ClassPad 101

for ClassPad Version 3.00+

Lesson 12

Geometry and Animation

Welcome

In this lesson, we will continue our exploration of Geometry by learning about some of its more advanced features. There are many things you can do with the Geometry application once you learn your way around. It is a great tool to use to help you decide whether or not a theorem is true before trying to prove it!

Lesson Goals

- To learn how to create an animation
- To understand constraints in Geometry
- To be able to state Thales' Theorem
- To be able to perform basic constructions

In Lesson 12, you will learn how to:

- Create an animation
- Generate a trace point
- Create an animation table
- Use construction tools

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

1. How do you add an animation?
2. What does it mean to constrain something?
3. How do you constrain something?
4. How do you know what information is showing in the measurement box?
5. How do you create an animation table?
6. How do you construct the midpoint of a line segment?
7. What does bisecting an angle of a triangle do to the side opposite it?

Time required

About 60 minutes.

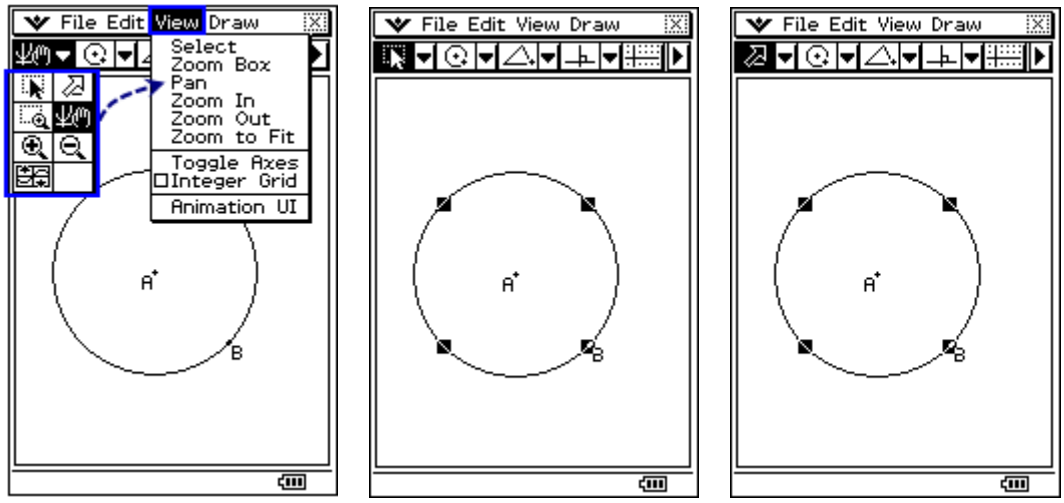
Getting Started

Before getting started with animation, let's review Geometry quickly. Recall from Lesson 3 that it is *important to know which mode you are in*. If not, you may draw a circle or line segment when you really just want to select something. When this happens, remember to use Edit/Undo/Redo quickly.

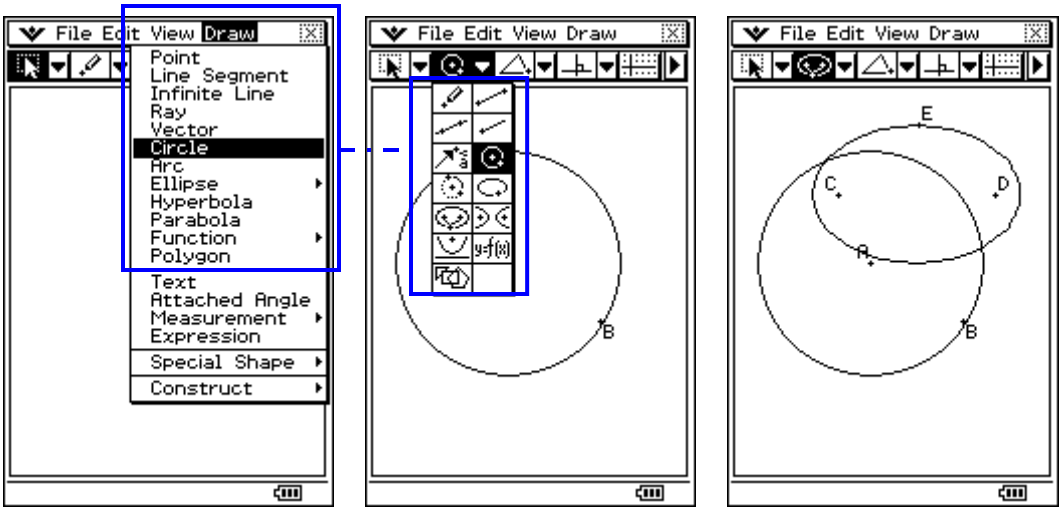
There is a logical pattern to Geometry's button palette's and menu items. Please take a few minute's to understand this logic; it is simple and will help you in the near future.

The first button palette is for changing to the selection mode (very important) and different types of zooming (less important). I am sorry, but there is no menu item for the select/deselect icon ( ). This is the only one without a menu item.

Note: When you are in the select/deselect mode ( ) clicking once selects an object, clicking again deselects it.



