

## Using Transformations of a Circle to Discover a General Equation for Circles

### Set Up for the ClassPad

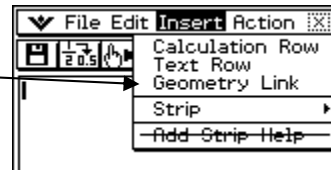


**Step 1:** Open the ClassPad Menu (M) and select **eActivity**.

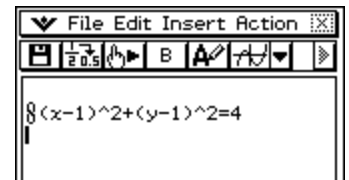
**Step 2:** Clear the screen if it is not clear already (**Edit, Clear All**).



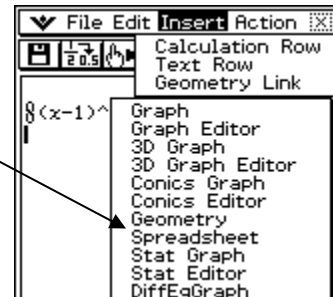
In the **eActivity** screen, insert a **Geometry Link**.




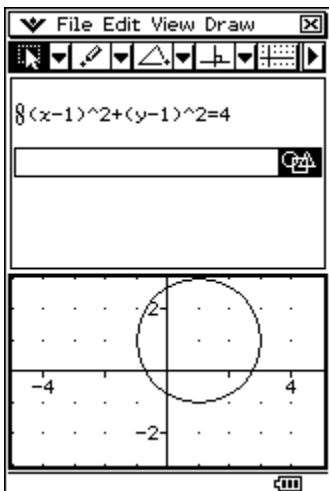
**Step 3:** Type the following equation into the Geometry Link  $(x - 1)^2 + (y - 1)^2 = 4$ .



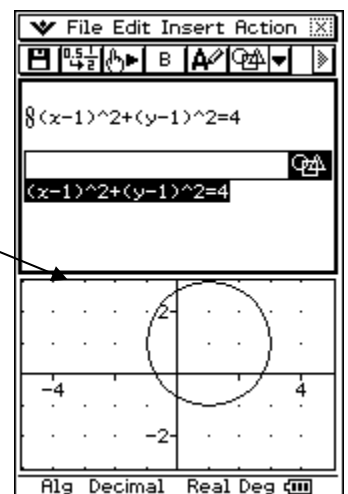
**Step 4:** Tap below the Geometry Link and insert a **Geometry Strip**.



**Step 5:** Ok. Now you are ready to do some graphing. Tap the  button until you have axes and the integer grid. Highlight the equation by your Geometry Link and drag and drop it into the Geometry window. You should have a circle graphed in the Geometry window. If you do not, ask a neighbor for help or ask the teacher.

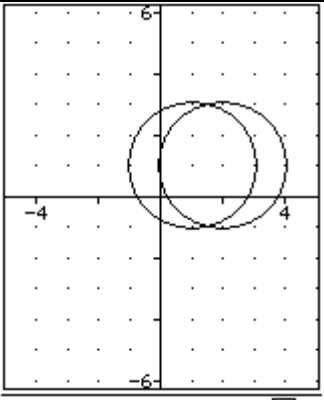
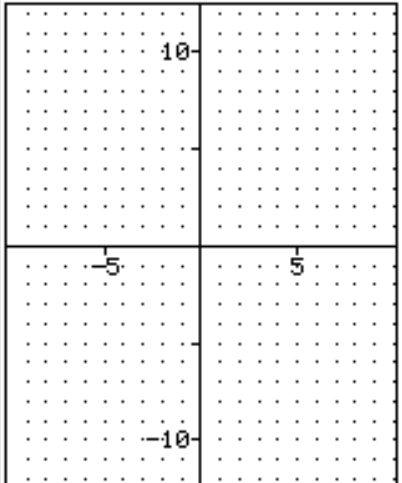


