

Creating the nave piers of Chartres Cathedral

Overview:

- Step 1. Create a new layer
- Step 2. Import and scale the drawing
- Step 3. Build the circular pier profile
- Step 4. Create the hexagonal pier profile
- Step 5. Draw the pier bases
- Step 6: Import and trace pier base molding profile
- Step 7. Create a new class
- Step 8. Move work to new class and prepare for extrusion
- Step 9. Extrude the bottom layer of the base
- Step 10. Model the middle and top layers of the base
- Step 11. Assemble the base
- Step 10. Extrude the pier column
- Step 11. Model the hexagonal pier
- Step 12. Create symbols

Learning Objectives for this tutorial:

- 1. Using the Basic Tools palette: Regular Polygon Tool, Mirror Tool
- 2. Tracing a 2D moulding profile
- 3. Clipping surfaces
- 4. Creating and organizing classes
- 5. Extruding objects
- 6. Extruding a profile along a path
- 7. Changing views and render modes
- 8. Adding solids
- 9. Creating symbols

Key dimensions for nave piers at Chartres Cathedral:

Pier width - 2.41m

Pier base height - 1m

Pier height - 9.4m

Step 1. Create a new layer

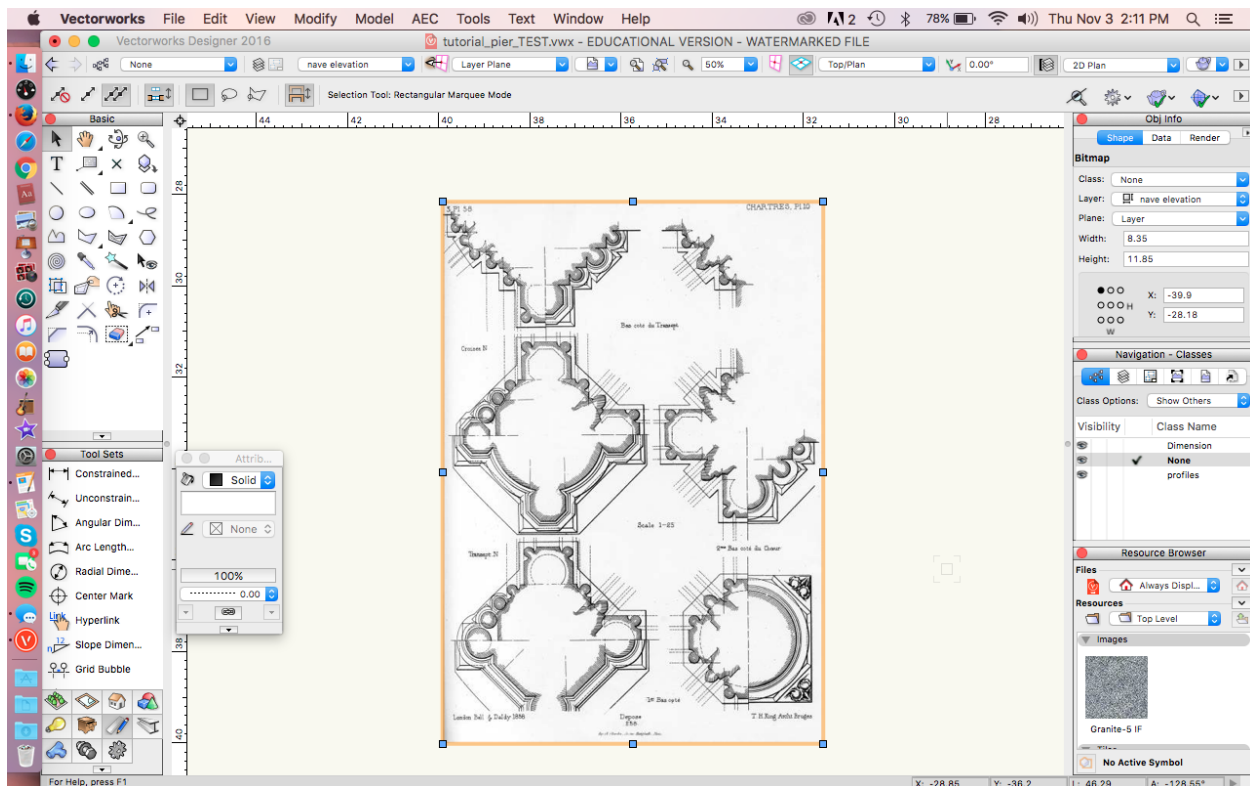
1. Open your floor plan file. You currently have two design layers, the imported floor plan image and the floor plan drawing that you created in Vectorworks. Create a new design layer and name it “Nave Elevation.”

Refer to the floor plan tutorial for how to create and edit Design layers.

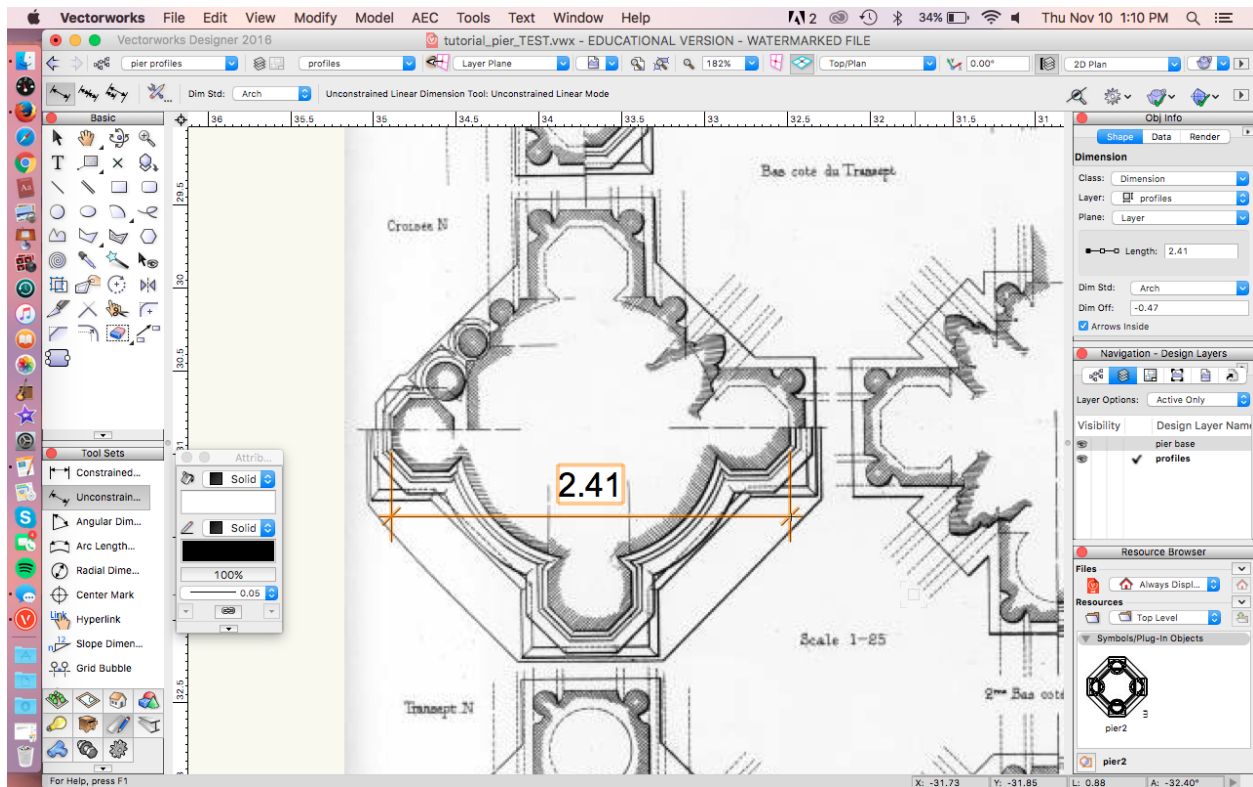
2. Make sure that the Nave Elevation layer is the active layer by double clicking on the name of the layer in the **Navigation** palette.

Step 2. Import and scale the drawing

1. Import the provided image of the pier base profiles (file name: chartres pier profile.jpg). Chartres has alternating piers, so you must construct two types: one with a circular column, and one with a hexagonal column. The profiles are composite images, combining different cross sections of the pier. The bottom half represents the base of the pier.

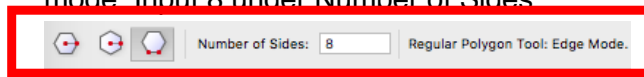


2. Scale the image using the **Scale Objects** tool (**Modify > Scale Objects**). Use the pier width of 2.41m as the new distance. “Pier” refers to the width of only the column and colonettes. It does not include the base, so measure between the innermost lines as shown in the screenshot below.

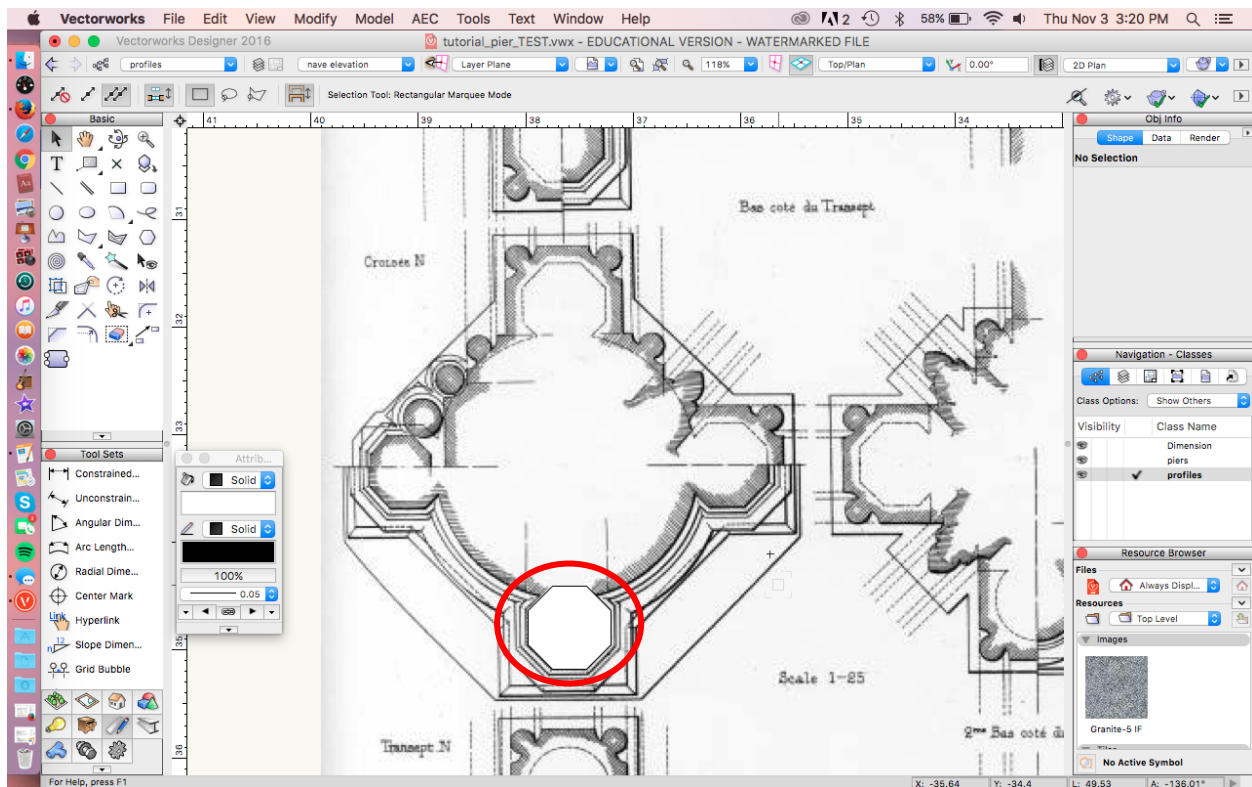


Step 3. Build the circular pier profile

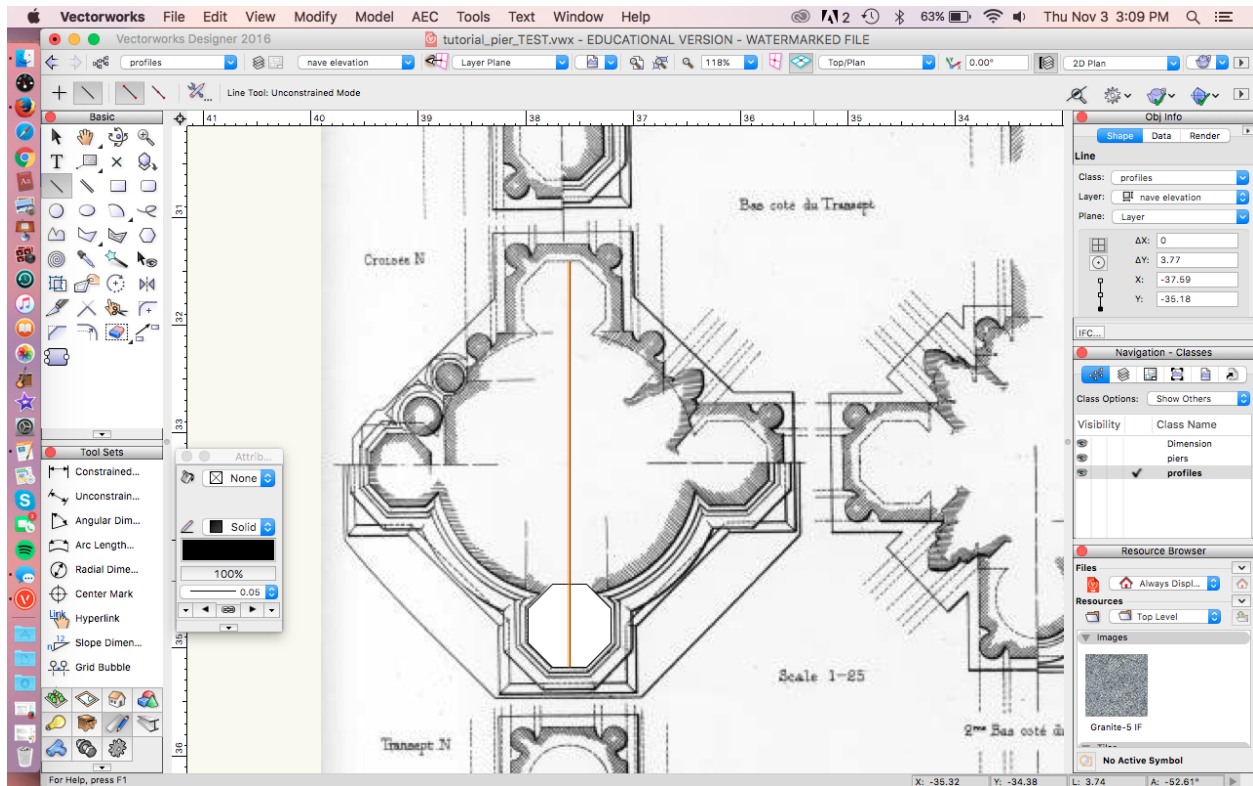
1. Work first on the circular pier with hexagonal colonnettes. Instead of relying on the drawing, we will use geometry to make the pier idealized and perfectly symmetrical.
2. Trace a hexagon on the bottom colonnette using the **Regular Polygon** tool in “Edge” mode. Input 8 under Number of Sides.



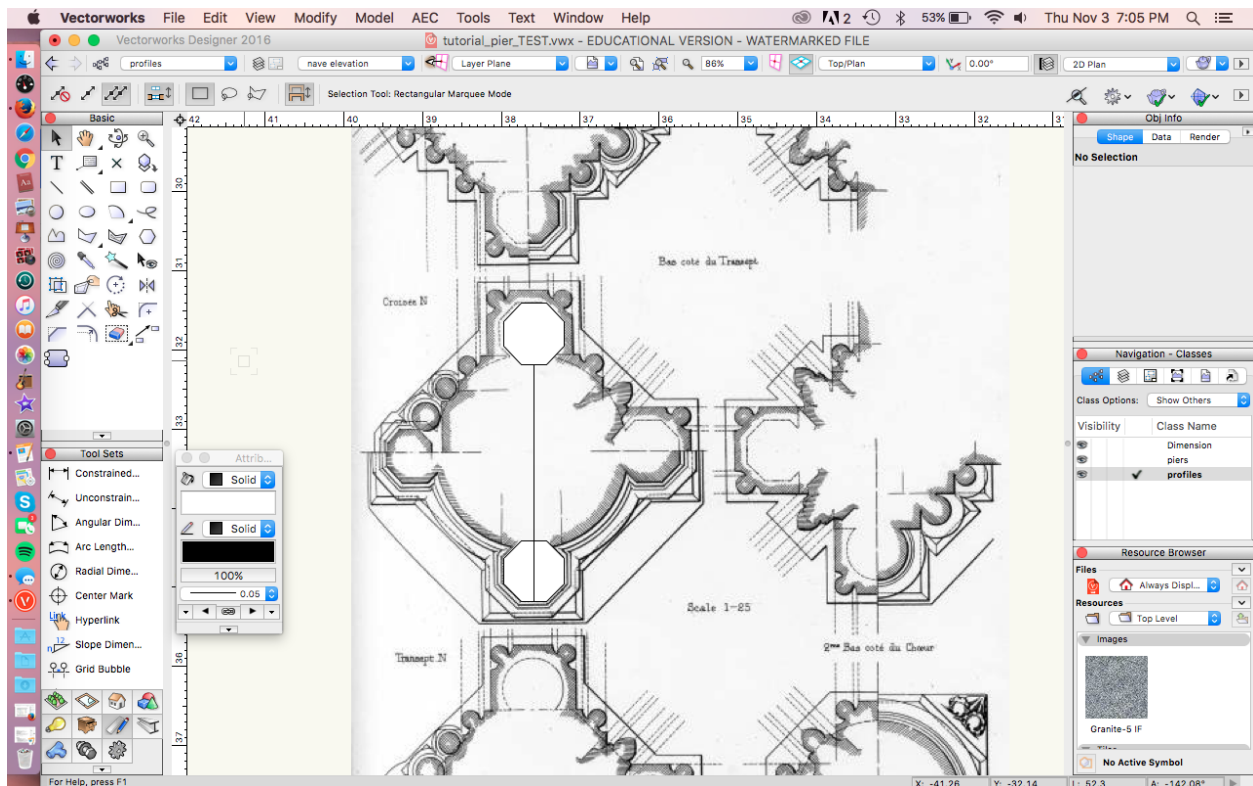
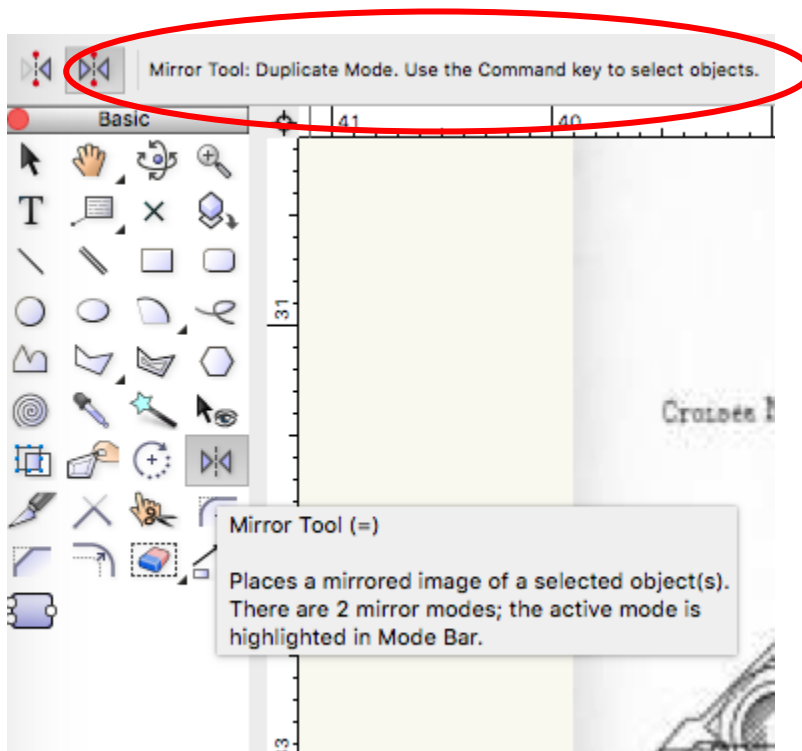
Hexagon Tool
Preferences dialog box



