Polygarden Landscaping Company

Explore/Explain Cycle I

Purpose:
Provide participants the opportunity to use technology to explore relationships in geometric figures that yield linear data, such as proportional change of one dimension in a two-dimensional figure. Participants will make connections between algebraic and geometric concepts that enhance their student's conceptual understanding of the Geometry TEKS.

Descriptor:
In a guided exploration, participants will manipulate sketches created in Geometer's Sketchpad. Problem-solving strategies of breaking a large problem into smaller components and working backwards will be utilized to facilitate the constructions and the development of geometry concepts.

Duration:
2 hours

TEKS:

a(5) Tools for geometric thinking. Techniques for working with spatial figures and their properties are essential in understanding underlying relationships. Students use a variety of representations (concrete, pictorial, numerical, symbolic, graphical, and verbal), tools, and technology (including but not limited to calculators with graphing capabilities, data collection devices, and computers) to solve meaningful problems by representing and transforming figures and analyzing relationships.

a(6) Underlying mathematical processes. Many processes underlie all content areas in mathematics. As they do mathematics, students continually use problem-solving, language and communication, connections within and outside mathematics, and reasoning (justification and proof). Students also use multiple representations, technology, applications and modeling, and numerical fluency in problem solving contexts.

G.5A Use numeric and geometric patterns to develop algebraic expressions representing geometric properties.

G.7A Use one- and two-dimensional coordinate systems to represent points, lines, rays, line segments, and figures

G.7B Use slopes and equations of lines to investigate geometric relationships, including parallel lines, perpendicular lines, and special segments of triangles and other polygons.

G.8A Find areas of regular polygons, circles, and composite figures.

G.11D Describe the effect on perimeter, area, and volume when one or more dimensions of a figure are changed and apply this idea in solving problems

TAKS Objectives:

- Objective 3: Linear Functions
- Objective 4: Formulate and Use Linear Equations and Inequalities
- Objective 6: Geometric Relationships and Spatial Reasoning
- Objective 7: Two- and Three-Dimensional Representations of geometric relationships and shapes
- Objective 8: Concepts and Uses of Measurement and Similarity
- Objective 10: Mathematical Processes and Tools

Technology:

- Spreadsheet technology
- Hand-held graphing calculator
- Dynamic geometry software (Geometer's Sketchpad)
- Graph link technology

Materials:

Advanced Preparation*:*

- Participant access to computers with Geometer's Sketchpad (latest version update available from http://www.keypress.com/sketchpad) and/or a projection device to use Geometer's Sketchpad as a whole group demonstration tool
- Sketches **Growing Pollys.gsp** and **Inscribed Circles.gsp** found on the CD.

For each participant:

- Graphing calculator
- Graph link (optional)
- **Polygarden Landscaping Company** activity sheets
- **Putting It All Together** activity sheet
- **Polygarden Landscaping Company Intentional Use of Data** activity sheet printed on green paper

For each group of 2 participants:

- Computers with Geometer's Sketchpad and Microsoft Excel
- Copy of the Technology Tutorial T^2

Polygarden Landscaping Company—Leader Notes

In this exploration the presenter will ask the participants to use Geometer's Sketchpad to collect and analyze data to discover the relationship between the length of the apothem of a regular polygon and its perimeter.

The relationship is a linear relationship in the form ***y = kx*** *, where* ***k*** *is the constant of proportionality or constant of variation. Participants will gather the data and analyze it on their own. During the Explain phase, participants will discuss several methods of analyzing the data and identify comparative advantages and disadvantages of each method.*

Polygarden Landscaping Company

Explore

Posing the Problem:

Polygarden Landscaping Company builds brick borders for flowerbeds that are always in the shape of regular polygons. To calculate the number of bricks necessary for a flowerbed, Brad, a bricklayer, needs to know the perimeter of the garden. On his last job Brad was not able to measure the perimeter of the flowerbed. He could only measure the distance from the center of the polygon to one side of the polygon. This distance is called the apothem. Is it possible for Brad to calculate the perimeter of the flowerbed if the only information he has is the length of the apothem and the number of sides of the garden?

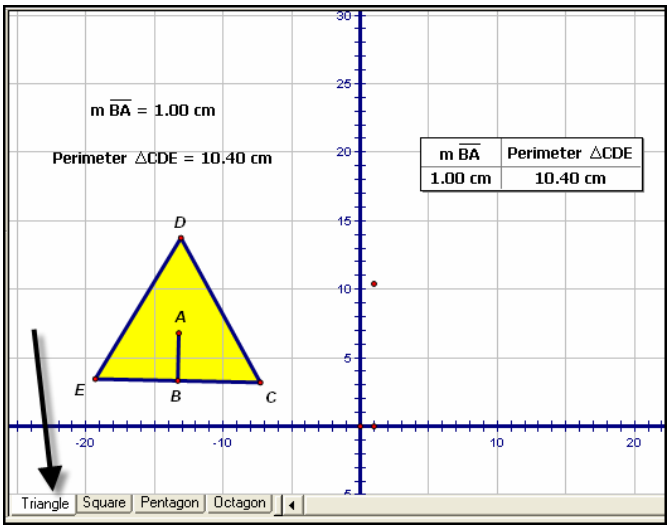
Obtaining and Analyzing the Data:

To solve this problem, use the problem-solving strategy of "solving a simpler problem." To do so, use geometric sketches to collect and analyze data.

Open the sketch Growing Polly's.

Participants might need instruction at this point about how to open Geometer's Sketchpad and find the sketch on the particular computers that are being used in the professional development.

Select the Triangle tab.



1. **Double click on the table to add another row; then click and drag point *C* away from point *B*. What do you observe?**

The measures change. The points are plotted and traced to create a graph.

2. **Double click on the table again, and then move point *C* farther away from point *B*. Repeat this process until you have 10 rows in your table.**

3. **What patterns do you observe in the table?**

Answers may vary. Participants may observe that this is a proportional relationship.

4. **What observations can you make about your graph?**

Participants may observe that the graph appears to be linear and passes through the origin.

5. **Develop an algebraic rule that describes the relationship of the length of the apothem, *x*, to the perimeter, *y*.**

y= 10.39x

6. **Verify that your function rule models your data. Explain your verification.**

Participants may have graphed the function rule over the scatterplot.

7. **Write a verbal description of the relationship between the length of the apothem of an equilateral triangle and its perimeter.**

The perimeter of an equilateral triangle can be calculated by multiplying the length of the apothem by 10.39.

