

## Drawing the floor plan of Chartres Cathedral

### Overview:

- Step 1. Set document to class template
- Step 2. Import the plan
- Step 3. Scale the plan
- Step 4. Organize your work into design layers
- Step 5. Drawing the nave walls
- Step 6. Drawing the apse
- Step 7. Drawing the west towers and narthex
- Step 8. Drawing the buttresses
- Step 9. Drawing the pier bases

### Learning Objectives for this tutorial:

- 1. Importing an image
- 2. Scaling objects
- 3. Measuring objects with Unconstrained Linear Dimension tool
- 4. Using the Basic Tools palette:
  - Line, Rectangle, Circle, Offset, 2D Polygon, Move by Points tools
- 5. Creating Design Layers
- 6. Drawing a 2D object
- 7. Adding surfaces
- 8. Building a 2D molding profile
- 9. Using the Duplicate Array tool

### Key dimensions for nave at Chartres Cathedral:

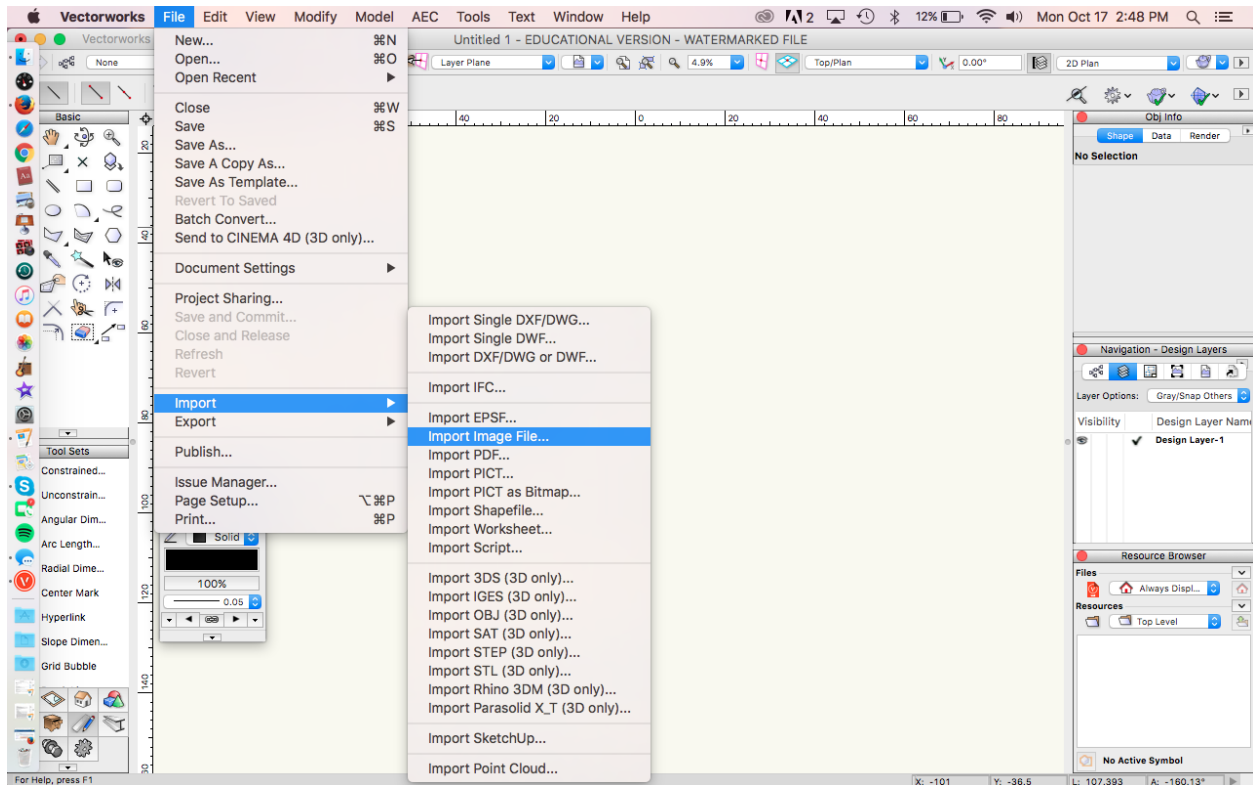
Nave width – 16.3m

Nave length – 130m

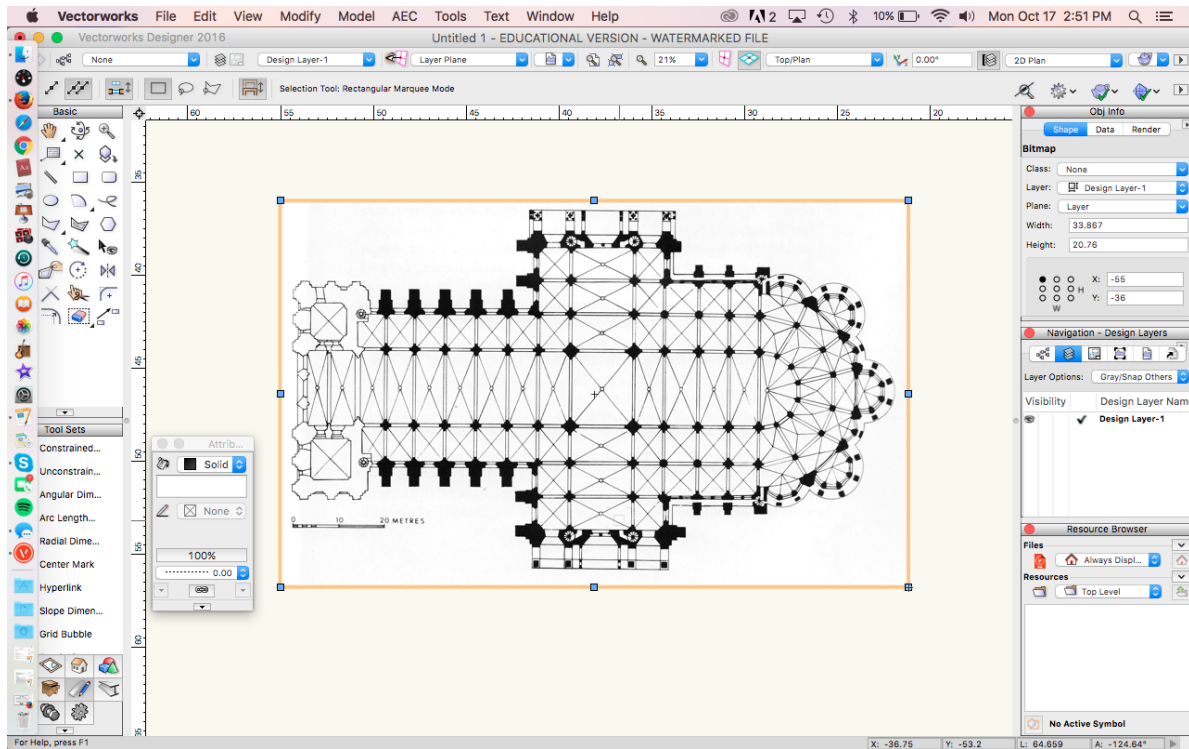
**Step 1. Set your document to the class template** located in the shared folder on Box (file name: digitalgothic\_doc.vwx). You must begin work from the template to ensure that you are working in the same scale and units (1/4-inch layer scale and unit of measurement set to meters) as the rest of the team.

