

Exploring the Area of a Circle

ID: 13637

Time required

15 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.

Topic: Circles

- Use technology to verify the circumference and area formulas for the circle.

Teacher Preparation and Notes

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.
- 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.
- To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "13637" in the keyword search box.

Associated Materials

- [ExploreAreaofCircle_Student.doc](#)
- [ExploreAreaofCircle.tns](#)

Suggested Related Activities

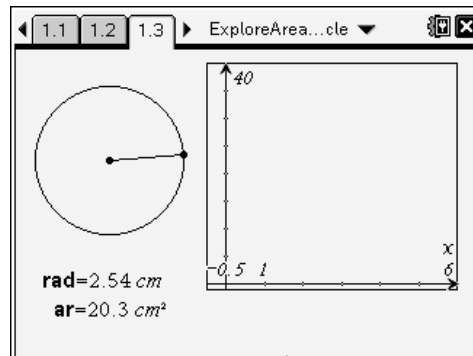
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- [Angles and Arcs \(TI-Nspire technology\) — 9978](#)
- [Circles, Circles, Everywhere! \(TI-Nspire technology\) — 8429](#)

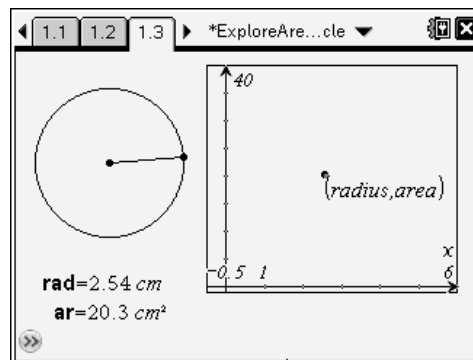
This activity utilizes the automatic data capture of the TI-Nspire handheld to investigate the mathematical relationship between the radius and area of a circle.

Investigation

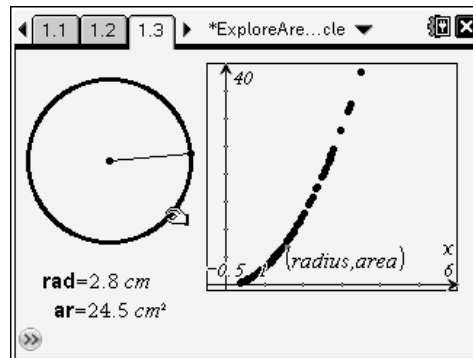
On the left side of page 1.3, a circle is constructed with the radius (**rad**) and the area (**ar**) calculated.



Direct students to create a scatter plot for the data in the graph on page 1.3. Select **MENU > Graph Type > Scatter Plot** to graph the data that will be captured. Students type **radius** for the x-variable. Press (tab) to move to the y-variable—type **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 (ctrl) + [G] to hide the Entry Line and free up some space on the screen.



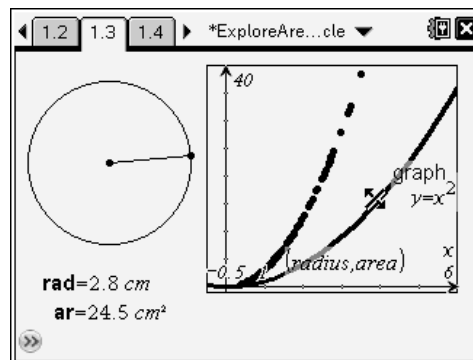
To capture the different values for the radius and area, students can grab the circle (but not by the radius point) and use the NavPad to adjust its size. As they do so, the data points will appear on the graph.


Students can advance to page 1.4 to see the collected data in Columns A and B.

Collect your measurement data here.

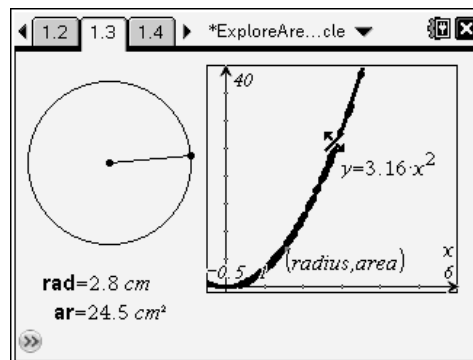
A	B	C	D	E
radius	area			
=capture(ra		=capture(ar,1)		
1	2.54018	20.2711		
2	4.83451	73.4269		
3	7.64199	183.469		

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 **(enter)**. Then have them drag the expression to the x-axis, which will graph the quadratic $y = x^2$. Press **(enter)** to accept the graph.



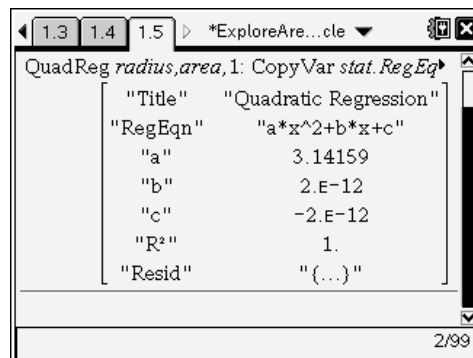
Next, students should move their cursor over the upper part of the function until the cursor looks like this:  Tell them to grab and drag the graph of $y = x^2$ until it visually models the data.

Students are to record the equation of this parabola on their worksheets.



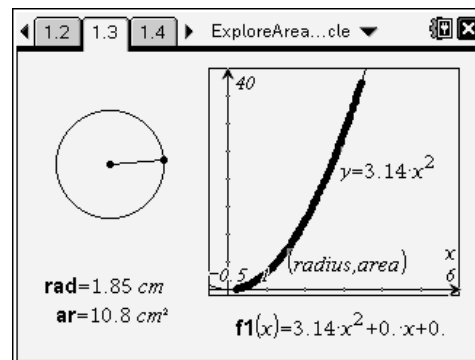
On page 1.5, students will perform a quadratic regression by selecting **MENU > Statistics > Stat Calculations > Quadratic Regression**.

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



Students can now return to page 1.3 to graph their quadratic regression. Have them select **Function** from the Graph Type menu and press \blacktriangle on the NavPad to access **f1**. After pressing $\text{\textcircled{enter}}$ 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 are to 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 π , x represents the radius