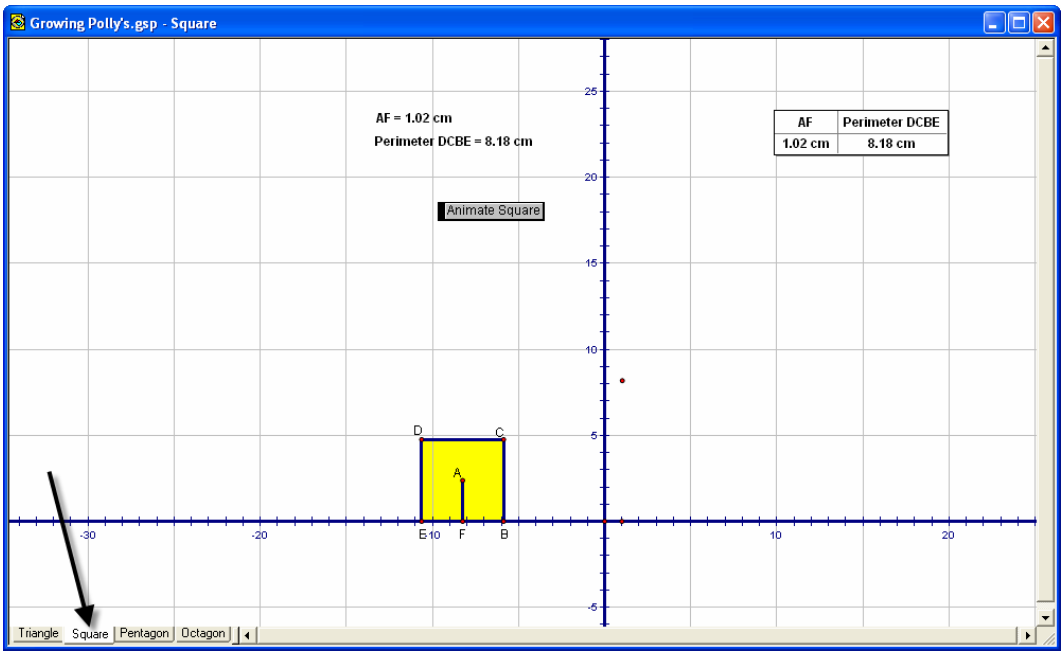
8. **What is the approximate perimeter of a flowerbed that is in the shape of an equilateral triangle with an apothem of 7.23 centimeters?**

75.12 centimeters

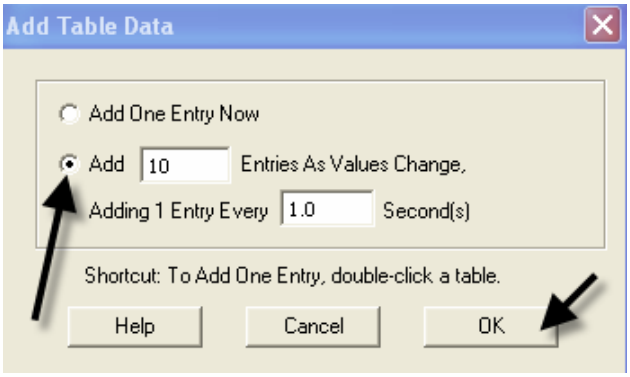
9. **What is the approximate length of the apothem of an equilateral triangle whose perimeter is 68.5 centimeters?**

6.6 centimeters

Select the **Square** tab.



1. ***Right*** **click in the table and select the Add Table Data option. Select the Add 10 Entries As Values Change, Adding 1 Entry Every 1.0 Second(s) and click OK.**



2. **Start the data collection process by clicking on the Animate Square button. After your table fills with data, stop the animation by clicking on the Animate Square button again. What happened?**

   The plotted points graphed creating a line. The table filled up as the square changed sizes.

3. **What patterns do you observe in the table?**

   Participants may observe that this is a proportional relationship.

4. What observations can you make about your graph?

Participants may observe that the graph appears to be linear and passes through the origin.

5. Develop an algebraic rule that describes the relationship of the length of the apothem, *x*, to the perimeter, *y*.

$y = 8x$

6. Verify that your function rule models your data. Explain your verification.

Participants may have graphed the function rule over the scatterplot.

7. Write a verbal description of the relationship between the length of the apothem of square and its perimeter.

The perimeter of a square can be calculated by multiplying the length of the apothem by 8.

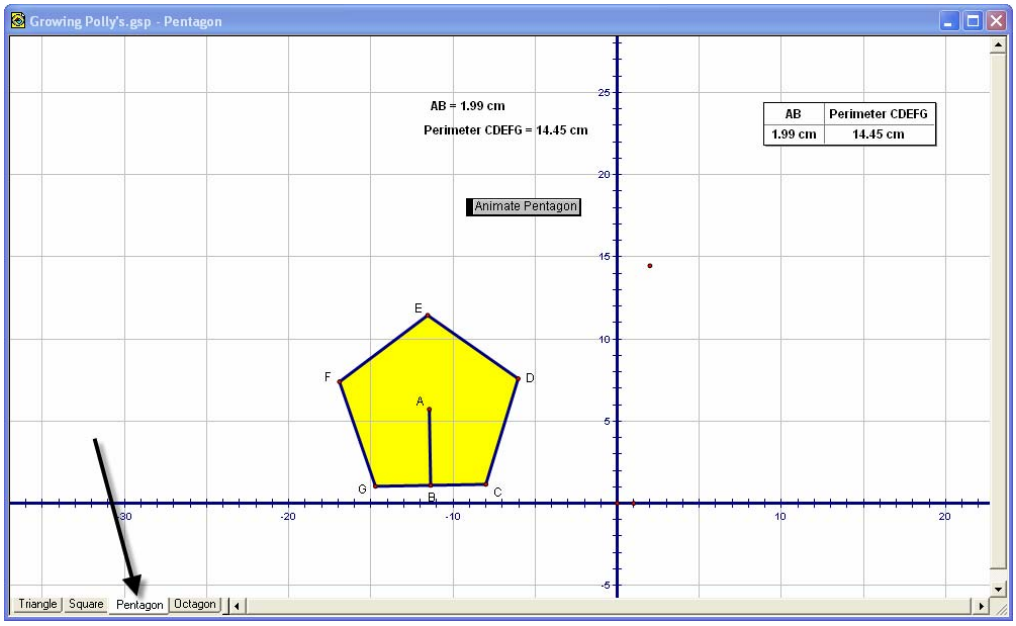
8. What is the approximate perimeter of a flowerbed that is in the shape of a square with an apothem of 7.23 centimeters?

57.84 centimeters

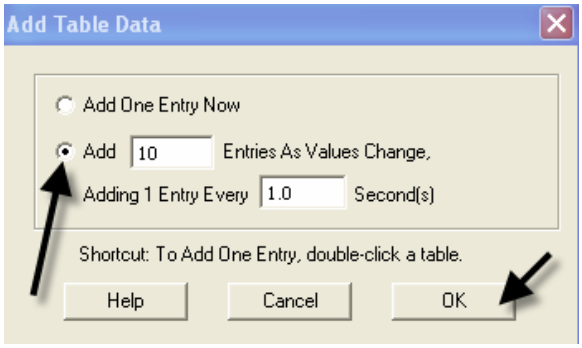
9. What is the approximate length of the apothem of a square whose perimeter is 68.5 centimeters?

8.6 centimeters

Select the Pentagon tab.



1. ***Right*** **click in the table and select the Add Table Data option. Select the Add 10 Entries As Values Change, Adding 1 Entry Every 1.0 Second(s) and click OK.**



2. **Start the data collection process by clicking on the Animate Pentagon button. After your table fills with data, stop the animation by clicking on the Animate Pentagon button again. What happened?**

   The plotted points graphed creating a line. The table filled up as the square changed sizes.

3. **What patterns do you observe in the table?**

   Participants may observe that this is a proportional relationship.