## Step 2. Import the plan

1. Go to File > Import > Import Image File.
2. Click OK on the **Image Import Options** window.

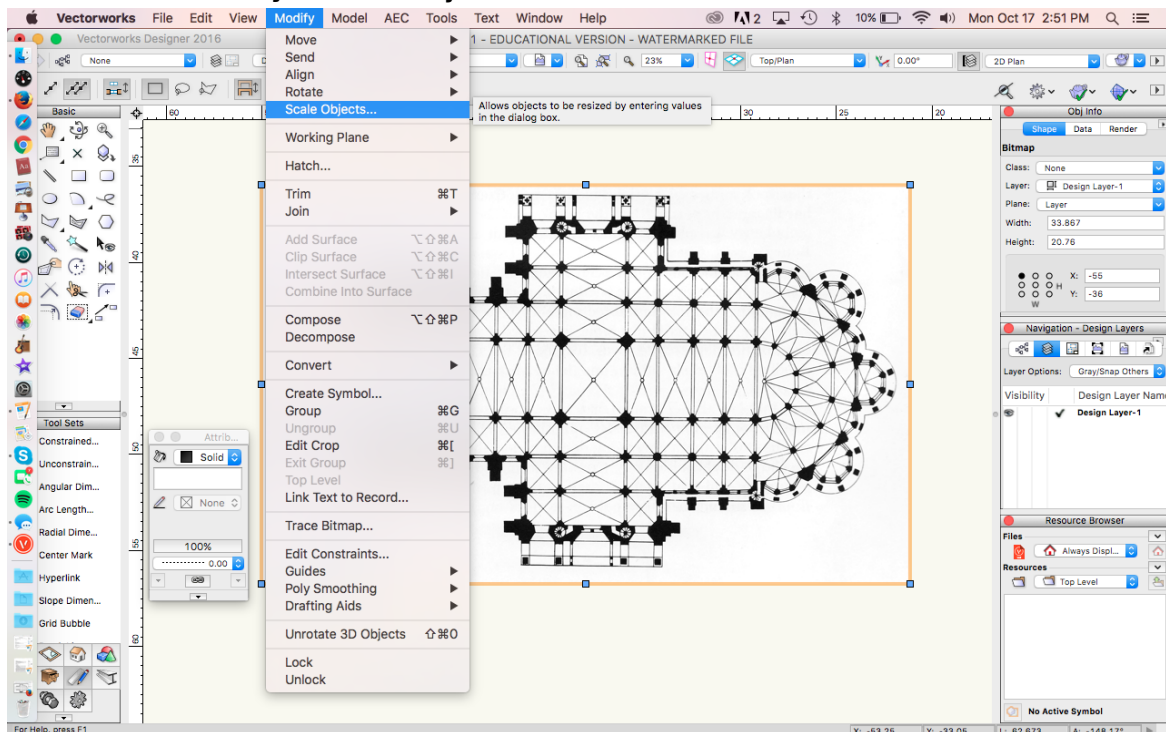


3. Navigate to the Chartres floor plan and import as a JPEG file (file name: floor plan\_chartres.jpg).

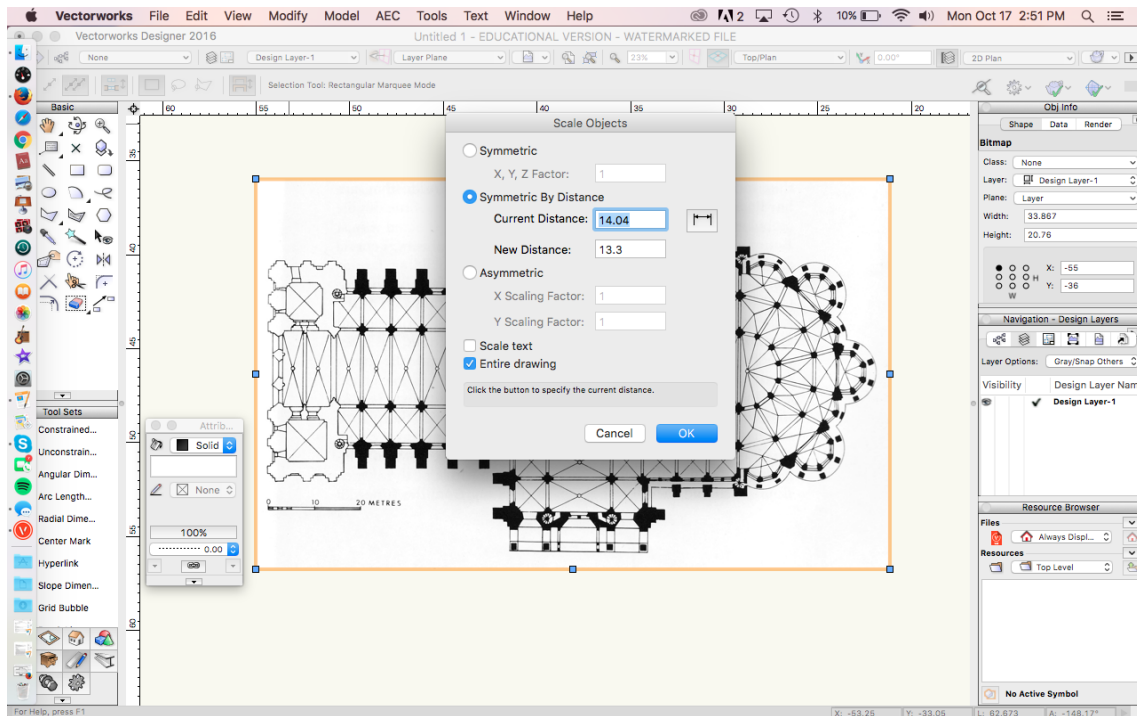


## Step 3. Scale the plan

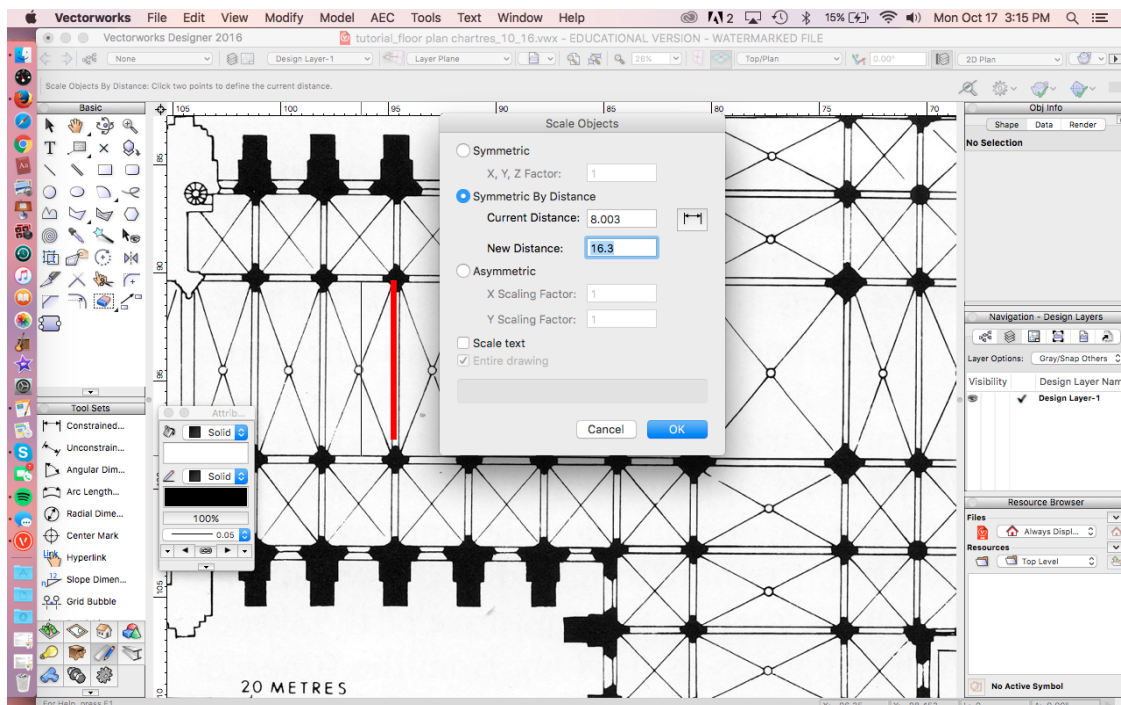
1. Select **Modify > Scale Objects**.



