ClassPad 101

for ClassPad Version 3.00+

Lesson 19

Introduction to Conics

Welcome

In this lesson we will look at different forms of conic sections. Conic sections are very interesting shapes that appear in nature. They also play an important role in the study of astronomy and other fields of science and math.

Before beginning, visit http://www.sparknotes.com/math/precalc/conicsections/section1.html to see how to visualize each conic section with double right circular cones and a piece of paper.

Lesson Goals

- To identify a conic section given an equation in standard form
- To be able to fit an equation in general form into standard form
- To gain a general understanding of the focal point of a parabola

In Lesson 19, you will learn how to:

- Insert a conic form
- Transform a general equation into a standard conic form
- Use the G-Solve menu in Conics
- Move data from the Conics editor to other Applications

Upon completion of this lesson, you will be able to answer the following questions:

1. How do you fit an equation into a conic form?
2. Explain how you would write the equation of a circle with center (2,3) and r=3 using the Insert Conics Form dialog.
3. What is the major axis of an ellipse?
4. Where is the focal point in relation to the parabola?
5. Explain how to visualize an ellipse using double right circular cones and a piece of paper.

Time required

About 60 minutes.

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Getting Started

We will begin this lesson by exploring circles! We will then learn about the ellipse, hyperbola and parabola conic sections.

PART I

In this part, you will learn how to input standard conic forms. As you will see, the standard form is more informative than the general form.

1. Using a Standard Form to Draw a Conic Section

a. Open C and clear the window (if needed)

b. Open the **Form** menu and select **Insert Conics Form**

c. Select the **standard form** of a **circle** and press **OK**

d. Change each uppercase letter to a number

e. **For example**, to center the circle at (1,-2) we set H to 1 and K to -2. For a radius of 2, we set r=2.

f. Click ^ to graph the circle

g. Select **Zoom / Quick Initialize** and click the $ arrow on the graph window

2. Displaying Information about a Conic Section

a. With your circle graphed, select **Analysis / G-Solve**

b. Select **Center** (notice the center is displayed)

c. Select **Analysis / G-Solve / y-Intercept**

d. Use your left and right arrows to move between y-intercepts

e. Try **Analysis / G-Solve / x-Cal**

f. Input **-1** for a y-value

The G-Solve menu lets us find information that is relevant to the current conic section.

3. Drawing More Than One Circle

The Conics application will let us draw only one circle, but we can work around this!

a. **Select** your circle's equation and then **Edit / Copy**

b. **Open eActivity**

c. **Insert** a **Conics Graph** window (^)

d. **Paste** your circle

e. **Select** your circle and **drag it** to the **Conics Graph** window

f. **Change** your equation and drag&drop it again

g. Make a random change and drag&drop to visualize the change

Fun example to try!

a. Clear the Conics Graph window

b. Can you figure out how to draw the four circles shown by changing the "original" equation slightly?

Hint: Do not change the numbers ☺

PART I
Practice Exercises

Before beginning the practice exercises, open a word document, type in the following information and then *save it as Lesson19 in your CASIO folder within My Documents*:

- Date: (enter today's date)
- To: (put your instructor's name here)
- From: (put your name here)
- Re: Lesson 19

1. Please begin by opening the Conics application and clearing the window, if needed.

2. **Using the standard form of a circle**, graph a circle with center **(-2,2)** and a radius of **1.5**. Adjust your window (zoom, pan,…) so that your circle looks good.
3. Display the circle's center in the graph window. Hint: Analysis/G-Solve.
4. With your circle graphed and its center showing, get a **screen capture**. Paste it into your Lesson19 document (under a title of PART I).
5. **Copy your circle's equation** and then **open eActivity.**
6. **Clear** the eActivity window and then **insert** a **Conics Graph** window.
7. **Paste your circle** below the Conics Graph strip.
8. Drag and drop it into the Conics Graph window.
9. **Modify the circle's equation** so that it draws **the reflection of the original circle about the x-axis.** Hint: You may need to clear the graph window and re-paste the equation a few times.
10. With our circle and its reflection showing, get a **screen capture.** Add two blank spaces following the first screen capture and then paste this one.
11. Ok, one more change. Change the **+ sign** that is connecting the two squared terms to a **– sign** [(x-H)^2**+**(y-K)^2 to (x-H)^2**-**(y-K)^2].
12. **Drag and drop** your changed equation into the Conics Graph window.
13. With the interesting graph showing, get a **screen capture.** Add two blank spaces following the last screen capture and then paste this one.