4. **What observations can you make about your graph?**

   Participants may observe that the graph appears to be linear and passes through the origin.

5. **Develop an algebraic rule that describes the relationship of the length of the apothem, *x*, to the perimeter, *y*.**

   y= 7.27x

6. **Verify that your function rule models your data. Explain your verification.**

   Participants may have graph the function rule over the scatterplot.

7. **Write a verbal description of the relationship between the length of the apothem of a regular pentagon and its perimeter.**

   The perimeter of a pentagon can be calculated by multiplying the length of the apothem by 7.27.

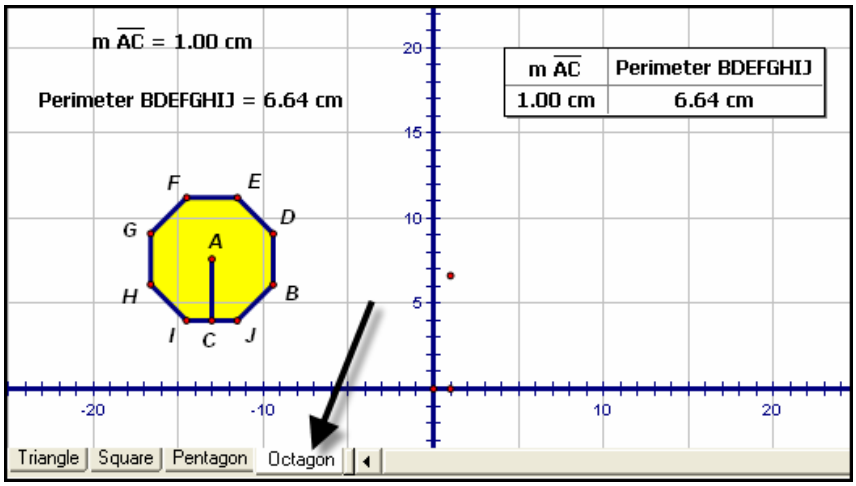
8. **What is the approximate perimeter of a flowerbed that is in the shape of a regular pentagon with an apothem of 7.23 centimeters?**

   52.56 centimeters

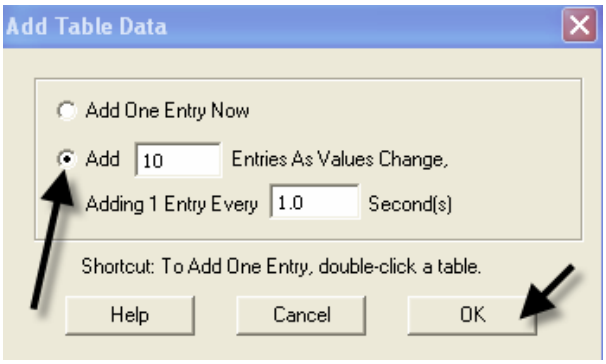
9. **What is the approximate length of the apothem of a regular pentagon whose perimeter is 68.5 centimeters?**

   9.4 centimeters

Select the Octagon tab.



1. ***Right*** **click in the table and select the Add Table Data option. Select the Add 10 Entries As Values Change, Adding 1 Entry Every 1.0 Second(s) and click OK.**



2. **Start the data collection process by clicking on the Animate Octagon button. After your table fills with data, stop the animation by clicking on the Animate Octagon button again. What happened?**

   The plotted points graphed creating a line. The table filled up as the square changed sizes.

3. **What patterns do you observe in the table?**

   Participants may have observed that this is a proportional relationship.

4. **What observations can you make about your graph?**

   Participants may observe that the graph appears to be linear and passes through the origin.

5. **Develop an algebraic rule that describes the relationship of the length of the apothem, *x*, to the perimeter, *y*.**

   y = 6.63x

6. **Verify that your function rule models your data. Explain your verification.**

   Participants may have graphed the function rule over the scatterplot.

7. **Write a verbal description of the relationship between the length of the apothem of regular octagon and its perimeter.**

   The perimeter of an octagon may be calculated by multiplying the length of the apothem by 6.63.

8. **What is the approximate perimeter of a flowerbed that is in the shape of a regular octagon with an apothem of 7.23 centimeters?**

   47.93 centimeters

9. **What is the approximate length of the apothem of a regular octagon whose perimeter is 68.5 centimeters?**

   10.33 centimeters

Putting It All Together

1. Complete the table.

Perimeter *versus* Apothem

Regular Polygon	Function Rule
Triangle	$y = 10.39x$
Square	$y = 8x$
Pentagon	$y = 7.27x$
Octagon	$y = 6.63x$

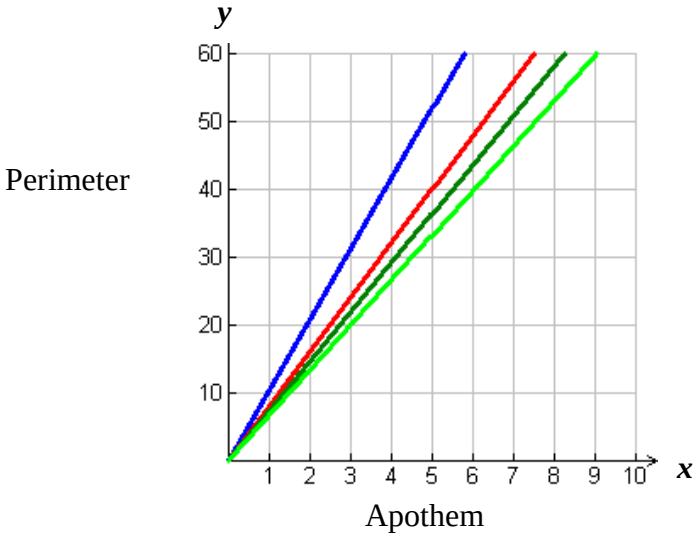
2. In what ways are the function rules the same?

They are all in the form $y = kx$.

3. In what ways are the function rules different?

The constant of proportionality is different.

4. Graph all four-function rules on the same set of axes. Sketch your graph. Label each line with the name of the polygon.
Sample graph:



5. **What observations can you make about your graph? Connect your observations to geometric properties observed in this exploration.**

   Participants should explain why the slopes of the lines decrease as the number of sides of the polygon increase.

6. **Look back at Brad's problem. Is it possible for Brad to calculate the perimeter of the flowerbed if the only information he has is the length of the apothem and the number of sides of the garden? Why or why not?**

   Yes, because that is what we did in the activity: each time we increased the number of sides we were able to find a function rule to find the perimeter given the length of the apothem.

7. **Is there a general rule or trend you can develop using the information gathered? If so what is it?**

   Yes, the higher the number of sides of the polygon the closer the measure of perimeter comes to its inscribed circle.

8. **If the length of the apothem remains constant, what is the effect on perimeter as the number of sides of the polygon increases?**

   The perimeter decreases.

9. **If you continue to increase the number of sides of the polygon while keeping the length of the apothem constant, what value will the perimeter approach?**

   The perimeter of the polygon approaches the circumference of the inscribed circle.