2. Select **Symmetric by Distance** in the pop-up window, then select the icon next to **Current Distance**. The goal is to scale the image to the actual size of Chartres. Use the known measurement for the width of the nave width for reference: 16.3 m.

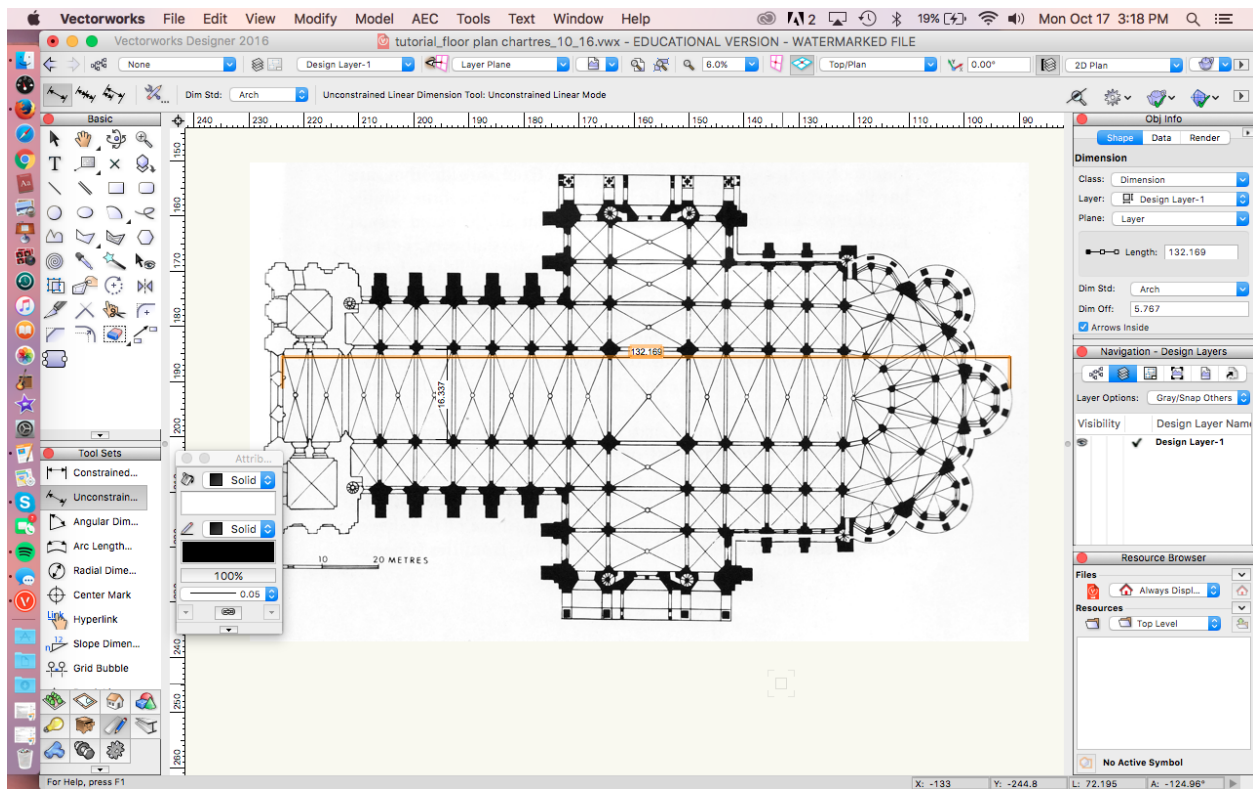
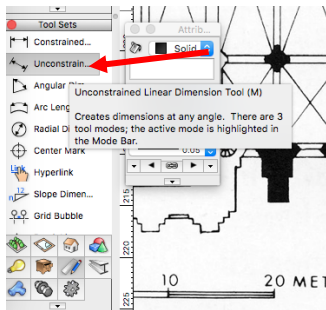


3. Measure between the two inner nave walls, and the window will reappear. A new number will appear in the **Current Distance** field, reflecting the current distance between the inner nave walls. Input 16.3 in the **New Distance** field.





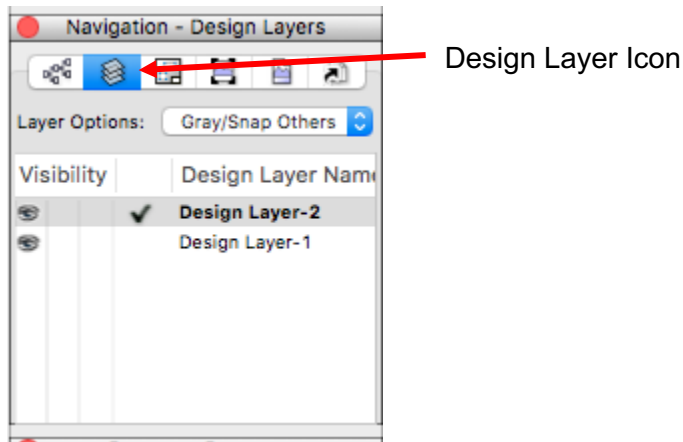
- Once your plan is to scale, use the **Unconstrained Linear Dimension** tool in the **Tool Sets** palette to check your scaling. Measure the length of the cathedral, which should be approximately 130m. If it's not, rescale the drawing.