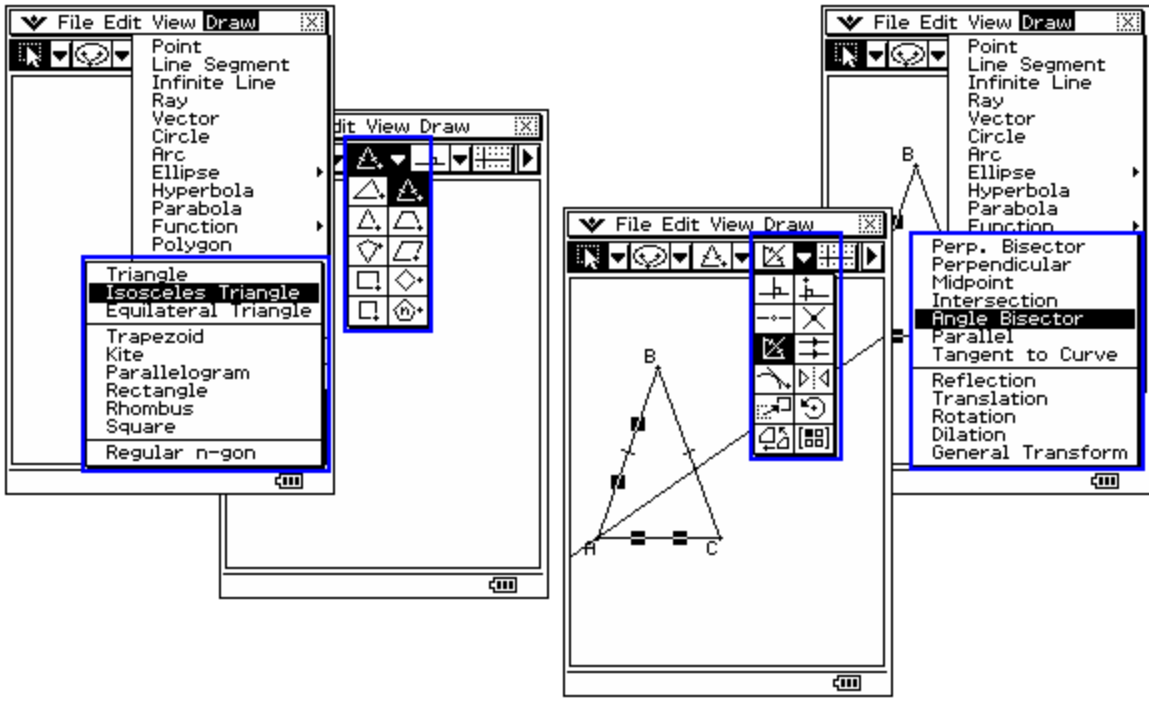
The next palette is for drawing basic shapes. When you select a basic shape, you **WILL stay in the mode** until you select something else. When you select a tool from the Draw menu, the toolbar updates to show the icon.



The next palette is for drawing special shapes and the last is for creating constructions. When you select one of these, you **WILL automatically change to the selection mode** ([ ]).

Each "**Special Shape**" menu item has a corresponding button.

Each "**Construct**" menu item has a corresponding button.



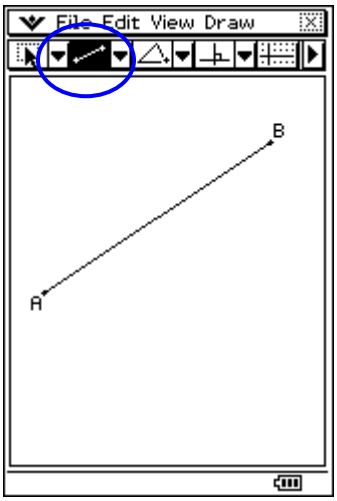
PART I

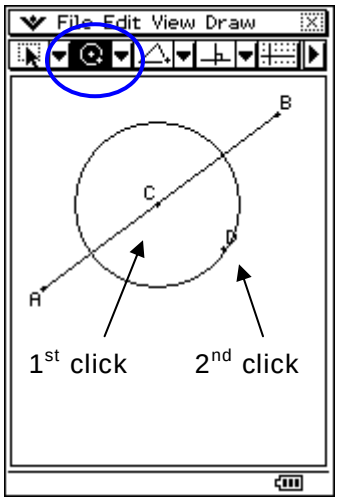
In this part, we will learn how to create an animation. To create an animation, we need to select a point and a curve, and then add the animation. Once the animation is added, we can run the animation and watch the point travel about the curve.

Important: If you try to add an animation without selecting what is needed, the **status bar** will display "**Need point and curve**".

1. Getting Ready for Animation

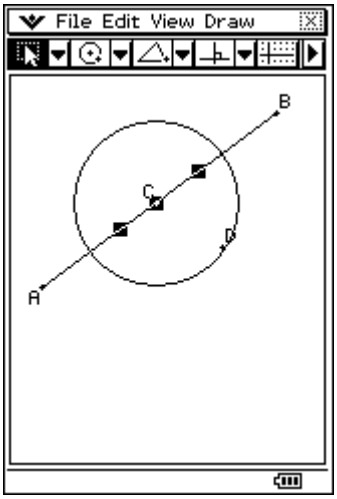
a. Click Menu and then Geometry
b. Select **Edit / Clear All**
c. Draw a **line segment**
d. Draw a small **circle** with its **center** on the **line segment**
e. Remember that **Edit / Undo / Redo** is useful