Explain

Debrief the Polygarden Landscaping Company

In this phase, use the debrief questions to prompt participant groups to share their responses to the data analysis. Participants may have used graphing calculators as a tool for their data analysis. Have them discuss how they used or could have used the calculators to help them analyze their data. This information is important to the discussion of relative advantages and disadvantages of different types of technology. The reasons that a participant group did not choose a particular technology are as important (if not more so) than the justifications a group gives for the technology that they did choose.

1. **What knowledge of geometric properties is necessary to complete each of the constructions?**
   Participants should discuss the properties of the polygons. For example the central angle of a regular hexagon equals 60° and the apothem is perpendicular to a side of the polygon.

After participants have answered, demonstrate the construction of the "Triangle Sketch" using Geometer's Sketchpad. Ask questions as you demonstrate. Point out to participants that this demonstration is not intended to train them in the use of Geometer's Sketchpad; they will get the opportunity to become familiar with it throughout the workshop with detailed steps available in the Technology Tutorial T^2. This demo is intended to provide an understanding of how the construction depends on the properties of geometric figures. Demonstrate only the "Triangle Sketch," however, be sure to connect the construction techniques and geometric properties to the sketch of the square, regular pentagon, regular hexagon and regular octagon. For detailed steps on the construction see the ***Technology Tutorial T^2****.*

2. **Construct a circle and its radius.**

Facilitator Questions
- How many degrees are in the central angle of an equilateral triangle?
  120 degrees
- What about a square, regular pentagon or octagon?
  90, 72 and 45 degrees respectively

3. **Demonstrate a rotation of the radius 120°.**

4. **Demonstrate a second rotation of the radius 120°.**

Facilitator Question
- Ask participants to predict the next step in the construction.
  Connect the points on the circle with line segments.

5. Construct segments joining the end points of the radii.

Facilitator Questions
- How do we know this is an equilateral triangle?
  Because the inscribed angles are each 60 degrees (the measure of an inscribed angle is equal to one half of the measure of the intercepted arc, which in this case was the same as the central angle that we rotated 120 degrees).
- What is the relationship between the apothem of a regular polygon and a side of the polygon?
  They are perpendicular.
- Do you have an idea of what we need to do in order to construct a perpendicular to the side of the polygon?
  We need the perpendicular from one side through its opposite vertex.

6. Construct the line through the center of the circle that is perpendicular to one side of the triangle.

Facilitator Questions
- Do we want this entire line?
- If not, what parts of it do we want?
  We only want the apothem (from the center of the triangle to the point on the side).

7. Construct the point of intersection of the perpendicular line and the side of the triangle.

8. Construct the segment joining the center of the circle to the point of intersection.

9. Hide the circle and all unnecessary lines and segments.

Facilitator Question
- What are the things we want to measure?
  The apothem and the perimeter.

10. Measure the length of the apothem.

11. Highlight the three vertices and show how the Measure /Perimeter option is unavailable or "grayed" out on the selection menu.

12. Construct the triangle interior.

13. Show how the program automatically labeled the points and rename if desired.

Facilitator Questions
- What relationship are we interested in?
  How the apothem is related to the perimeter.
- What are the independent and dependent variables?
  The perimeter is the dependent and the apothem length is the independent.
- How can we explore that relationship?
  Build a table, plot the points.

14. Create the table.

15. Plot points to create the graph.

16. Trace the point.

17. Manipulate the triangle.

Facilitator Questions
- What type of function does this appear to be?
  Linear
- What other kinds of parent functions are there in this family?
- How can you determine the value of the constant of proportionality?

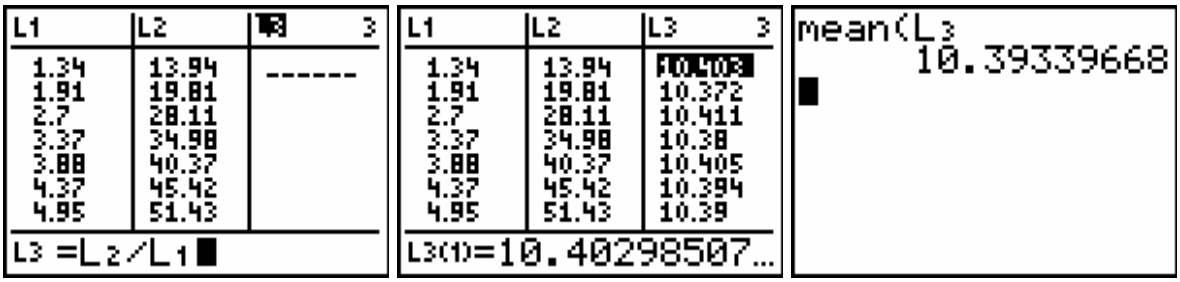
Debrief Putting It All Together

The explanations that follow come from the data collected for the triangle. The other three polygons use the same kind of analysis. Use facilitation questions to connect the explanations for the triangle to the other polygons.

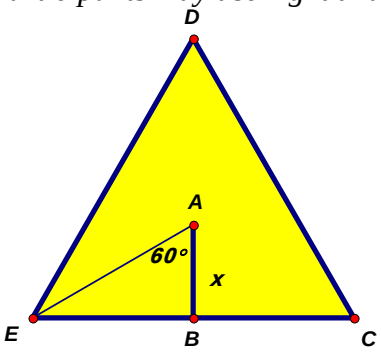
1. What process did you use to develop your algebraic rules?

Participants should share their methods. Sample methods are shown below. If participants do not discuss each of these methods, the leader will bring them into the discussion.

Participants may use the list feature of a graphing calculator to find a constant of proportionality, the write the rule in the form y = kx. In this case y = 10.39x.



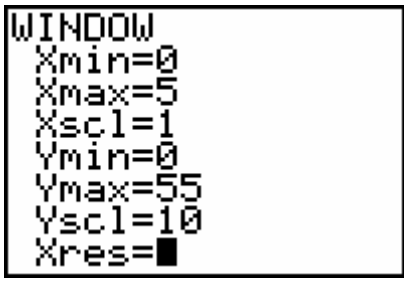
Participants may use right triangle trigonometry to develop the rule, P = 6x(tan(60°)) .

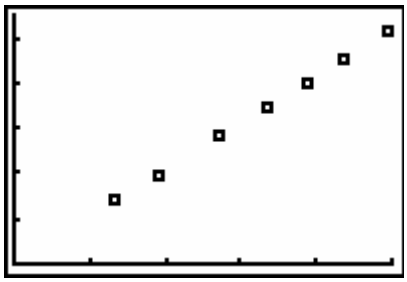


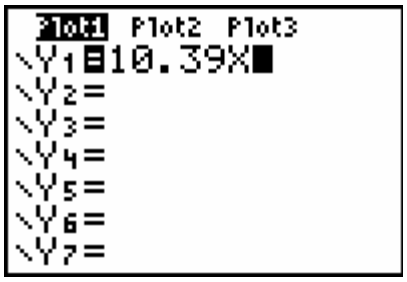
EB = xtan(60°) , ***EC = 2EB*** *so* ***EC = 2xtan(60°)*** .
The perimeter equals ***3EC*** *so* ***P = 6xtan(60°)*** .

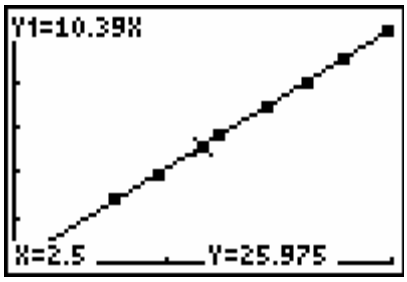
2. How did you verify your function rule?

