Title of Unit: Exploring Area and Perimeter

Grade Level: 7th grade (general math)

Time Span: 5-6 days (each day being about 45min)

Tools/Technology:
1. Graph paper
2. Overhead graph paper
3. 5 Rectangles and squares with different areas and perimeters
4. Geoboards and rubberbands for each student
5. Overhead geoboard
6. Tangrams
7. Graphing calculator (TI83+ or TI73) for each student
8. Teach graphing calculator and overhead connection
9. Corresponding worksheets
10. Textbook (Transition Mathematics)
OBJECTIVES:
1. Students will be able to find area and perimeter of squares and rectangles
2. Students will be able to devise formula for area of squares and rectangles
3. Students will be able to devise formula for perimeter of any shape
4. Students will be able to make shapes a given area
5. Students will be able to make shapes a given perimeter
6. Students will be able to find fractional areas
7. Students will be able to find the maximum area of a rectangle given a perimeter
8. Students will be able to design a 1 story home using their knowledge of area and perimeter

STANDARDS:
1A: Use pictures, diagrams, or patterns

1B: Seek a general solution

1C: Devise formulas

2B: Solve real-life problems dealing with scale drawings

3G: Use ratio and proportions to solve problems involving change of scale drawings or maps, recipes, etc.

4B: Construct scale drawings and models with reasonable measurement and accuracy

4C: Develop geometric ideas such as measurement formulas, using geoboards, and graph paper

4F: Model situations geometrically to interpret, formulate, and solve problems.

5A: Use measurement in everyday situations

5B: Understand the use of units, square units, and cubed units

5C: Know and apply formulas for perimeter and area of polygons
   : Understand length, area, and volume and make relationships between measurements

5E: Use graphing calculators

7A: Identify, describe, represent, extend, and create patterns (numerical and geometric)

7B: Describe and represent numerical and geometric patterns and functions using equations, graphs, and tables
**Day 1:** Use graph paper to explore area and perimeter
   - Students will trace shapes onto graph paper to count the area and perimeter of the shapes
   - Students will come up with the formula for area and perimeter of a square and rectangle

**Day 2:** Use geoboards to explore area and perimeter
   - Students will be asked to find area of various polygons using the geoboard
   - Contest: who can find the most shapes with a given area and or perimeter

**Day 3:** Use of tangrams to explore fractional areas
   - Students will use tangrams pieces to see how the areas relate
   - Given one piece area students will find the other 6 areas

**Day 4:** Use a graphing calculator to explore maximum area and perimeter
   - Students will use a graphing calculator to make conjectures and scatter plots to find the maximum area given a perimeter

**Day 5:** Final assessment: Students will design a 1 floor house with various rooms on graph paper using area and perimeter.
   - Students will use a large sheet of graph paper to design a one-floor home with various rooms and label each room with area and perimeter
   - Students will find the overall area and perimeter of the home he/she designed
Day 1:

Objectives:
1. Students will be able to find area of rectangles and squares by counting squares on graph paper
2. Students will be able to find perimeter of rectangles and squares by counting squares on graph paper
3. Students will devise formulas for area and perimeter of rectangles and squares

Materials:
- Overhead of graph paper
- Square and rectangular shapes with different area and perimeter
- Graph paper
- Area and perimeter worksheet #1

Outline of Activity:
T: Today we are going to be talking about perimeter and area of square and rectangular shapes. Show overhead of graph paper and define one square as 1 square unit. Place a square shape (transparent) on the overhead so that students can see the units through the shape. Explain that perimeter is the distance around the shape, and that area is how many square units are in the shape.

Tell students what the perimeter is and pick a volunteer to explain how he/she found it. (Answer should be that they counted the boxes around the shape)

Tell students what area of object is and pick a volunteer to explain how he/she found it.

Do another example with students this time using a rectangle. Instead of telling students area and perimeter, see if they can come up with it on their own and explain it.