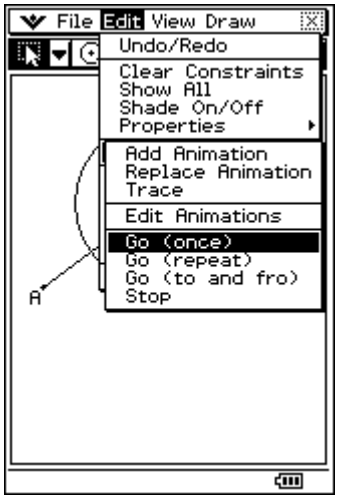




2. Adding and Running an Animation

a. **Click** to change to **Selection mode**
b. Select the **line segment**
c. Select the **center** of the **circle**
d. Open the **Edit menu** and select **Animate / Add Animation**
e. Open the **Edit menu** and select **Animate / Go (once)** or Go (repeat) or Go (to and fro)
f. Press Esc or the Clear key to stop, if needed



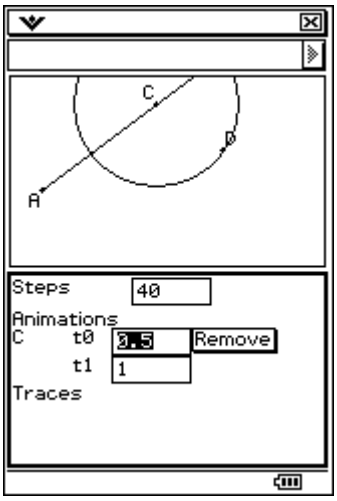


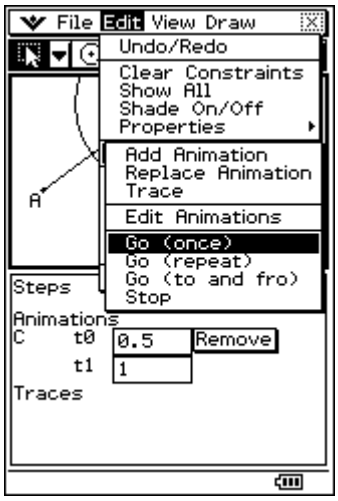
What is going on?

a. Open the **Edit menu** and select **Animate / Edit Animations**.
b. Notice a window opens that contains information about our animation.
c. When we create an animation, the segment or curve we use is given a starting point of t0 and ending point t1.
d. When we run this animation, it will step 20 times between the starting and ending point.

3. Editing our Animation

a. If needed, open the **Edit menu** and select **Animate/Edit Animations**
b. Change **Steps** to **40**
c. Change **t0** to **0.5**
d. Click in the Geometry window
e. Run your animation one time [**Go (once)**]
f. Change **Steps** back to **20** and **t0** to **-0.5**
g. Run your animation again [**Go (once)**]

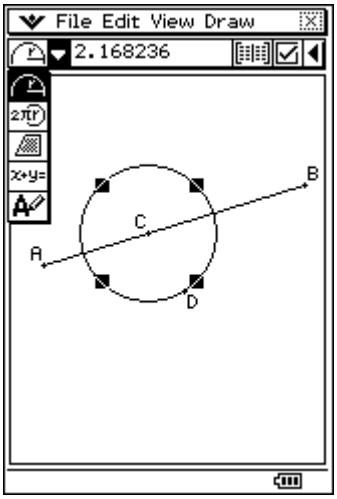


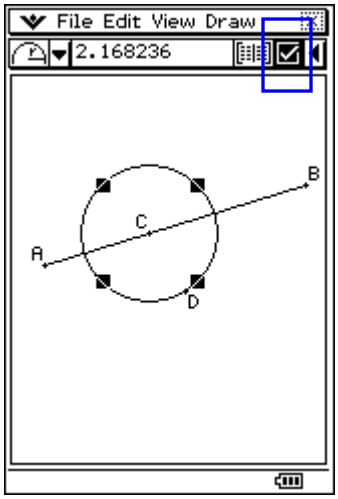


4. Placing a Constraint on our Circle

Before beginning, **please repeat parts 1 and 2 above** (1. Getting Ready for Animation & 2. Adding and Running an Animation).

a. We want our circle to stay a constant size and so we will "**constrain**" its radius
b. Click ▶ to uncover the **Measurement box**
c. Select just the circle
d. Change the dropdown button to show
e. Click on the ☑ (it will change to ☑)
f. Run your animation again





Placing a constraint on an object can be very useful. Whenever you need an object to maintain its shape:

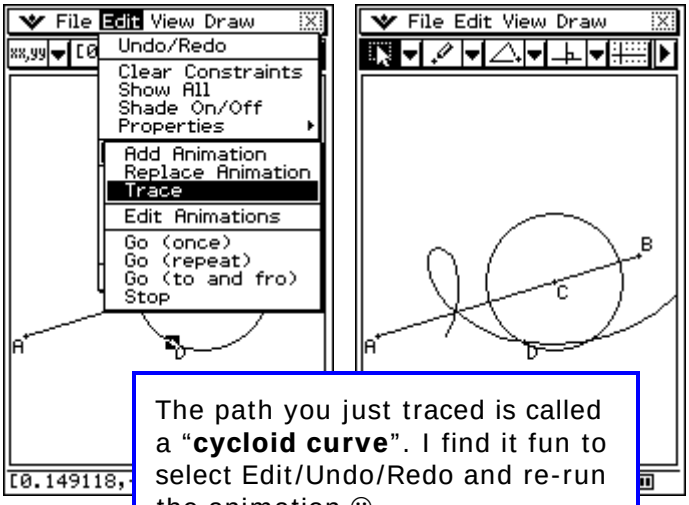
a. Advance the toolbar.
b. Select the object and the icon showing the measurement you want to constrain.
c. Click the ☑ button.
d. To remove a constraint, click the ☑ button again.