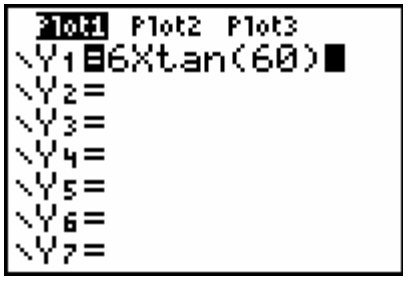
Participants may have created a scatterplot using a graphing calculator then graphed the rule over the scatter plot.

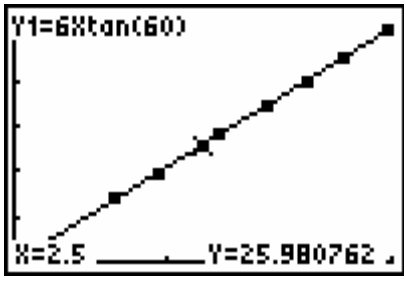








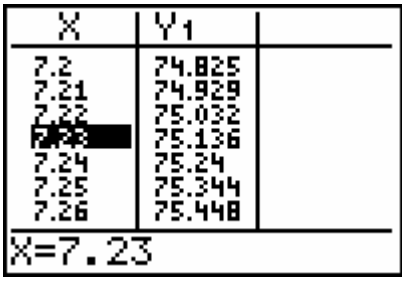




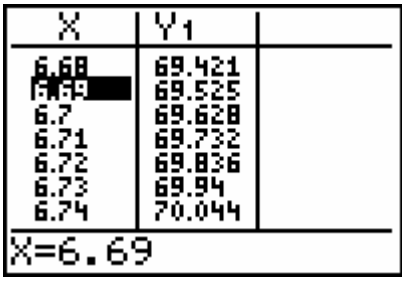
Explain how to verify their function rule using Geometer's Sketchpad. For detailed steps on the verification of the function rule see the ***Technology Tutorial T²****.*

3. **How did you determine the approximate perimeter of an equilateral triangle with an apothem of 7.23 centimeters?**

   Participants may have used the table feature of the calculator.



4. **How did you determine the approximate length of the apothem of an equilateral triangle with a perimeter of 68.5 centimeters?**
   Participants may have used the table feature of the calculator.



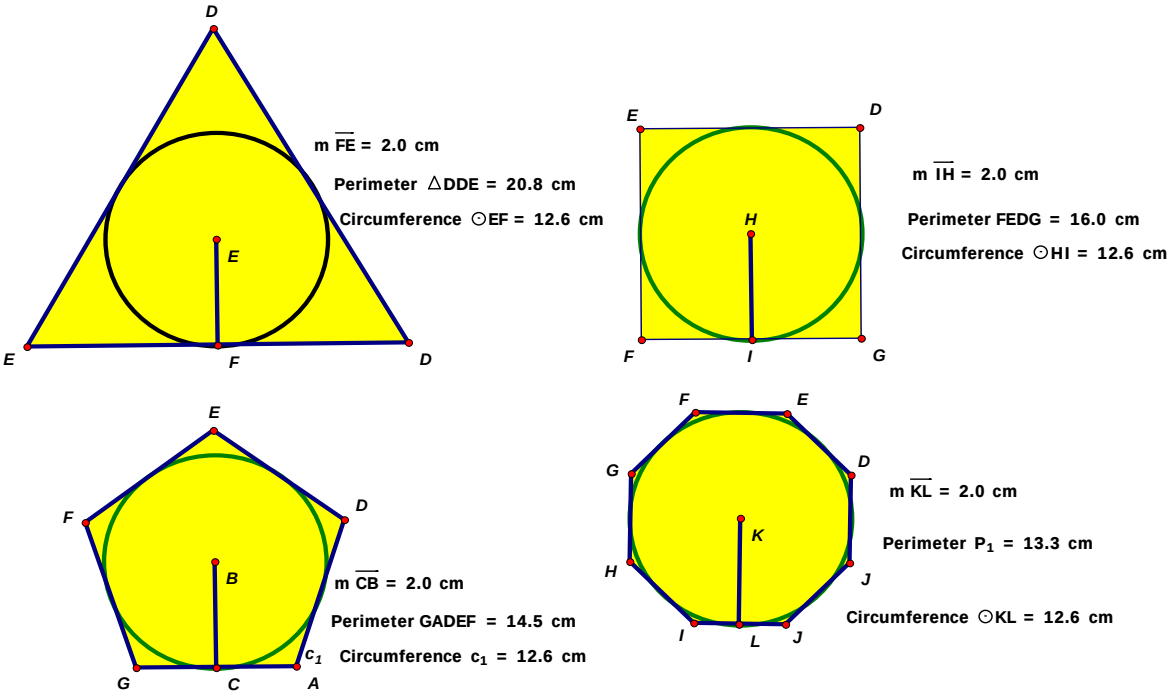
5. **How did you explain your graph of all four functions in a geometric context?**
The slopes of the lines decrease as the number of sides of the polygon increase because the apothem is the radius of the inscribed circle. So as the number of sides increases the ratio of the perimeter to circumference decreases.

6. **If the length of the apothem remains constant, what is the effect on perimeter as the number of sides of the polygon increases?**
The perimeter decreases.

7. **If you continue to increase the number of sides of the polygon while keeping the length of the apothem constant, what value will the perimeter approach?**
The perimeter of the polygon approaches the circumference of the inscribed circle. This is illustrated in the sketch below.

To view these sketches electronically, open the sketch ***Inscribed Circles****.*

Participants might be confused about the concept of the inscribed circle, especially since the equilateral triangle's construction used a circle circumscribed about triangle. This sketch can help them see the relationship between the apothem and the radius of the inscribed circle.



8. How will the use of these technologies promote a better understanding of the targeted mathematical concepts?
Participant answers might include:

- Students can easily see that the apothem is related to the inscribed circle.

- The tie of algebra to geometry becomes obvious, thus opening up the idea of exploring relationships in other areas.

- Technology allows students to see several different cases, enabling them to make and test conjectures quickly.

Polygarden Landscaping Company
Intentional Use of Data—Leader Notes

1. *At the close of the* ***Putting it All Together,*** *distribute the* ***Polygarden Landscaping Company Intentional Use of Data*** *activity sheet to each participant.*

2. *Prompt the participants to work in pairs to identify those TEKS that received greatest emphasis during this activity. Prompt the participants to also identify two key questions that were emphasized during this activity. Allow four minutes for discussion.*

Facilitation Questions
- Which TEKS formed the primary focus of this activity?
- What additional TEKS supported the primary TEKS?
- How do these TEKS translate into guiding questions to facilitate student exploration of the content?
- How do your questions reflect the depth and complexity of the TEKS?
- How do your questions support the use of technology?

3. *As a whole group, share responses for two to three minutes.*

4. *As a whole group, identify the level(s) of rigor (based on Bloom's taxonomy) addressed, the types of data, the setting, and the data sources used during this Explore/Explain cycle. Allow three minutes for discussion.*

Facilitation Question
- What attributes of the activity support the level of rigor that you identified?