Have students explore area and perimeter through completing area and perimeter worksheet #1
Homeroom: __________________ Name: __________________
Date: ______________________ Area and perimeter #1

**Part 1:**
In this section you will use the graph paper and the shapes provided to explore the area and perimeter of each shape. (Shapes are numbered 1-5). Trace each shape onto your graph paper and compute the area and perimeter for each.

**SHAPE #1**
1. Identify this shape: _________________
2. The perimeter is _______________ units
3. The area is _______________ square units

**SHAPE #2**
4. Identify this shape: _________________
5. The perimeter is _______________ units
6. The area is _______________ square units

**SHAPE #3**
7. Identify this shape: _________________
8. The perimeter is _______________ units
9. The area is _______________ square units

**SHAPE #4**
10. Identify this shape: _________________
11. The perimeter is _______________ units
12. The area is _______________ square units

**SHAPE #5**
13. Identify this shape: _________________
14. The perimeter is _______________ units
15. The area is _______________ square units
Part 2:

In this section, you will use your graph paper to draw shapes with given areas and perimeters. For each question, label the shape with the number, the area, and the perimeter.

**SHAPE #1:** Draw a **square**
- Perimeter of 8 units
- Area of 4 square units

**SHAPE #2:** Draw a **rectangle**
- Perimeter of 12 units
- Area of 8 square units

**SHAPE #3:** Draw a **rectangle**
- Perimeter of 14 units
- Area of 12 square units

**SHAPE #4:** Draw a **square**
- Perimeter of 12 units
- Area of 9 square units

Part #3:

In this section, you will answer the question and discover the formula for area and perimeter.

Look at the rectangle to the right.

1. What are the two lengths? _______in. and _______in.

2. What are the two widths? _______in and _______in.

3. What is the perimeter? ________________in

4. What is the relationship between perimeter and length and width of shape. ________________________________________________________________________

5. Does this relationship hold true for all rectangles? What about squares? Explore this idea by looking back at the example you have completed. ________________________________________________________________________

6. What is the area of the above shape? ______________square in

7. What is the relationship between area and length and width of the rectangle? ________________________________________________________________________

8. What would the perimeter and area of a rectangle be if the length is 82cm and the width is 5cm? Perimeter = _______________ Area = _______________
Part 1:
In this section you will use the graph paper and the shapes provided to explore the area and perimeter of each shape. (Shapes are numbered 1-5). Trace each shape onto your graph paper and compute the area and perimeter for each.

SHAPE #1
1. Identify this shape: ____Square__(2x2)___________
2. The perimeter is ______8_______ units
3. The area is ________4______ square units

SHAPE #2
4. Identify this shape: _____Rectangle____(10x3)________
5. The perimeter is _______26________ units
6. The area is ________30_______ square units

SHAPE #3
7. Identify this shape: _____Rectangle____(5x6)_______
8. The perimeter is _______26_______ units
9. The area is _________30______ square units

SHAPE #4
10. Identify this shape: ______Rectangle__(15x2)_________
11. The perimeter is ________34_______ units
12. The area is ___________30____ square units

SHAPE #5
13. Identify this shape: _____Rectangle (8x9)___________
14. The perimeter is ____34________ units
15. The area is ________72_______ square units
Part 2:

In this section, you will use your graph paper to draw shapes with given areas and perimeters. For each question, label the shape with the number, the area, and the perimeter.

**SHAPE #1:**
- Draw a **square**
- **Perimeter** of 8 units
- **Area** of 4 square units

**SHAPE #2:**
- Draw a **rectangle**
- **Perimeter** of 12 units
- **Area** of 8 square units

**SHAPE #3:**
- Draw a **rectangle**
- **Perimeter** of 14 units
- **Area** of 12 square units

**SHAPE #4:**
- Draw a **square**
- **Perimeter** of 12 units
- **Area** of 9 square units

Part #3:

In this section, you will answer the question and discover the formula for area and perimeter.

Look at the rectangle to the right.

5. What are the two lengths? __5____ in. and __5____ in.

6. What are the two widths? _____2_____in and __2______in

7. What is the perimeter? ______14__________in

8. What is the relationship between perimeter and length and width of shape.

   Answers will vary: __________perimeter is adding all the sides together

   ____________________________________________________________
5. Does this relationship hold true for all rectangles? What about squares? Explore this idea by looking back at the example you have completed.