Very Helpful Hint: If you are trying to change a shape and cannot, check to see if it is under a constraint. You can also clear all constraints by selecting Edit/Clear Constraints.

5. Adding a Trace Point to an Animation

Imagine point D is an ant clinging to a wheel. What path will it follow as the wheel turns?

a. First we need to add one more animation
b. **Select point D** (the point on our circle's edge) and **the circle**
c. Open the **Edit menu** and select **Animate / Add Animation**
d. Deselect everything
e. **Select just point D**
f. Open the **Edit menu** and select **Animate / Trace**
g. Run the animation again



The path you just traced is called a "**cycloid curve**". I find it fun to select Edit/Undo/Redo and re-run the animation ☺

PART I
Practice Exercises

Before beginning the practice exercises, open a word document, type in the following information and then *save it as Lesson12 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 12

1. Please open the Geometry application and clear the window.
2. Draw two circles so that they overlap.
3. Change to selection mode.
4. Select one of the circles and the point on the edge of the other circle.
5. Get a **screen capture** and paste it into your Lesson 12 document (under a title of PART I).
6. Add an animation for the circle and point you have selected.
7. Run your animation.
8. Get a **screen capture.** Add two blank spaces following the first screen capture and then paste this one.
9. Select the circle with the point on the edge used in animation and constrain its radius.

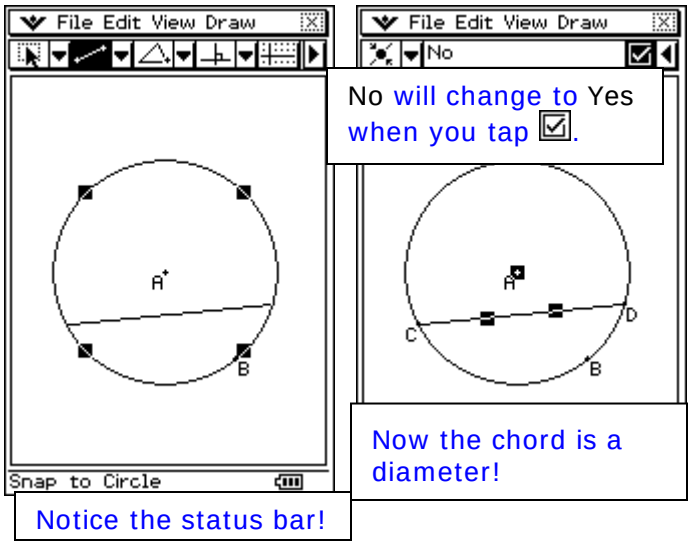
10. Select only the center of the circle you just constrained and add it as a trace point.
11. Run your animation again.
12. Get a **screen capture** with your trace showing. Add two blank spaces following the second screen capture and then paste this one.

PART II

In this part, we will use the animation table to explore what is happening to measurements during an animation.

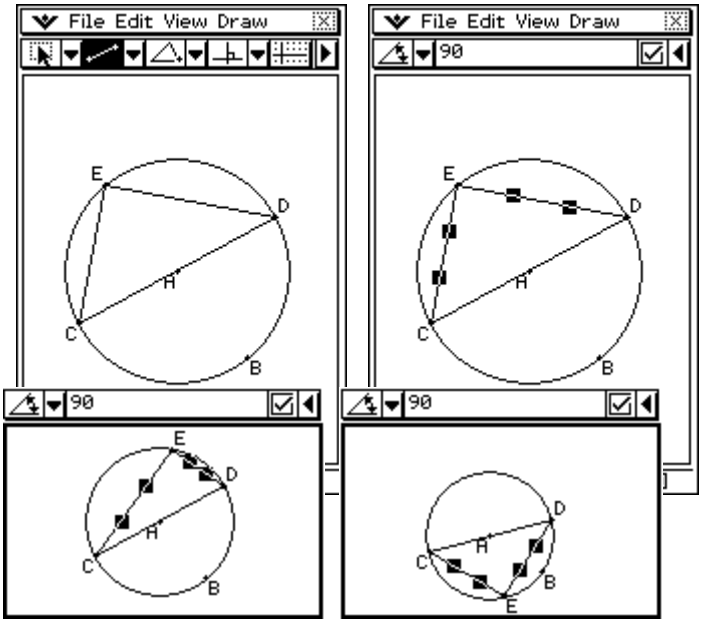
1. Drawing a Circle's Diameter

a. Open Geometry and clear the window
b. Draw a good sized **circle**
c. Select the **line segment** tool
d. Draw a chord (tap one side of circles edge and then the other)
e. **Advance** the toolbar
f. Select the **chord** and the **circle's center**
g. Set measure type to ☒
h. Click the ☑ to **constrain** or lock the chord & center



