Area & Perimeter of Leaves

Ages 8-13

Youth explore the variety of leaves in the garden. They trace the outline of a leaf and determine its area and perimeter from the tracing. They then analyze and compare the two types of measurements.



Perimeter is the distance around a closed shape. It is a linear measurement. **Area** is the space inside a closed shape. It is a square measurement.

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What You Need

For Each Person

- sheet of 1-centimeter-squared graph paper
- ✤ 30-centimeter piece of string
- 🏽 journal
- ✤ pencil and crayons

For Each Pair

- clipboard or table workspace
- ✤ centimeter ruler
- ✤ scissors

For the Group

- ✤ databoard
- marking pens
- 1-centimeter-squared graph paper
- meter stick

MATH IN THE GARDEN

Getting Ready

- 1. Make sure there are leaves you can pick in the garden, otherwise bring a few stems with leaves that vary in size and shape. Avoid difficult-to-measure leaves, for example ones that are lobed, jagged, larger than a hand span, or smaller than a thumb.
- 2. Draw illustrations of leaves on the databoard labeled with area and perimeter near the illustrations.

Here We Go

- 1. Show the youth how to pick a leaf carefully from the lower and back part of a plant. Have everyone collect and observe a leaf.
- 2. Ask what the distance around the entire leaf is called. [perimeter]
- 3. Have them note the different sizes of the various leaves. Ask if they know what all the space within the perimeter is called. [area]
- 4. Show your illustration of leaves on the databoard with the area and perimeter labeled. With their help, define a perimeter and an area of a leaf.
- 5. Ask the youth if they have ever used an area or perimeter measurement. You may want to give them an example of buying a rug for a room or a belt for pants.

What's the Area?

- 1. Ask if anyone knows how area is measured and described. Tell them it is described in square units. Show a sheet of centimeter-squared graph paper. Shade in one square. Tell them this is a unit of square measurement a square centimeter and it is how they are going to measure the area of leaves.
- 2. With the help of a volunteer, trace your leaf onto a sheet of centimeter-squared paper. Show the tracing.

3. Ask the youth what strategies they would use to determine the area. Tell them they need to count all the squares inside the leaf to find the area. The partial squares need to be added up also. They will record the area on the leaf tracing, as so: Area = ____ square centimeters.

- 4. Have each youth work with a partner to help each other trace leaves on centimeter-squared graph paper and calculate the area.
- 5. When everyone has finished, ask volunteers to explain their various strategies for counting the squares, and partial squares, to calculate the area of their leaves.
- 6. Organize the centimeter paper leaf tracings from the smallest area to the greatest area. Start by asking for the leaf with the smallest area, and then find the leaf with the greatest area. With those two benchmarks, line up the other tracings from smallest to greatest area between the benchmarks.
- 7. Ask:
 - * Were you surprised by the placement of any of the leaves? Why?
 - * Do you notice any shape similarities among the leaves with the greatest areas?
 - * Do you notice any shape similarities among the leaves with the smallest areas?
 - * Are there leaves of dissimilar shape that have similar areas?
 - How might leaf shape be helpful to a plant? [large round ones have more surface area to catch low levels of sunlight such as on a forest floor, long thin leaves can bend in the wind, small leaves can reduce water loss]



What's the Perimeter?

- 1. Have a volunteer help you demonstrate how to use string to measure the distance around the perimeter of a leaf. Once the string borders the entire leaf, cut the string and retain the measured length.
- 2. Hold up the string and ask what it represents. When everyone identifies it as the perimeter, point out that perimeter is a linear measurement. It only has length unlike a square unit of measurement that has both length and width.
- Use a centimeter ruler or meter stick to measure the cut string. Write this perimeter measurement in centimeters next to the leaf tracing, as so:
 Perimeter = ____ centimeters.

- 4. Have youth work in pairs to determine the perimeters of their leaf tracings. Be sure to have them record the perimeter on the leaf tracing.
 5. Once finished, have the youth compare the perimeter strings with the leaf tracings themselves.
 6. Now organize the strings with their leaves from the shortest perimeter to the longest perimeter. Start by asking for the string with the shortest perimeter, and then find the string with the longest perimeter. With those two benchmarks, line up the other leaf tracings.

 - 8. With the following demonstration, recap the difference between area and perimeter. Ask a volunteer to tie a loop of string as long as the longest perimeter, and then make a long and very skinny shape. Invite the group to describe the area of this shape. [small, narrow, not much area at all] Now ask the volunteer to make a circle out of the same loop and invite descriptions of this area. [much bigger than the last one] Note the surprise that the same perimeter can have more than one area.



More Math in the Garden

Creating Different Areas Challenge each youth to use a perimeter string to make a shape with the largest possible area, and then with the same string to make a shape with the smallest possible area. What common characteristics do the shapes with the largest (or smallest) area share?

Creating Different Perimeters Challenge youth to use the area measurement of their leaves to create different shapes that have the same area but different perimeters.