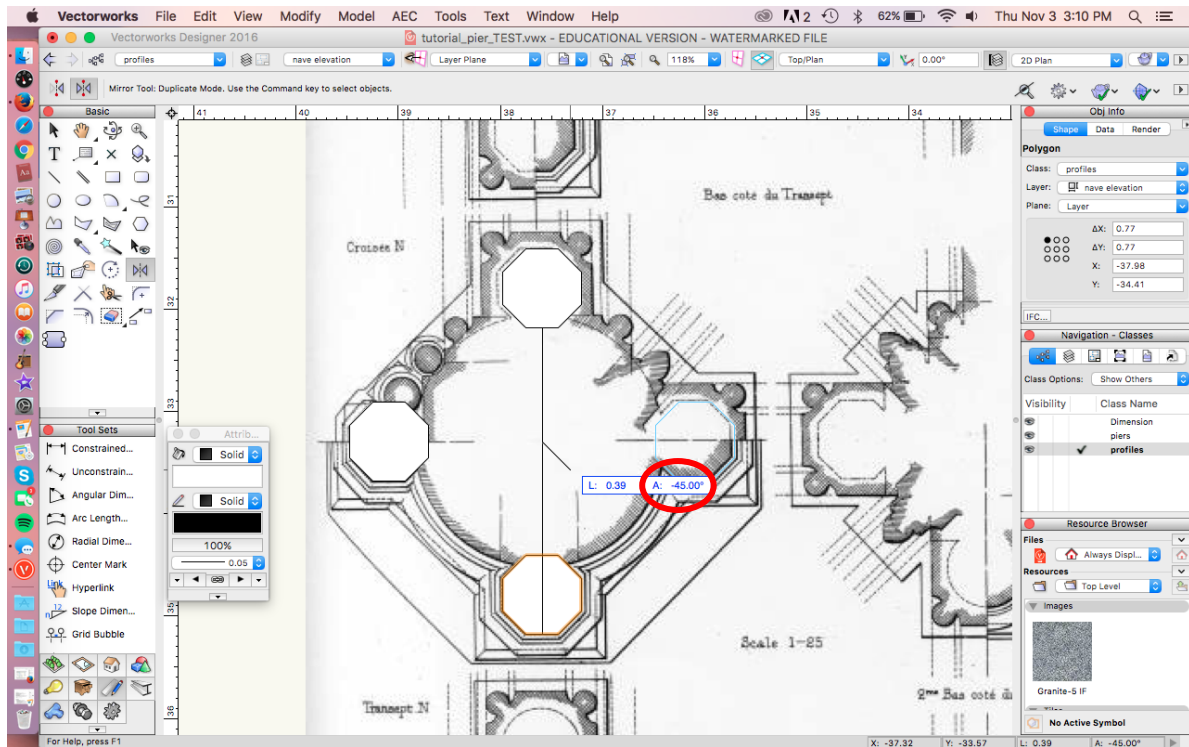
3. Draw a vertical reference line up from the midline of the hexagon's outer edge. Make the line exactly 2.41m, using one of 2 methods:
Either click tab before finishing the line, which will allow you to manually enter the length.
Or, after you complete the line, go to the **Object Info** palette and change the ΔY length to 2.41m.



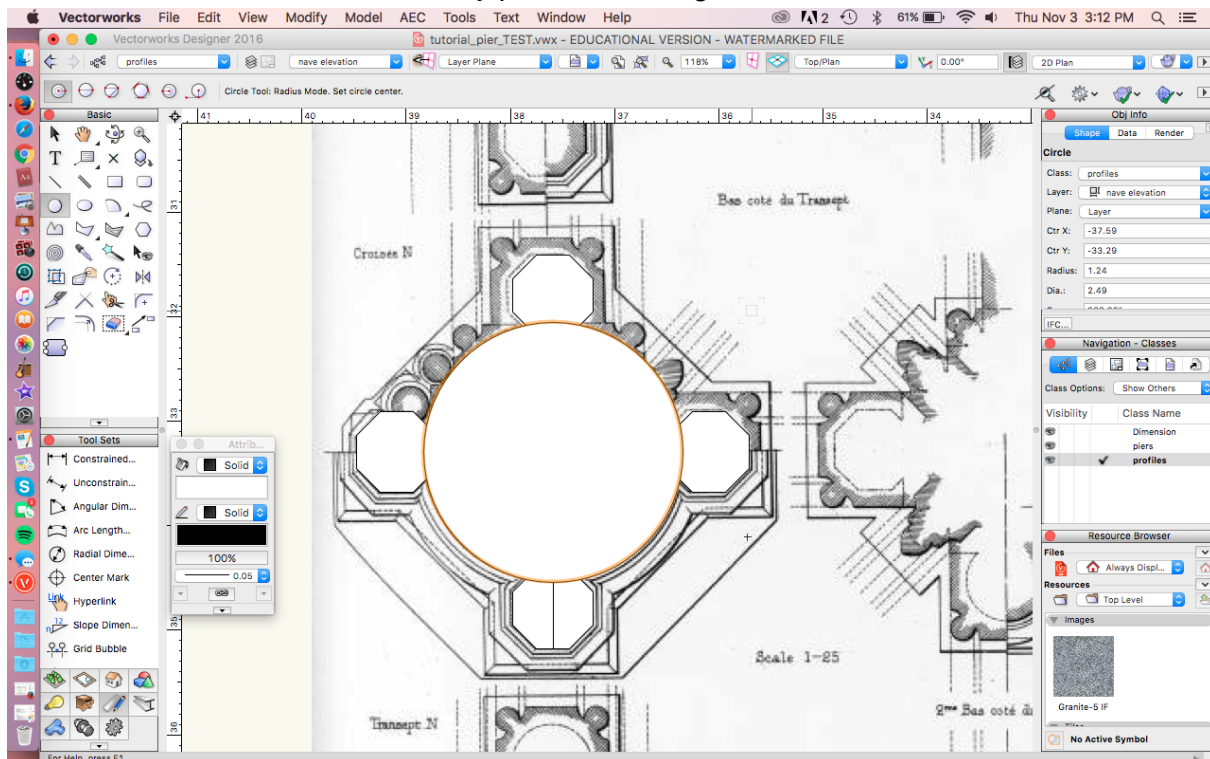
4. Use the **Mirror Tool** in “Duplicate” mode to copy the hexagon to the opposite side. Click at the center point of your reference line and drag the mouse to the left until the mirrored hexagon is correctly placed opposite of the original.



5. Repeat to create the left and right hexagons, dragging the mouse until you have a 45° angle.

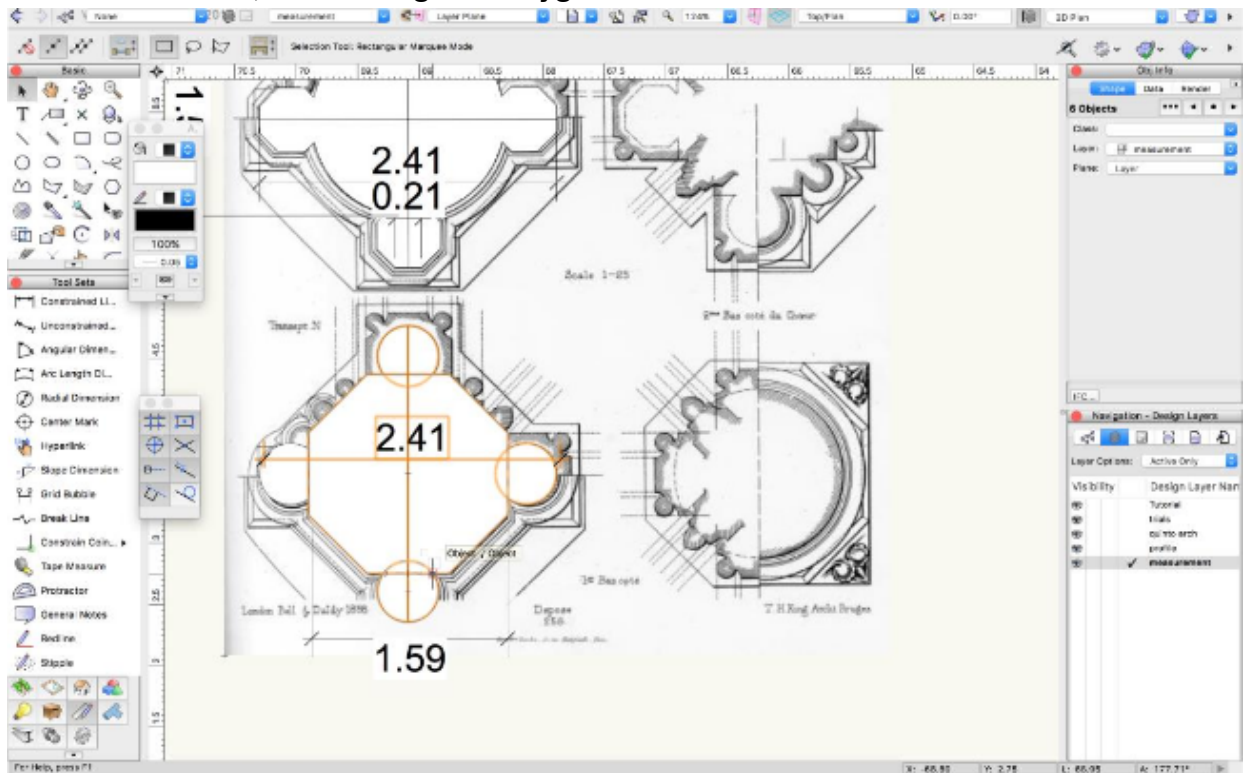


6. Draw the center column using the **Circle** tool in “Radius” mode. Start at the center of the reference line, and end at any point on the edge of the circle.



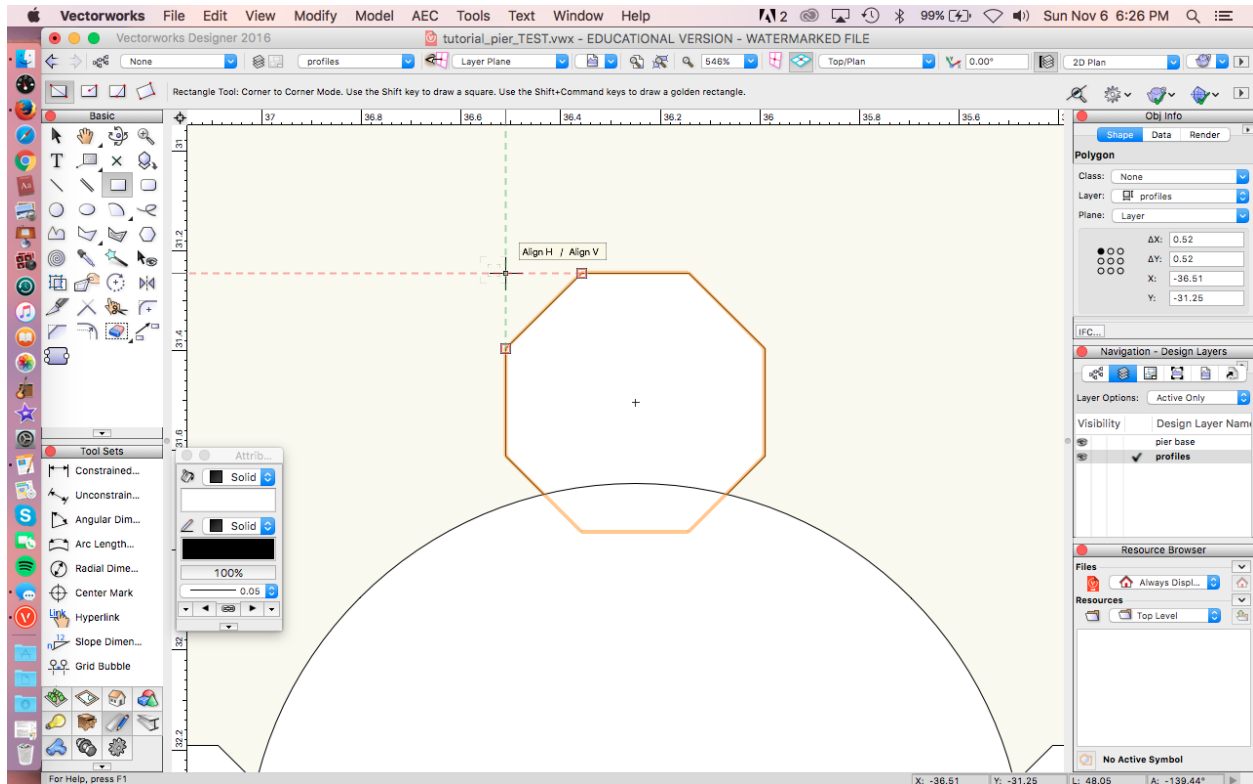
Step 4. Create the hexagonal pier profile

1. Repeat Step 3; but this time, use the **Circle** tool in “Circle by Three Points” mode for the colonnettes, and the **Regular Polygon** tool for the central column.

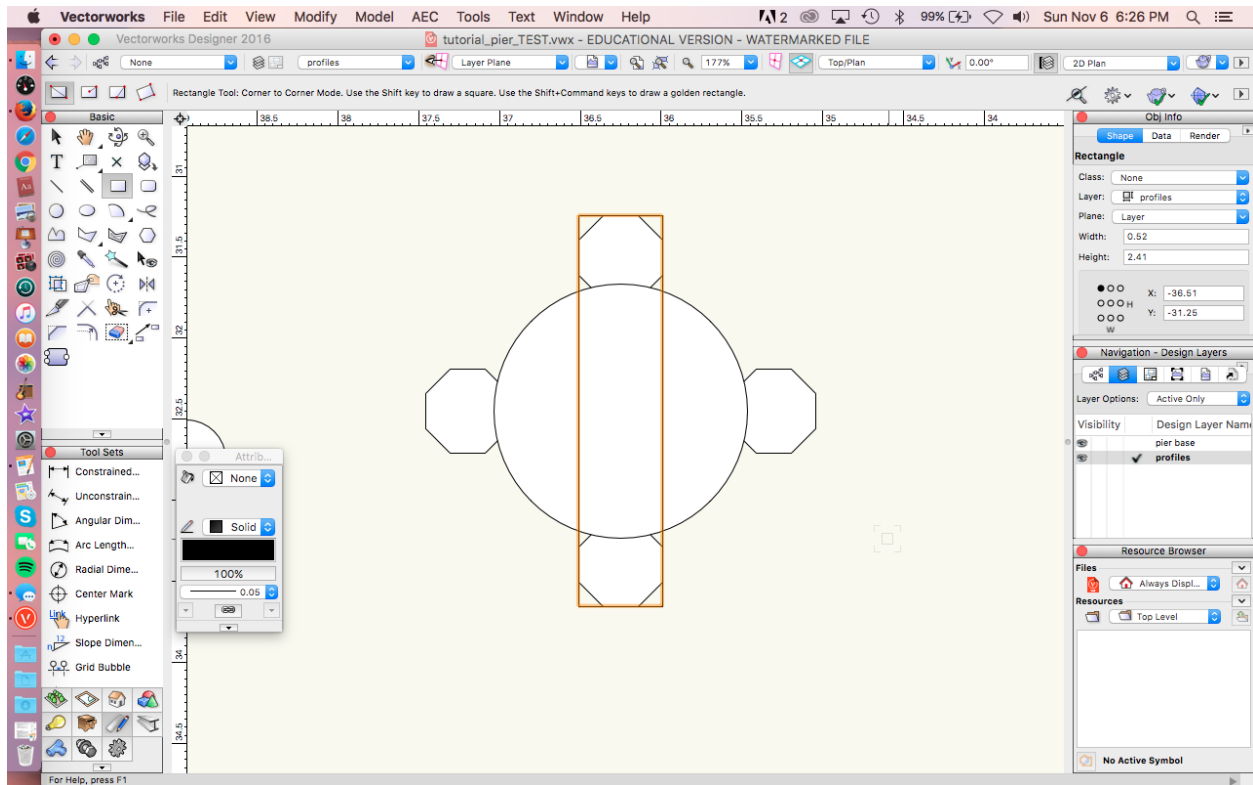


Step 5. Draw the pier bases

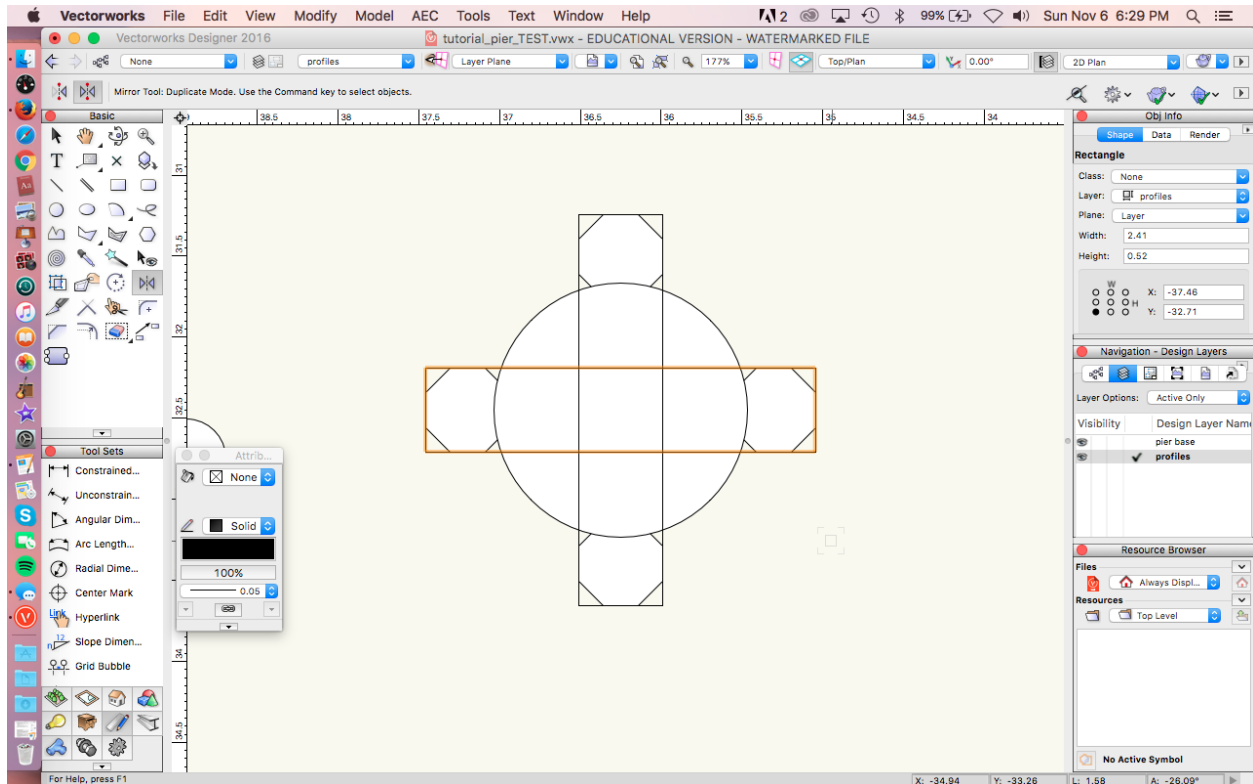
1. Turn the visibility off for the pier drawing. Again, to ensure symmetry, you will use simple geometry to create the pier bases rather than following the drawing.
2. Use the **Rectangle** tool in “Corner to Corner” mode to create reference lines. Starting at the top left corner, run your mouse over the two corner edges of the hexagonal colonnette. Then snap to the intersection of the two points.