________ Yes, the perimeter is always found by adding all the sides together.
_____________________________________________________________
_____________________________________________________________

7. What is the area of the above shape? _______10________ square in

7. What is the relationship between area and length and width of the rectangle?

________ Answers will vary: Area is length times width.
_____________________________________________________________
_____________________________________________________________

8. What would the perimeter and area of a rectangle be if the length is 82cm and the width is 5cm? Perimeter = ___174 cm_____ Area = ____410 sq.cm_______
Day #2
Objectives:
1. Students will be able to find area and perimeter of various polygons by using the geoboards.
2. Students will be able to make polygons with certain areas and perimeters

Materials:
Overhead geoboard
Rubberbands
Geoboard for each student
Geoboard paper

Description of Lesson
Explain the objective of today’s lesson. Using overhead geoboard, define one square unit. Show students other ways to show one square unit. Show _ square unit and have students guess what the area of the triangle would be. Once students come up with _ square unit, have him/her explain how he/she got that answer. Show another irregular polygon, have students explore the area and perimeter of it. Explain the use of “helper rubberbands” to break up the shape into easier areas and perimeters. Show how to do this on the overhead. Do not complete the whole shape, but have students finish on their own. Have students explain different ways they came up with the answer.

T: Put another polygon the overhead and have students emulate it on their own geoboard and figure out the area and perimeter. Have volunteer come to overhead and show how he/she found the answer. Ask if anyone else found it a different way, and have him or her come to overhead and show how he/she got the answer.

Continue this for at least 2 more examples.

Break students into pairs.

Have students find different shapes that have the same area.
For example find as many different shapes with the area of 4 square units.
Have them copy each one they found onto the geoboard paper.

Use the second geoboard paper and have students explore perimeter. Have students find different shapes with the same perimeters. For example find all possible shapes with the perimeter of 8 units. Copy each one found onto the geoboard paper.

Bring students back together as a whole group to discuss their findings.
Ask students how many of each they found.
Have some students show one way they found the given area/perimeter.
Discuss differences in shapes with the same area/ the same perimeter.
**Day 3:**

**Objectives:**
1. Students will explore area through use of tangrams
2. Students will find fractional areas
3. Students will find area of 6 pieces given one piece’s area

**Description of Lesson:**

Review area and perimeter problems from previous day by going over a few of the solutions found in the homework problem.

Hand out tangram pieces and allow students some time to try to form a square with the seven pieces.

Have a volunteer come to overhead to show how to make the square using all the pieces. This will allow students to become familiar with the pieces and peak their interest.

Complete an area problem using the tangrams as a whole class.

Ex. The tangram piece labeled #5 is 1 square unit. Find the area of each of the other pieces. Encourage students to lay pieces on other pieces to see how they are related. For example two #3 pieces will make up the #4 pieces, therefore, the area of piece 3 is 1/2 square unit. Continue until chart is completed.

<table>
<thead>
<tr>
<th>Tangram piece</th>
<th>Area (square unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 1/2</td>
</tr>
<tr>
<td>2</td>
<td>1 1/2</td>
</tr>
<tr>
<td>3</td>
<td>1/2</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1/2</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
</tr>
</tbody>
</table>

Hand out tangram worksheet and have students complete it individually. (Area and Tangram)
Task: Below is one set of tangrams, you also have one set punched out for you. Notice that the pieces are numbered. Complete the following table using your knowledge of area and tangrams. One row has been done for you as an example.

<table>
<thead>
<tr>
<th>Number of piece</th>
<th>Name of piece</th>
<th>Area of piece (square units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Right isosceles triangle</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Part II:

Explain a strategy to determine how you found the area for piece #4.
Part III:
Suppose that the area of the entire square is one square unit, fill in the chart below so that each piece has the correct area. Notice again, that one has been done for you.