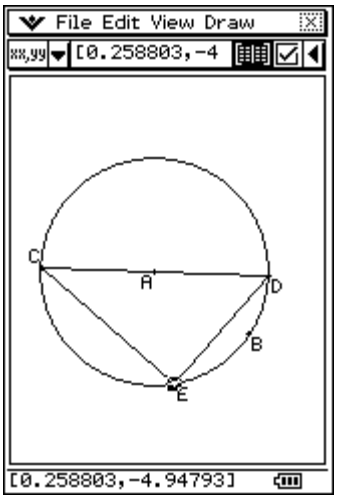
2. Minor Exploration

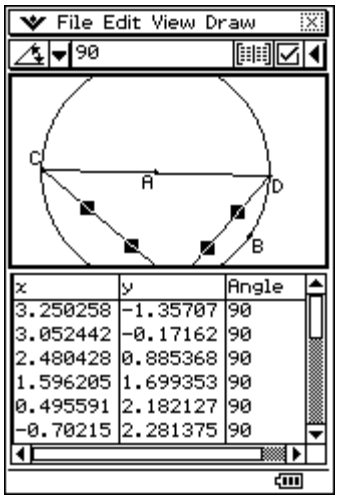
a. Draw a **line segment** from **one end** of the **diameter** to the upper **edge of the circle**.
b. **Draw** another segment to construct a **triangle**, as shown
c. **Measure** the **upper angle** of your triangle
d. Click in an empty space (to deselect) and then **select** the **vertex point** on the **circle's edge**
e. **Drag** the vertex point and **measure** the angle again
f. Is this a coincidence?



3. Viewing a Measurement with the Animation Table

a. **Select** the **vertex point** on the circle's edge AND **select the circle**
b. Open the **Edit menu** and select **Animate / Add Animation**
c. Run your animation
d. Advance the toolbar
e. **Select** the **vertex point** on the edge
f. Click the table button ( )
g. **Select** our inscribed angle and click again





During the first half of the sixth century B.C., a gentleman named Thales discovered that an angle inscribed in a semicircle will always be a right angle. This discovery is today referred to as Thales' Theorem:

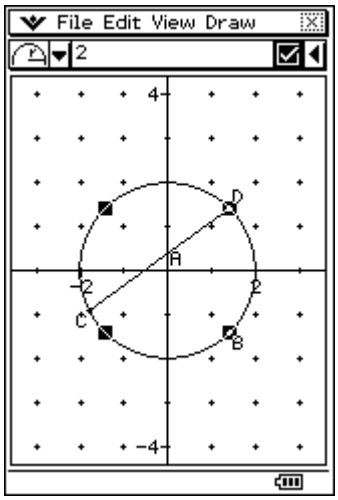
Thales' Theorem
An angle inscribed in a semicircle is a right angle.

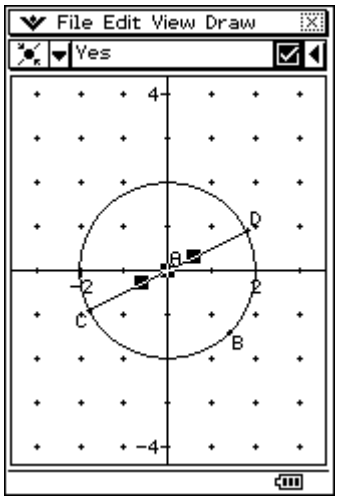
So, if you ever need to construct a right triangle just draw a triangle in a semi-circle (half circle) and use the diameter as the hypotenuse.

Other results Thales is credited for:
- A circle is bisected by its diameter.
- The base angles of an isosceles triangle are equal.
- The vertical angles formed by two intersecting lines are equal.

4. Getting Ready to Analyze Area

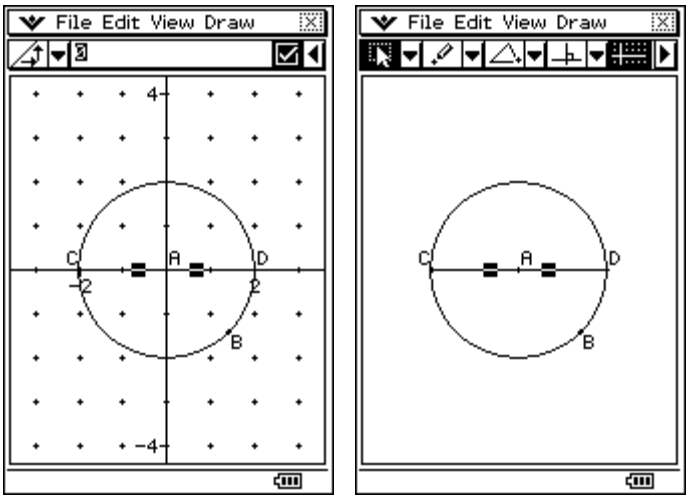
a. Please clear your Geometry window
b. **Turn on** the axes and grid (click three times)
c. **Draw** a **circle centered** at the **origin**
d. **Draw** a **chord** (line segment)
e. Select the circle and **constrain** its **radius** to **2**
f. Select your **chord** and the **circles center**
g. **Constrain** them to touch





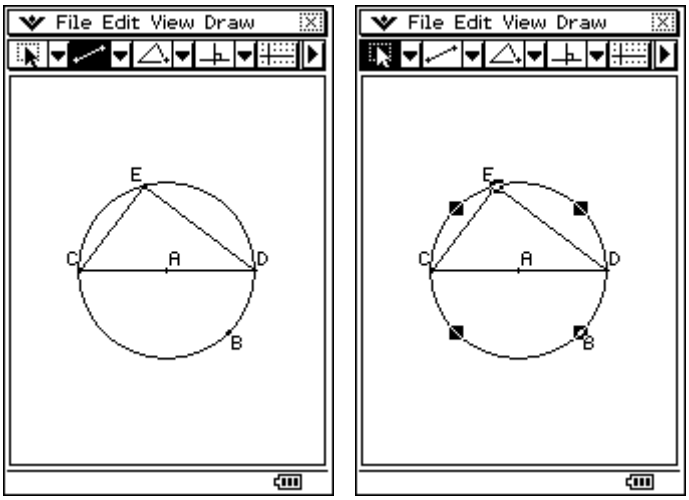
5. Changing the Diameter to be Horizontal

a. **Select** just the **diameter** of the circle
b. **Change** the measurement icon to show [slope icon] (slope icon)
c. **Change** the value in the measurement box to **0** and click [✓]
d. Click the [◀] arrow
e. Click [grid] once to turn the axes and grid off