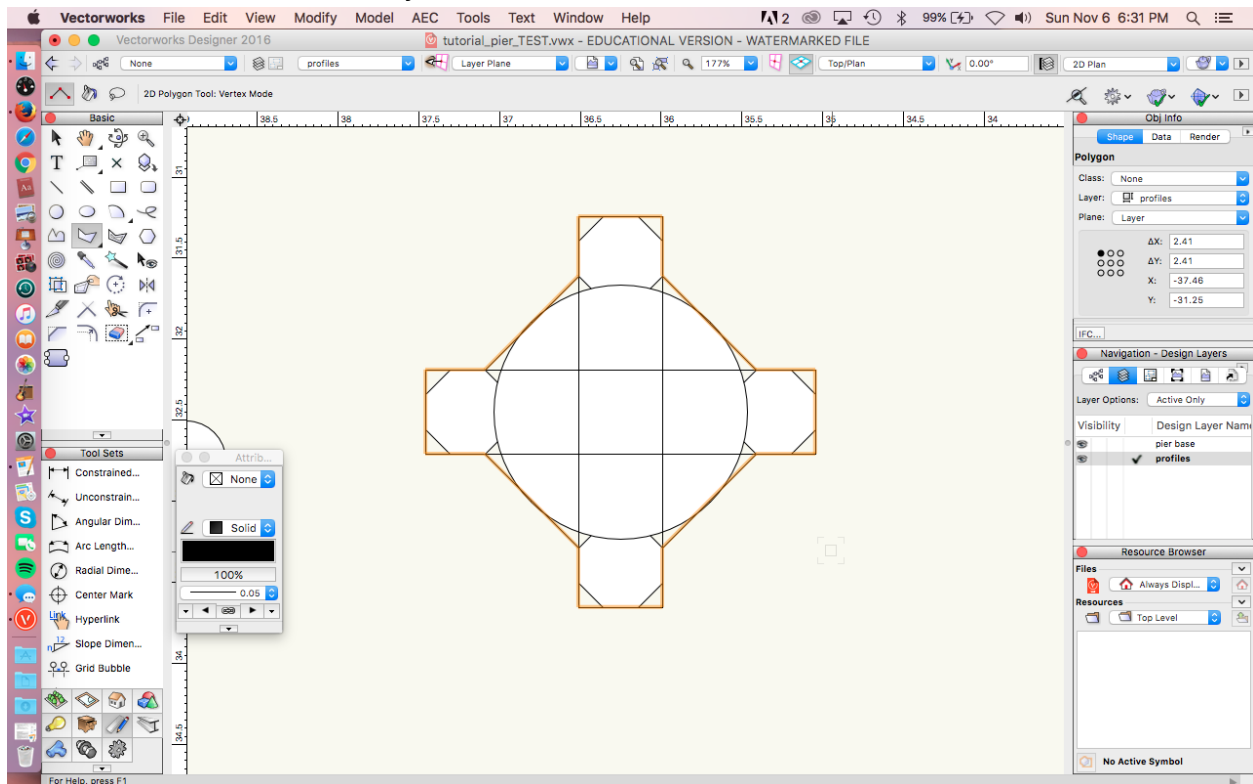
3. Drag the mouse to the opposite edge at the bottom, and find the intersection again to create a rectangle that perfectly encompasses the colonnettes. Change to no fill in the **Attribute** palette.



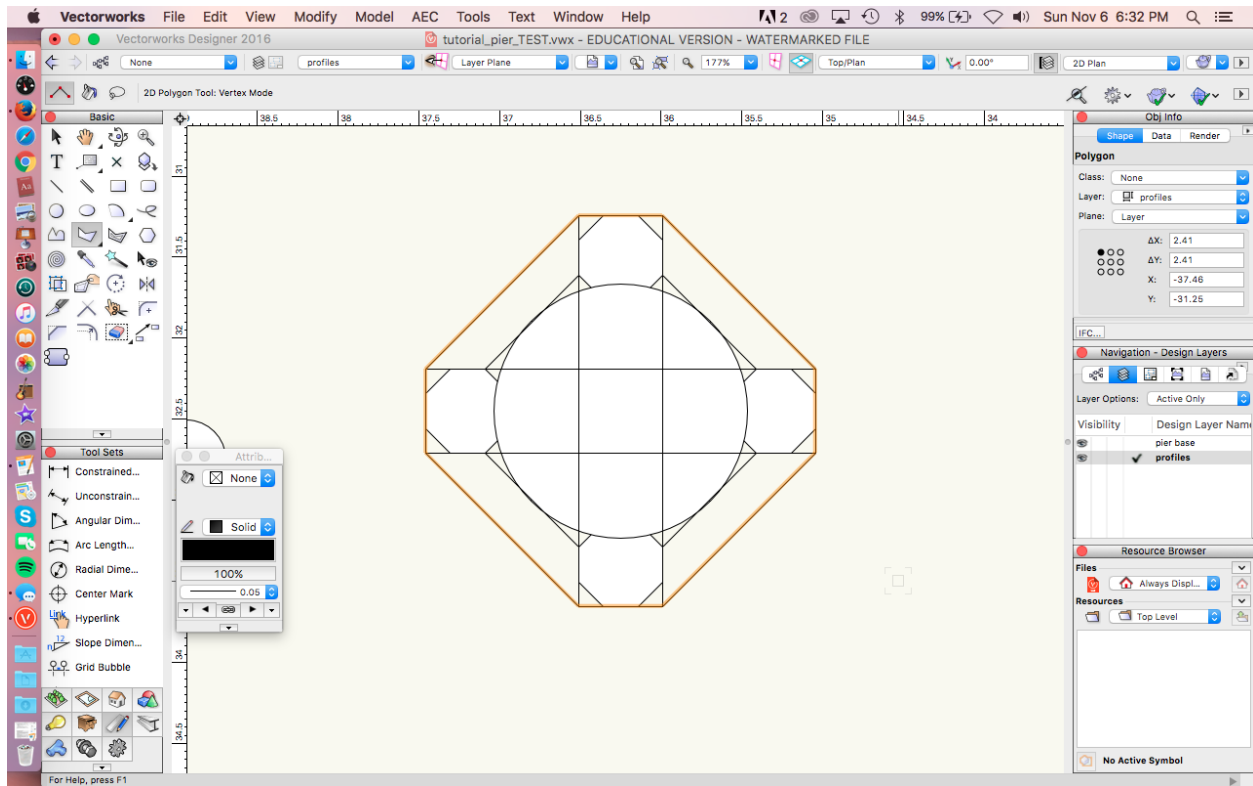
4. Mirror the rectangle to create a cross using the **Mirror Tool** in “duplicate mode.”



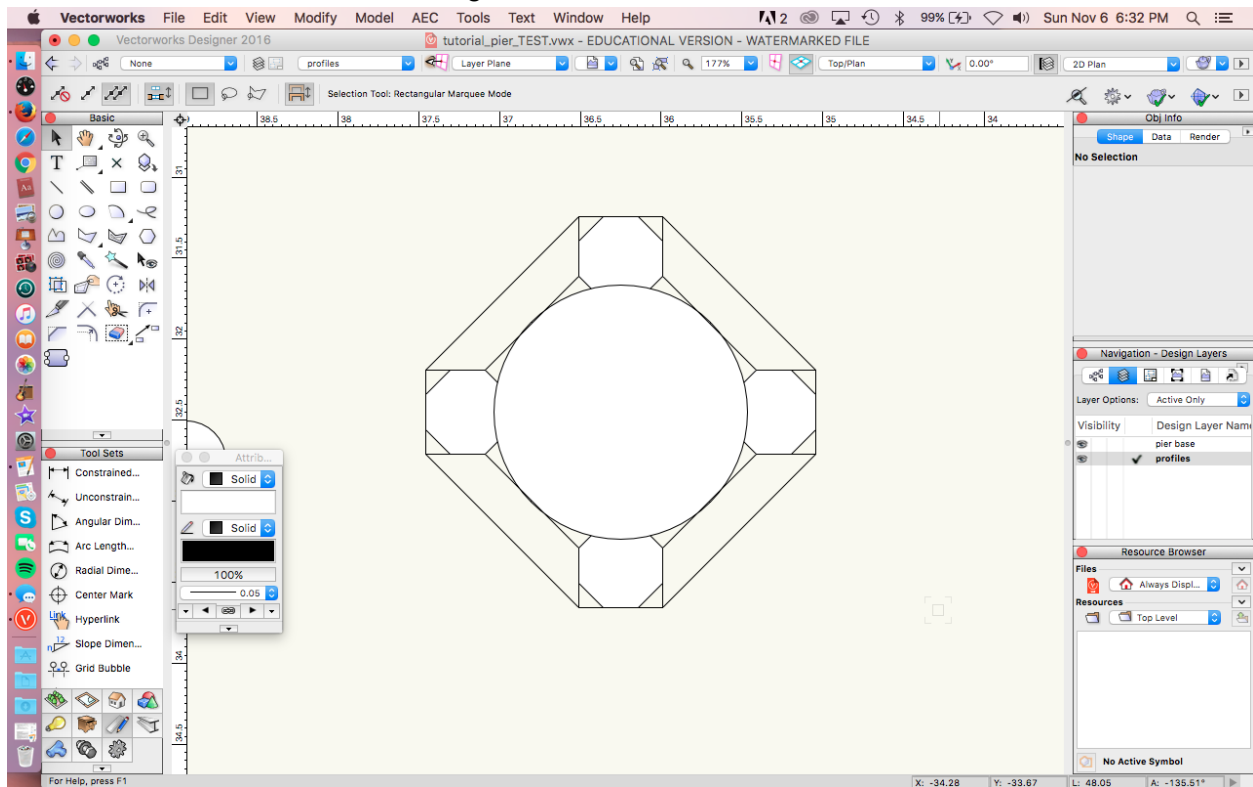
5. The current profile corresponds with the top layer of the base. Using the **2D Polygon** tool, draw the middle layer as shown. Then make it no fill.



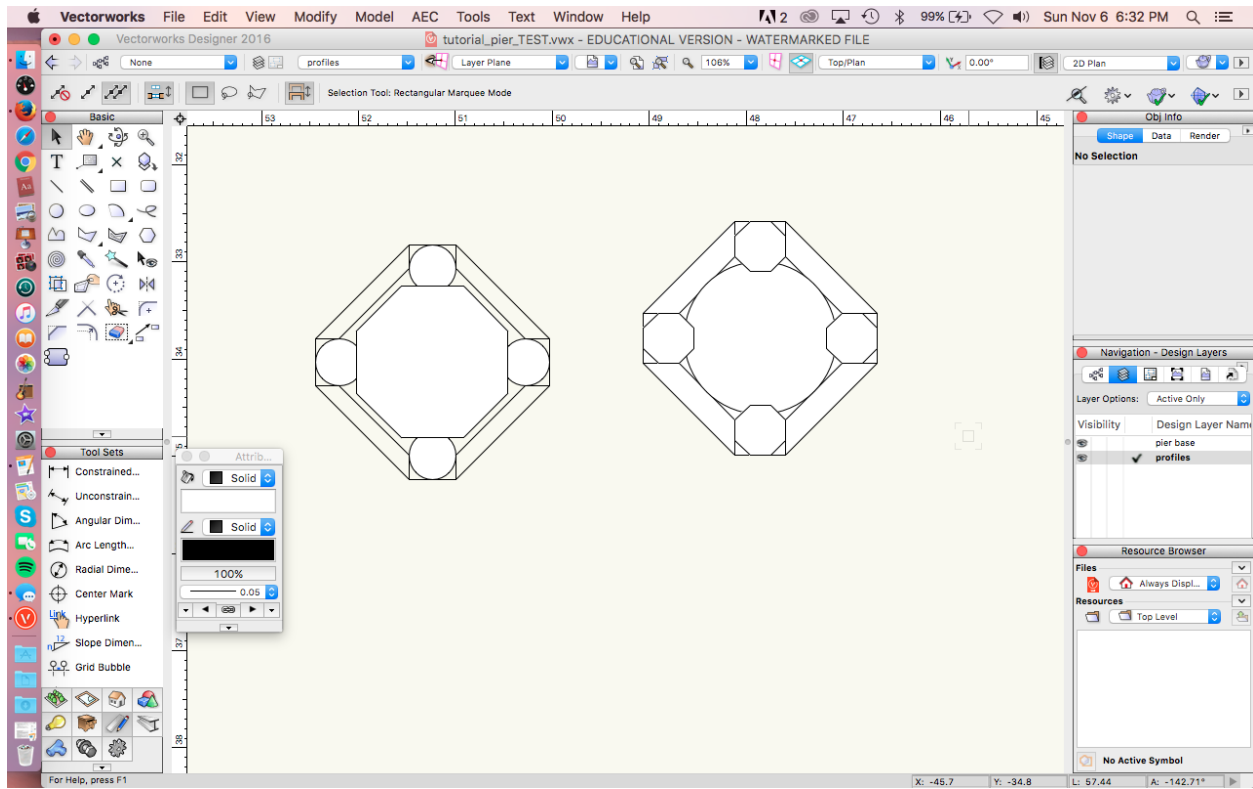
- Using the **2D Polygon** tool, draw the bottom layer by tracing around all outer corners and making it no fill.



- Delete the reference rectangles.

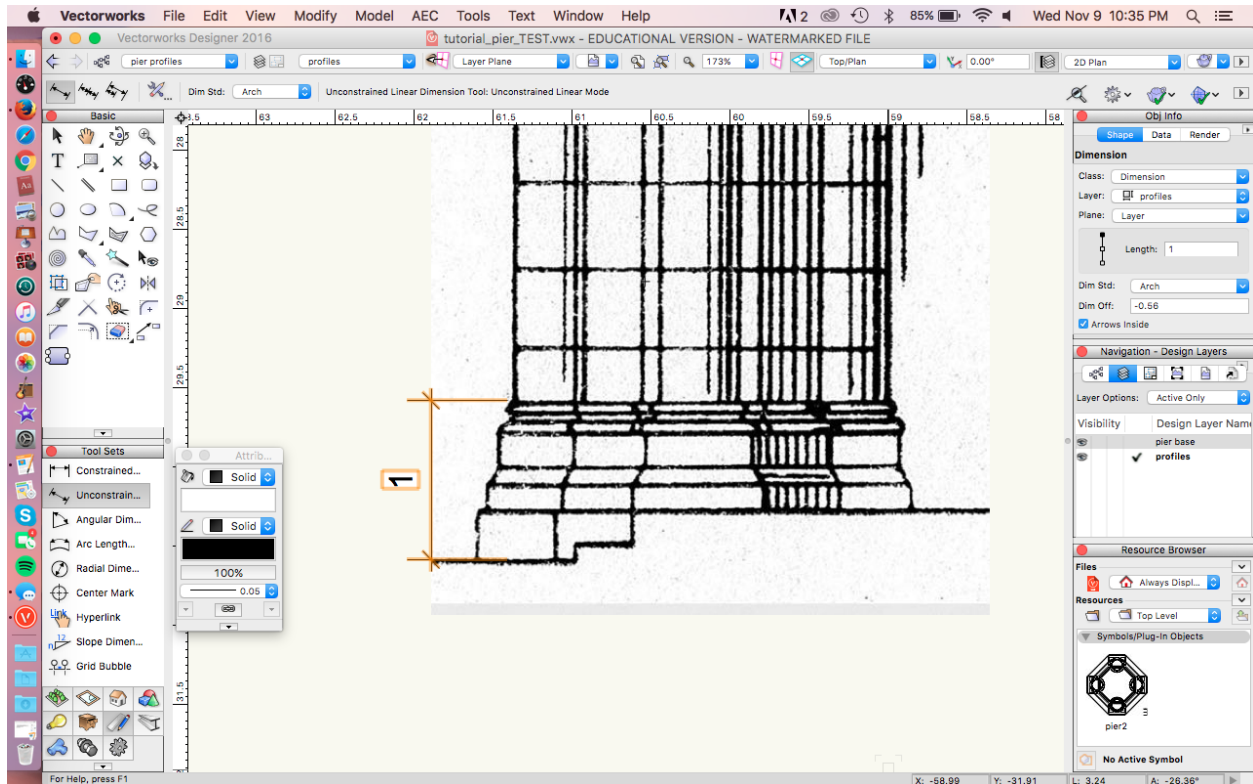


8. Repeat steps 1-6 to create the pier base for the hexagonal pier.



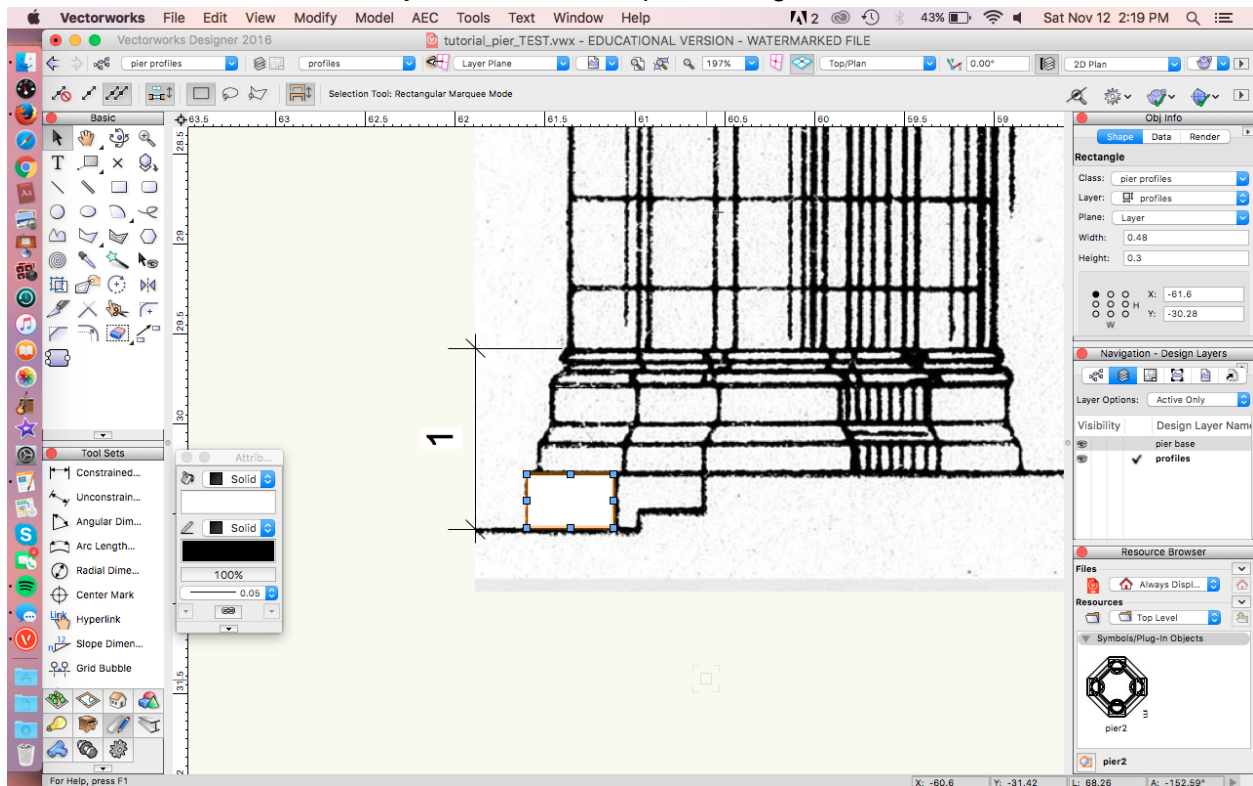
Step 6: Import and trace pier base molding profile

1. Now that you've created the 2D profile, you need to create the 3D profile. Import the provided image of the pier base (file name: pier base profile.png), and scale it to 1m height. In the pop-up window, make sure to uncheck the option “scale whole drawing” so that it doesn't affect the entire file.