<table>
<thead>
<tr>
<th>Number of piece</th>
<th>Cost of piece</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1/16</td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>
Task: Below is one set of tangrams, you also have one set punched out for you. Notice that the pieces are numbered. Complete the following table using your knowledge of area and tangrams. One row has been done for you as an example.

<table>
<thead>
<tr>
<th>Number of piece</th>
<th>Name of piece</th>
<th>Area of piece (square units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Right isosceles triangle</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Right isosceles triangle</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Right isosceles triangle</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Square</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Right isosceles triangle</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Parallelogram</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Part II:

Explain a strategy to determine how you found the area for piece #4.

Answers will vary: I found that piece 5 was one sq. unit, so I took that piece (5) and saw how many fit onto piece four. Two piece 5 fit, so the area of piece 4 is 2 sq. unit.

Part III:

Suppose that the area of the entire square is one square unit, fill in the chart below so that each piece has the correct area. Notice again, that one has been done for you.

<table>
<thead>
<tr>
<th>Number of piece</th>
<th>Cost of piece</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4/16 (1/4)</td>
</tr>
<tr>
<td>2</td>
<td>4/16 (1/4)</td>
</tr>
<tr>
<td>3</td>
<td>1/16</td>
</tr>
<tr>
<td>4</td>
<td>2/16 (1/8)</td>
</tr>
<tr>
<td>5</td>
<td>1/16</td>
</tr>
<tr>
<td>6</td>
<td>2/16 (1/8)</td>
</tr>
<tr>
<td>7</td>
<td>2/16 (1/8)</td>
</tr>
</tbody>
</table>
Day #4
Objectives:
- In small groups, students will use their basic understanding of perimeter and area to explore and investigate finding the maximum area of a rectangular shape.
- Students will be able to compute maximum area given a perimeter
- Students will be able to use a graphing calculator to make a scatter plot

Materials:
Overhead of introduction problem
20 popsicle sticks each
exploring area worksheet
graphing calculator (TI-73 or TI-83+)

Description of Lesson

Put introduction problem on overhead and read to students. Have a student explain in his or her own words what needs to be done to solve this problem.

Pose the problem: You need to design a rectangular garden along an existing wall in your backyard. The garden needs to be surrounded by a small fence to protect it from animals. You have 20 sections of 1-meter long fence pieces. Your task is to design a garden to maximize the amount of vegetables you can grow. How many sections would you use along the width and the length of the garden?

T: There are many different rectangular gardens that can be made using the 20 sections of fencing. Using the manipulatives (popsicle sticks) explore possible widths and lengths or the garden.

Choose a few volunteers to come to overhead to show how they arranged the 20 popsicle sticks to enclose the garden.

Have students record the tries in the chart on the worksheet.

S: Use the graphing calculator to explore the question further. (Follows along with questions on exploring area worksheet).
1. Enter possible widths into L1 by typing each number and pressing enter
   (Note: Numbers will range from 1-9 because the width can not be negative and cannot exceed the number of fence pieces being used…keep in mind that there are 2 widths)
2. Enter the lengths into L2:
   Through the opening activity, students should have noticed that the length will be 20-2*width. In this case, the width is L1.
   Therefore, the formula students will enter into L2 will be 20-2*L1.
   (Go to top of L2, so that L2 is highlighted and enter in desired formula. Press enter and the desired lengths will appear)

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>42</td>
</tr>
<tr>
<td>8</td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>42</td>
</tr>
</tbody>
</table>

   L2(1)=18

3. Answer Question #4 to help you figure out the formula to enter into L3.
   (Enter this formula just as you did for L2)

<table>
<thead>
<tr>
<th>L1</th>
<th>L2</th>
<th>L3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>42</td>
</tr>
<tr>
<td>8</td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td>10</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>42</td>
</tr>
</tbody>
</table>

   L3 = "L1*L2"

4. Use L1 and L3 to make a scatterplot. This will visually display the relationship between the width of the garden and the area of it.

5. From the information in the lists, come up with a "friendly" window for your graph.
6. Once your graph is displayed, the trace button can be used to explore the data and display each of the coordinates. The left and right arrows can be used to change which coordinate the cursor is on, so further investigation can be done.