5. *As a whole group, discuss how this activity might be implemented in other settings. Allow five minutes for discussion.*

Facilitation Questions

- How would this activity change if we had access to one computer per participant?
- How would this activity change if we had access to one computer per small group of participants?
- How would this activity change if we had access to one computer for the entire group of participants?
- How might we have made additional use of available technologies during this activity?
- How does technology enhance learning?

6. *Prompt the participants to set aside the completed Intentional Use of Data activity sheet for later discussion. These completed activity sheets will be used during the elaborate phase as prompts for generating attributes of judicious users of technology.*

Polygarden Landscaping Company
Intentional Use of Data *(possible participant answers)*

TEKS		*a(5), a(6), G.5A, G.7A, G.7B, G.8A, G.11D*	
Question(s) to Pose to Students	Math	*What type of relationships could be found among the measurements you gathered?*	
	Tech	*How did technology help you with the gathering of data?*	
Cognitive Rigor		Knowledge	√
		Understanding	√
		Application	√
		Analysis	√
		Evaluation	√
		Creation	√
Data Source(s)		Real-Time	*When using the computer sketch.*
		Archival	*none*
		Categorical	*none*
		Numerical	*none*
Setting		Computer Lab	*Each student uses the computer.*
		Mini-Lab	*In groups students take turns or groups switch out.*
		One Computer	*A student operates the control as other students read directions, entire class records data.*
		Graphing Calculator	*Could be used to enter data and find relationships.*
		Measurement Based Data	*Could be done at stations or individually.*
Bridge to the Classroom		*This activity transfers directly to the classroom with the only modifications being the settings addressed above.*	

Polygarden Landscaping Company

Explore

Posing the Problem:

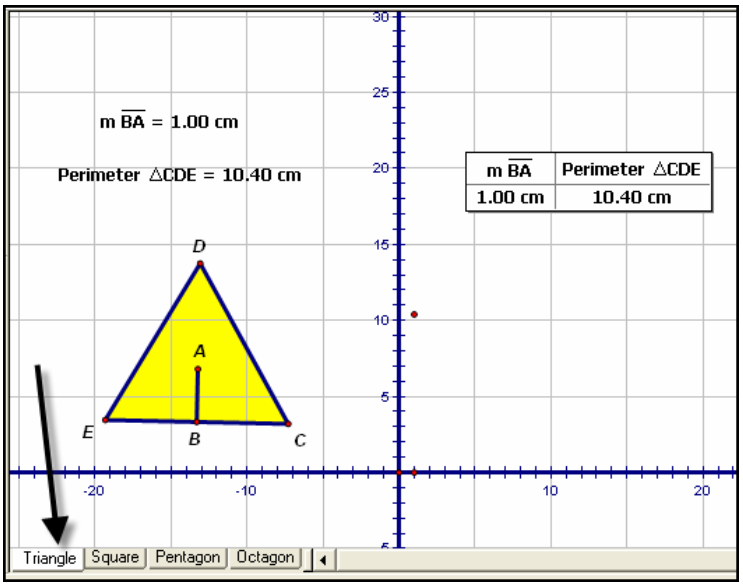
Polygarden Landscaping Company builds brick borders for flowerbeds that are always in the shape of regular polygons. To calculate the number of bricks necessary for a flowerbed, Brad, a bricklayer, needs to know the perimeter of the garden. On his last job Brad was not able to measure the perimeter of the flowerbed. He could only measure the distance from the center of the polygon to one side of the polygon. This distance is called the apothem. Is it possible for Brad to calculate the perimeter of the flowerbed if the only information he has is the length of the apothem and the number of sides of the garden?

Obtaining and Analyzing the Data:

To solve this problem, we can use the problem-solving strategy of "solving a simpler problem." To do so, you will use geometric sketches to collect and analyze data.

Open the sketch **Growing Polly's.**

Select the **Triangle** tab.



1. Double click on the table to add another row then click and drag point *C* away from point *B*. What do you observe?

2. Double click on the table again, and then move point *C* farther away from point *B*. Repeat this process until you have 10 rows in your table.

3. What patterns do you observe in the table?

4. What observations can you make about your graph?

5. Develop an algebraic rule that describes the relationship of the length of the apothem, *x*, to the perimeter, *y*.

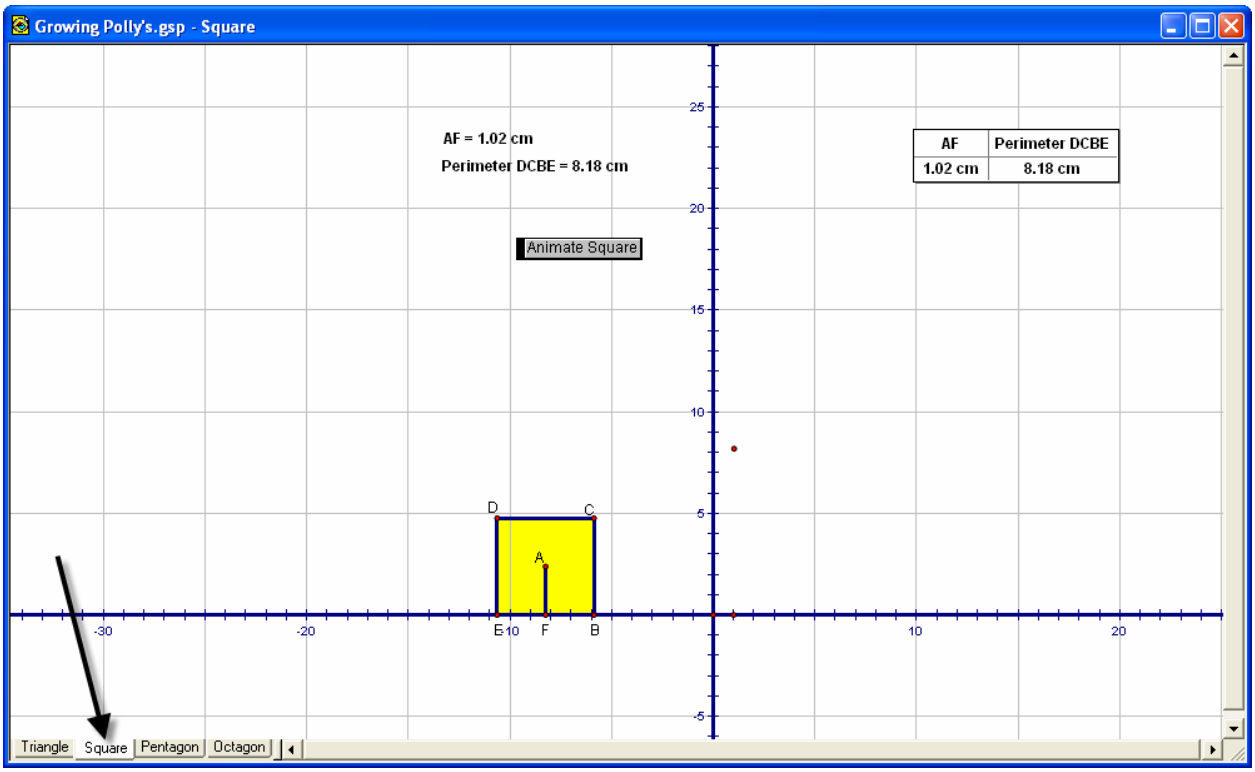
6. Verify that your function rule models your data. Explain your verification.