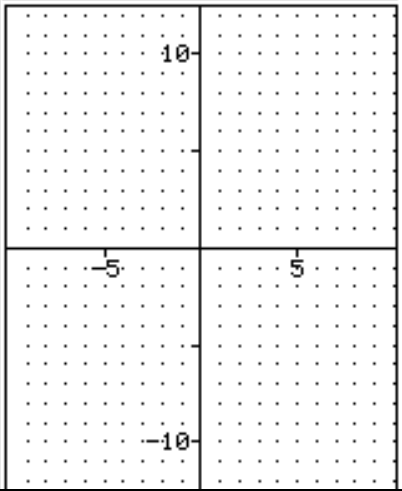
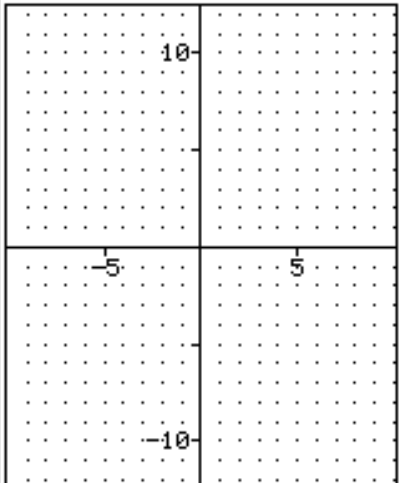
**Step 6:** You will be transforming the graph as part of our activity today. It will be helpful to compare the original graph to the graph of the “new equation.” Tap below the Geometry Strip and enter  $(x - 1)^2 + (y - 1)^2 = 4$ . Then highlight and drag to the Geometry window below. This unlinked equation will not change as we change the linked one.

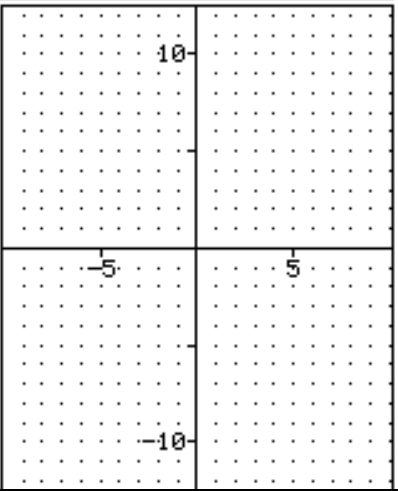
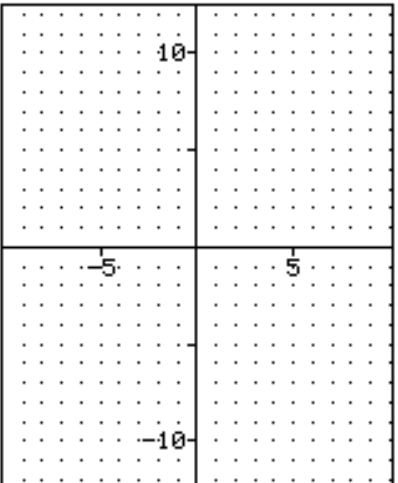


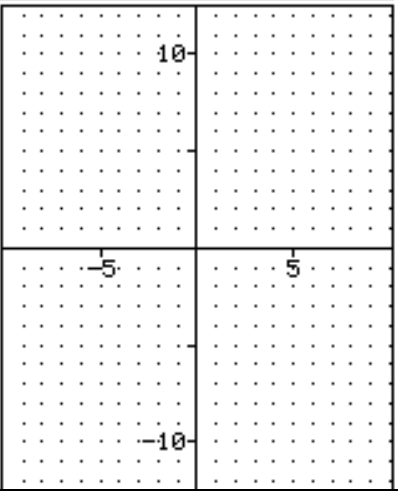
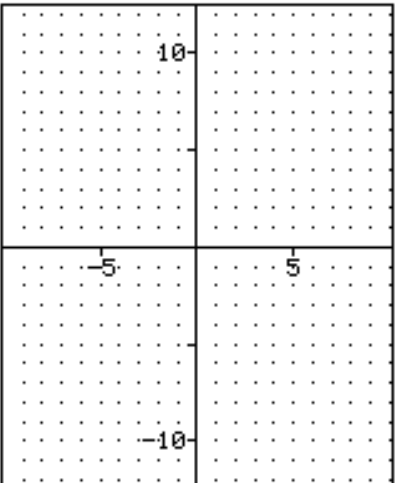
Use the Geometry link you have to created to help you fill out the following table. Ask a neighbor or the teacher if you have questions.

