


Creating a Kaleidoscope with Geometer's Sketchpad

A. Drawing the Paths


1. Select the straightedge tool, which looks like this: 

In the top left corner, draw two small line segments that form an "X."

2. Select the compass tool, which looks like this: 

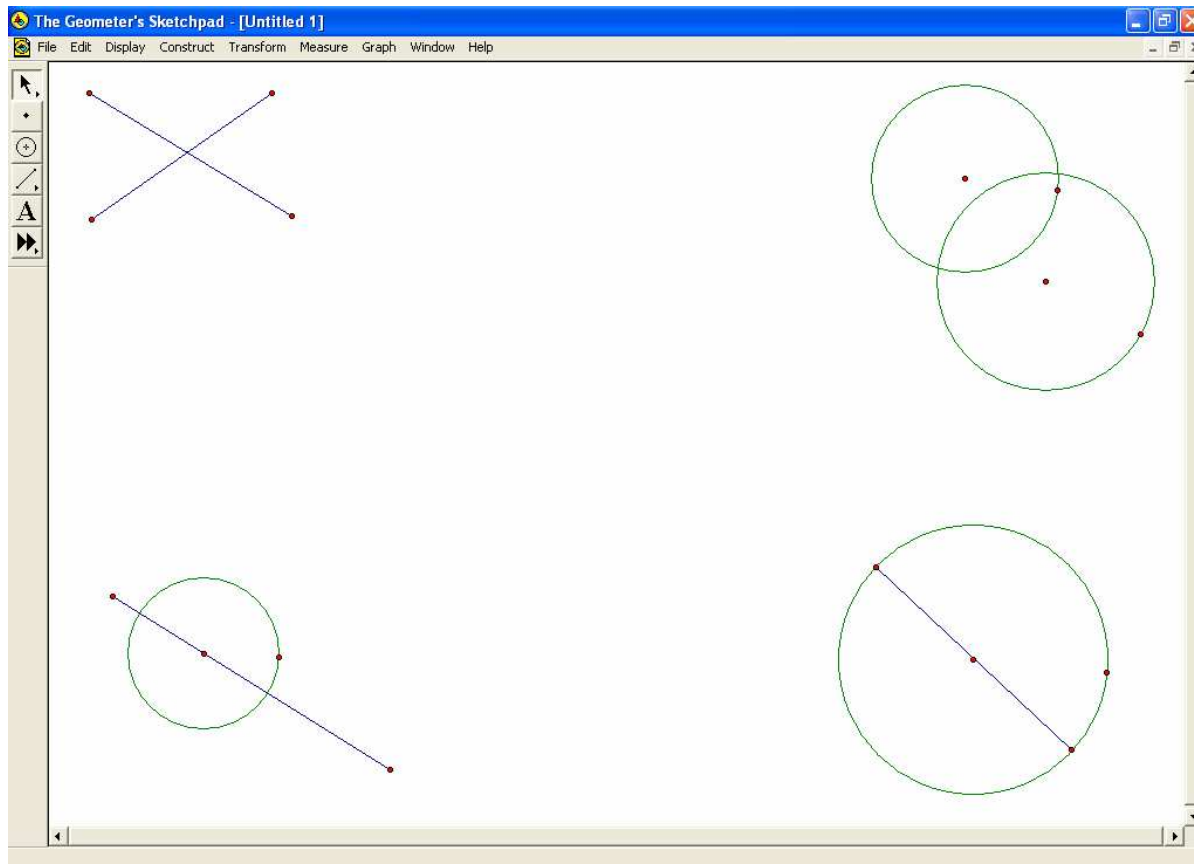
In the top right corner, draw two small intersecting circles. Notice when you draw the circles that the first click establishes the center of the circle, and the second click establishes the radius.

3. In the bottom left corner, draw a segment. Then draw a circle whose center is on the segment. Do this by selecting the compass tool, and then making the first click (the center) on the segment. After you draw the circle, use the


selection arrow tool  to wiggle the center of the circle around. Notice that as you wiggle the center, it never leaves the segment.