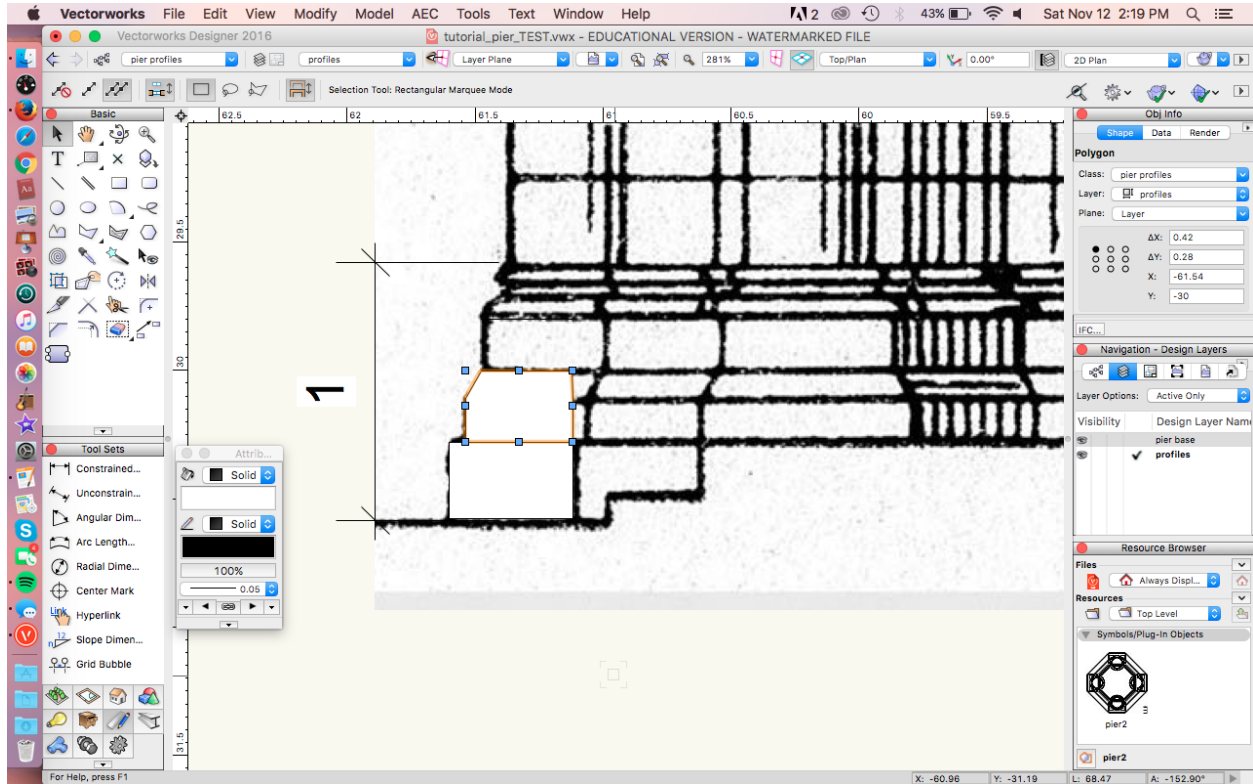


2. There are three (3) different layers of the base, which correspond to the three (3) levels that you created in the 2D profile.

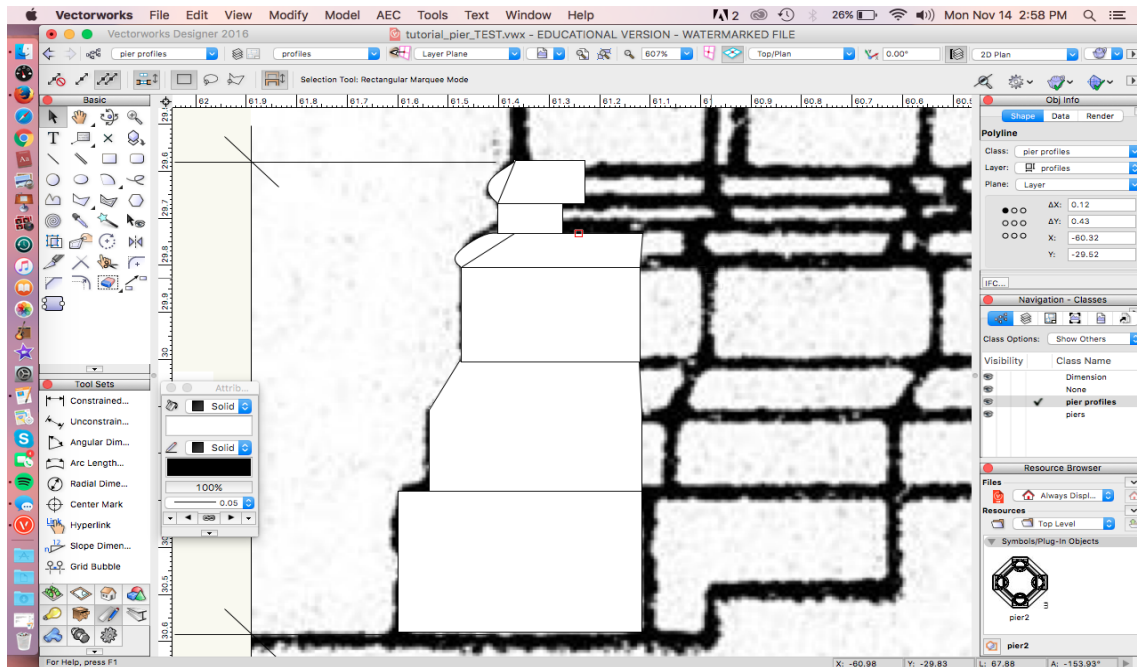
3. Start with the bottom layer, which is a simple rectangle.



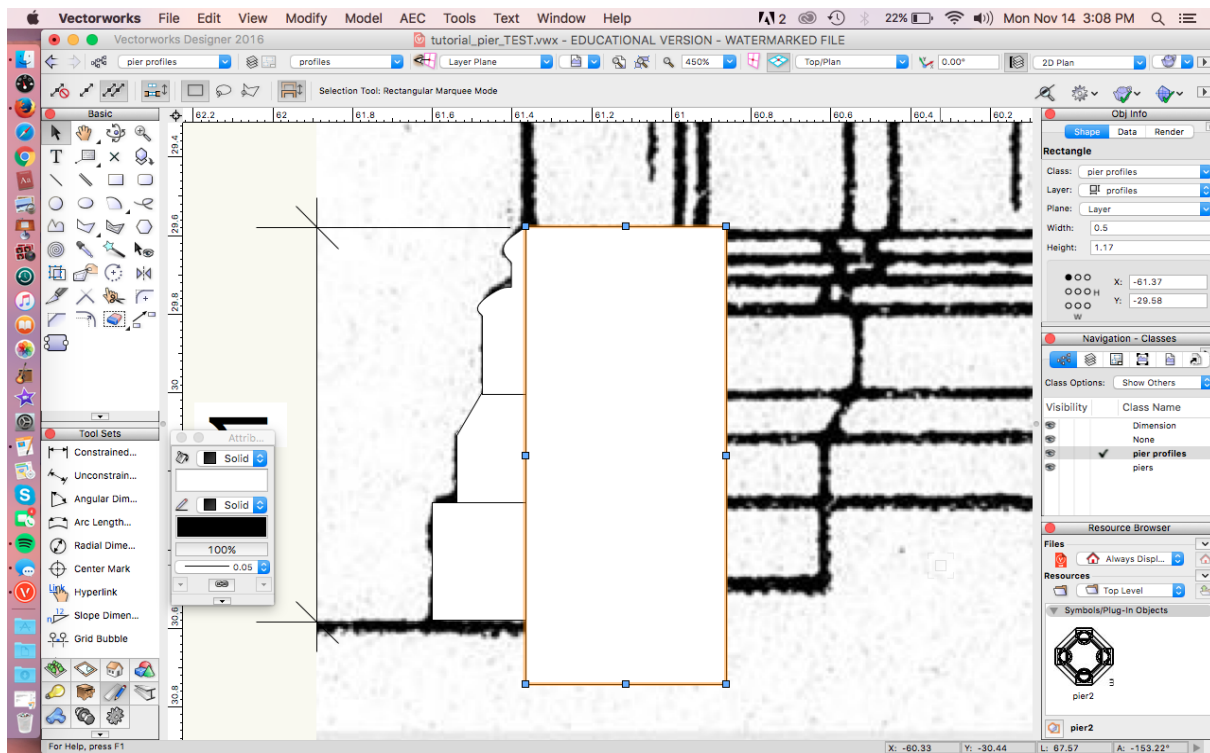
4. Next, trace the middle layer using the 2D Polygon tool.



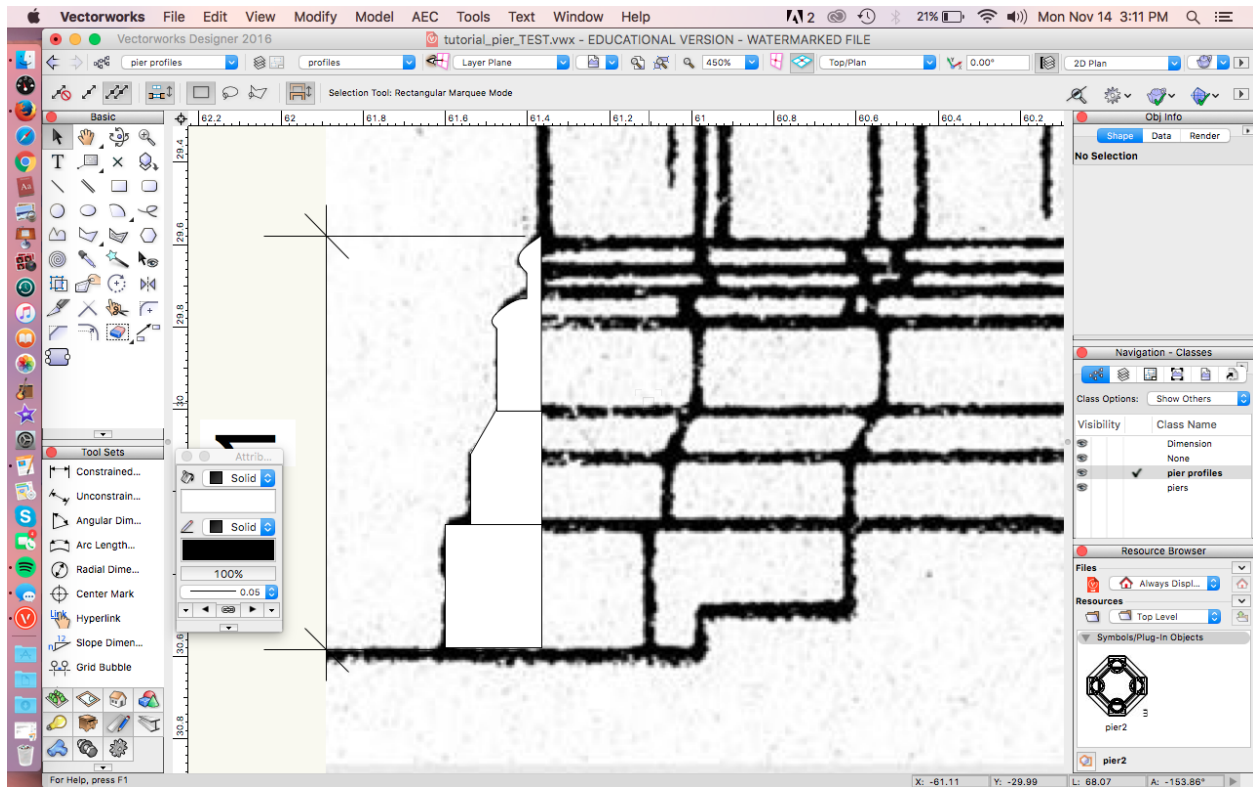
5. Use the **Polyline** tool to trace the rounded edges of the top layer, and fill in with the **2D Polygon** tool. To combine the polygons, go to **Modify > Add Surface**.



6. Once you finish tracing, you need to turn it into a profile. Draw a rectangle that overlaps the profile at the edge of the column, and make sure it covers all the shapes you created.

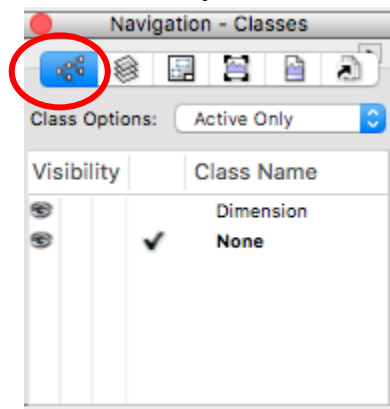


7. Select all the objects, including your overlapping rectangle. Go to **Modify > Clip Surface**, and the parts of the profile that are covered will be cut out. The profile will be a uniform size.

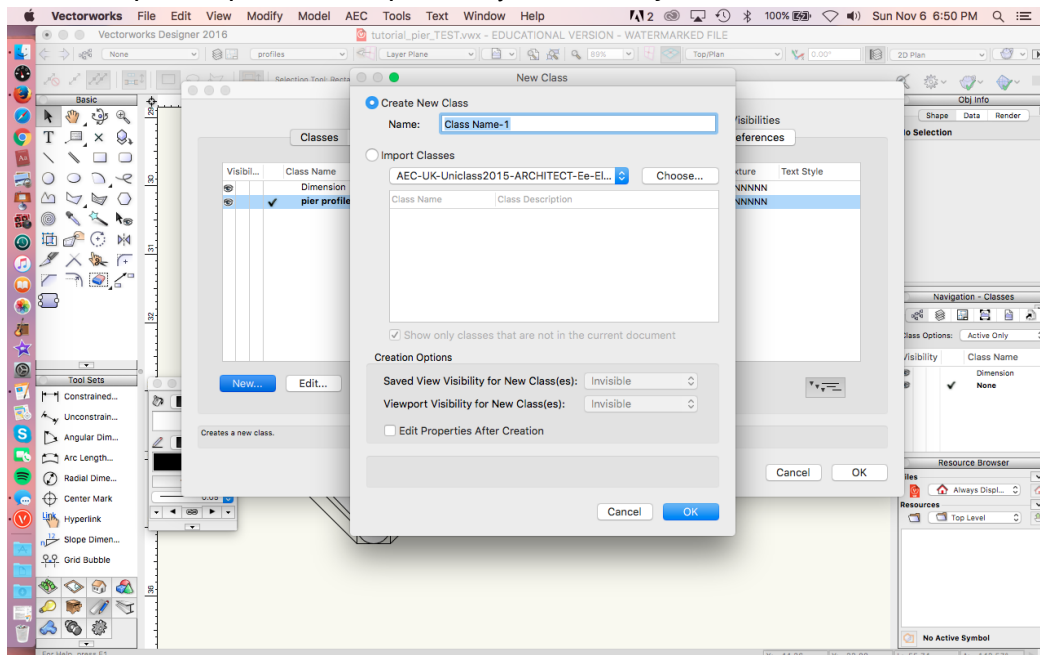


Step 7. Create a new class

1. In constructing your floor plan, you learned about one way to organize your work with **Design Layers**. Before you start building your elevation, however, it is important to understand another organizational tool: **Classes**. (This is also covered in the Lynda.com videos).
2. **Design Layers** should be thought of as the levels of the elevation, from floor to vault, while classes are aspects of the elevation, like arches or windows. You will build your nave arcade in a new class, within the Nave Elevation layer. This way you will be able to view or edit your arcade independently.
3. In the **Navigation** palette, click on the **Classes** icon. You will see that two (2) classes already exist, **Dimension** and **None**. At the moment, your profiles are in the class **None**.

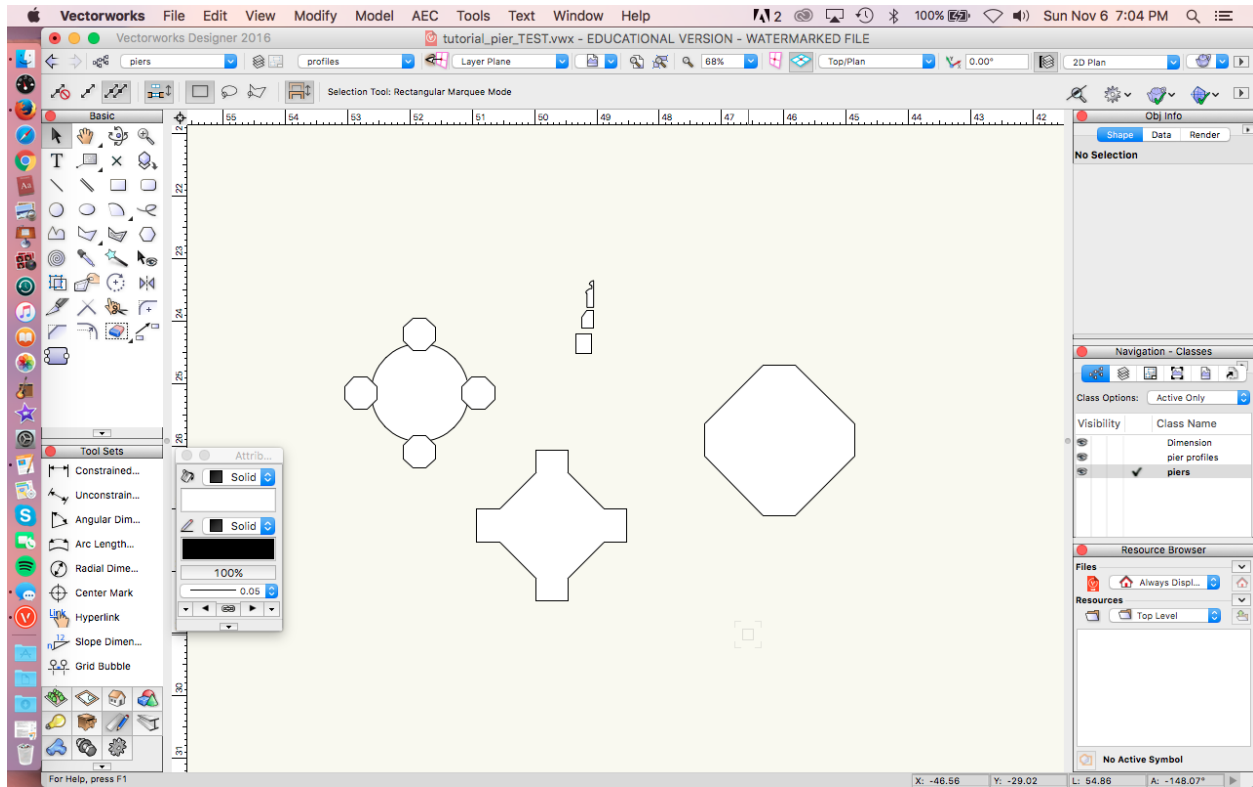


4. Double click on the **Classes** icon and then click **New** to create a new class. Name it “piers.”
5. Create another **Class**, and call it “profiles.” This will be your dump class to keep extra copies of profiles and pictures just in case you need them in the future.



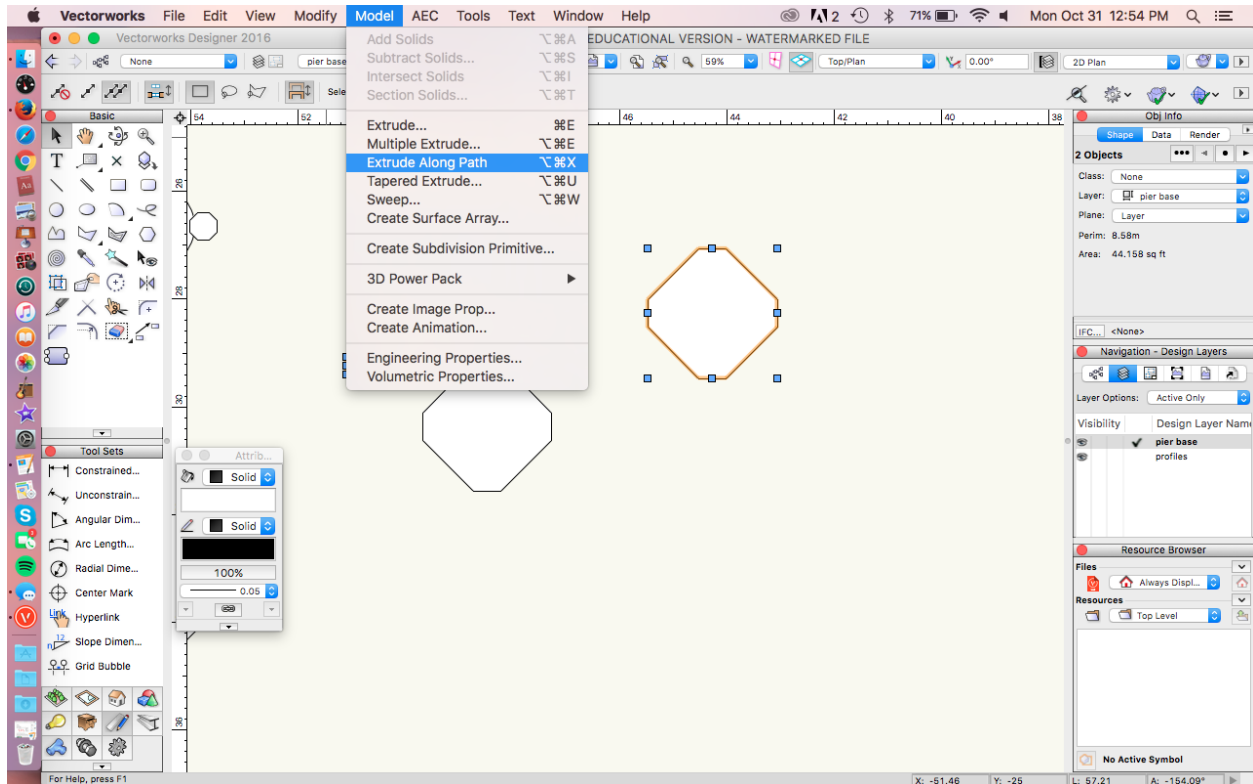
Step 8. Move work to new class and prepare for extrusion

1. Copy and paste a copy of the circular pier base profile and the three molding profiles, and move them out of the way of the rest.
2. In the **Object Info** palette, change to the “piers” class.
3. Move the originals to the “profiles” class.
4. Return to the “piers” class, and separate the levels of the base.