7. Write a verbal description of the relationship between the length of the apothem of an equilateral triangle and its perimeter.

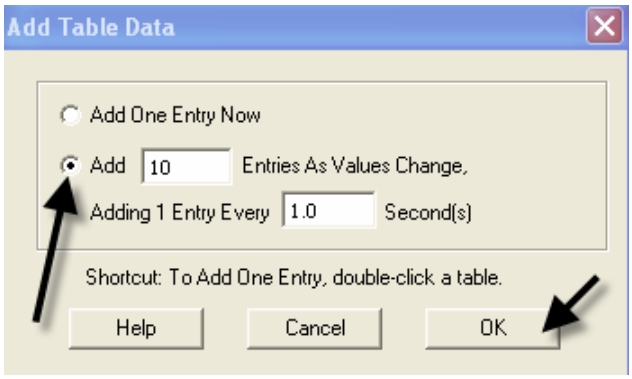
8. What is the approximate perimeter of a flowerbed that is in the shape of an equilateral triangle with an apothem of 7.23 centimeters?

9. What is the approximate length of the apothem of an equilateral triangle whose perimeter is 68.5 centimeters?

Select the **Square** tab.



1. ***Right*** click in the table and select the **Add Table Data** option. Select the **Add 10 Entries As Values Change, Adding 1 Entry Every 1.0 Second(s)** and click **OK**.



2. Start the data collection process by clicking on the **Animate Square** button. After your table fills with data, stop the animation by clicking on the **Animate Square** button again. What happened?

3. What patterns do you observe in the table?

4. What observations can you make about your graph?

5. Develop an algebraic rule that describes the relationship of the length of the apothem, *x*, to the perimeter, *y*.

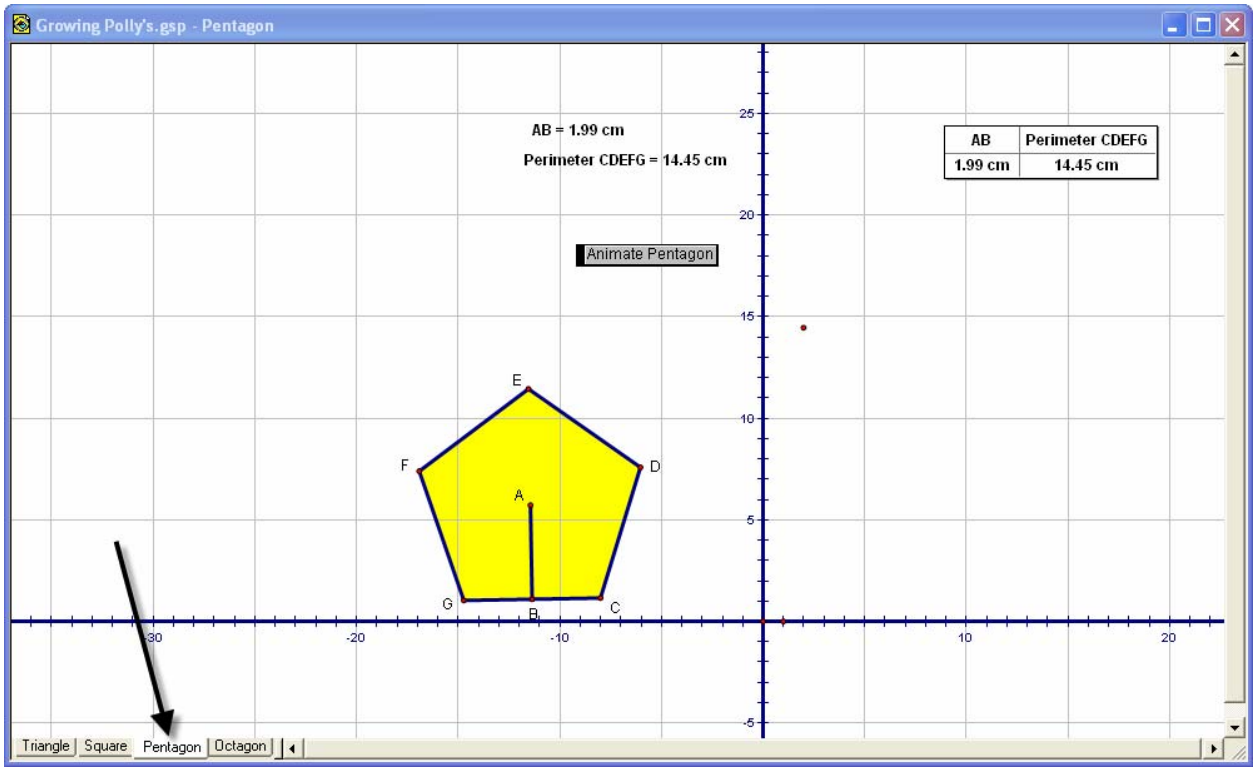
6. Verify that your function rule models your data. Explain your verification.

7. Write a verbal description of the relationship between the length of the apothem of square and its perimeter.

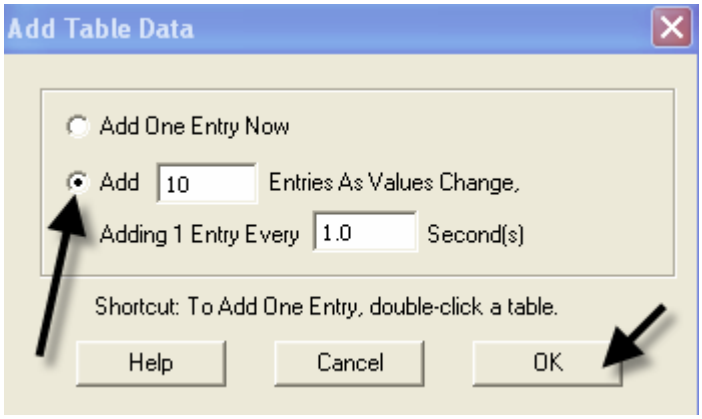
8. What is the approximate perimeter of a flowerbed that is in the shape of a square with an apothem of 7.23 centimeters?

9. What is the approximate length of the apothem of a square whose perimeter is 68.5 centimeters?

Select the **Pentagon** tab.



1. ***Right*** click in the table and select the **Add Table Data** option. Select the **Add 10 Entries As Values Change, Adding 1 Entry Every 1.0 Second(s)** and click **OK**.



2. Start the data collection process by clicking on the **Animate Pentagon** button. After your table fills with data, stop the animation by clicking on the **Animate Pentagon** button again. What happened?

