Polygarden Landscaping Company

Explore

Posing the Problem:

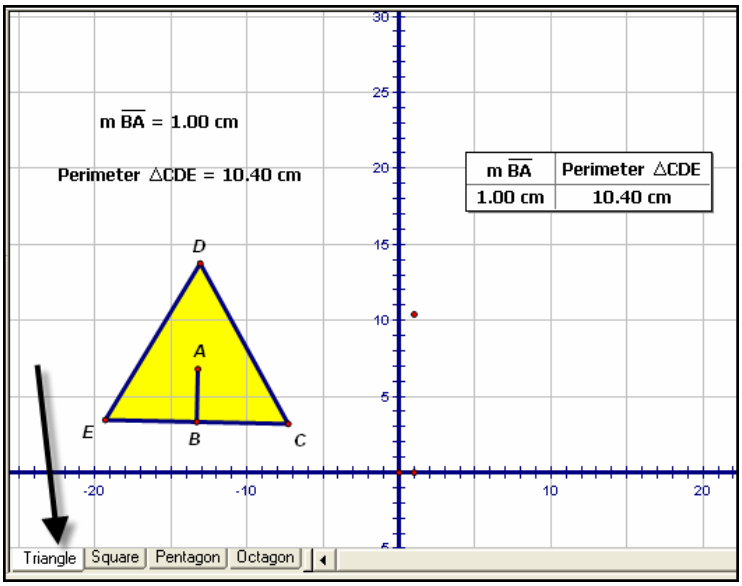
Polygarden Landscaping Company builds brick borders for flowerbeds that are always in the shape of regular polygons. To calculate the number of bricks necessary for a flowerbed, Brad, a bricklayer, needs to know the perimeter of the garden. On his last job Brad was not able to measure the perimeter of 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*.

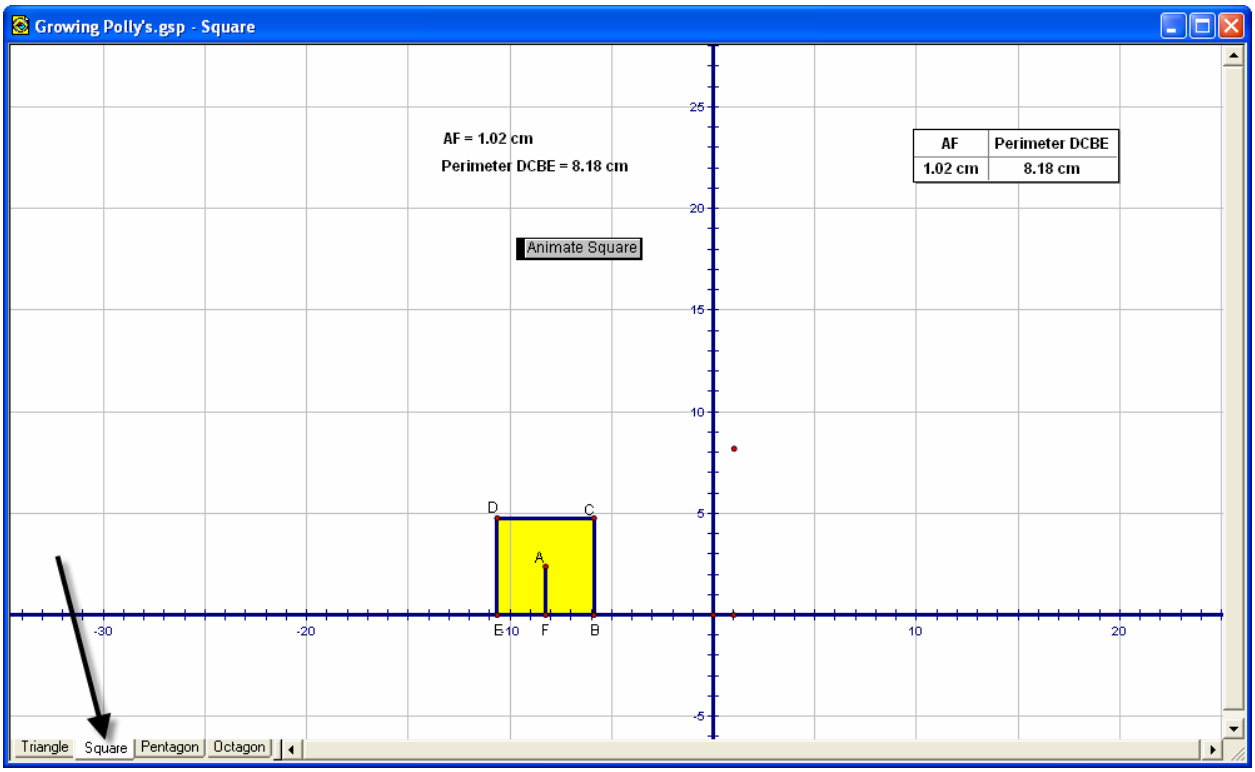
6. Verify that your function rule models your data. Explain your verification.