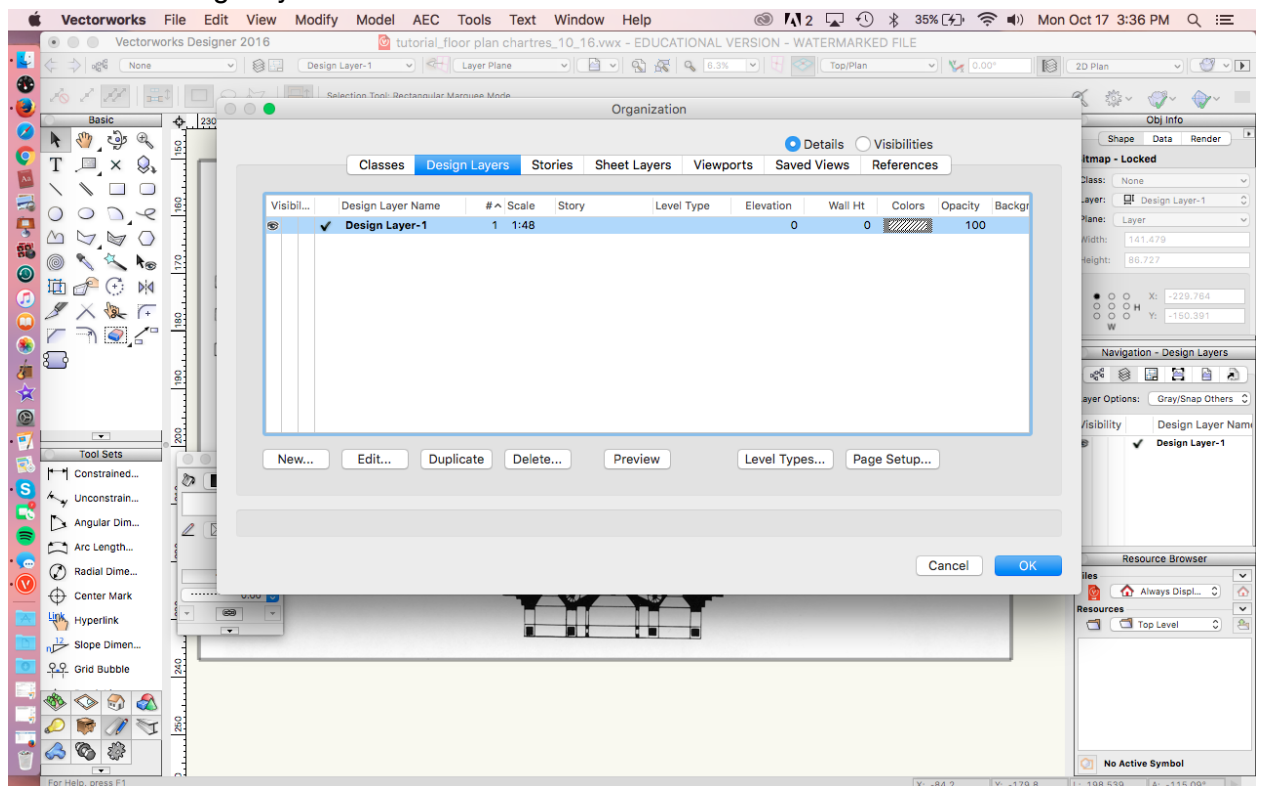
#### Step 4. Organize into Design Layers

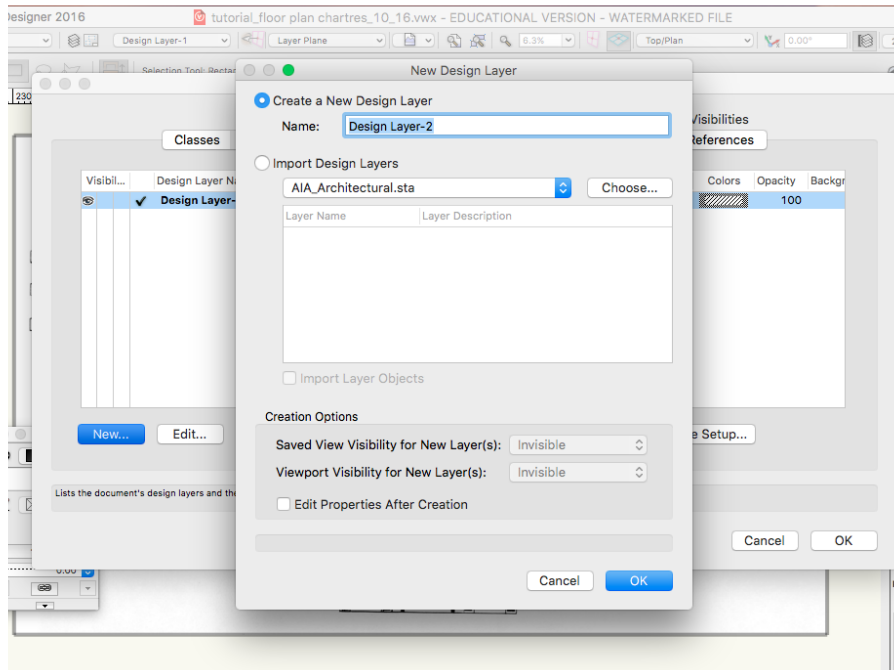
Move the floor plan image onto a new design layer so that you can reference the drawing without disturbing your own floor plan drawing.

1. Refer to the **Navigation** palette: Select the **Design Layer** icon to view **Layer Options**, **Visibility**, and **Design Layers**.

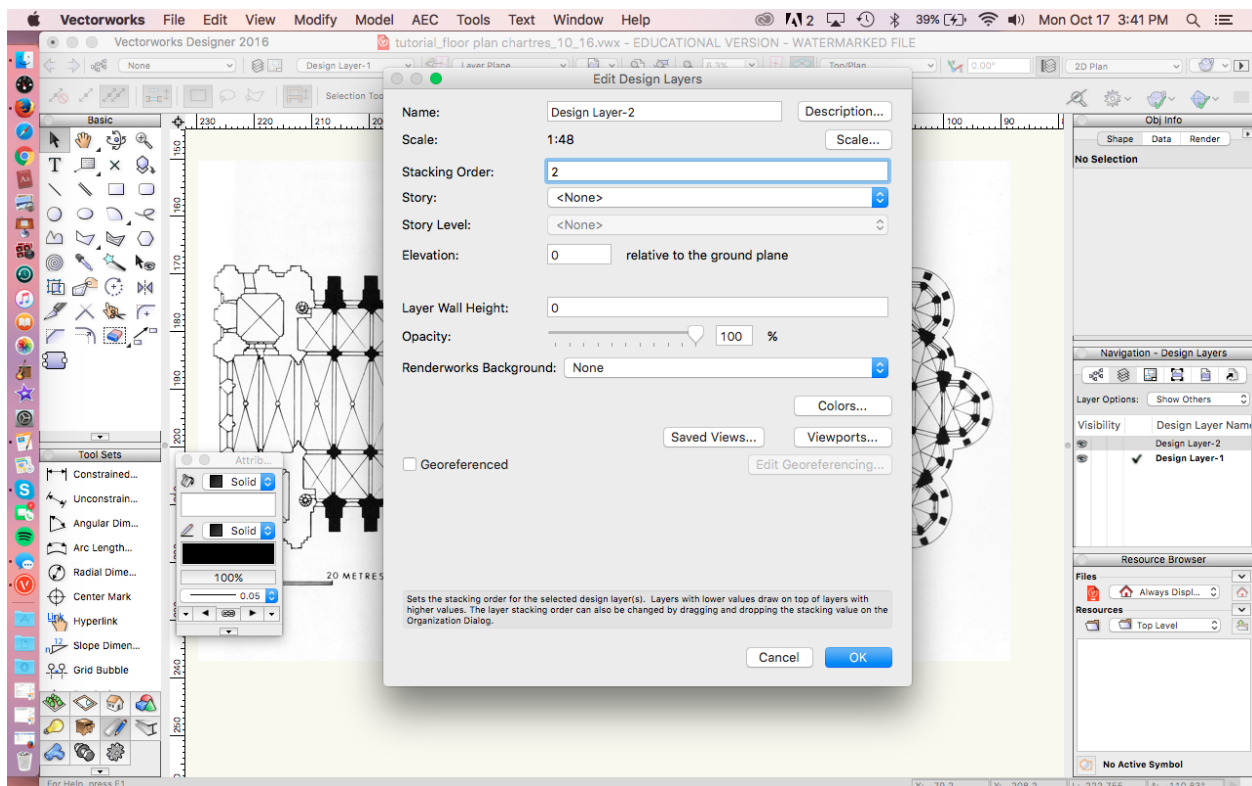


2. Double click on the Design Layer icon in the **Navigation** palette, and the “Organization” window will appear. Click the “New” button in the lower left corner. Enter a new name in the “Create a New Design Layer” name field, or leave as “Design Layer-2”. Click OK to create new design layer.

