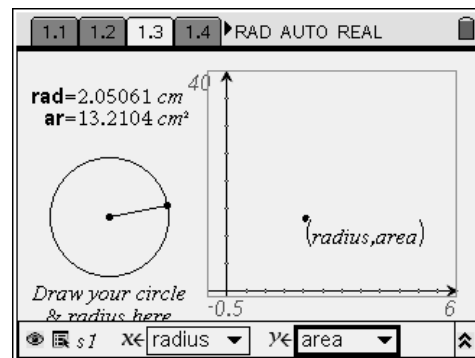


On page 1.4, students should move to the formula cell for Column A and select **MENU > Data > Data Capture > Automated Data Capture**. Have them press h, choose **Link To:** and select **rad** as the variable to be captured. They may then repeat the procedure to select **ar** to be the variable automatically captured into Column B. The data is now ready to be captured.

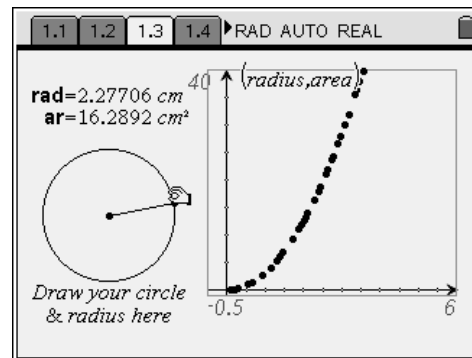
A	radius	B	area	C	D	E
1	2.05061	13.2104				
2						
3						
4						

Direct students to return to page 1.3 and select **MENU > Graph Type > Scatter Plot** to graph the data that will be captured. Students should press · to open the drop-down menu for the x-variable—select **radius**. Press e to move to the drop-down menu for the y-variable—select **area**.

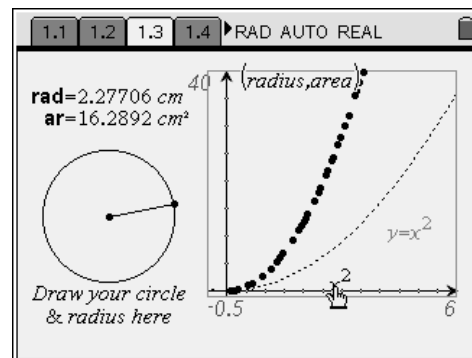
Students may have to adjust the graph so as to provide more organization and better visibility. Once the scatter plot is set up, they can press / + G to hide the Entry Line and free up some space on the screen.



To capture the different values for the radius and area, students can grab the circle (but not by the radius point) and use the NavPad to adjust its size. As they do so, the data points will appear on the graph. Students can advance to page 1.4 to see the collected data in Columns A and B.

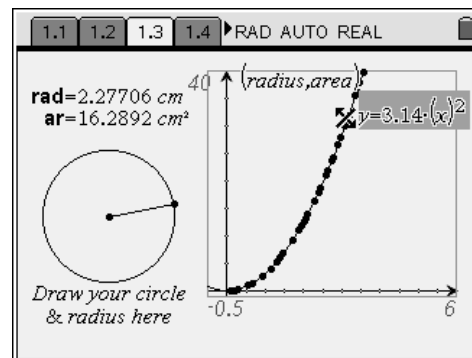


Students can now do a quadratic transformation to fit a model function to the data. Have them use the **Text** tool (**MENU > Actions > Text**) to place a text box with the expression  $x^2$  on the graph and press  $\cdot$ . Then have them drag the expression to the x-axis, which will graph the quadratic  $y = x^2$ . Press  $\cdot$  to accept the graph.



Next, students should move their cursor over the upper part of the function until the cursor looks like this:  $\text{⌘}$  Tell them to grab and drag the graph of  $y = x^2$  until it visually models the data.

Students should record the equation of this parabola on their worksheets.



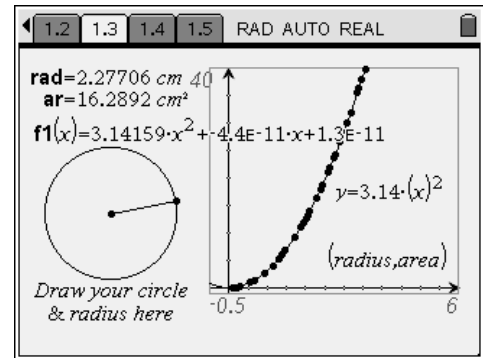
On page 1.5, students will perform a quadratic regression by selecting **MENU > Statistics > Stat Calculations > Quadratic Regression**.

To set up the regression, they should choose **radius** as the X List and **area** as the Y List. (Press  $\text{⏏}$  to move between the drop-down menus.) The regression equation may be set to be saved as **f1**.

"Title"	"Quadratic Regression"
"RegEqn"	"a*x^2+b*x+c"
"a"	3.14159
"b"	-4.4E-11
"c"	1.3E-11
"R²"	1.
"Resid"	"(...)"

Students can now return to page 1.3 to graph their quadratic regression. Have them select **Function** from the Graph Type menu and press **▲** on the NavPad to access **f1**. After pressing **·** to display its graph, they can use the **Attributes** tool so the function appears as a dashed line. Students may need to move the regression equation to a place on the screen that better allows it to be seen.

Students should record the function on their worksheets and then answer the exercise questions.

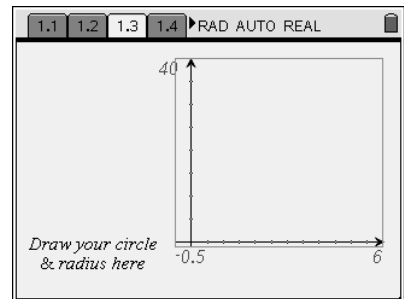
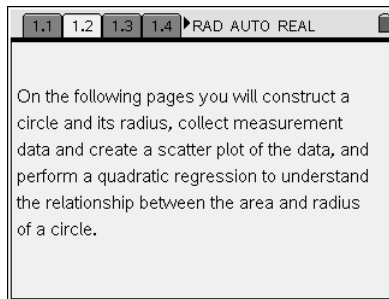
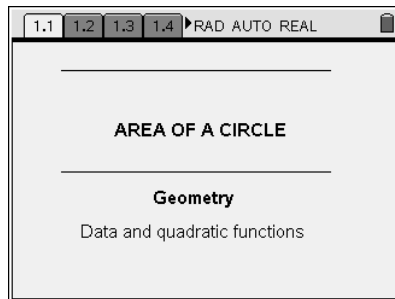


**Exercises – Student Worksheet Solutions**

1. Both have approximately 3.14 as the coefficient of  $x^2$ .  
**f1** has an  $x$  term and constant term, but both are very close to zero.
2. Independent: radius; dependent: area
3. Domain:  $x \geq 0$ ; range:  $y \geq 0$
4. The radius is always a positive value (length is always positive).
5.  $a$  represents  $\pi$ ,  $x$  represents the radius

**Areas of a Circle – ID: 9420**

(Student)TI-Nspire File: *GeoAct13\_AreaOfCircle\_EN.tns*



Collect your measurement data here.

	A	B	C	D	E
1					
2					
3					
4					

A7 |

