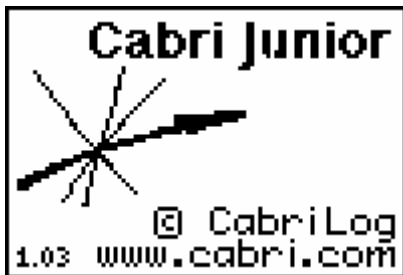Constructing Regular Polygons

First, turn on your TI-84 and press the APPS key. Arrow down until you see Cabri Jr and press ⊆. You should now see this introduction screen.

To begin the program, press any key. If a drawing comes up on the screen, press the o key (note the F1 above and to the right of the key – this program uses F1, F2, F3, F4, F5 names instead of the regular key names) and arrow down to NEW. It will ask you if you would like to save the changes. Press the ψ key and then enter to not save the changes.

One .8xv file is needed for this activity. Use the TI-Navigator™ to send these files to your students' TI-84 or use TI-Connect™ and a TI Connectivity Cable.

We are now ready to begin.

Regular polygons are polygons where all of the angles have the same degree measure and all sides have the same length. An equilateral triangle is an example of a regular polygon with three sides.

Earlier, we constructed an equilateral triangle. To do this, we constructed a line segment and then used the compass tool to construct circles with radius of the length of the line segment and radii at the endpoints. That works fine for a triangle, but what can you do for other shapes?

To do this, we need to know how to calculate the measure of the interior angles of a regular polygon. Your text likely has a formula for this measurement as well as an explanation of how that formula is developed.

The sum of the angles in a polygon is $S = (n-2)*180$, where n is the number of sides.

Thus, the degree measure of each angle in a regular polygon is $d = \dfrac{(n-2)*180}{n}$. The table below summarizes this for several regular figures.

Name	Number of sides	Sum of angles	Measure of each angle for a regular figure
Triangle	3	180°	60°
Quadrilateral	4	360°	90°
Pentagon	5	540°	108°
Hexagon	6	720°	120°
Heptagon	7	900°	128.6°
Octagon	8	1080°	135°

Describe the pattern in the column labeled "Sum of Angles".

Using this information, we can use rotations to construct regular polygons. For the equilateral triangle construction, begin with a line segment AB near the bottom of the screen. There is a file entitled "REGULAR" that you can use for the first two figures.
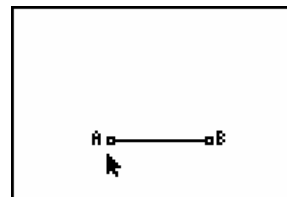
At the bottom of the screen, we will indicate the angle of rotation needed for a triangle. From the table, this is 60°. Use the Alpha-Num tool to enter the phrase and the value. Note that you must press the □ key to change from text to numbers.
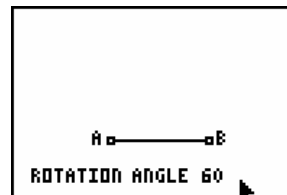
For this construction, we need a tool that we haven't used in previous constructions. Press α and choose the Rotation tool.
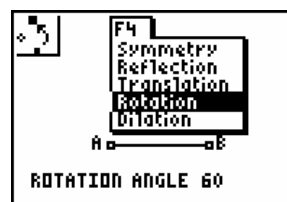
To use the Rotation tool, you must press ⊆ on three screen objects – the center of rotation (in this case vertex A), the object to be rotated (in this case side AB) and the rotation angle (in this case, the value 60°). The order of selection of these three objects does not matter. The new endpoint will be point C. Notice that the degree symbol was added to the diagram.
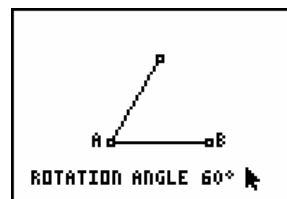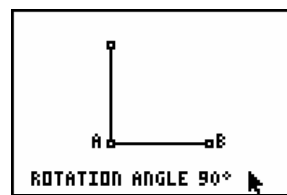
Complete the figure by repeating the rotation from point C or connecting B to C with a line segment. Measure the sides and angles of the triangle. You should have an equilateral triangle. Test your figure by dragging point A or B. The sides will vary in size, but remain equal in length. Will the angles always remain 60°? Save your figure.
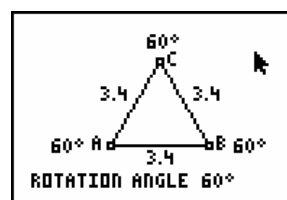
Let's move on to the square, a regular four-sided figure. Start by opening the file "REGULAR". Move the cursor to the rotation angle of 60° and press ⊆. Change the value to 90°.
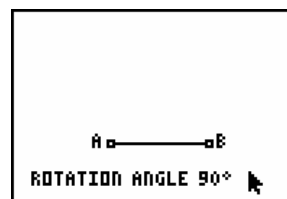
Complete the first rotation by pressing ⊆ on point A, line segment AB and the angle of rotation, 90°. The new point will be labeled C. We will need to do a second rotation to get point D. Will you do a third rotation or just connect B to D with a line segment?
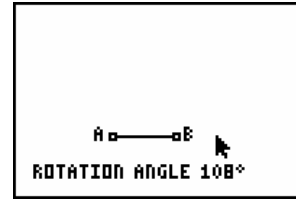Once the construction is complete, measure the sides and angles
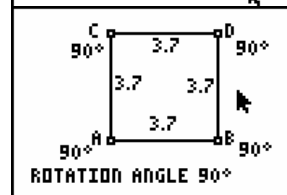
to verify that this is a square. What will happen if you drag point A or B? Why can't you drag points C or D in the figure? Save your figure

From the table, the interior angle for a regular pentagon is 108°. Open the file "REGULAR" and change the value on the screen from 90° to 108°.

Using the rotation tool, select point A, line segment AB and the rotation angle, 108°. The new point will be labeled C. How many more rotations will be needed to complete the figure? When you are finished, save your figure.
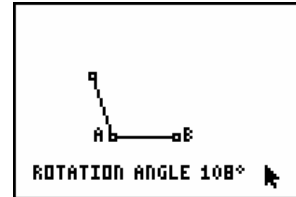
Can you repeat the process to construct a ten sided regular figure? What about a 20-sided regular figure? What happens to the shape of the figure as you continue to increase the number of sides?