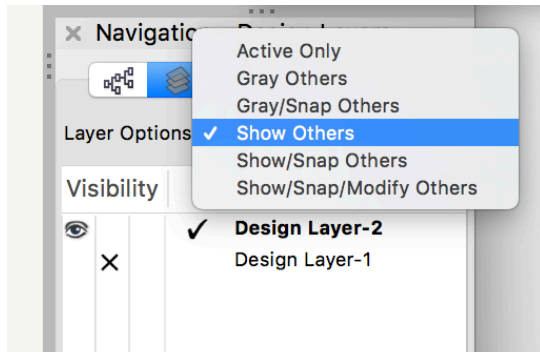




3. The stacking order of design layers is important, because the objects in the top layer will cover objects in the bottom layer. Therefore, be sure to place the floor plan image on Design Layer 1 and draw your floor plan on Design Layer 2. There are several ways to manage the stacking order of design layers. Refer to the introductory videos on Lynda.com.

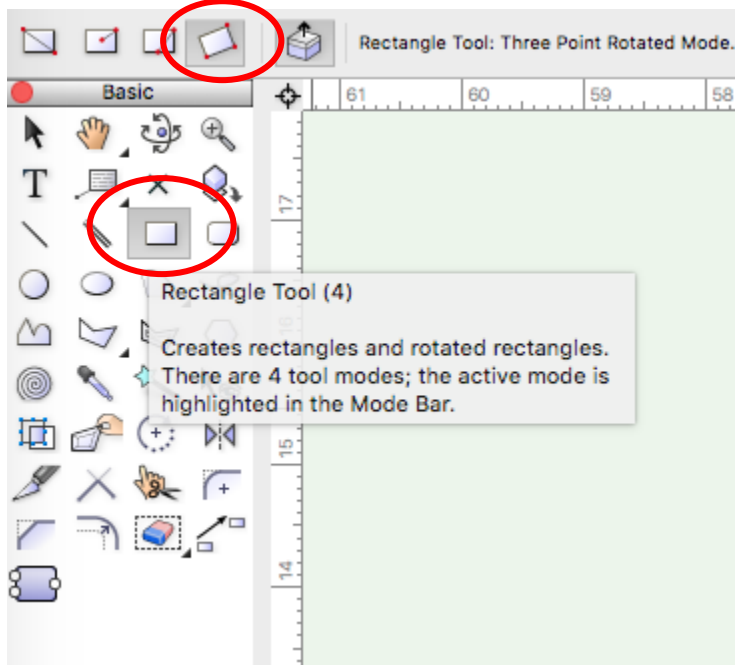


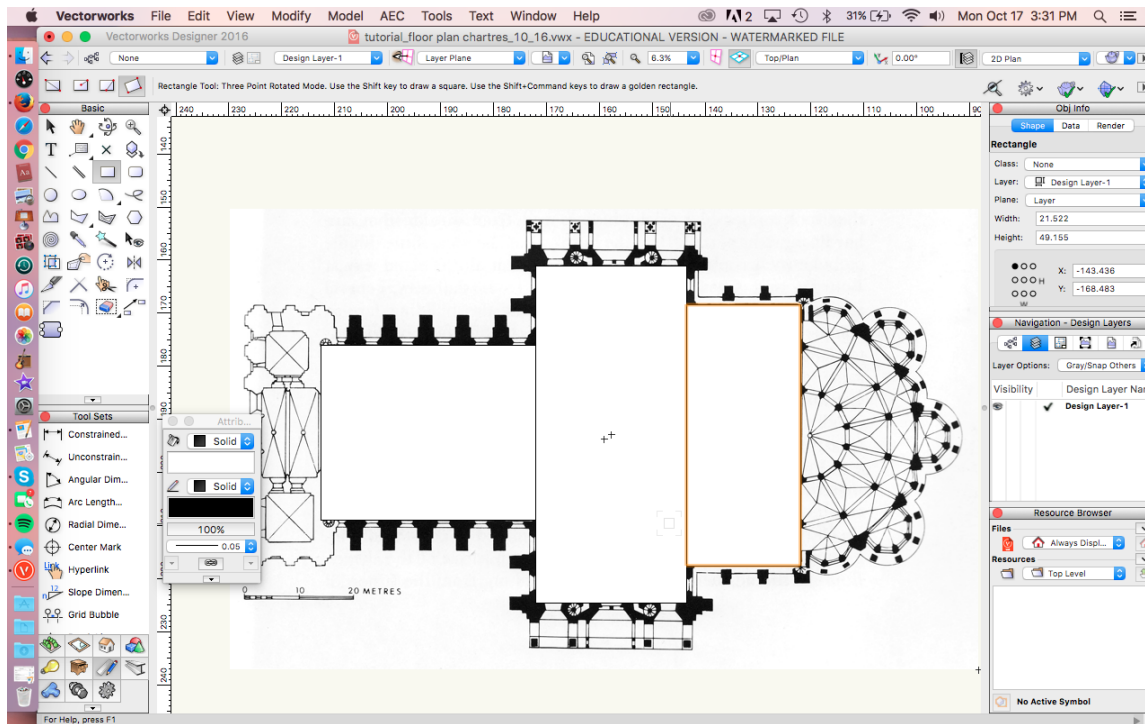
4. Under **Layer Options**, make sure that “Show Others” is selected. Make sure Design Layer 2 is the active layer, denoted by a checkmark.
  - To move an object to another layer, select it and change its design layer in the **Object Info** palette. In the **Navigation** palette, you can toggle the visibility of each layer so that you can view your plan without the drawing underneath. Refer to the Lynda.com introductory videos for review.