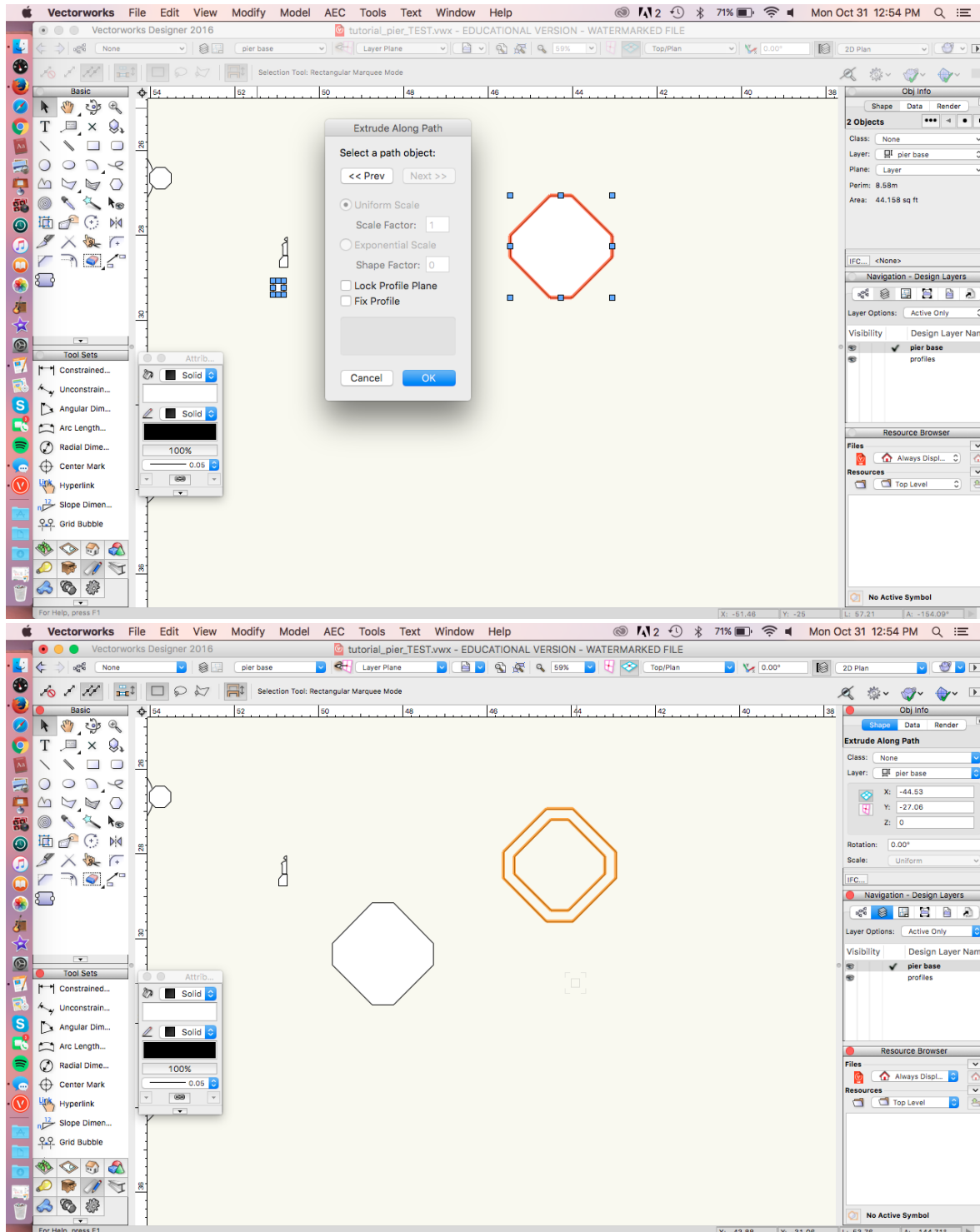


Step 8. Extrude the bottom level of the base

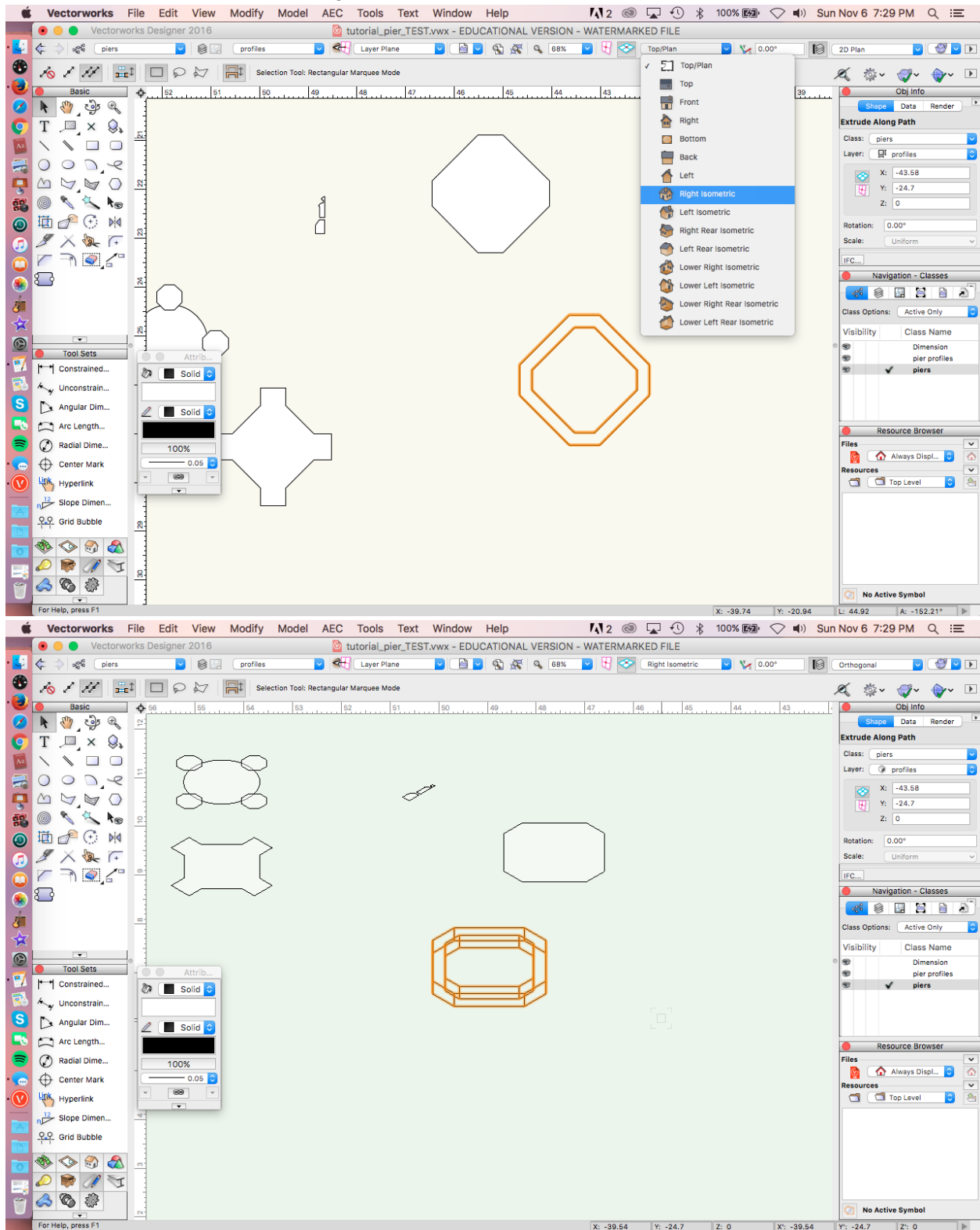
1. Make a copy of the bottom layer of the base.
2. Select the bottom layer of the molding profile and one copy of the bottom layer of the base. Go to **Model > Extrude Along Path**.



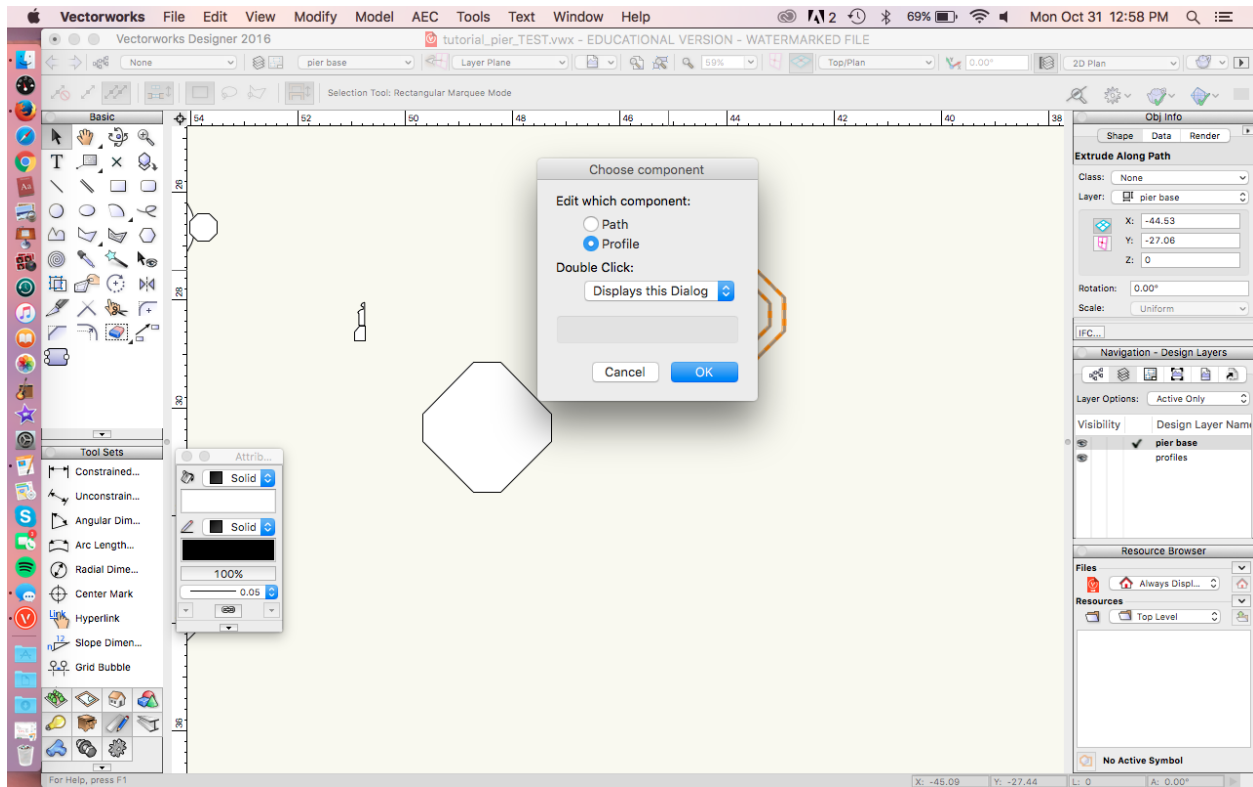
3. The window that pops up allows you to choose the path, so make sure the pier base, not the molding profile, is selected. It will be highlighted in red. Click OK. **Note: If this creates an incorrect shape, double check your shapes are solid, you may need to also click on the lock plane or fix profile box.*



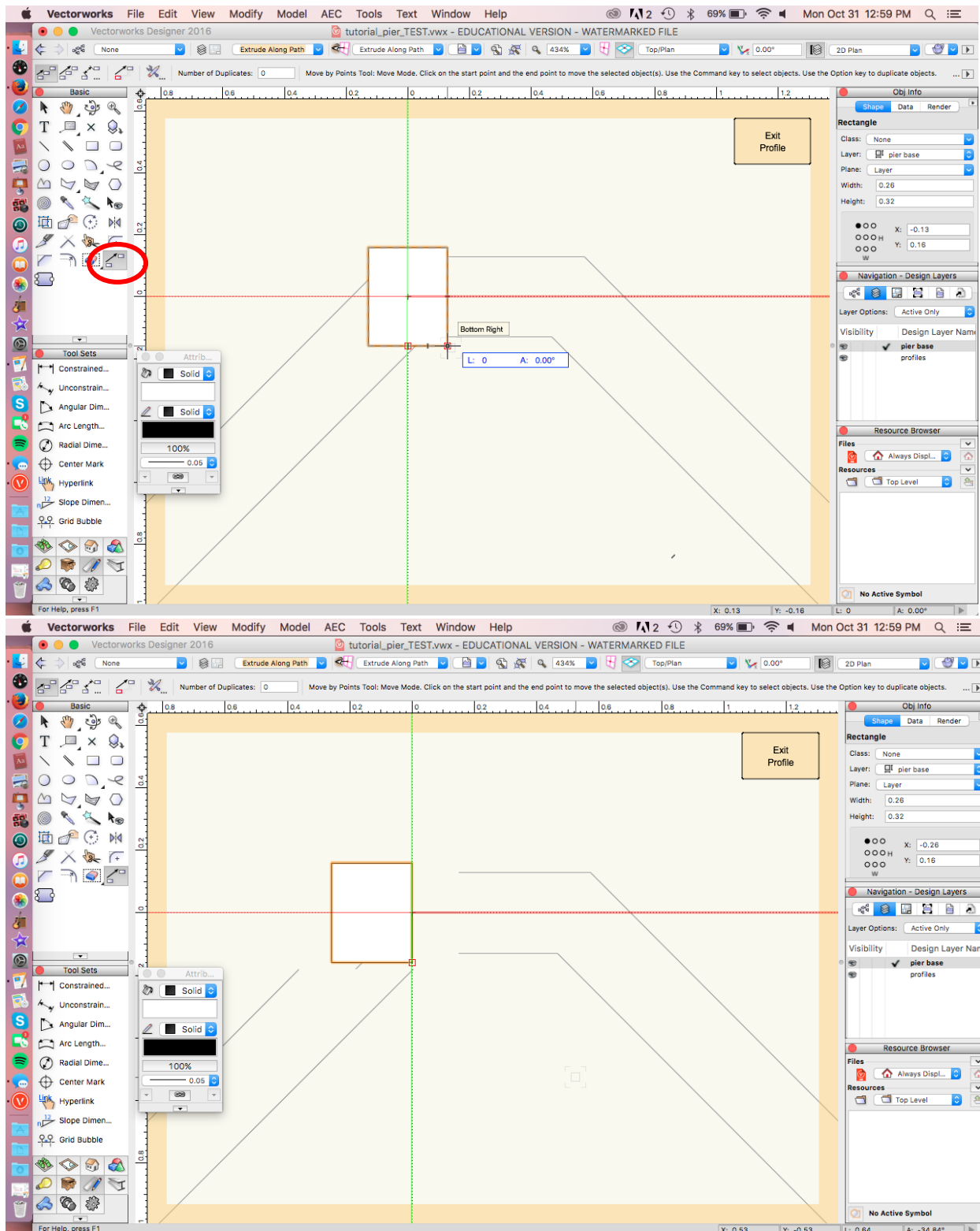
4. You have created a 3D object. To view it in 3D, click in the top right hand corner where it says **Top/Plan**. In the scroll down menu, select either **Right Isometric** or **Left Isometric**. This will change the view.



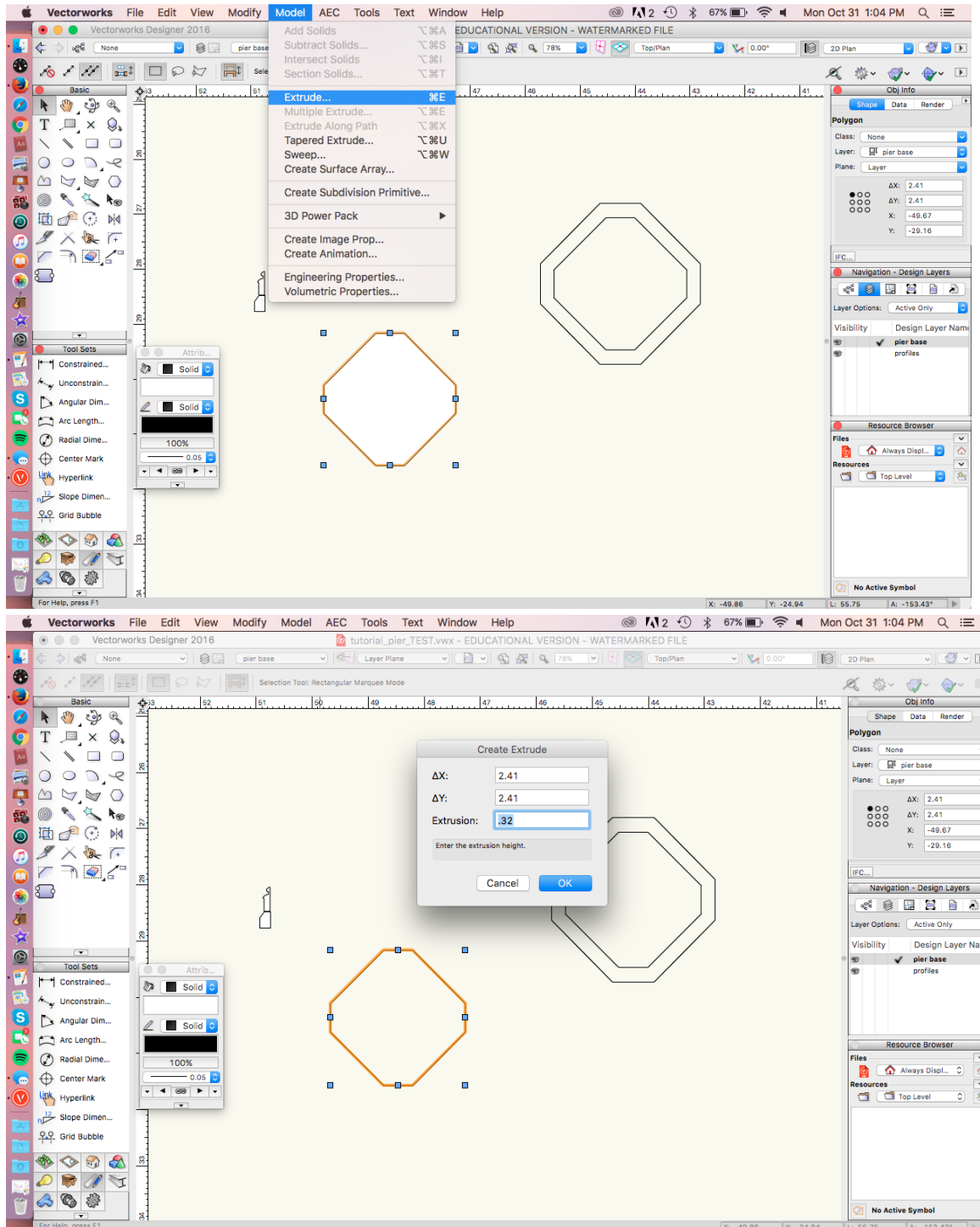
5. Return to **Top/Plan** view. To edit the profile, double click on your extrusion, and then select **Profile**. Or, right click and at the bottom of the pop up is an “Edit Profile” option.