PART II

In this part, we will work with two more conic sections: the hyperbola and ellipse. How are they similar? How are they different?

1. Exploring the Standard Form of an Ellipse

a. Open C and clear the window (if needed)

b. Select **Form / Insert Conics Form**

c. Select the **standard form** of an **ellipse** and press **OK**

d. **Change** the **uppercase letters** as shown

e. **Turn the integer grid** on by selecting: ⮟ **/ Graph Format** and check **Grid Points**

f. **Pan** the Graph window

g. **Locate** the center: Analysis/G-Solve/Center

h. **Change** the equation and graph again

i. **Locate** the center

j. Does the changed graph make sense?

k. **Change** the equation and graph again

l. **Locate** the center

m. A circle is a special kind of ellipse!

With circles, we talk about "**the radius**" and say the diameter is twice the radius.

With ellipse, we talk about the "**major axis**" and "**minor axis**".

2. Changing an Ellipse to a Hyperbola

a. **Graph** the ellipse shown

b. **Change** the **+** to a **–** and **graph** again

c. Select **Analysis / G-Solve / Asymptotes**

d. Wow! Do the dimensions of this box look familiar?

e. Notice the linear eqns that pass through opposite corners of the box guide the hyperbola

3. Exploring Hyperbolas using eActivity

a. **Select** your hyperbola's equation and then **Edit / Copy**

b. **Open eActivity** and clear the window

c. **Insert** a **Conics Graph** window (^) and then minimize it

d. **Change** the next line to a math line and **paste** your hyperbola

e. Press **EXE**

f. On the next line **type** in **expand(** and then drag your hyperbola to it

g. Press **EXE**

h. **Drag the result** to the next line and **change** the **–y^2/4 to +y^2/4**

i. Press **EXE**

j. **Expand** the **Conics Graph** strip

k. Drag&drop the results shown (zoom as needed)

Note: If BOTH the x^2 and y^2 terms are preceded by a + sign we have an ellipse!

4. Fitting General Form Equations into Standard Form

Fitting an Ellipse

a. Open the eActivity named **L19_PartII_Step4**

b. **Expand** the 1st strip titled **Exercise 1**

c. What kind of conic section is this?

d. **x^2 and y^2 terms** are both positive, so I will guess ellipse

e. Select **Fit / Fit into Conics Form**…**Done!**

Fitting a Hyperbola

a. **Expand** the 2nd strip titled **Exercise 2**

b. Select **Fit / Fit into Conics Form**

c. Can you guess the right form? [Hint: Think about the signs of the **x^2 and y^2 terms]**

d. Try **Exercise 3** on your own. [Hint: It is the other hyperbola form]

Mystery Form

a. **Expand** the 4th strip titled **Exercise 4**

b. What kind of conic section is this?

c. **x^2 and y^2 terms** are both positive, so I will guess ellipse

d. Select **Fit / Fit into Conics Form**…**Error!**

e. Notice that the x^2 and y^2 are **both being divided by the same value**. Is this a circle?