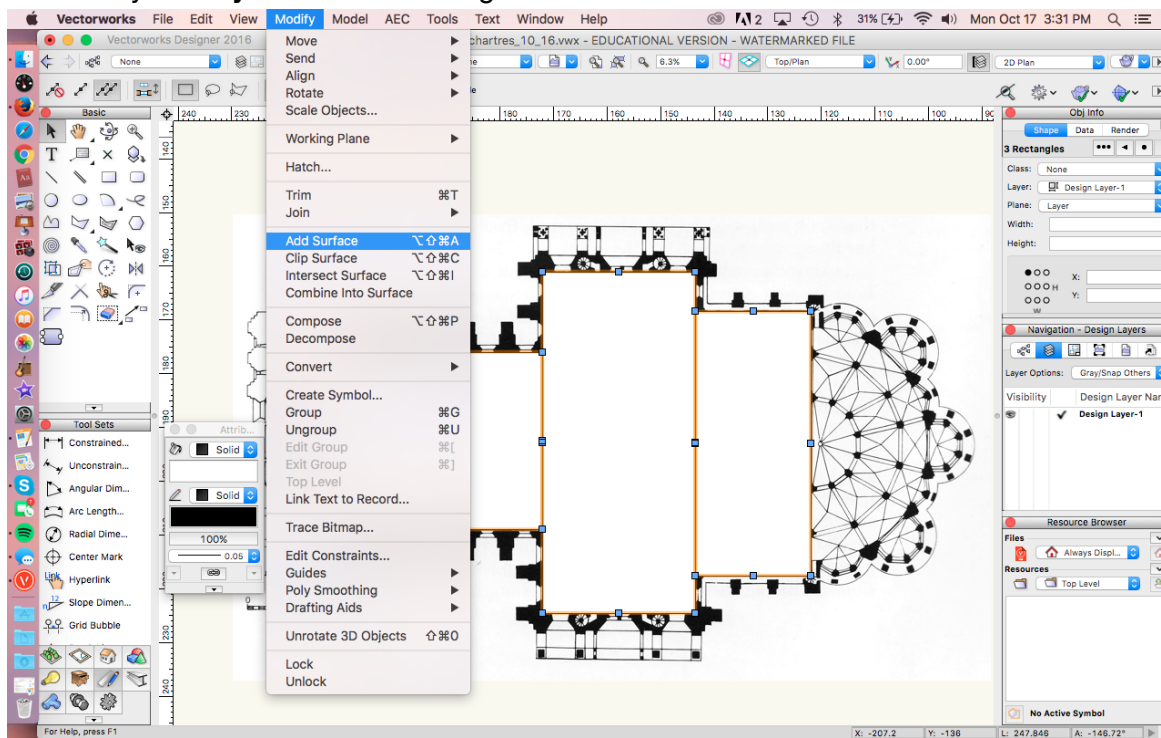
Step 5. Create the nave walls

1. Outline the interior wall of the nave and transept using the rectangle tool. The “Three Points Rotated” mode is the easiest method to accurately trace the walls.

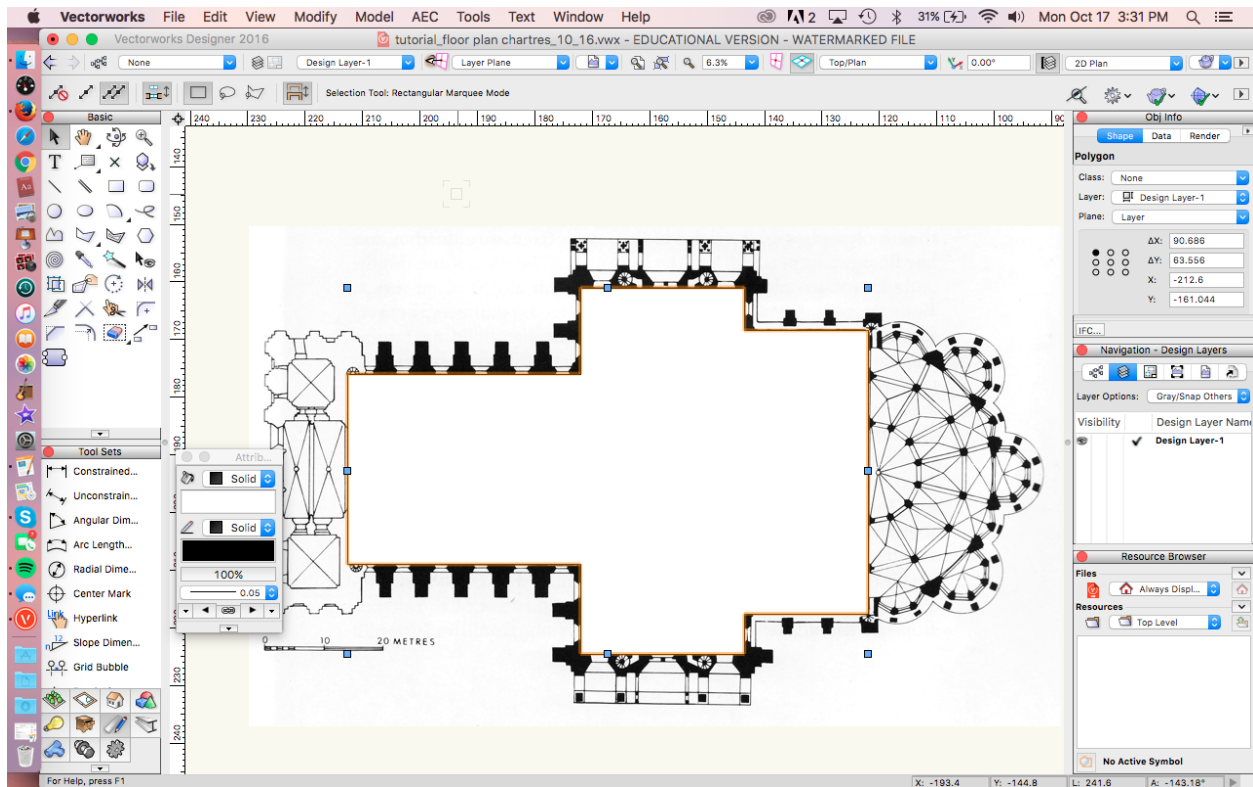




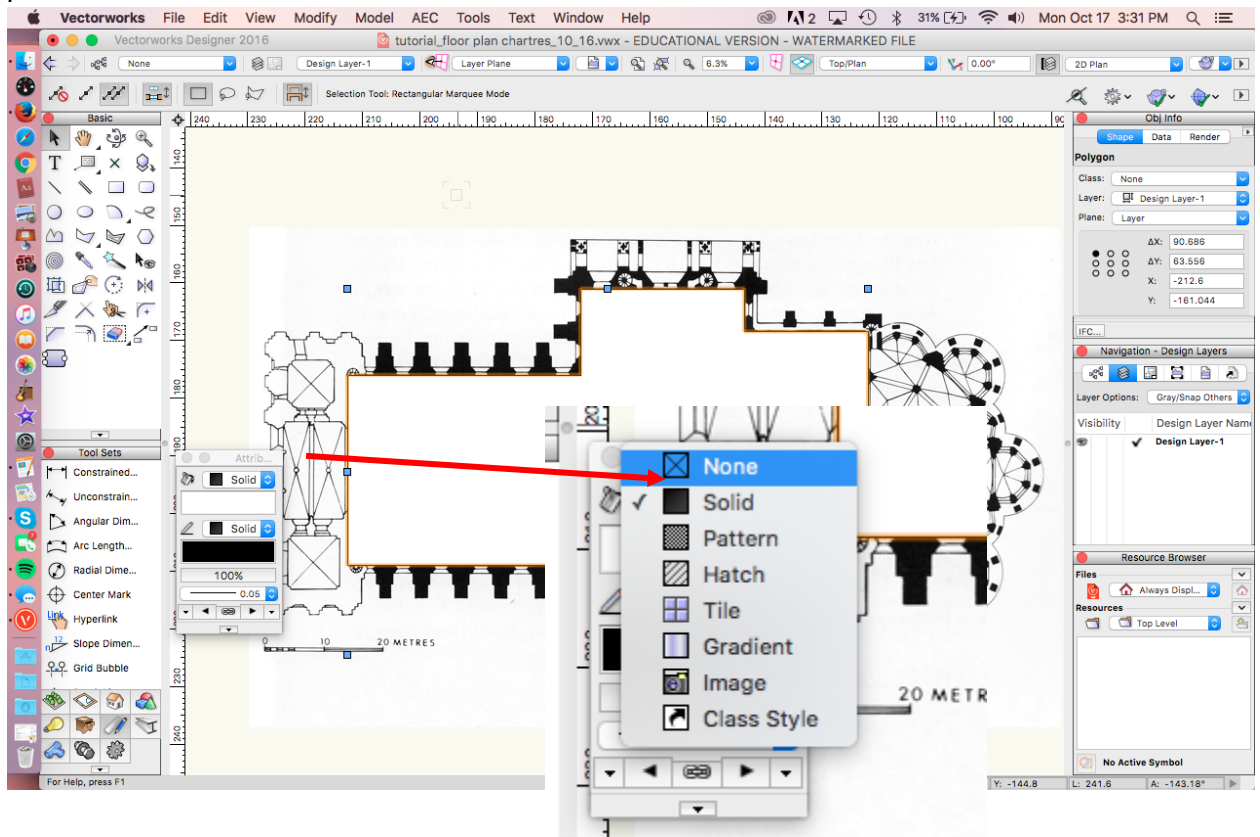
2. Select all the objects by holding down the shift key. Go to **Modify > Add Surface**. This will create a single polygon. If it doesn't, make sure your objects abut or overlap slightly. Try **Modify > Add Surface** again.



