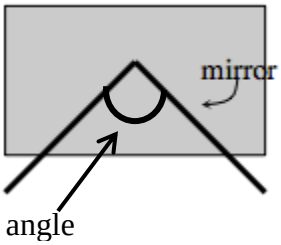
1.1.5 What shapes can you find?

Building a Kaleidoscope

Your Task: Place a hinged mirror on a piece of colored, unlined paper so that its sides extend beyond the edge of the paper (see the figure below). Explore what shapes you see when you look into the mirror, and how those shapes change when you change the angle of the mirror. Make sure to always keep the ends of the mirror extended beyond the edge of the paper as you change the angle of the mirror. Discuss the questions below with your team. Be ready to share your responses with the rest of the class.



1-38. To complete your exploration, answer these questions together as a team.

What happens to the shape you see as the angle formed by the mirror gets bigger (wider)?

What happens as the angle gets smaller?

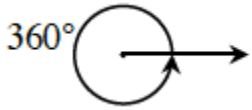
What is the smallest number of sides the shape you see in the mirror can have?

What is the largest?

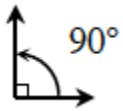
With your team, find a way to form a **regular hexagon** (a shape with six equal sides and equal angles).

How might you describe to another team how you set the mirrors to form a hexagon? What types of information would be useful to have?

1-39. A good way to describe an angle is by measuring how *wide* or *spread apart* the angle is. For this course, you can think of the **measure of an angle** as the measure of rotation of the two sides of the mirror from a closed position. The largest angle you can represent with a hinged mirror is 360°. This is formed when you open a mirror all the way so that the backs of the mirror touch. This is a called a **circular angle** and is represented by the diagram below.



Other angles may be familiar to you. For example, an angle that forms a perfect "L" or a quarter turn is a 90° angle, called a **right angle** (shown below). Four right angles can together form a circular angle.

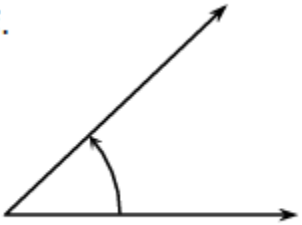


What if the two mirrors are opened to form a straight line? What measure would that angle have? Draw this angle and label its degrees.

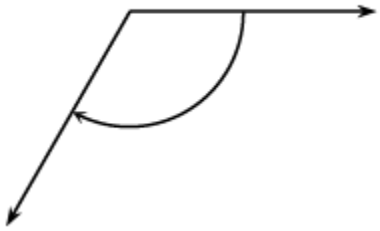
How is this angle related to a circular angle?

Based on the examples above, estimate the measures of the angles shown below. Then confirm your answer using a **protractor**, a tool that measures angles.

i.

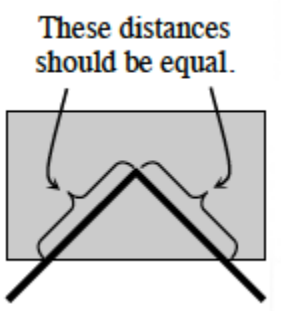


ii.



iii.

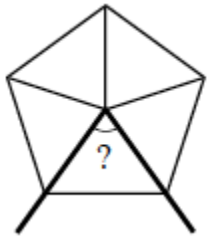
1-40. Now use your understanding of angle measurement to create some specific shapes using your hinged mirror. Be sure that both mirrors have the same length on the paper, as shown in the diagram below.



Antonio says he can form an **equilateral triangle** (a triangle with three equal sides and three equal angles) using his hinged mirror. How did he do this? Once you can see the triangle in your mirror, place the protractor on top of the mirror. What is the measure of the angle formed by the sides of the mirror?

Use your protractor to set your mirror so that the angle formed is 90°. Be sure that the sides of the mirror intersect the edge of the paper at equal lengths and that the ends of the mirror are hanging over the edge of the paper. When you look into the mirror now, what shape do you see?

Carmen's mirror shows the image below, called a **regular pentagon**. She noticed that the five triangles in this design all meet at the hinge of her mirrors. She also noticed that the triangles must all be the same size and shape, because they are reflections of the triangle formed by the mirrors and the paper.



What must the sum of these five angles at the hinge be?

What is the angle formed by Carmen's mirrors? Test your conclusion with your mirror.

Discuss with your team and predict how many sides a shape would have if the angle that the mirror forms measures 40°. Explain how you made your prediction.

Check your prediction using the mirror and a protractor. Describe the shape you see with as much detail as possible.

1-41. Reflect on what you learned during today's activity.

Based on this activity, what are some things that you think you will be studying in Geometry?