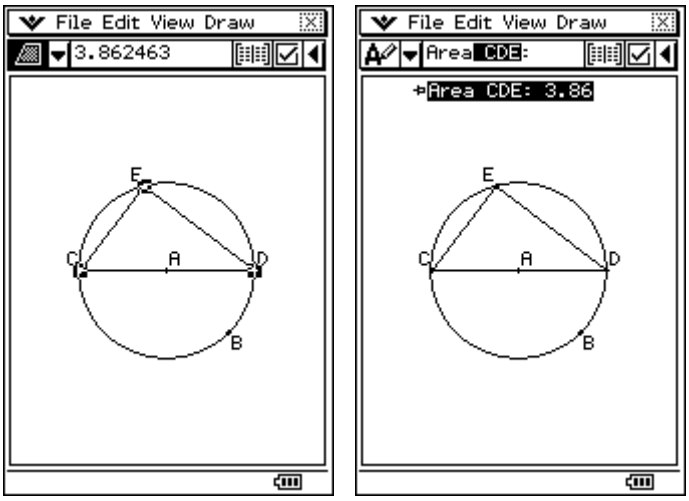
6. Setting Up an Animation to Generate Areas to Analyze

a. **Draw** a **right triangle** in either semicircle using the line segment tool
b. **Change** to the selection mode ([cursor])
a. Select the **vertex point** on the circle's edge and the **circle**
c. Open the **Edit menu** and select **Animate / Add Animation**



7. Displaying the Triangle's Area in the Window

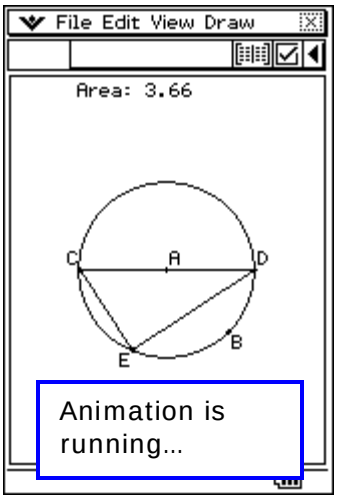
d. **Advance** the toolbar
e. **Select** the **three vertices** of the triangle
f. **Click** [area icon] (area icon)
g. Change **Area** to **Area CDE** in the measurement box and press EXE or click [✓]
h. If you want to, select point **E** and then drag it

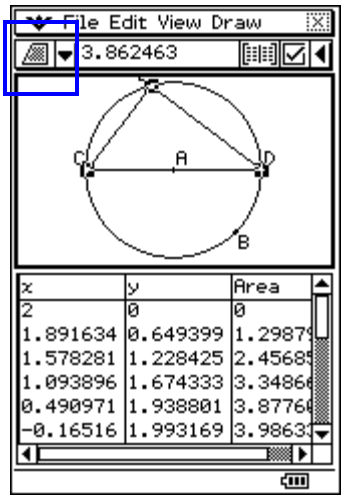


8. Analyzing Area and Animation

a. Run your animation
b. Advance the toolbar
c. Select the **vertex point** on the circles **edge**
d. Click the button
e. Select **all three vertices** (make sure the icon for area is showing)
f. Click the table button ( ) again
g. Scroll to see the areas

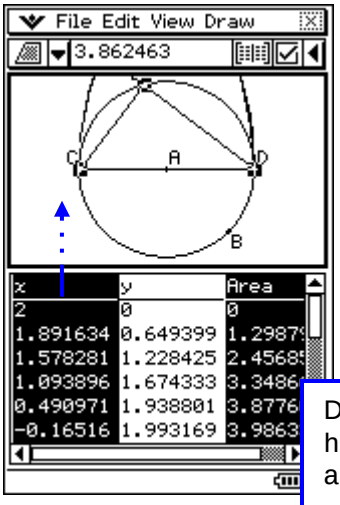
(When do you think the area is the largest?)

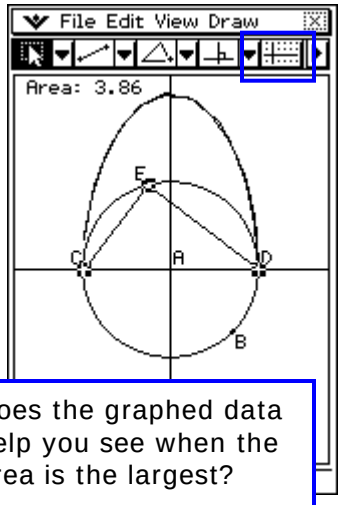




9. Viewing the *x*-Value and Area Graphically

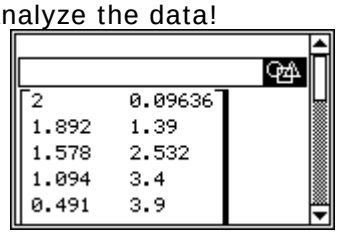
a. **Select** the column of **x-values** by clicking on it
b. **Select** the column of **area values** by clicking on it
c. Press on **one of the selected columns** and **drag** to the Geometry window
d. Your data points are plotted for you (x, area)
e. Click the **Resize** button
f. Turn the axes back on, if you want to