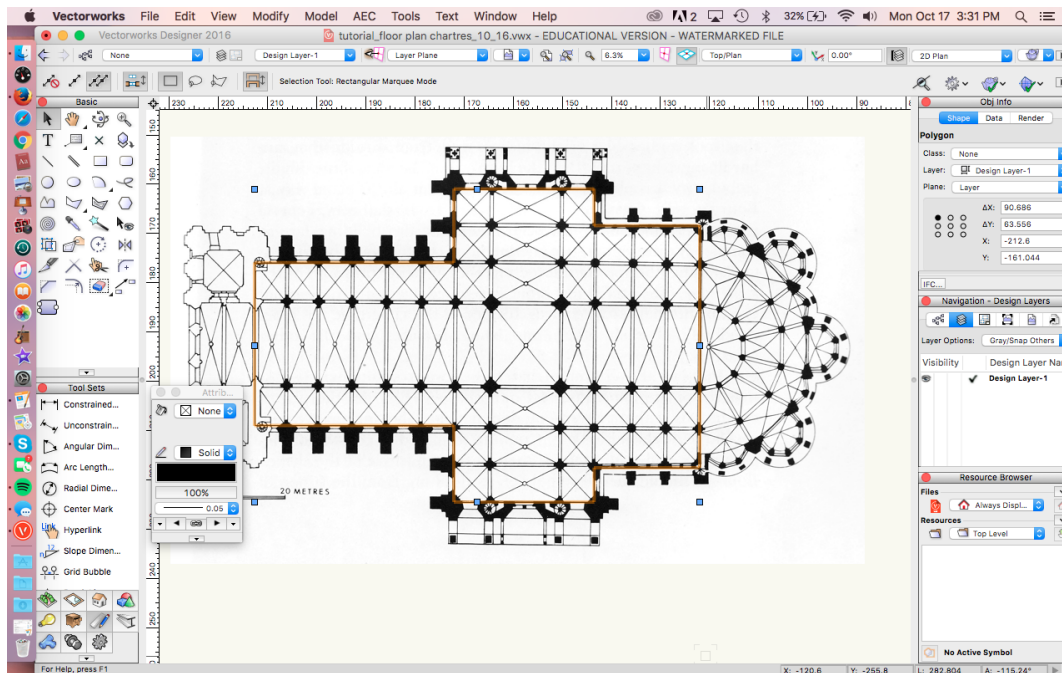




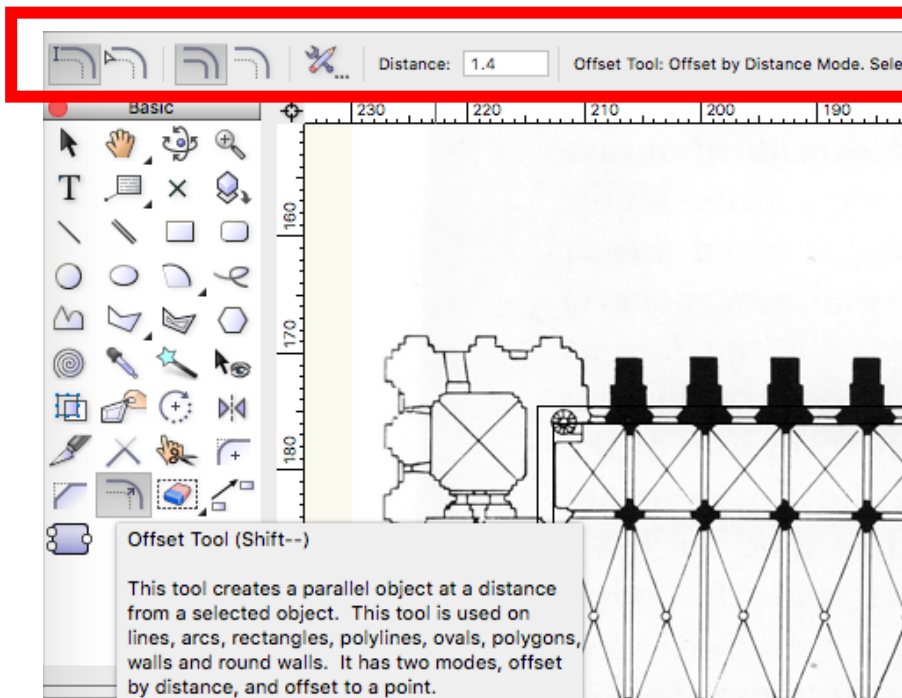
3. With polygon selected, change the fill from “Solid” to “None” under the **Attributes** palette.