3. What patterns do you observe in the table?

4. What observations can you make about your graph?

5. Develop an algebraic rule that describes the relationship of the length of the apothem, *x*, to the perimeter, *y*.

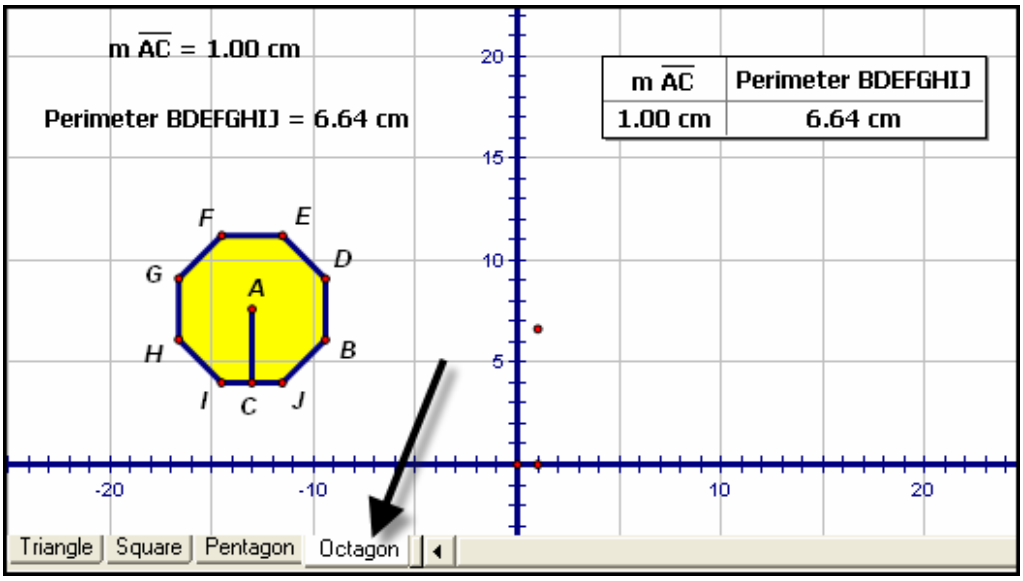
6. Verify that your function rule models your data. Explain your verification.

7. Write a verbal description of the relationship between the length of the apothem of a regular pentagon and its perimeter.

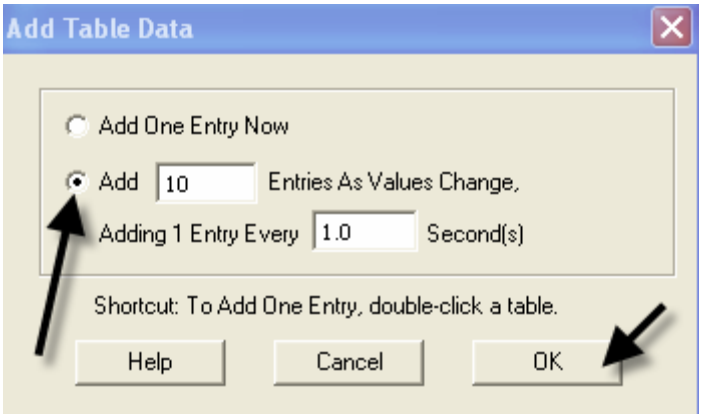
8. What is the approximate perimeter of a flowerbed that is in the shape of a regular pentagon with an apothem of 7.23 centimeters?

9. What is the approximate length of the apothem of a regular pentagon whose perimeter is 68.5 centimeters?

Select the **Octagon** tab.



1. ***Right*** click in the table and select the **Add Table Data** option. Select the **Add 10 Entries As Values Change, Adding 1 Entry Every 1.0 Second(s)** and click **OK**.



2. Start the data collection process by clicking on the **Animate Octagon** button. After your table fills with data, stop the animation by clicking on the **Animate Octagon** button again. What happened?

3. What patterns do you observe in the table?

4. What observations can you make about your graph?

5. Develop an algebraic rule that describes the relationship of the length of the apothem, x, to the perimeter, y.

6. Verify that your function rule models your data. Explain your verification.

7. Write a verbal description of the relationship between the length of the apothem of regular octagon and its perimeter.

8. What is the approximate perimeter of a flowerbed that is in the shape of a regular octagon with an apothem of 7.23 centimeters?

9. What is the approximate length of the apothem of a regular octagon whose perimeter is 68.5 centimeters?

Putting It All Together

1. Complete the table.

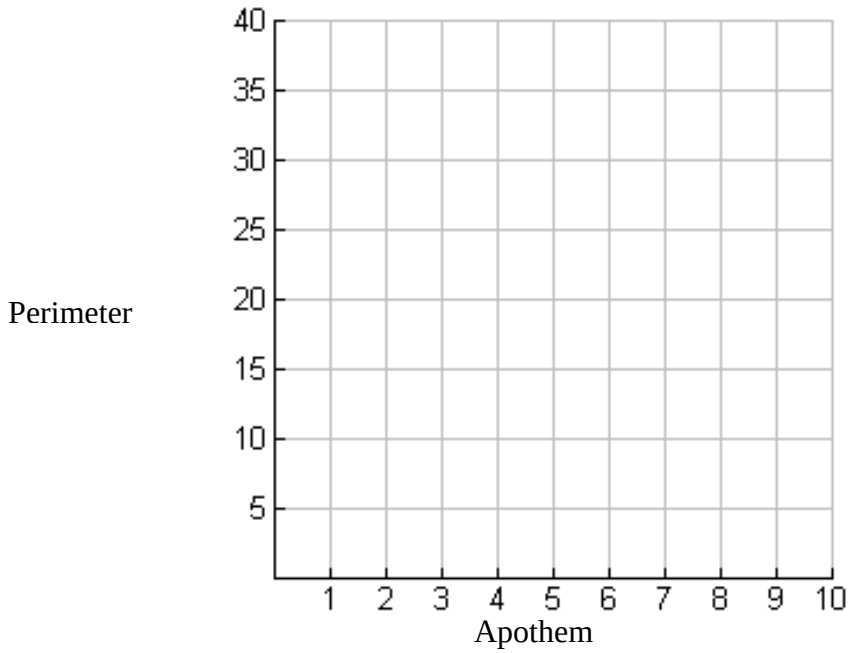
Perimeter *versus* Apothem

Regular Polygon	Function Rule
Triangle	
Square	
Pentagon	
Octagon	

2. In what ways are the function rules the same?

3. In what ways are the function rules different?

4. Graph all four-function rules on the same set of axes. Sketch your graph. Label each line with the name of the polygon.



5. What observations can you make about your graph? Connect your observations to geometric properties observed in this exploration.

6. Look back at Brad's problem. Is it possible for Brad to calculate the perimeter of the flowerbed if the only information he has is the length of the apothem and the number of sides of the garden? Why or why not?

7. Is there a general rule or trend you can develop using the information gathered? If so what is it?

8. If the length of the apothem remains constant, what is the effect on perimeter as the number of sides of the polygon increases?

9. If you continue to increase the number of sides of the polygon while keeping the length of the apothem constant, what value will the perimeter approach?

Polygarden Landscaping Company
Intentional Use of Data

TEKS		
Question(s) to Pose to Students	Math	
	Tech	
Cognitive Rigor	Knowledge	
	Understanding	
	Application	
	Analysis	
	Evaluation	
	Creation	
Data Source(s)	Real-Time	
	Archival	
	Categorical	
	Numerical	
Setting	Computer Lab	
	Mini-Lab	
	One Computer	
	Graphing Calculator	
	Measurement Based Data	
Bridge to the Classroom		