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

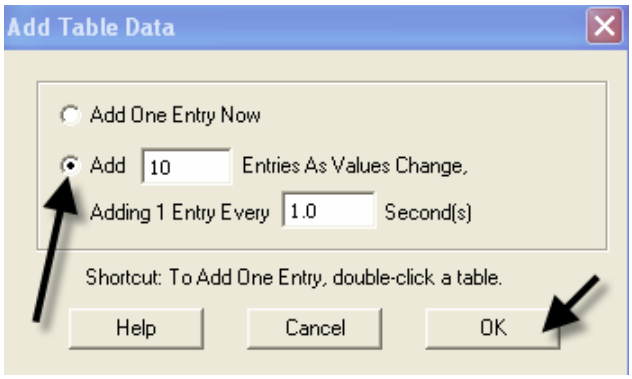
8. What is the approximate perimeter of a flowerbed that is in the shape of an equilateral triangle with an apothem of 7.23 centimeters?

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*.

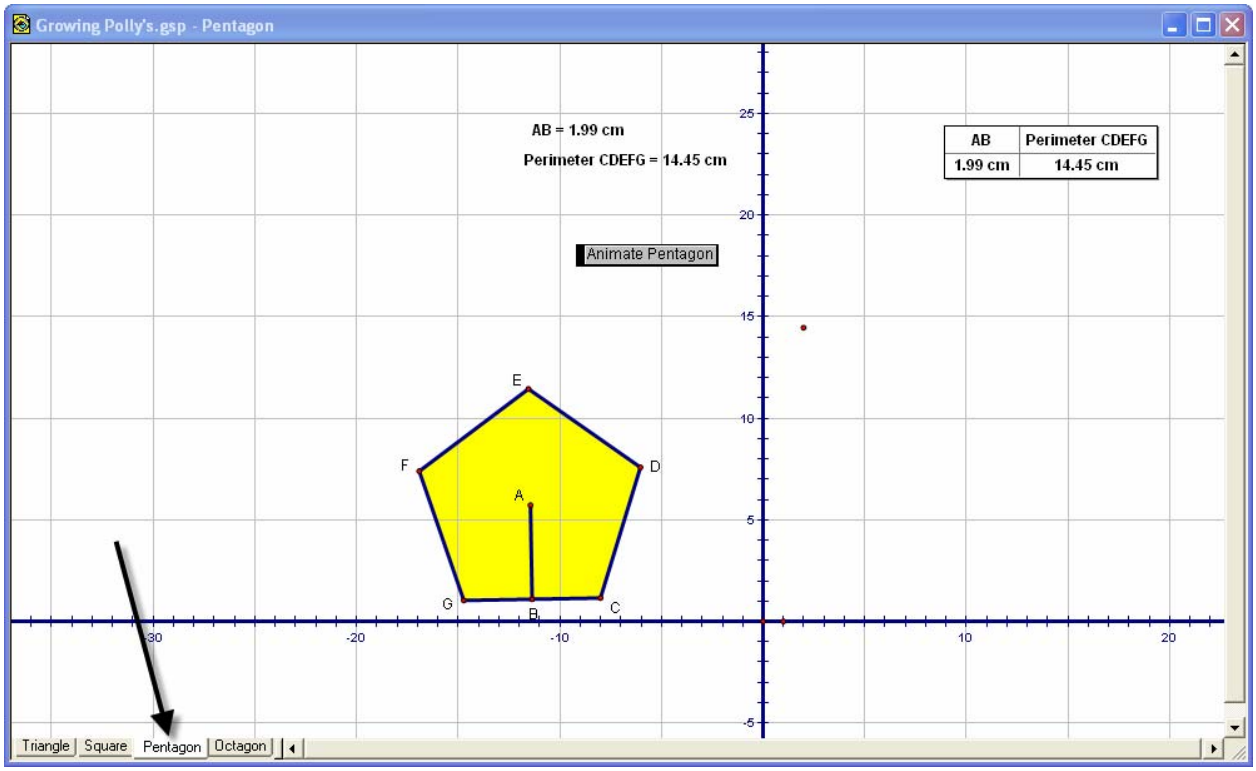
6. Verify that your function rule models your data. Explain your verification.

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

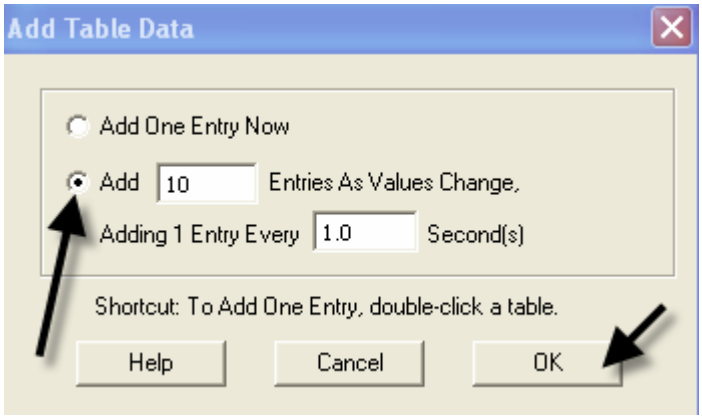
8. What is the approximate perimeter of a flowerbed that is in the shape of a square with an apothem of 7.23 centimeters?