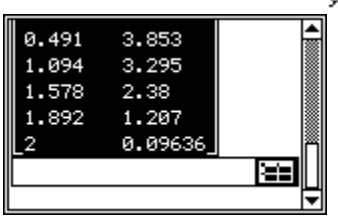


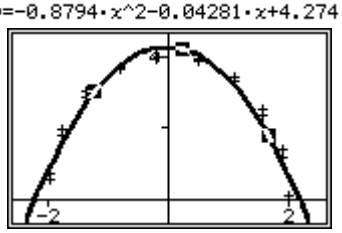


This data could be copied and then analyzed more in another application such as Statistics or Spreadsheet.
Optional:
If you have time, save the current Geometry file, open eActivity, insert a Geometry strip, and open your saved Geometry file. Once open, select the trace path and then drag to eActivity. Next, insert a List Editor or Spreadsheet strip. Select the matrix containing trace point data and drag to new strip.

Analyze the data!







PART II
Practice Exercises

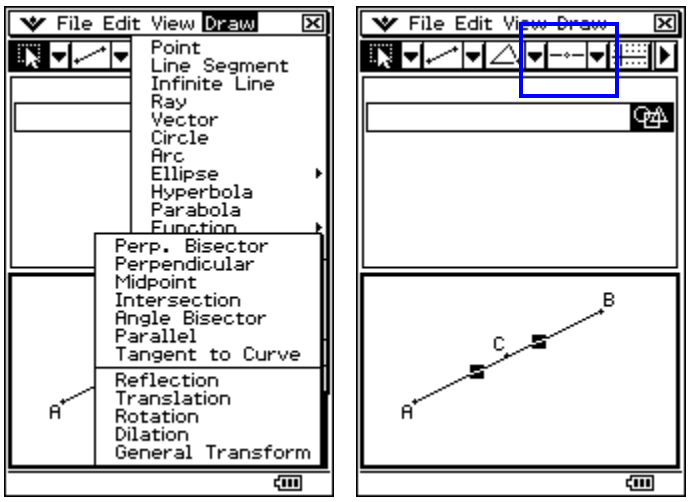
1. Open the eActivity named **L12_PartII_a** (in the Lesson 12 folder).
2. Expand the Geometry strip.
3. Select point B and line segment DE.
4. Add an animation to animate point B along line segment DE.
5. Run your animation.
6. Get a **screen capture** and paste it into your Lesson12 document (under a title of PART II).
7. Advance the toolbar, deselect everything and then select points A, B and C. The area of triangle ABC should be showing in the measurement box.
8. Create an animation table showing the areas. Scroll the table to show the largest area.
9. Get a **screen capture.** Add two blank spaces following the first screen capture and then paste this one.
10. **Save** your work as an eActivity named **L12_PartII_a**_your initials here.
11. Open the eActivity named **L12_PartII_b**.
12. Add an animation to animate point B along line segment DE.
13. Run your animation.
14. Create an animation table showing the areas of the triangle during animation.
15. Why do you think the areas in this animation are the same? Inside the eActivity window type: **The areas are the same because…** Be sure to complete the sentence.
16. Get a **screen capture.** Add two blank spaces following the second screen capture and then paste this one.
17. **Save** your work as an eActivity named **L12_PartII_b**_your initials here.

PART III

In this part, you will learn how to do constructions in Geometry. Usually when we create a construction, we must first select something. Watch the status bar for helpful hints.

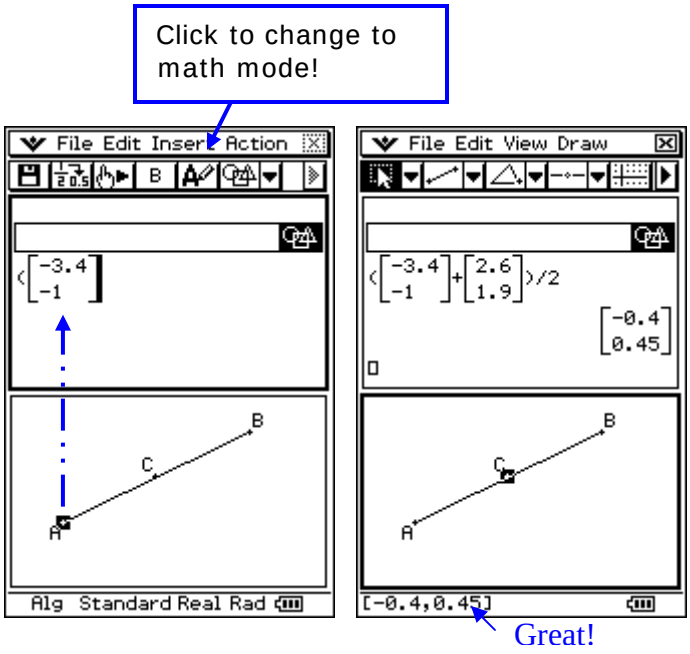
1. Finding the Midpoint of a Line Segment

a. Open eActivity and clear the window
b. Insert a **Geometry strip**
c. Draw a **line segment**
d. **Select** your line segment
e. Open the **Draw menu** and select **Construct / Midpoint**
f. Midpoint C is plotted for you
g. **NOTICE** the midpoint icon is now showing on the toolbar