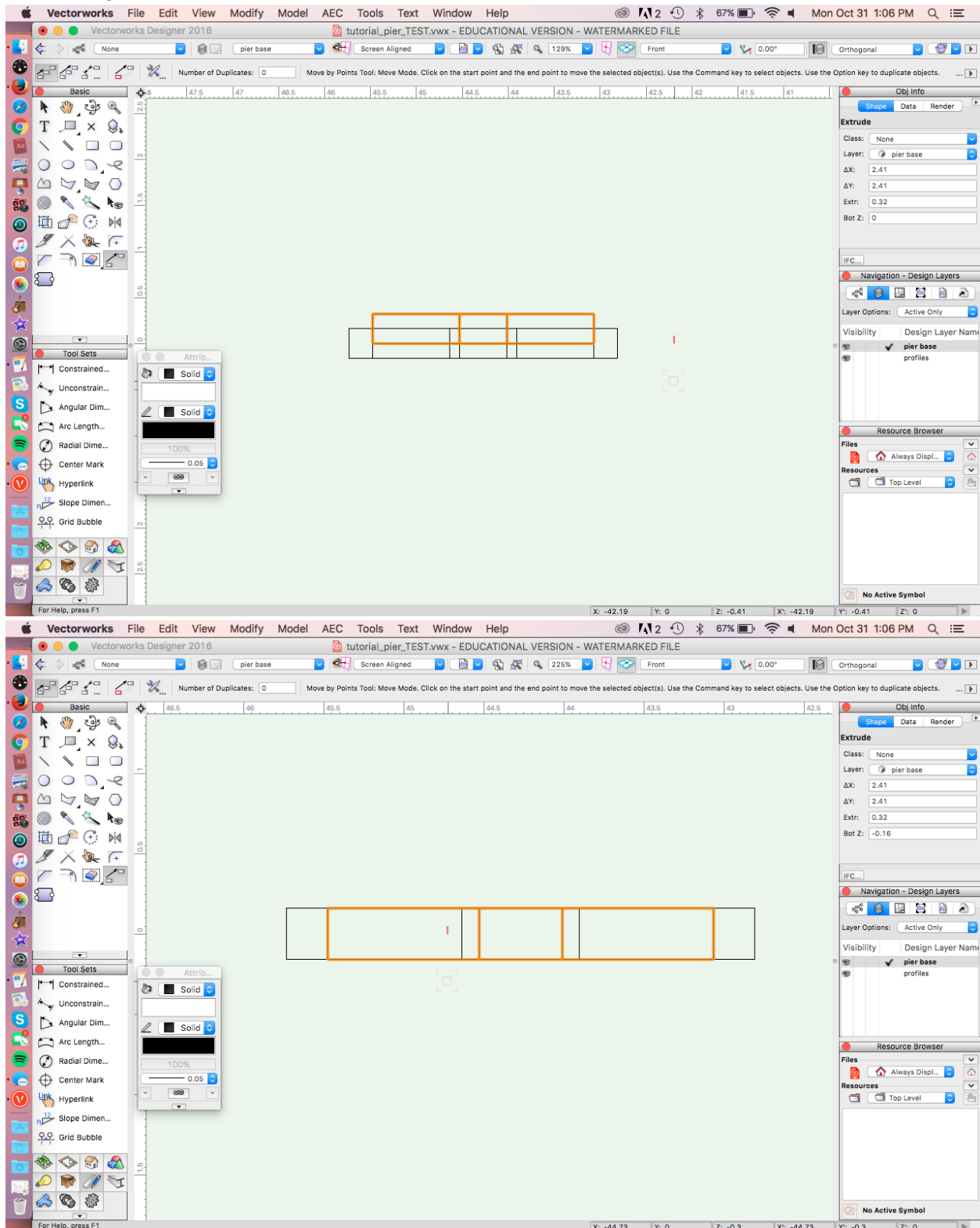
- As you can see, the profile has been extruded along its central axis. Use the **Move by Points** tool to change this so that the profile runs along the outside of the path, and the size of the base profile stays the same. Click **Exit Profile** in the top right corner to leave edit mode.



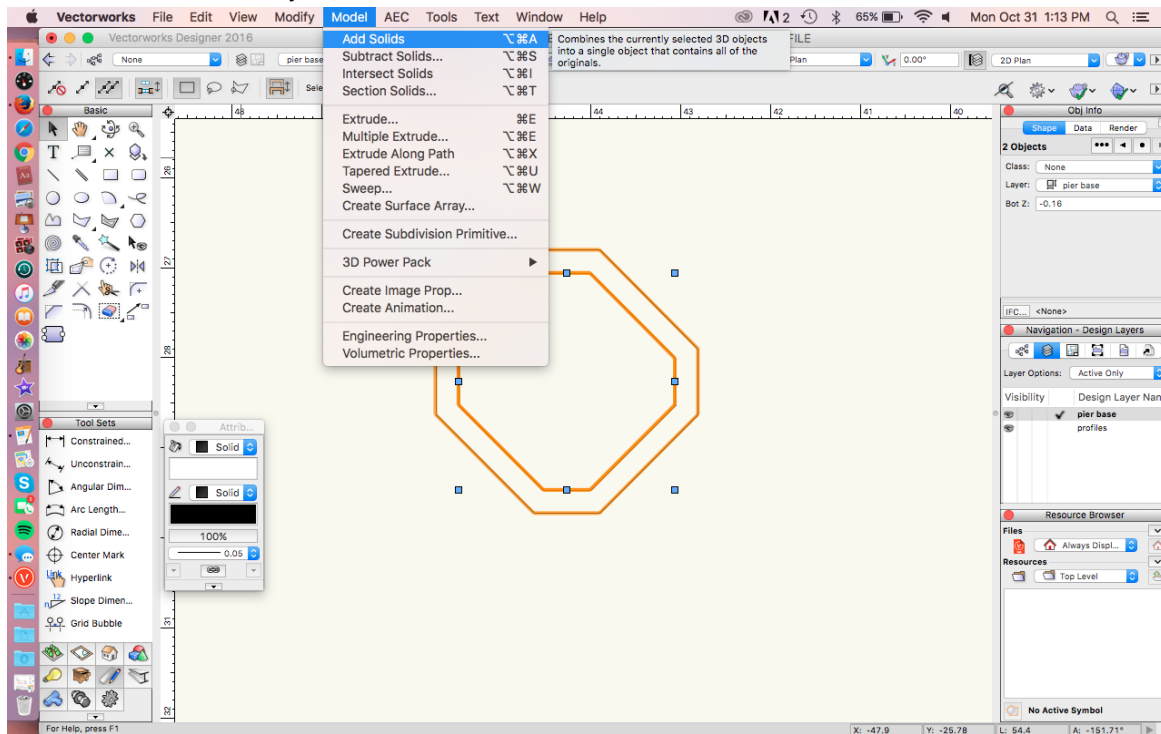
7. At the moment, the base is hollow, so we need to fill it. Go to front view so that you can see the height of your extrusion. Use the **Unconstrained Linear** dimension tool to measure the height of the bottom layer, then return to **Top/Plan** view.
8. Select the copy of the bottom layer and select **Model > Extrude**. In the pop-up window, enter the height of the bottom layer, which you measured in the step above. It will be extruded to. Fit it inside the extruded base.



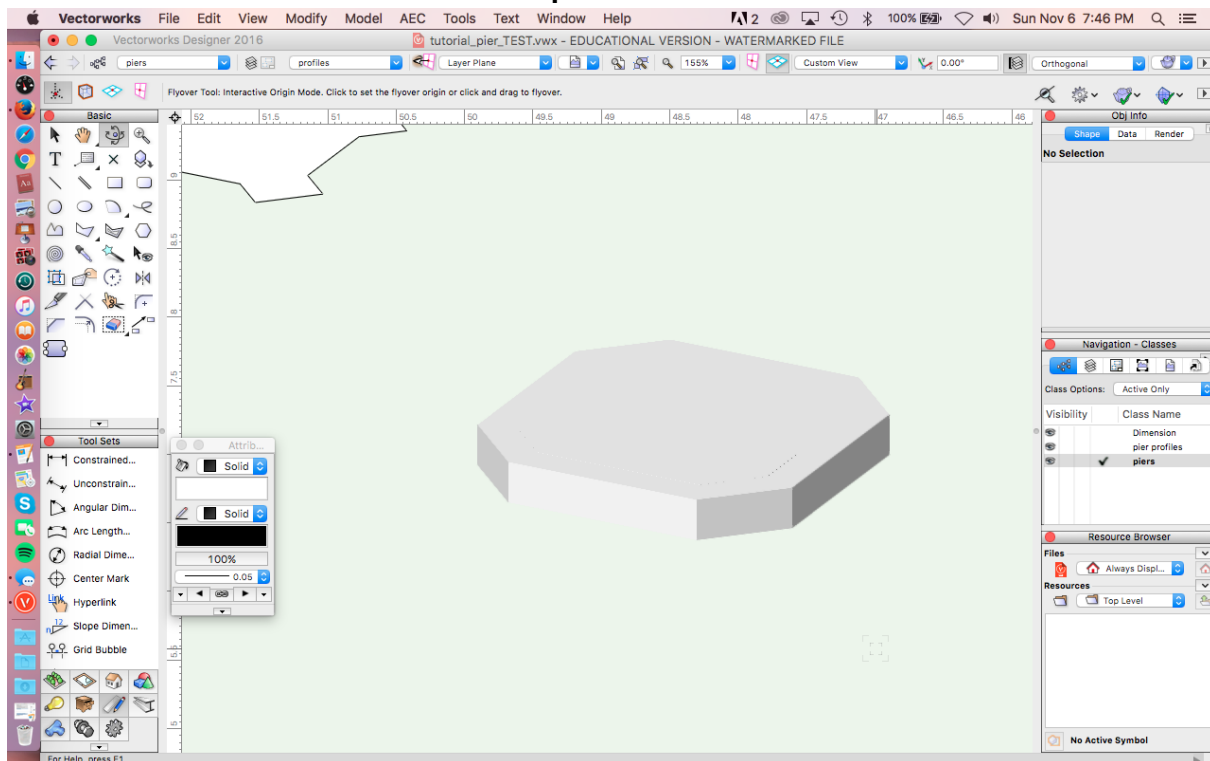
- Return to **Front** view and make sure that the two shapes are lined up. Use the **Move by Points** tool to move them into place. Return to **Top/Plan** view to make sure they are still aligned.



10. Select both objects, and select **Model > Add Solids**. The base is now one solid shape.

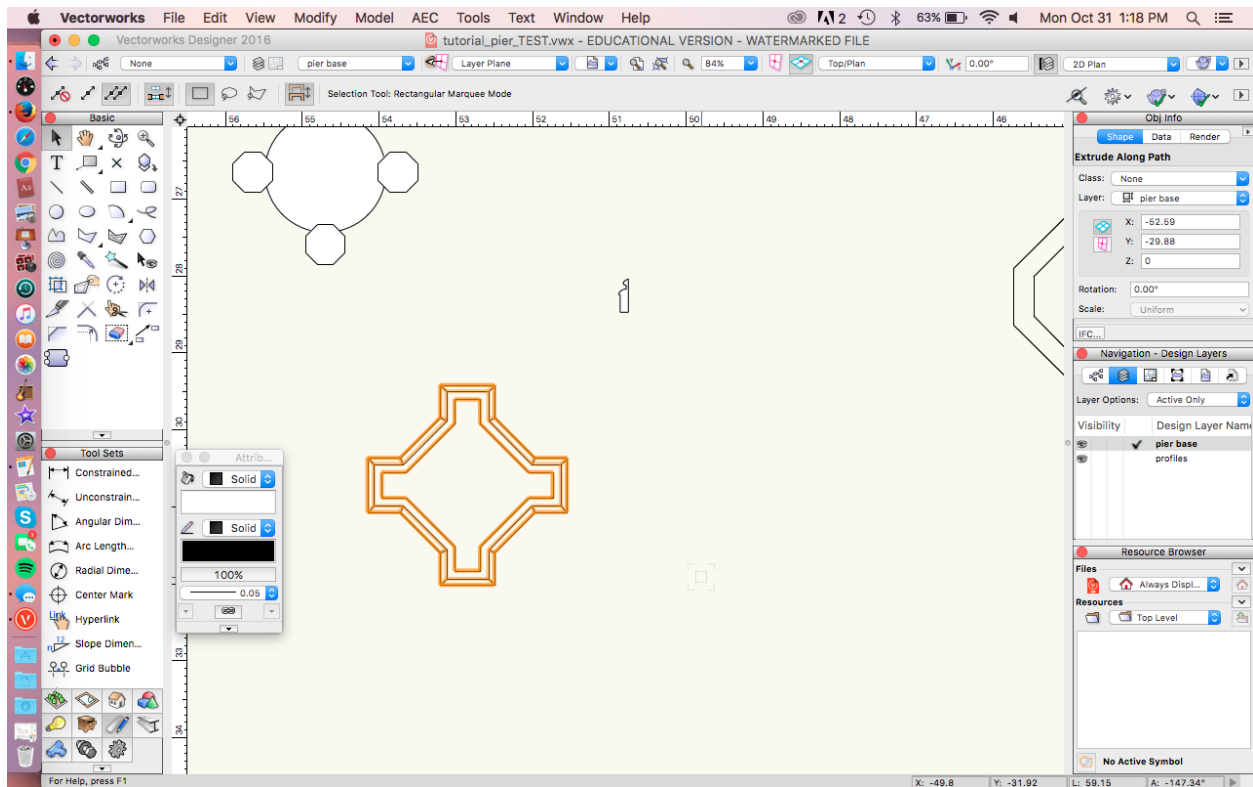


11. To properly view the solid base, go to **Right Isometric** or **Left Isometric** view. Now select the icon that looks like a tea kettle in the upper right-hand corner to change the render mode from **Wireframe** to **Open-GL**.

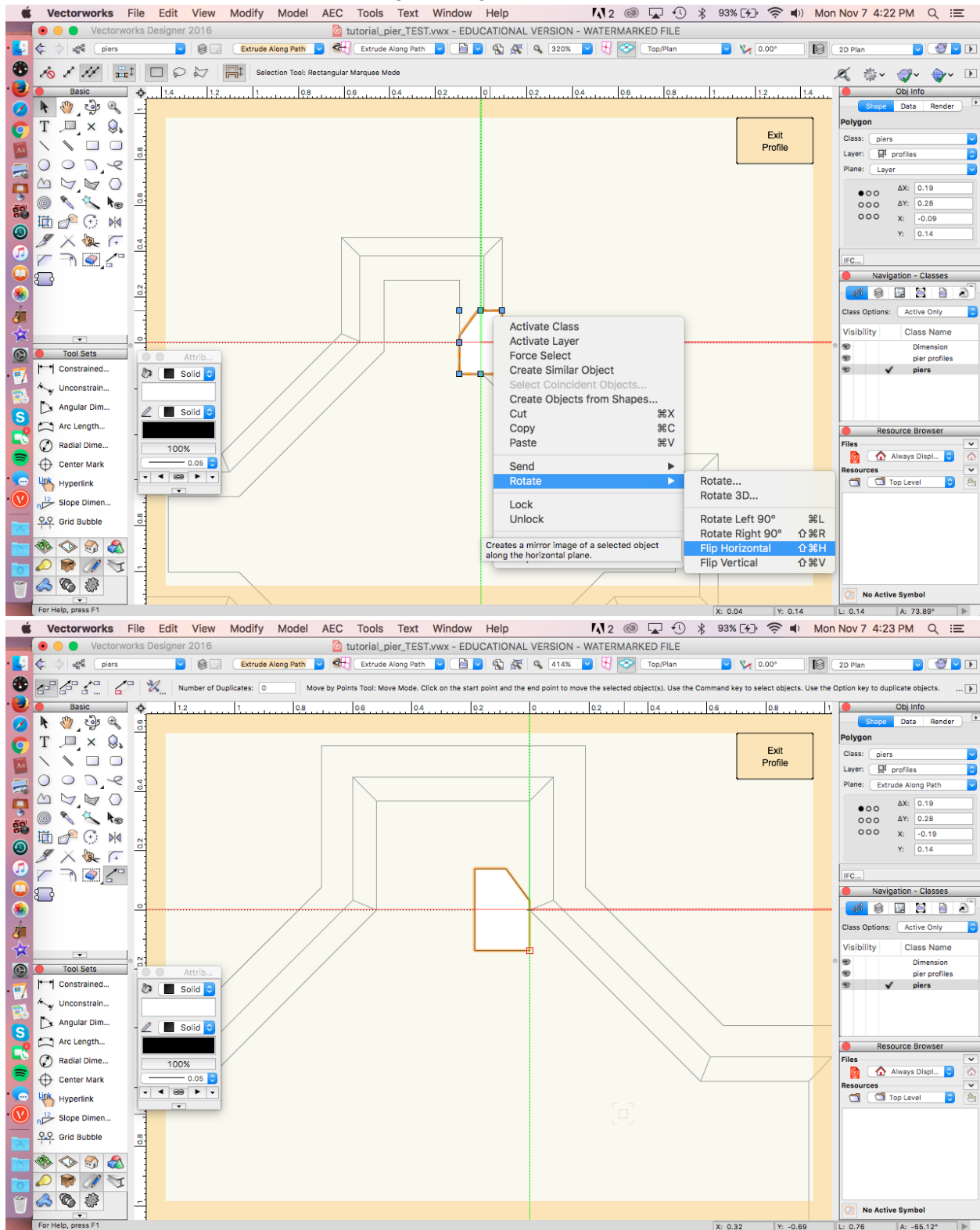


Step 8. Model the middle and top layers of the base

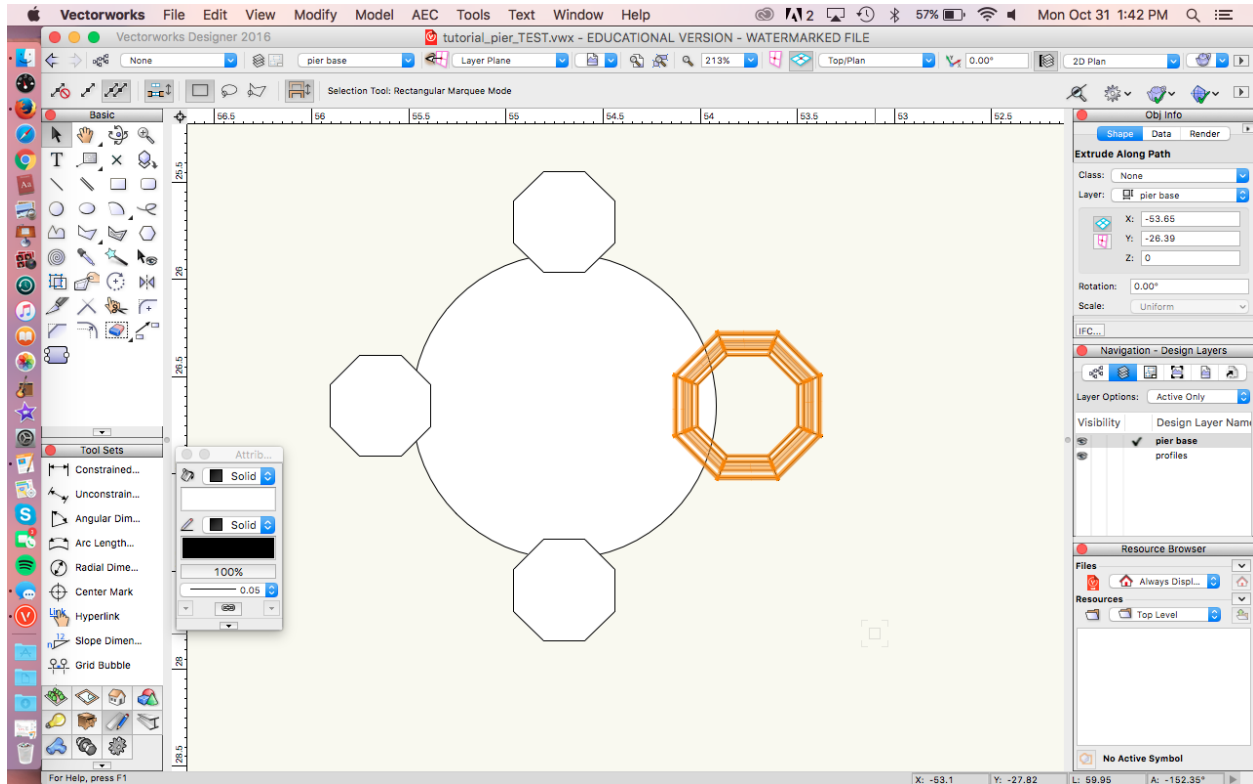
1. Return to **Top/Plan** view. Select the middle layer of the base and the middle layer of the molding profile. Go to **Model > Extrude Along Path**.