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*.

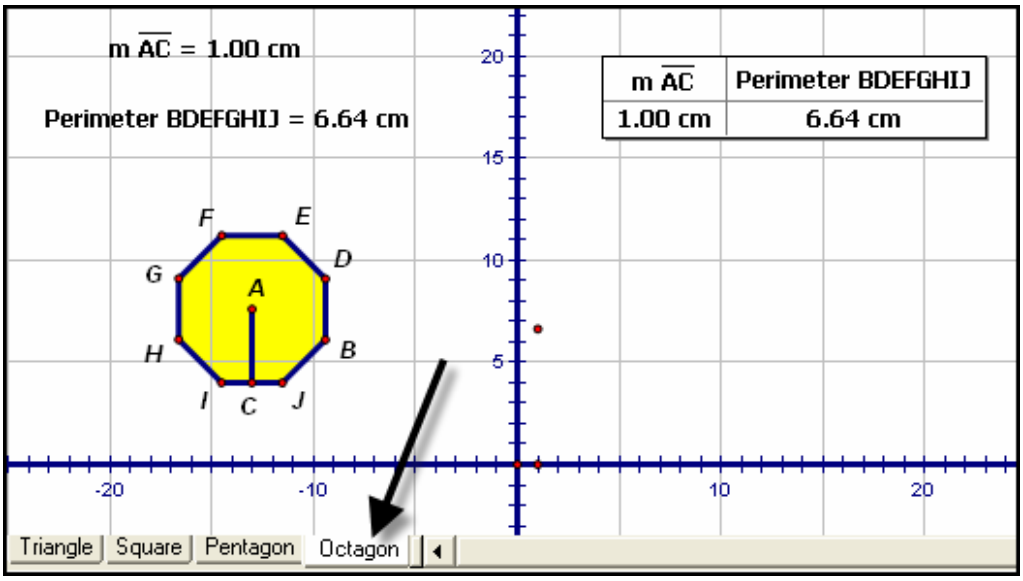
6. Verify that your function rule models your data. Explain your verification.

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

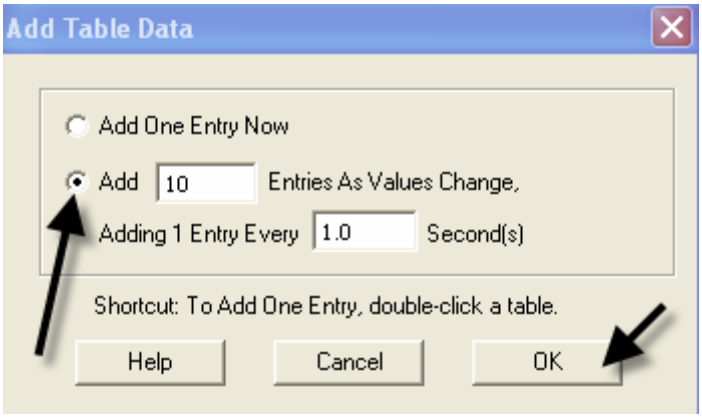
8. What is the approximate perimeter of a flowerbed that is in the shape of a regular pentagon with an apothem of 7.23 centimeters?

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.

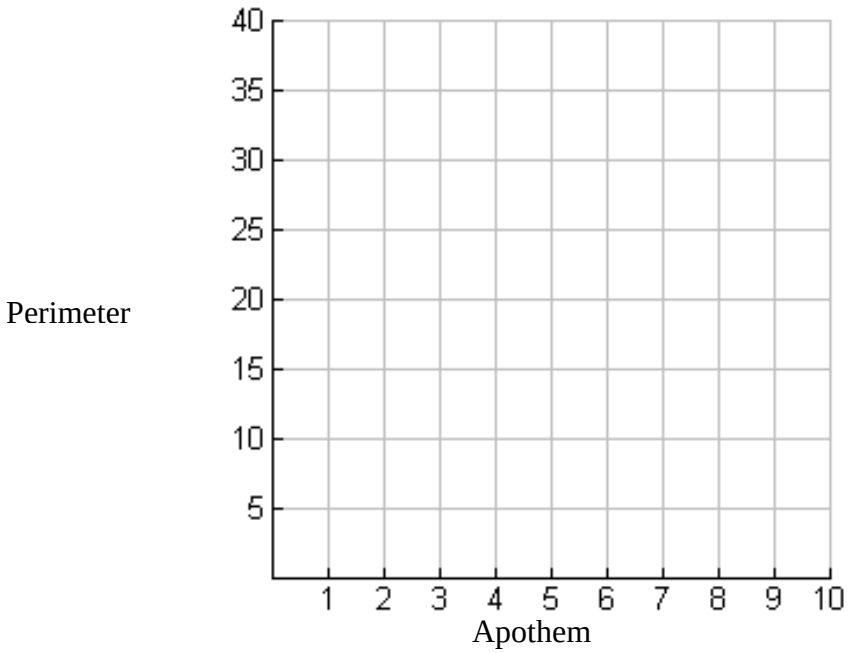
Perimeter *versus* Apothem

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?

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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		