f. Select **Fit / Fit into Conics Form** and **choose a circle…Done!**

PART II
Practice Exercises

1. Please open the eActivity application.
2. Open the eActivity named **L19_PartII_a** in the **Lesson 19** folder.
3. **Expand** the Conics Editor strip labeled **Exercise 1**.
4. Fit the equation inside the Conics Editor into a standard conic form.
5. Once you have the standard form, click the button to graph it.
6. With the equation in standard form and its graph showing, get a **screen capture**. Paste it into your Lesson19 document (under a title of PART II).
7. Close the Conics Graph window by clicking the **upper right** ⊠ to return to eActivity.
8. **Expand** the Conics Editor strip labeled **Exercise 2**.
9. Fit the equation inside the Conics Editor into a standard conic form.
10. Once you have the standard form, click the button to graph it. Zoom if needed!
11. With the equation in standard form and its graph showing, get a **screen capture**. Add two blank spaces following the first screen capture and then paste this one.
12. Open the ⮟ menu and select eActivity to return to eActivity.
13. **Save** your work as an eActivity named **L19_PartII_a**_your initials here.
14. Open the eActivity named **L19_PartII_b** in the **Lesson 19** folder.
15. This is an eActivity that I found on the web at http://edu.casio.com/products/cpeactivity/index.html. See the Note strip for more information.
16. It is interesting to see conic sections in polar form. The form looks so different, but the shapes are the same.
17. Open the strip labeled Ellipse and then click the button to graph it.
18. With the equation and graph showing, get a **screen capture.** Add two blank spaces following the second screen capture and then paste this one.
19. Try opening the other strips and changing coefficients. Have fun exploring!

PART III

One conic section that we have not talked about yet is the parabola. When we put a parabola into standard conic form, it will look different than what you would expect.

1. Exploring the Standard Form of a Parabola

a. Open C and clear the window (if needed)

b. Select **Form / Insert Conics Form**

c. Select the **standard form** of a parabola opening vertically and press **OK**

d. **Change** the **uppercase letters** as shown

e. **Locate** the Vertex: Analysis/G-Solve/Vertex

2. Exploring the Standard Form of a Parabola (Again)

a. Clear your Conics Editor window again

b. Select **Form / Insert Conics Form**

c. Select the **standard form** of a parabola opening horizontally and press **OK**

d. **Change** the **uppercase letters** as shown

e. **Graph** your parabola

f. **Change** the leading coefficient to **0.5** and **graph again**

g. **Locate** the Focus (Analysis/G-Solve/Focus)

h. **Locate** the Directrix (Analysis/G-Solve/ Directrix)

i. **An interesting fact:**

Each point on a parabola is equally distant from the focal point and directrix line

PART III
Practice Exercises

1. Open the eActivity named **L19_PartIII_a** in the **Lesson 19** folder.
2. **Expand** the Conics Editor strip labeled **Exercise 1**.
3. Graph the equation inside and then change the equation so that it opens in the opposite direction.
4. With the new equation and its graph showing, get a **screen capture**. Paste it into your Lesson19 document (under a title of PART III).
5. Use the **upper right** ☒ or open the ⮟ menu and select eActivity to return to eActivity.
6. **Expand** the Conics Editor strip labeled **Exercise 2**.
7. Graph the equation inside and then change the equation so that it opens in the opposite direction.
8. With the new equation and its graph showing, get a **screen capture**. Add two blank spaces following the first screen capture and then paste this one.
9. Return to eActivity. You have two options!
10. **Save** your work as an eActivity named **L19_PartIII_a**_your initials here.
11. Open the eActivity named **L19_PartIII_b** in the **Lesson 19** folder.
12. This is another eActivity that I found on the web at http://edu.casio.com/products/cpeactivity/index.html.
13. Read through the eActivity, opening each Geometry strip along the way and have fun!
14. With the strip labeled **Animation** open, get a **screen capture.** Add two blank spaces following the second screen capture and then paste this one.
15. You can try the **Your turn**! Part if you want to, it is up to you.

PART IV

Reflection Exercises

You have just completed the nineteenth lesson in ClassPad 101. You are doing great (thank you). Please take a few moments to copy and paste the following three questions at the end of your Lesson 19 document and answer them.

1. Approximately how long did it take you to complete this lesson?
2. Which activity did you enjoy the most?
3. Did you find any part of this activity difficult to follow? If so, which part? Also, how did you overcome the difficulty?

Assessment 19: Introduction to Conics

- **Checkpoint**: Your word processed document, titled "Lesson19", should contain the following activities:
  1. Three screen captures from PART I.
  2. Three screen captures from PART II.
  3. Three screen captures from PART III.
  4. Three reflection questions with answers from PART IV.
- **Submit** your **Lesson19 document** to your instructor for grading.