![Graph with coordinates](image)

7. Complete the rest of the corresponding worksheet.

Bring class together as a whole and discuss different strategies and problems faced in the activity and have various people explain how they came up with their final answer and answers to certain questions on the worksheet.
Name: _____________________________

Using the Graphing Calculator

Within your groups, your job is to complete this activity following the directions and suggestions very carefully. Once you have finished and discussed this activity, you will have a better understanding of maximizing area using your graphing calculators.

The Problem: You need to design a rectangular garden along an existing wall in your backyard. The garden needs to be surrounded by a small fence to protect it from animals. You have 20 sections of 1-meter long fence pieces to work with. Your task is to design a garden to maximize the amount of vegetables that can be grown. How many sections would you use along the width? Along the length?

From the opening activity just completed, you should have some possible widths and lengths for the garden. But, did you find the largest possible area for the garden? Follow the instructions and questions below to make sure that you have found the largest area.

Suggestion: Start by drawing a picture

1. If you were to use 2 sections of the fencing along each width, how many would remain for the length? ___________________________
   What would be the area of the garden? ___________________________
   (Remember to label your answer with the correct units)

2. Fill in the table with other possible widths and length

<table>
<thead>
<tr>
<th>Width (m)</th>
<th>Length (m)</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Enter possible widths into L1 of your calculator…remember there are two widths so your values will **not** go up to 19.

3. If you know the width, how can you find the length? Write an equation that shows how the width and length are related. (Keep in mind that the total amount of fencing being used is 20 meters)

4. Now that you have that formula, enter it into L2. (Make sure that you go to the top of L2 so that it is highlighted, enter the formula, and hit enter. Once you hit enter, the values for the length will appear).

5. Would it make sense to enter 0 in for the width of your garden? Why /Why not?

6. What is the largest number of pieces that you can use for the width? (Keep in mind that there are 20 pieces of fencing and 2 widths)

7. Now that you have the values for the length and width, you need to find a formula for area using L1 and L2. (Remember that L1 is your widths, and L2 is the areas). Write a formula for area in terms of L1 and L2.

8. Scroll through L3. Are the values you found in the opening activity in your list? Describe a pattern you see when looking at the data in L3.

9. Use L1 and L3 to make a scatterplot. This will visually display the relationship between the width of the garden and its area. Make sure you find a “friendly” window. Sketch the graph below and be sure to include your viewing window.
10. Use the trace button on your calculator to complete the following statement.
The largest possible area of ______________ m$^2$ is found by using ______________ pieces for the width, and ______________ pieces for the length.

11. How does the pattern you observed in question #8 show up on the scatter plot?
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

12. Suppose you had to plant a garden in the corner of your yard where there are 2 existing walls. How would you expect the values for the length and width to change? Would this make the garden larger or smaller? Explain your reasoning?
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

13. If you had the choice between putting the garden along the one existing wall or in the corner, what would you choose? Keep in mind that there are only two back corners in your yard, would this effect your decision? Explain your answer.
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

14. Did you find this activity useful in helping you understand maximum area? Why/Why not? What did you like most about this activity? What did you like least? Would you suggest that this activity be used again?
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
Using the Graphing Calculator

Within your groups, your job is to complete this activity following the directions and suggestions very carefully. Once you have finished and discussed this activity, you will have a better understanding of maximizing area using your graphing calculators.

The Problem: You need to design a rectangular garden along an existing wall in your backyard. The garden needs to be surrounded by a small fence to protect it from animals. You have 20 sections of 1-meter long fence pieces to work with. Your task is to design a garden to maximize the amount of vegetables that can be grown. How many sections would you use along the width? Along the length?

From the opening activity just completed, you should have some possible widths and lengths for the garden. But, did you find the largest possible area for the garden? Follow the instructions and questions below to make sure that you have found the largest area.

