# Paper


# Portal

# Paper Portal

**Challenge - Teacher Notes**

## Portal Definition

When using this activity with your students it is important to explain to them the definition of the word portal. Dictionary.com defines portal as "a door, a gate, or entrance, esp. one of imposing appearance, as to a palace." The main idea is that a portal is a large opening to walk through.

## Paper Portal Challenge

Paper Portal is an activity in which the teacher challenges the students to cut a hole in a single sheet of 8 ½" x 11" paper that is big enough to walk through.

## Paper Portal Procedure

1. Introduce the challenge above. You might cut a small hole in a piece of paper to dramatize the difficulty of cutting a hole in the paper big enough to walk through.
2. Give students a period of time (possibly at home) to try to find a solution to the challenge.
3. Discuss any student solutions and whether or not they believe this challenge can be met.
4. Pass out the Paper Portal template and explain to students how to correctly cut the template.
5. Allow them to cut out their own Paper Portal.

## Paper Portal Template Cutting Instructions

1. Fold the Paper Portal template in half along the longest line segment on the paper.
2. You will only be cutting along each solid line on the template except for where you see the arrows.
3. Cut **from the fold** to the end of each line segment without an arrow.
4. On the rays (line segments with arrows) cut **from the edges** of the folded paper to the endpoint of each ray. The arrows indicate that the paper should be cut from the edges. The arrows are used because the printer will not print all the way to the edge of the paper.
5. Finally, cut the solid black line along the fold. **Very Important**: Do not cut the fold on the very end of each side of the paper. This will ruin your paper portal. There is no black line segment in these locations.
6. Unfold the paper and you will have a portal opening big enough to walk through!!

# Paper Portal

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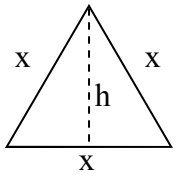
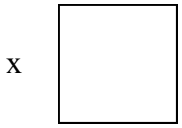
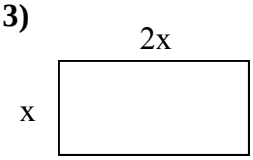
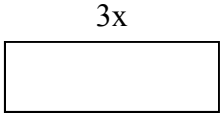
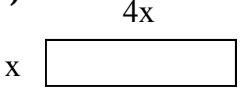
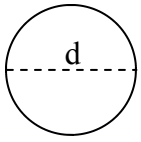
**Perimeter and Area**

Use your Paper Portal, a tape measure, and mathematical reasoning to complete the chart below. First, identify the value of each variable. Then write equations for the perimeter and area of each polygon using variables. Use these equations to find the perimeter (or circumference) and area of each polygon (or circle). Finally, try to generalize a rule for finding the largest area when given a fixed perimeter. Round longer decimal answers to the nearest hundredth.

| Polygon Dimensions (and circle) | Perimeter and Area Equations (using variables) | Perimeter of Polygons (and circle) | Area of Polygons (and circle) |
|---|---|---|---|
| **1)**   | x = ___ h = ___<br>P = _____<br>A = _____ | P = _____ | A = _____ |
| **2)**   | x = _____<br>P = _____<br>A = _____ | P = _____ | A = _____ |
| **3)**   | x = _____<br>P = _____<br>A = _____ | P = _____ | A = _____ |
| **4)**   | x = _____<br>P = _____<br>A = _____ | P = _____ | A = _____ |
| **5)**   | x = _____<br>P = _____<br>A = _____ | P = _____ | A = _____ |
| **6)**   | d = ___ r = ___<br>C = π d<br>A = π $r^2$ | C = _____ | A = _____ |

# Paper Portal

## ***Teacher Tips***

(1 of 2)

**Lesson Description:** Paper Portal is a geometry lesson that begins with a fascinating challenge: Can students cut a hole in a single sheet of 8 ½" x 11" paper that is big enough to walk through? After students are shown the solution to this challenge the remainder of the lesson involves an investigation of the different polygon and circle areas that may be found using a fixed perimeter (the paper portal).

**Math Content:** Perimeter, Area, Measurement, Comparing the Areas of Different Figures with a Fixed Perimeter, Writing Perimeter and Area Equations with Variables

**Time Required:** 1 Class Period

**Paper Portal includes:**

* 1 Paper Portal Challenge Teacher Notes
* 1 Paper Portal Activity Template
* 1 Paper Portal Perimeter and Area worksheet
* 1 Paper Portal Perimeter and Area worksheet Answer Key
* 2 Paper Portal Teacher Tips pages
* 1 Paper Portal Cover Page

**Materials Needed:** scissors (1 per group), tape measures (1 per group)

**Suggested Grade Level:** 5th - 8th

**Teacher Testimonial:**

Paper Portal is an activity that begins with a fascinating challenge for your students. Can they cut a hole in a single sheet of paper big enough to walk through? After letting them work on this problem for a few days you can reveal the intriguing solution. Then students use their Paper Portal to conduct a hands-on investigation of the areas of different shapes that can be made with a fixed perimeter. Learning and fun come together in this activity!

**Teacher Tips:**

* Have the students work in groups of three or four to complete the Perimeter and Area worksheet. This way they can have a few students form (and hold) the figures and another student do the measuring.
* Make sure students understand that the value of x on each problem on the worksheet is different. Some students may assume that each x has the same value.
* Do not expect students to get the same answers that are on the answer key. **The answer key is intended as only as an approximate guide.** Student answers should be fairly close to the answers on the key, but will vary due to differences in measurement. However, the key relationship between fixed-perimeter figures and their respective areas should become apparent. **In general, the closer a fixed-perimeter figure gets to becoming a circle the bigger its area will be.**