4. In the bottom right corner, draw a circle. Then draw a segment where both endpoints are on the circle.

Your drawing should look something like this now:



B. Drawing the vertices of the polygons

1. Place a point on one of the segments at the top left with the point tool, which looks like this: . Immediately after placing the point on the segment, choose **Color** from the **Display** menu, and change the color of the point to blue.
2. Place another point on the same segment, and then another on the other segment. You should now have three blue points on the segments. Wiggle the blue points and notice that they never leave the segments.
3. Now look at your circles in the upper right. Place two points on one circle and two points on the other. Wiggle the points with the selection arrow tool and see how they never leave their respective circles.
4. In the lower left corner, place two points on the circle and one point on the segment.
5. In the lower right corner, place two points on the circle and one point on the segment.

C. Drawing the polygons

1. With the selection arrow tool, start by making sure that nothing is selected. You do this by clicking on some blank white space. Then select the three blue points in the top left portion of your screen. Choose **Triangle Interior** from the **Construct** menu. Make sure that you have three points (and nothing else) selected, or you won't be able to construct the interior. Make sure that the points you use are blue and not red.
2. Repeat the prior step with the four points in the upper right corner, but this time choose **Quadrilateral Interior** from the **Construct** menu. Again, make sure that you are using only blue points. Right click the quadrilateral interior, and change the color. Light colors work better than dark.
3. Repeat this procedure with the points in the bottom left, and with the points in the bottom right. Change the colors of the triangle interiors so that each of your polygon interiors is a different color.

D. Animating the polygons

1. Carefully select the vertices of the shapes that you just constructed. These should be all of the blue points. In addition, select the center of the circle in the lower left corner, and the segment endpoints in the lower right corner. Choose **Show Labels** from the **Display** menu. Each point should now be labeled with a capital letter.
2. Keep the points selected—this means don't click on anything else just yet. Now, from the Edit menu, choose **Action Buttons**, and then **Animation**. A dialogue

box will appear. Click "OK" on the dialogue box, and a button will appear near the top left part of the screen that says "Animate Points." Enjoy.

3. Now right-click the **Animate Points** button that you just made, and choose **Properties**. The dialogue box will appear again. You can change the direction and speed of each of the points with this dialogue box, although you have to stop the points and restart them for the changes to occur.

E. Hiding the structure

1. Stop your animation, and move all of your segments and circles to the center of the screen with the selection arrow tool. It will look very messy.
2. Click on the point tool, then choose **Select All Points** from the **Edit** menu. All the points in the drawing will be highlighted. Now select **Hide Points** from the **Display** menu. All the points and their labels should disappear.
3. Click on the compass tool, choose **Select All Circles** from the **Edit** menu, and then choose **Hide Circles** from the **Display** menu. All the circles should disappear.
4. Click on the straightedge tool, choose **Select All Segments** from the **Edit** menu, and then choose **Hide Segments** from the **Display** menu. All the line segments should disappear, and your screen should show nothing other than the colorful polygons and the **Animate Points** button.
5. Click on the selection arrow tool, and then click the **Animate Points** button, and the polygons will still animate. The points, circles and segments are still there, we just can't see them.

F. Rotating

1. Near the bottom of the screen, draw a small circle. Draw a segment from the center of the circle to the point that is on it. Situate the resulting radius so that it's pointing to the top of the circle. Now draw a second radius of the circle that points up to around 11 o'clock.
2. Select the three points at the bottom of your screen in this order: the 12 o'clock point, the center, and the 11 o'clock point. Select **Mark Angle** from the **Transform** menu.
3. Place a point just below your colorful polygons. With the point highlighted, select **Mark Center** from the **Transform** menu.
4. Now select each of your four polygons (and nothing else). Select **Rotate** from the **Transform** menu. A dialogue box appears; click on **Rotate**. Notice that four more polygons appear on the screen, and as you move the 11 o'clock point on your small circle, the polygons also move, rotating around the point you just designated as the center of rotation.

5. Move the point so that your new set of polygons doesn't overlap with the original set. Rotate these polygons two or three times again, so that you have four or five sets of polygons.
6. Click on the **Animate Points** button, and you'll start to get a kaleidoscope effect. Notice that you can change the rotation angle even when the polygons are animated.

G. Reflecting

1. Select the vertical radius of your circle at the bottom of the screen. Now choose **Mark Mirror** from the **Transform** menu. This marks it as the line of reflection. Select your polygons—all of them—and then choose **Reflect** from the **Transform** menu. A reflection of your shapes should appear.
2. Now click on the Animate Points button again.