Suggestion: Start by drawing a picture

1. If you were to use 2 sections of the fencing along each width, how many would remain for the length? _______16_units_________________
   What would be the area of the garden? _______32 sq units__________________
   (Remember to label your answer with the correct units)

2. Fill in the table with other possible widths and length  Answers will vary

<table>
<thead>
<tr>
<th>Width (m)</th>
<th>Length (m)</th>
<th>Area (m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>42</td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>42</td>
</tr>
</tbody>
</table>

Enter possible widths into L1 of your calculator…remember there are two widths so your values will not go up to 19.
3. If you know the width, how can you find the length? Write an equation that shows how the width and length are related. (Keep in mind that the total amount of fencing being used is 20 meters)

\[ 20 - 2 \times \text{width} \]

4. Now that you have that formula, enter it into L2. (Make sure that you go to the top of L2 so that it is highlighted, enter the formula, and hit enter. Once you hit enter, the values for the length will appear).

5. Would it make sense to enter 0 in for the width of your garden? Why / Why not?

\[ \text{Answers will vary: No, because it would be a straight line with no area} \]

6. What is the largest number of pieces that you can use for the width? (Keep in mind that there are 20 pieces of fencing and 2 widths)

\[ 9 \text{ because you have 2 widths and 2 lengths, so if the length is one that leaves 18 more for the width and it is a rectangle so each width has to be the same:9} \]

7. Now that you have the values for the length and width, you need to find a formula for area using L1 and L2. (Remember that L1 is your widths, and L2 is the areas). Write a formula for area in terms of L1 and L2.

\[ L1 \times L2 \]

Enter this formula into L3 just as you entered the formula in L2.

8. Scroll through L3. Are the values you found in the opening activity in your list? Describe a pattern you see when looking at the data in L3.

\[ \text{Yes, the values are in L3. The pattern I see is that the area goes up, then starts to come down} \]

9. Use L1 and L3 to make a scatterplot. This will visually display the relationship between the width of the garden and its area. Make sure you find a “friendly” window. Sketch the graph below and be sure to include your viewing window.

\[ \text{Graph showing data points for L1 and L3} \]
10. Use the trace button on your calculator to complete the following statement.
   The largest possible area of \( \frac{50}{m^2} \) is found by using \( 5 \) pieces for the width, and \( 10 \) pieces for the length.

11. How does the pattern you observed in question #8 show up on the scatter plot?
   The pattern shows up on the scatter plot because the graph goes up then it comes down just like the numbers in the table.

12. Suppose you had to plant a garden in the corner of your yard where there are 2 existing walls. How would you expect the values for the length and width to change? Would this make the garden larger or smaller? Explain your reasoning?
   Answers will vary: I would expect the length and width to be larger because you only need one of each now, therefore the area of the garden would be larger.

13. If you had the choice between putting the garden along the one existing wall or in the corner, what would you choose? Keep in mind that there are only two back corners in your yard, would this effect your decision? Explain your answer.
   Answers will vary: I would choose to have it in the corner, because I could make the garden larger with less fence.

14. Did you find this activity useful in helping you understand maximum area? Why/Why not? What did you like most about this activity? What did you like least? Would you suggest that this activity be used again?
   Answers will vary. There is no right or wrong answer.
Day 5:

Objectives:
1. Students will be able to design a one-floor home using their knowledge of area and perimeter.

Materials:
- large sheets of graph paper
- final assessment worksheet

Description of Lesson:

Explain what students will be required to do to earn full points on the assessment. (See worksheet) Hand out worksheets and graph paper. Allow students time to begin project. If students need a calculator, one may be used. If students do not finish, either assign for homework, or allow to finish in class the next day.
Your Task: Use your knowledge of area and perimeter to design a one-floor house. Make sure that the house contains at least the following rooms:
   1. Living room/Den
   2. Bathroom
   3. Kitchen
   4. 2 bedrooms

If you wish to make more rooms, you may. Make sure that each room has the dimensions, area, and perimeter labeled. Also, include a key for each box on the graph paper. You may want to use 1 box = 1 sq. foot

Note: The maximum area for your house is 1200 sq. feet and the minimum is 800 sq. feet.