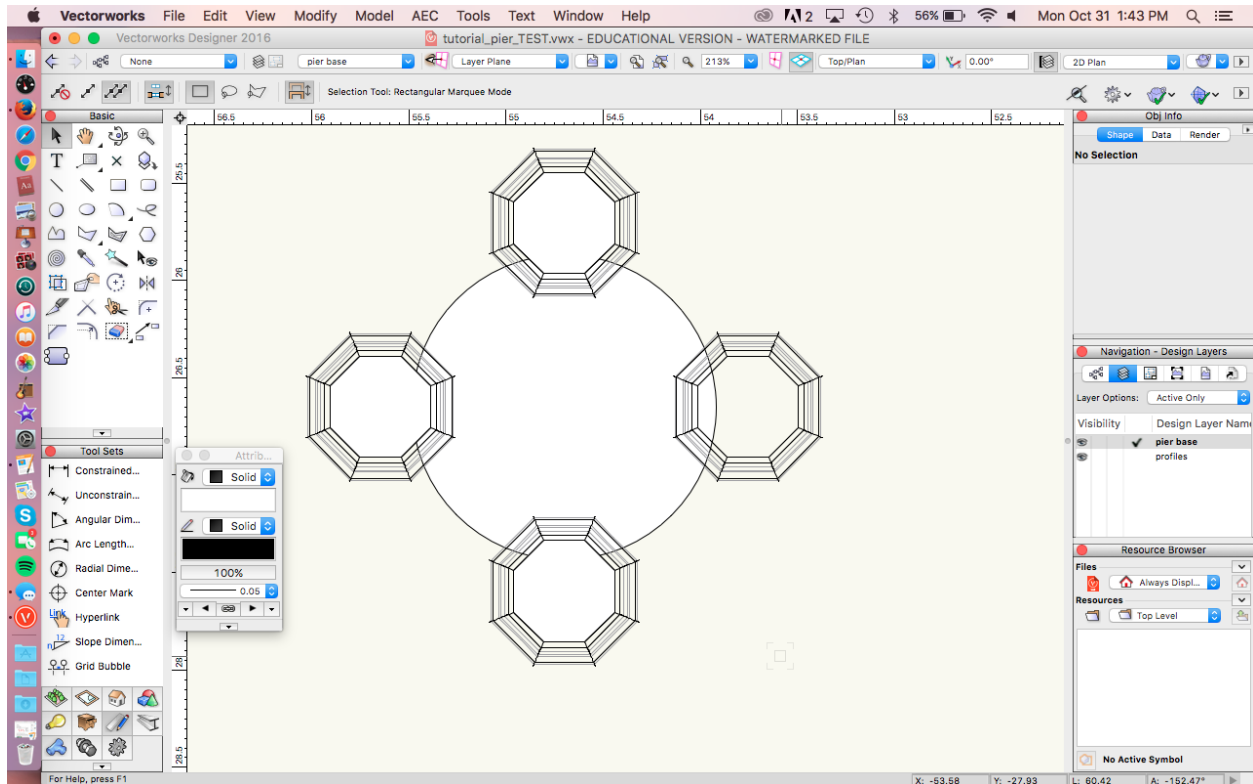
2. Double click on the extrusion and edit profile. As you can see, the molding profile is situated the wrong way - it's facing inward. Right-click on the profile to flip it horizontally and move it so that it runs along the edge.



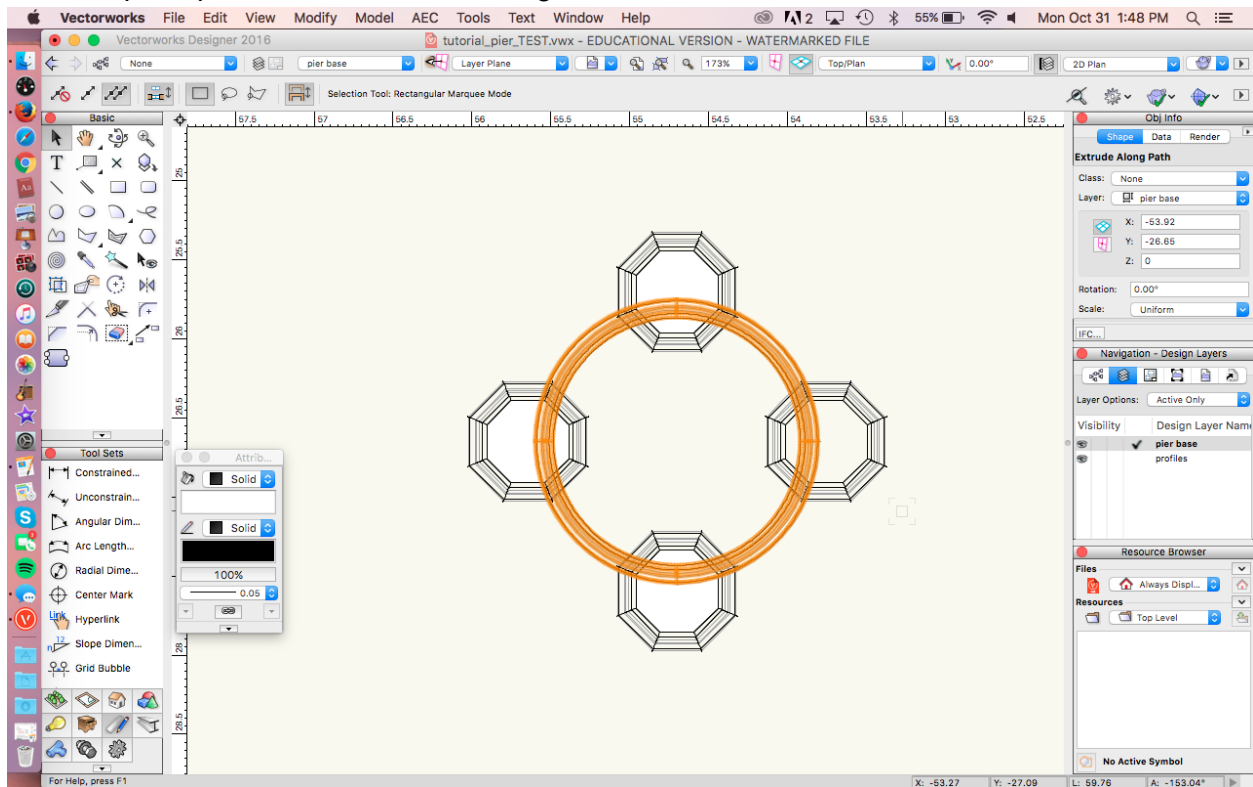
3. Because the top layer of the base is so complex, you will have to extrude each colonnette and column individually. Before you extrude, make a copy of both the top layer base profile and molding profile.
4. Extrude the top layer of the molding profile along one of the colonnettes. Once again, enter the extrusion and flip and move the profile along the outside edge.



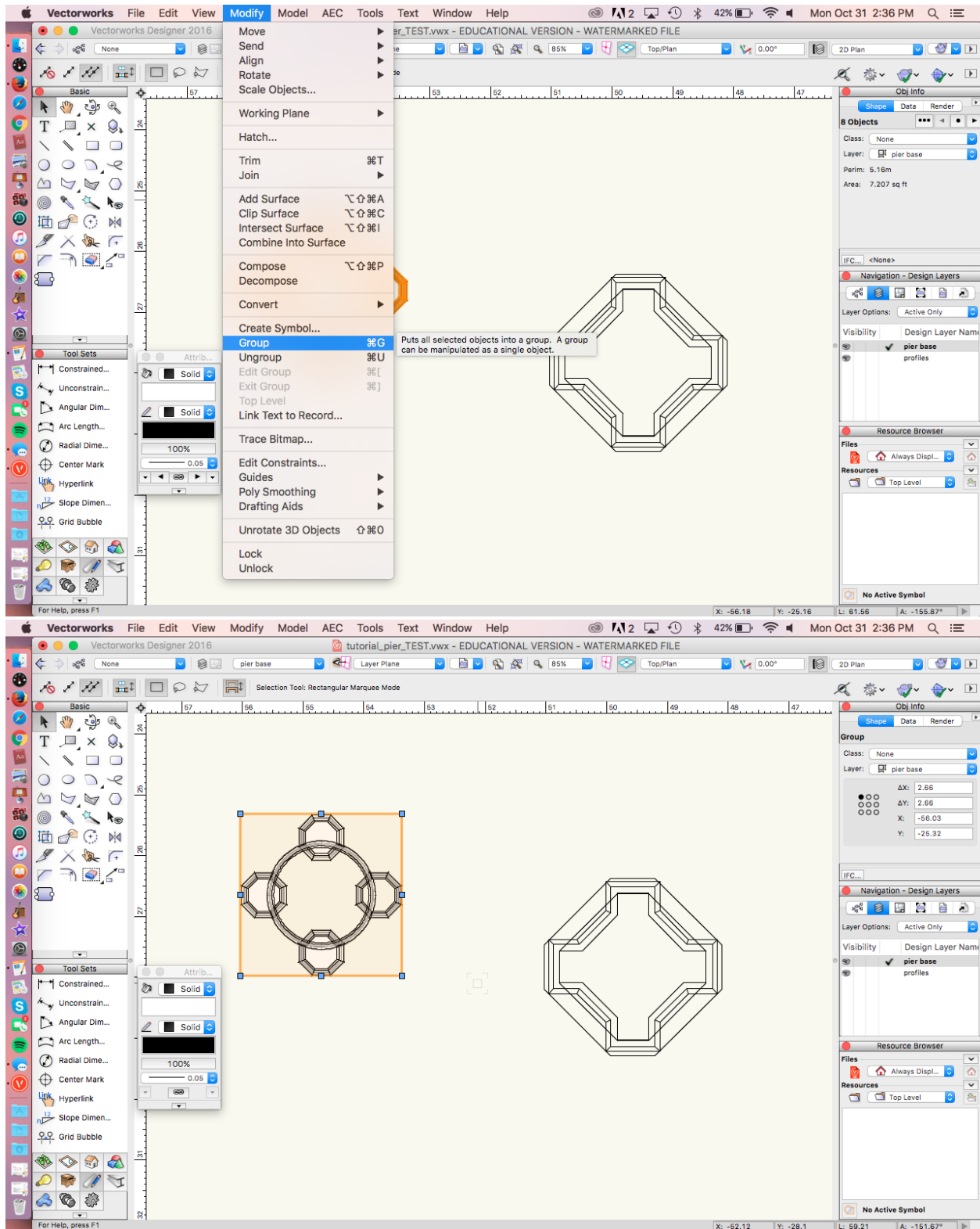
5. Use the **Mirror** tool to create the other three colonnettes.



6. Use the second copy of the molding profile to extrude the central column, making sure to flip the profile and move to the edge.

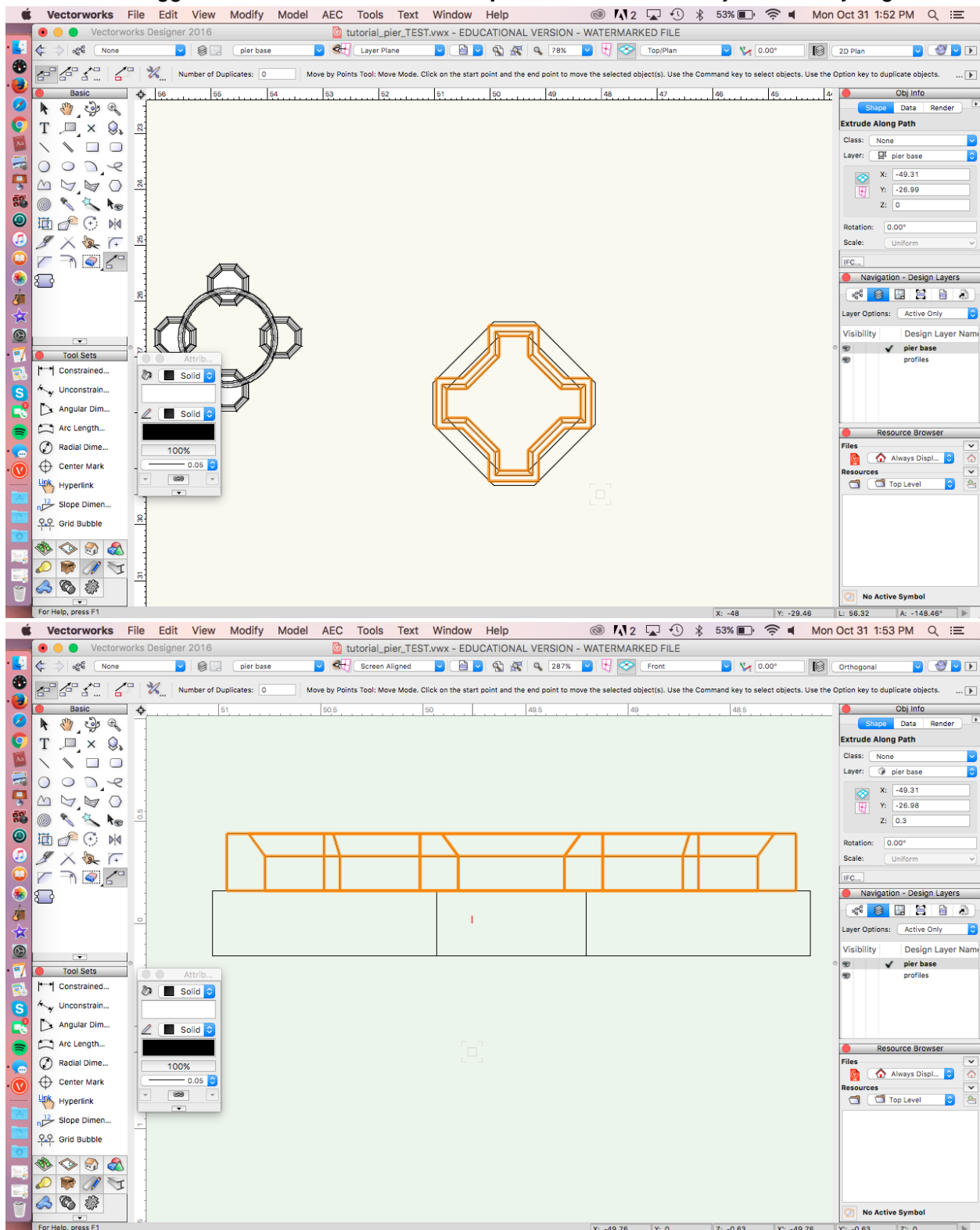


7. Select the five components of the top layer. To group the components, go to **Modify > Group**.

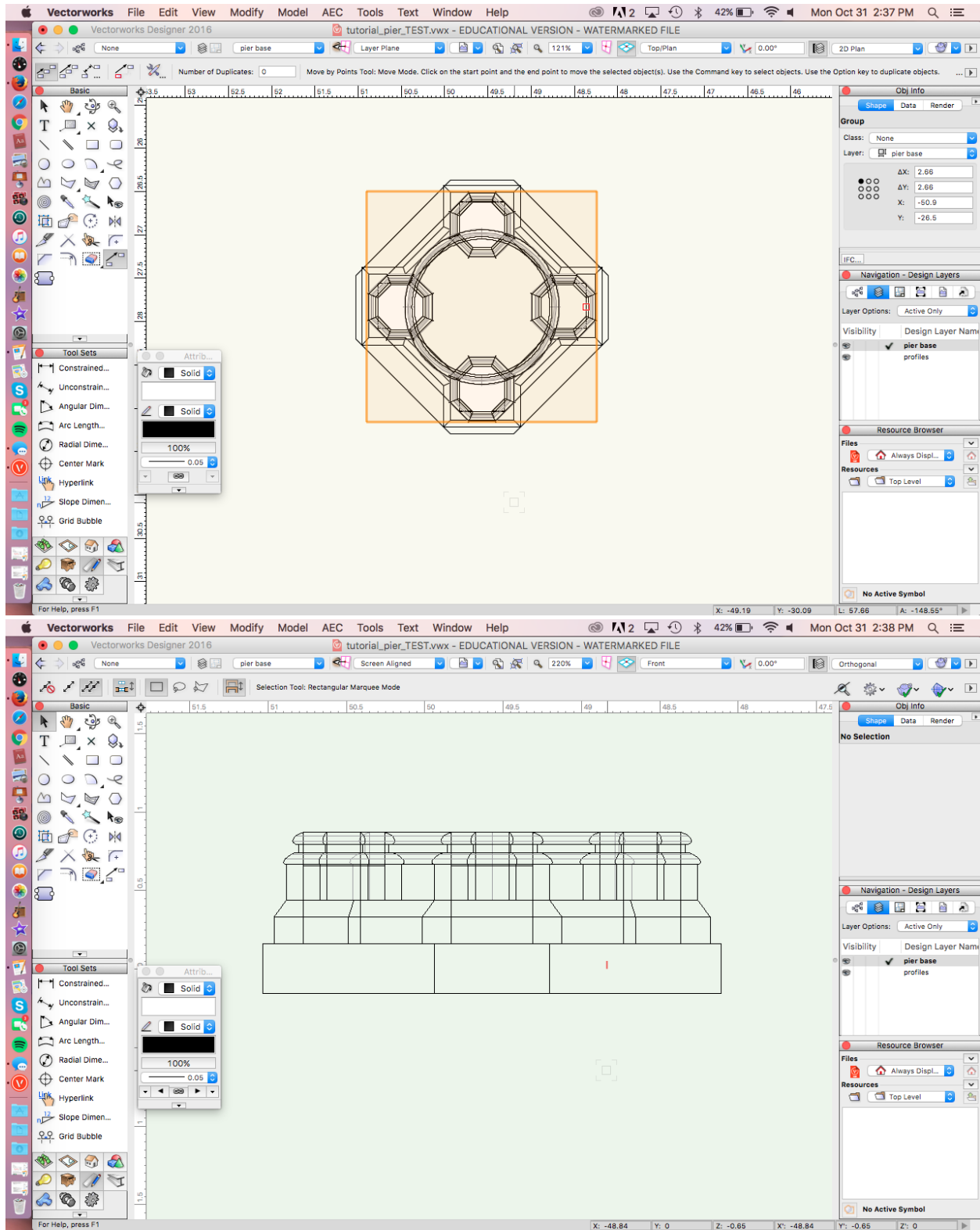


Step 9. Assemble the base

1. Starting in **Top/Plan** view, align the bottom and middle layers using the **Move by Points** tool. Toggle between **Front** view and **Top/Plan** view until the layers are fully aligned.