2. Evaluating the Midpoint in eActivity

a. Click in eActivity and input a **(**
b. Select **point A** and **drag it to eActivity**, just following the **(**
c. Add a **+** sign
d. Select **point B** and **drag it to eActivity**, just following the **+** sign
e. Type in **) / 2**
f. Change to **Math mode** and click  (decimal)
g. Click on point C
h. Compare your eActivity results with the coordinates in the status bar



3. Bisecting an Angle

a. Insert another Geometry strip into your eActivity

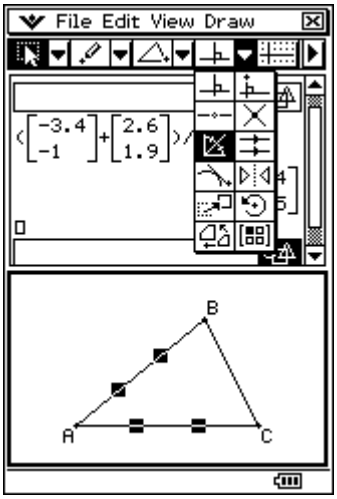
b. Draw an **acute triangle** (Draw/ Special Shape/ Triangle)

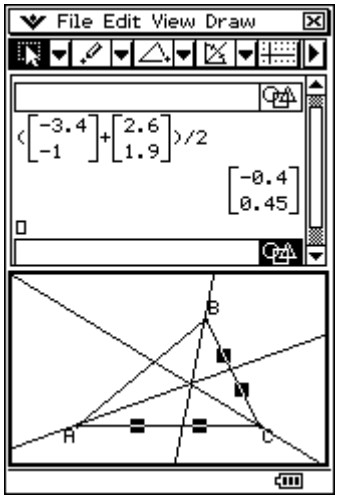
c. Select **two sides** of your triangle

d. Draw an **angle bisector** (select Draw /Construct/ Angle Bisector or select it's button)

e. Select **two other sides** and just click the  button

f. Bisect the last angle





4. Drawing a Tangent Line to a Curve

A "tangent" to a curve is a line that just touches the curve. Have you ever heard the saying "going off on a tangent"? Notice the tangent line goes away from the curve in either direction.

a. Clear your eActivity window and insert a Geometry strip

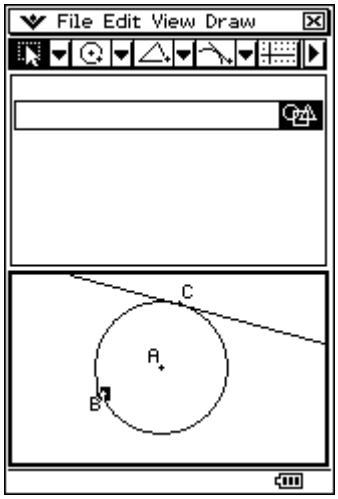
b. Draw a **circle**

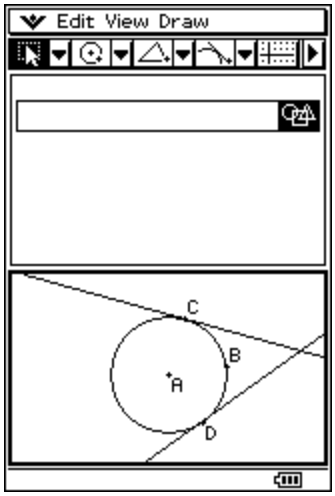
c. Open the dropdown construction button palette and **select** 

d. With the  **button selected**, **click** on the **circle**

e. Click the  button again to select it

f. Click on the other side of your circle





PART III
Practice Exercises

1. Open the eActivity application and then **open L12_PartIII_a**.
2. Expand the Geometry strip.
3. Read the directions inside the eActivity.
4. Click **Resize** to enlarge the Geometry window. If needed, zoom your window to show the bisected angle (use the + and – keys). Press Swap if you need to re-read the directions!
5. With the 2nd tangent line and angle bisectors showing, get a **screen capture** and paste it into your Lesson12 document (under a title of PART III).
6. Notice that when you bisected the angle formed by the tangent lines, two angle bisectors were drawn. One for each pair of vertical angles. I thought this was interesting ☺.
7. Return to eActivity and **save** your work as an eActivity named **L12_PartIII_a**_your initials here.
8. **Open** the eActivity named **L12_PartIII_b**.
9. Expand the Geometry strip.
10. Follow the directions inside the eActivity.
11. Get a **screen capture.** Add two blank spaces following the first screen capture and then paste this one.
12. There are a few very interesting things happening as you move one of the vertices. The point where your three angle bisectors meet is called the triangle's **incenter**. If you have time, look up "incenter of a triangle".
13. **Save** your work as an eActivity named **L12_PartIII_b**_your initials here.
14. Clear your eActivity window and insert a Geometry window.
15. Draw a line segment.
16. Draw a circle to the left or above of your line segment.
17. Select **Draw / Construct / Reflection**. Notice the status bar.
18. Click on your line segment. Zoom to see both circles, if needed.
19. Select just the center point of each circle. Press on a selection handle and drag to eActivity. An expression containing matrices should appear.
20. Get a **screen capture.** Add two blank spaces following the second screen capture and then paste this one.

PART IV

Reflection Exercises

You have just completed the twelfth lesson in ClassPad 101. Awesome. Please take a few moments to copy and paste the following three questions at the end of your Lesson12 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 12: Geometry and Animation

- **Checkpoint**: Your word processed document, titled "Lesson12", 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 **Lesson12 document** to your instructor for grading.