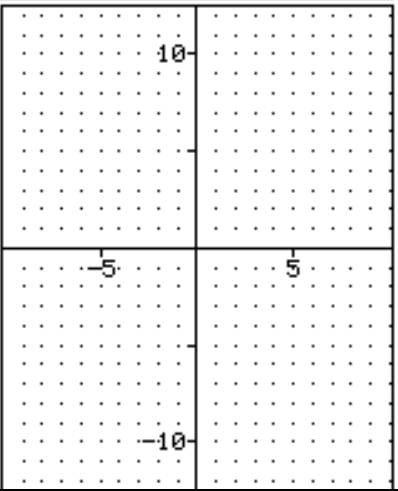
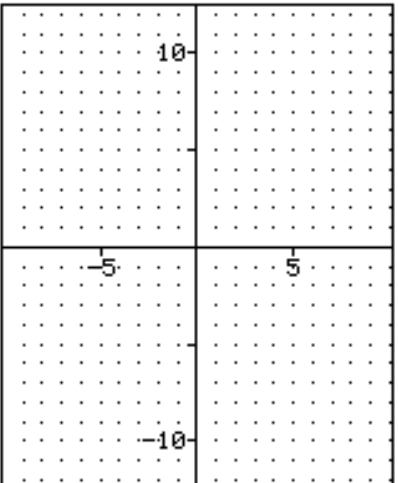
HELPFUL HINT: You may need to zoom in/out (press + or -) or use **RESIZE** (at the bottom of the screen in the middle) to see the circle.

Original Equation: $(x - 1)^2 + (y - 1)^2 = 4$			Original Center: (1,1)	Original Radius: 2
New Equation (Enter these by editing the Geometry Link and press EXE when finished.)	Sketch the graph	How did it change the graph from the original?	Where is the center of the circle?	What is the radius?
Ex: $(x - 2)^2 + (y - 1)^2 = 4$		moved the graph right 1 unit	(2, 1)	2 units
$(x - 5)^2 + (y - 1)^2 = 4$				

Original Equation: $(x - 1)^2 + (y - 1)^2 = 4$			Original Center: (1,1)	Original Radius: 2
New Equation (Enter these by editing the Geometry Link and press EXE when finished.)	Sketch the graph	How did it change the graph from the original?	Where is the center of the circle?	What is the radius?
$(x + 3)^2 + (y - 1)^2 = 4$				
$(x - 1)^2 + (y - 6)^2 = 4$				

Original Equation: $(x - 1)^2 + (y - 1)^2 = 4$			Original Center: (1,1)	Original Radius: 2
New Equation (Enter these by editing the Geometry Link and press EXE when finished.)	Sketch the graph	How did it change the graph from the original?	Where is the center of the circle?	What is the radius?
$(x - 4)^2 + (y - 2)^2 = 9$				
$(x + 5)^2 + (y + 4)^2 = 25$				

Original Equation: $(x - 1)^2 + (y - 1)^2 = 4$			Original Center: (1,1)	Original Radius: 2
New Equation (Enter these by editing the Geometry Link and press EXE when finished.)	Sketch the graph	How did it change the graph from the original?	Where is the center of the circle?	What is the radius?
<p>Let's make some predictions! Fill in all the columns and then use your ClassPad to check your prediction.</p> <p><math>(x)^2 + (y)^2 = 16</math></p>				
<p><math>(x - 2)^2 + (y + 1)^2 = 1</math></p>				

Original Equation: $(x - 1)^2 + (y - 1)^2 = 4$			Original Center: (1,1)	Original Radius: 2
New Equation (Enter these by editing the Geometry Link and press EXE when finished.)	Sketch the graph	How did it change the graph from the original?	Where is the center of the circle?	What is the radius?
$(x - 4)^2 + (y - 2)^2 = 36$				
$(x + 4)^2 + (y + 4)^2 = 10$				

### Conclusions:

- 1) If you change the number that is added to or subtracted from the  $x$ , how does it change the graph?
  
- 2) If you change the number that is added to or subtracted from the  $y$ , how does it change the graph?
  
- 3) If you change the number on the other side of the equal sign, how does it change the graph?
  
- 4) Where can you find the center in the equation?
  
- 5) Where can you find the radius in the equation?
  
- 6) Given that  $(h, k)$  is the center of a circle and  $r$  is the radius, can you write a general equation that will work for all circles?
  
- 7) Compare your conclusions with a neighbor. If you have any different answers discuss your thinking and try to reach a shared conclusion. Ask the teacher for help if you get stuck.

**Extension:**

Create a design with circles on your ClassPad and write the equation for each circle in the design.

**Practice and Application:**

*Without using the ClassPad, identify the center and radius for the following circles.*

1)  $x^2 + y^2 = 49$

2)  $(x - 9)^2 + (y - 10)^2 = 4$

3)  $(x + 5)^2 + (y - 1)^2 = 25$

*Complete the following transformations. Write the new equation of the circle for each problem.*

4)  $(x + 5)^2 + (y + 7)^2 = 36$  Translated 5 left, 4 down

5)  $(x + 2)^2 + (y - 1)^2 = 5$

a) Reflected about the y-axis

b) Reflected about the x-axis

c) Reflected about the origin