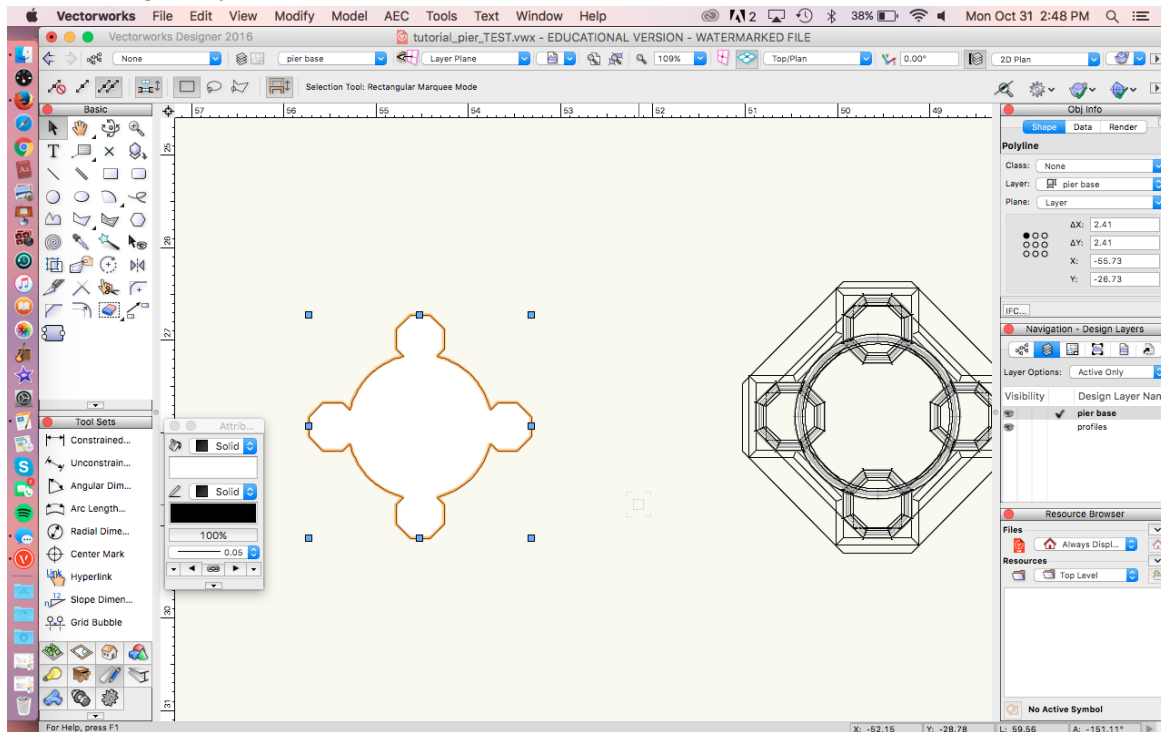


2. Align the top layer to the other two layers.

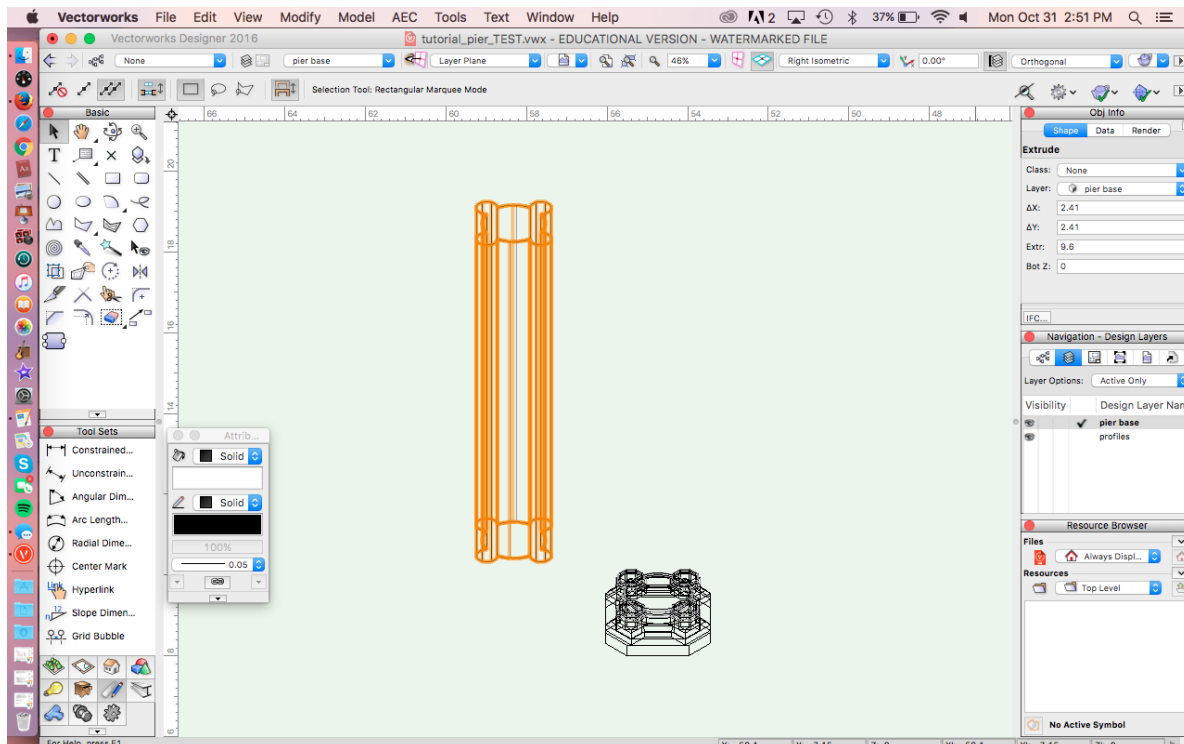


Step 10. Extrude the pier column

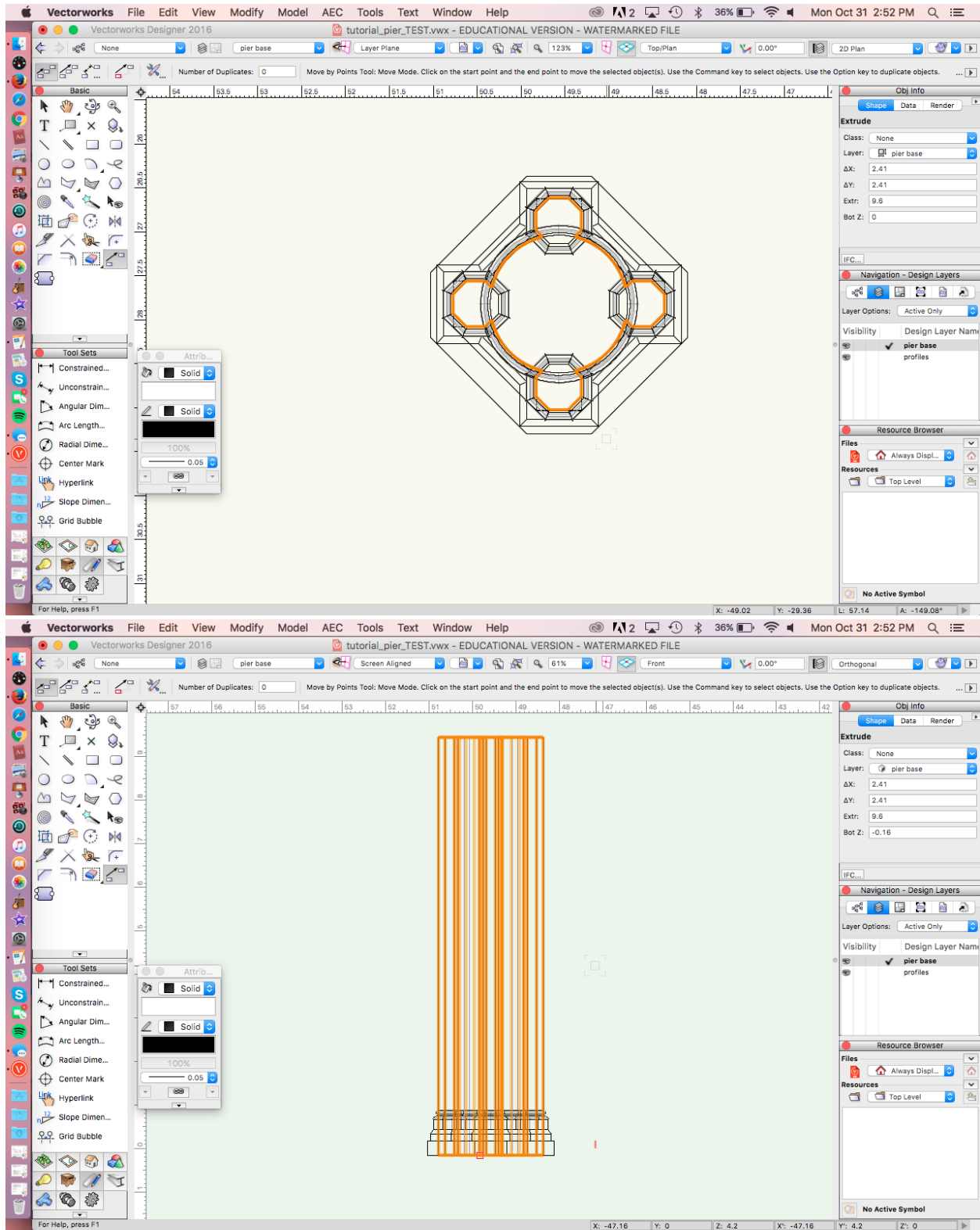
1. Select the second copy of the top layer, and go to **Modify > Add Surface** to create a single object.



2. Select **Modify > Extrude**, and enter 9.6m, the height of the pier, into the pop-up window. Click OK.

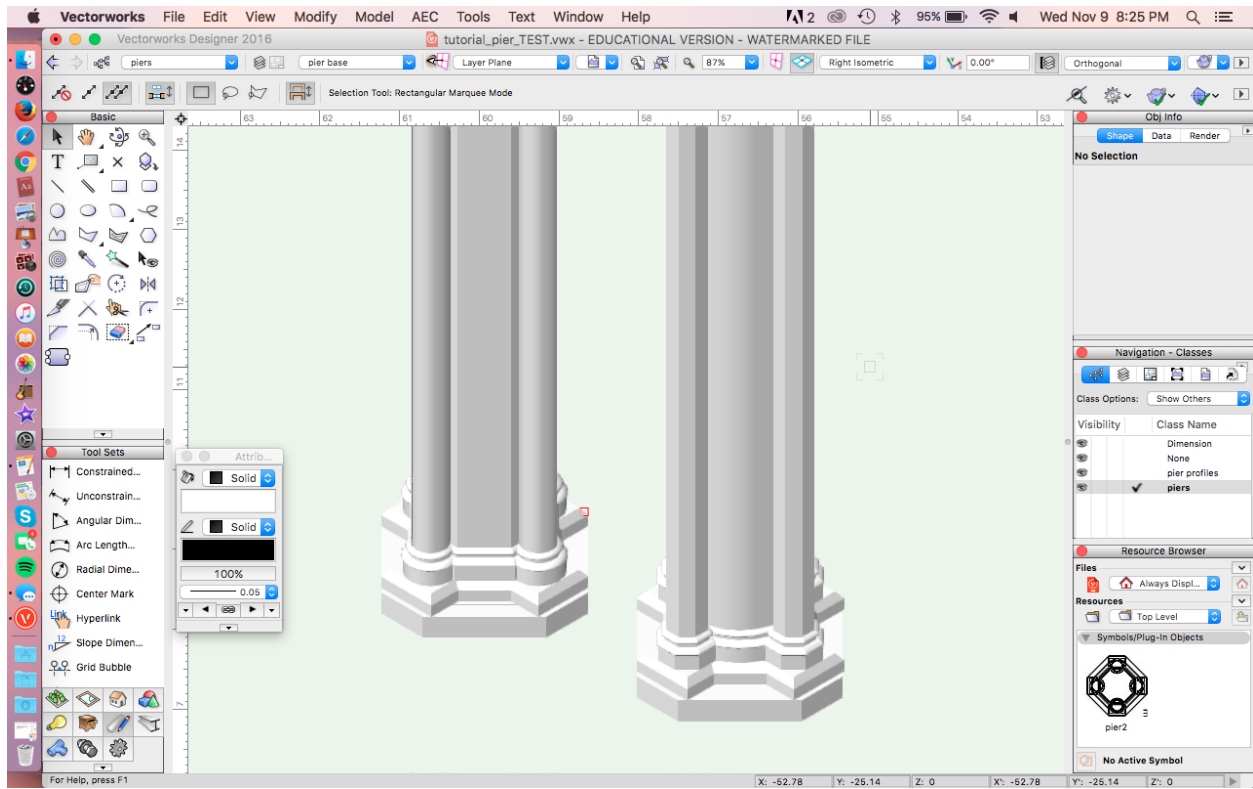


3. Align the column with the base.



Step 11. Model the hexagonal pier

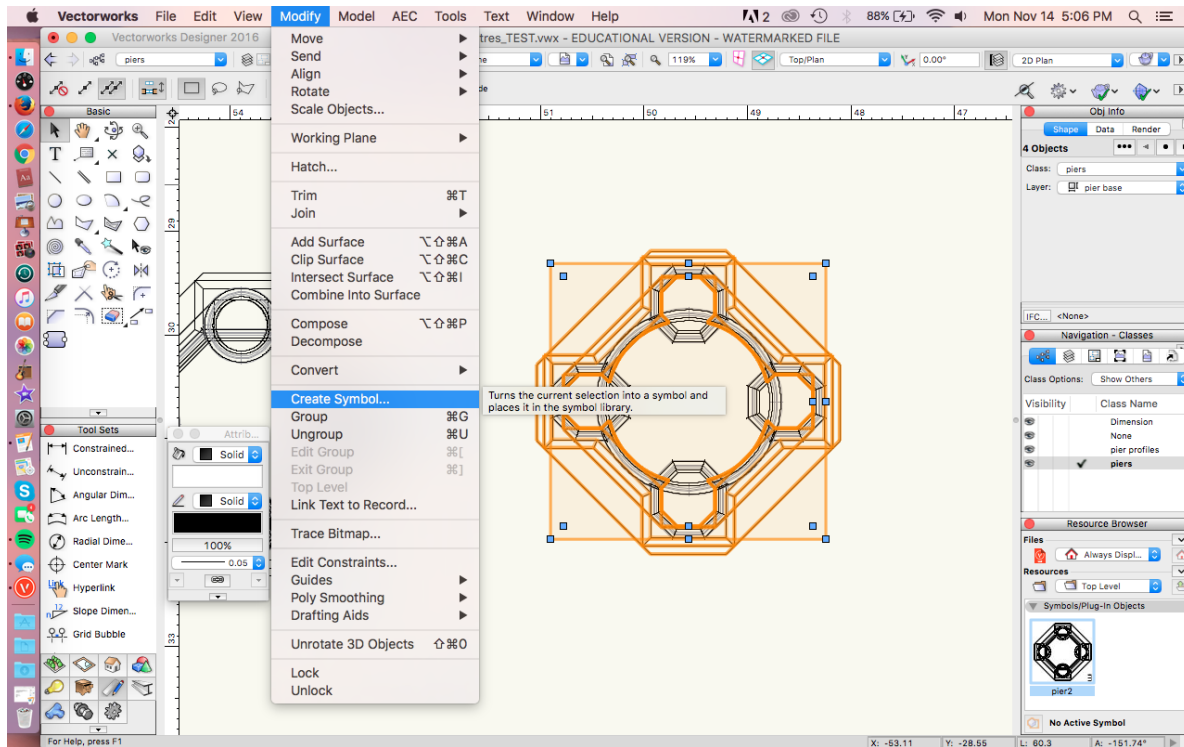
1. Repeat steps 7-10 to create the second pier.



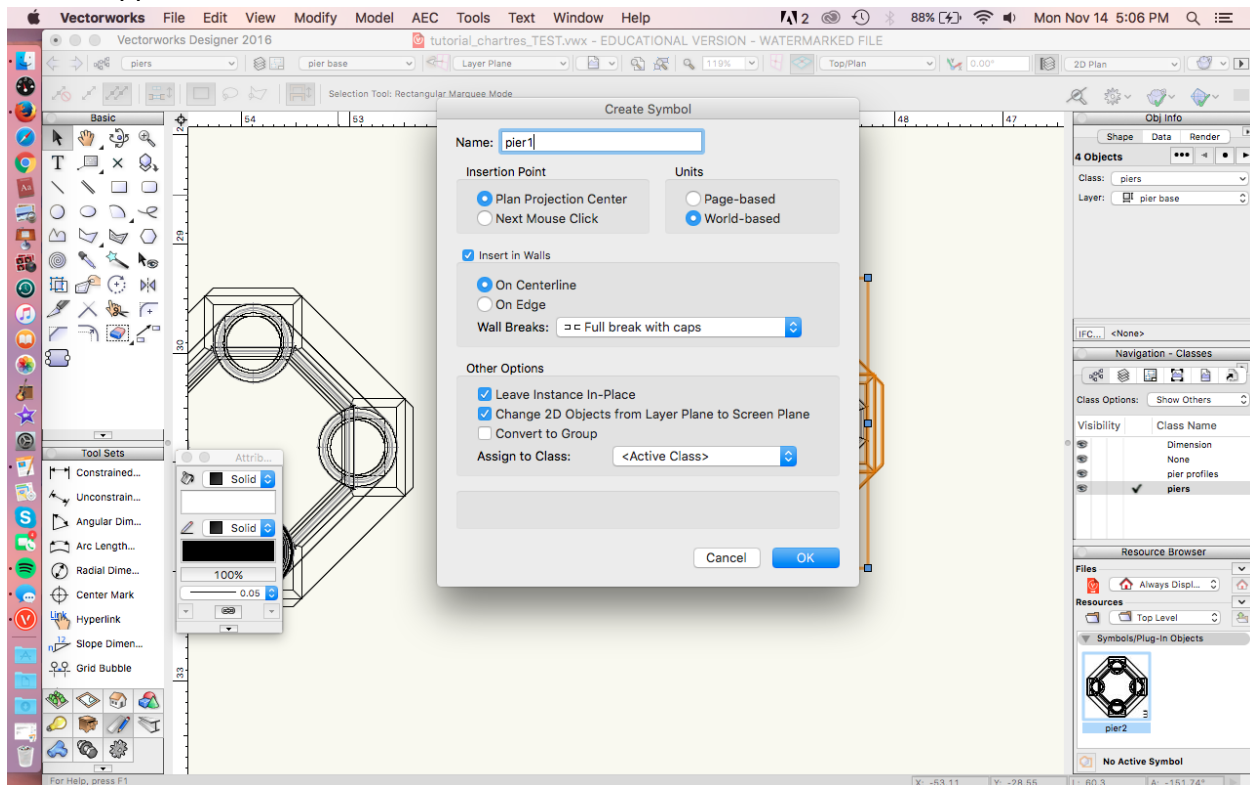
Step 12. Create symbols

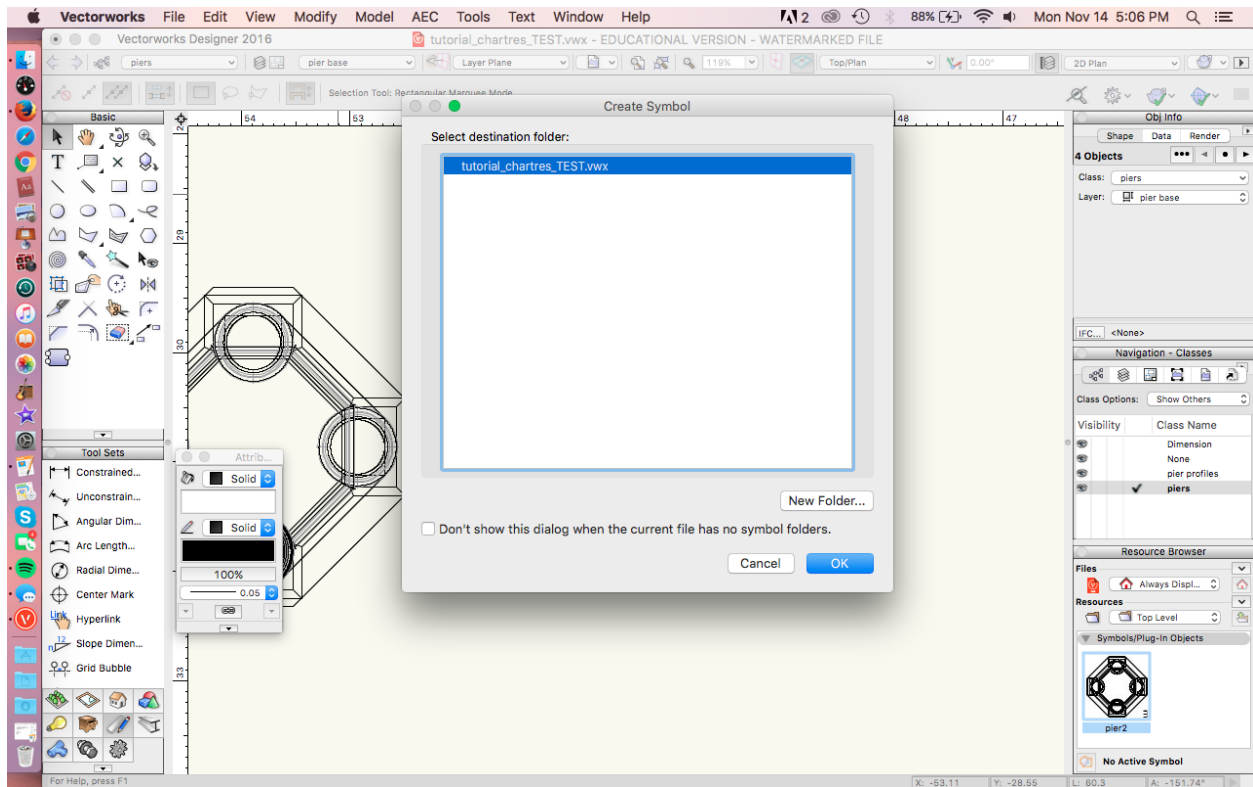
Symbols are instances of an object. Using symbols will allow you to edit an object globally in your document as well as help you maintain file size. Symbols are stored in the **Resource Browser**. For how to use symbols refer to: http://app-help.vectorworks.net/2016/eng/VW2016_Guide/Symbols/Creating_New_Symbols.htm

1. Return to **Top/Plan** view. Select all the components of one of the piers, and select **Modify > Create Symbol**.



2. Name the symbol “pier 1”. Select your file as the destination folder and the symbol will appear in the **Resource Browser**.





3. Repeat steps 1-2 for the other pier, naming it “pier 2”.

In this tutorial, you constructed the base and shaft of the nave piers. To do this you:

- Divided the base profile into three levels using the polygon and mirror tools
- Traced the molding profile in three levels using the polyline and polygon tools
- Extruded each level separately to create the base
- Extruded the pier itself