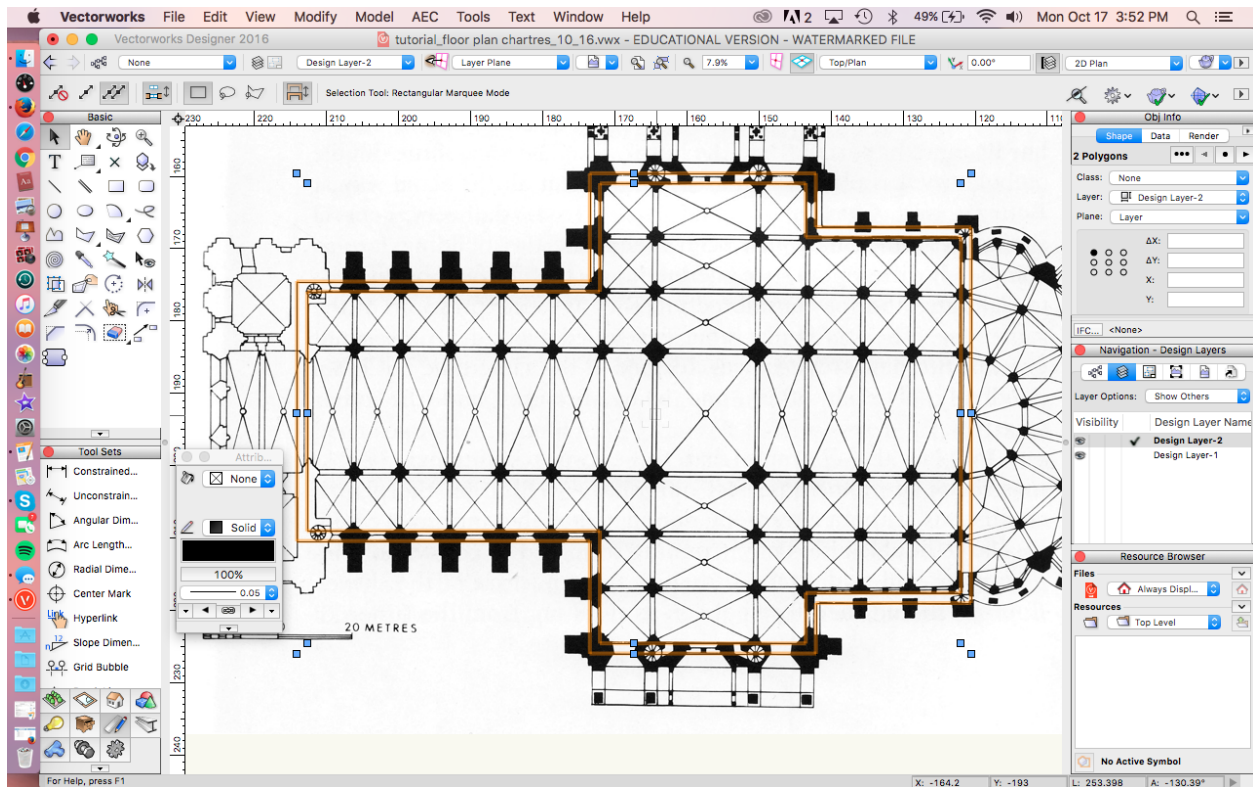




4. Now that you have the inner wall, you can easily create the outer wall using the **Offset** tool. Measure the thickness of the wall, which should be approximately 1.4 m thick. Select the object to be offset. Click the **Offset** tool from the **Basic Tool** palette. Then select the first tool option, “Distance Mode” and the third option, “Duplicate and Offset” mode from the “Offset Tool Preferences” dialog box.” Enter 1.4 meters into the **Distance** field. Click the point where the offset should be placed. In this case, click outside the selected polygon. You have now created the outer wall of the nave and transept.

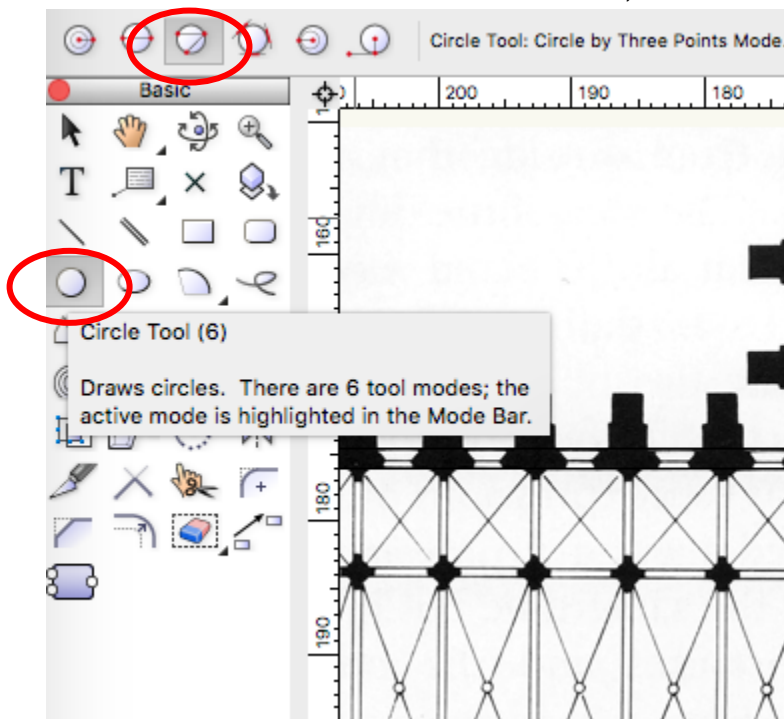


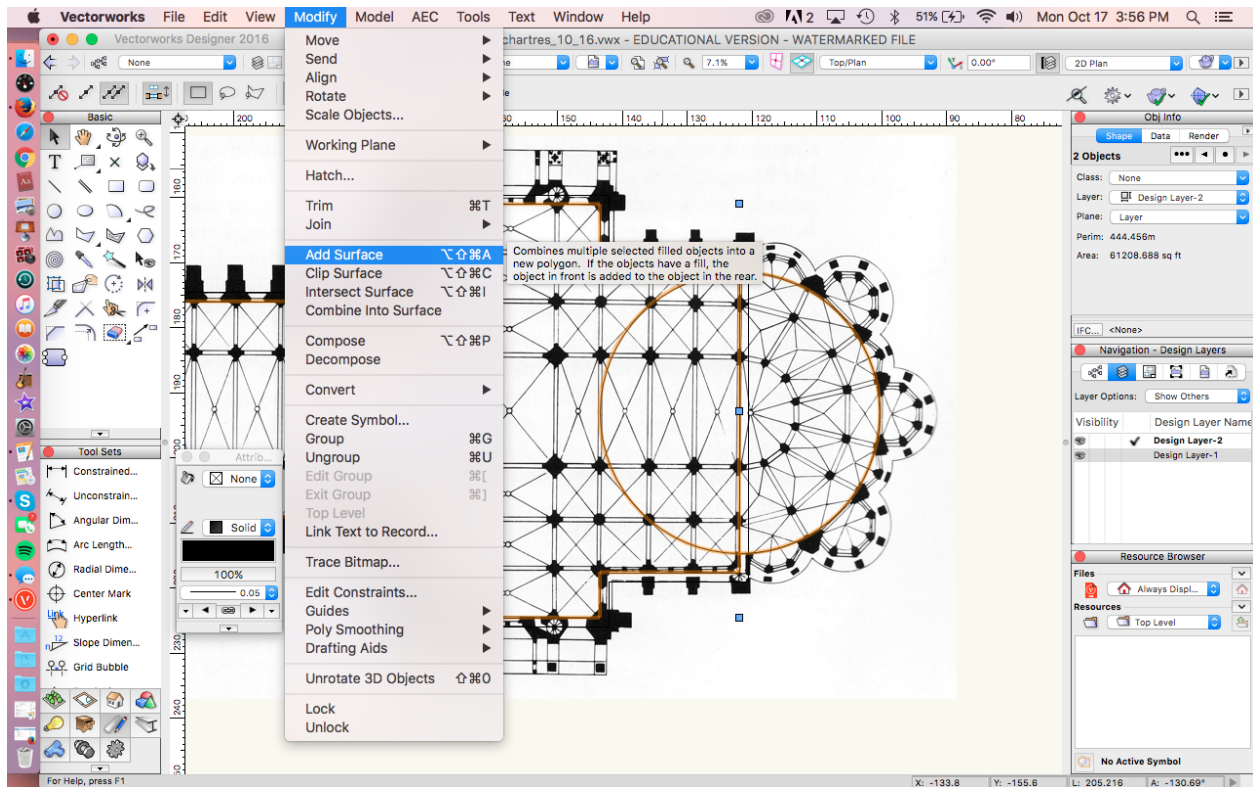
Offset Tool Preferences dialog box



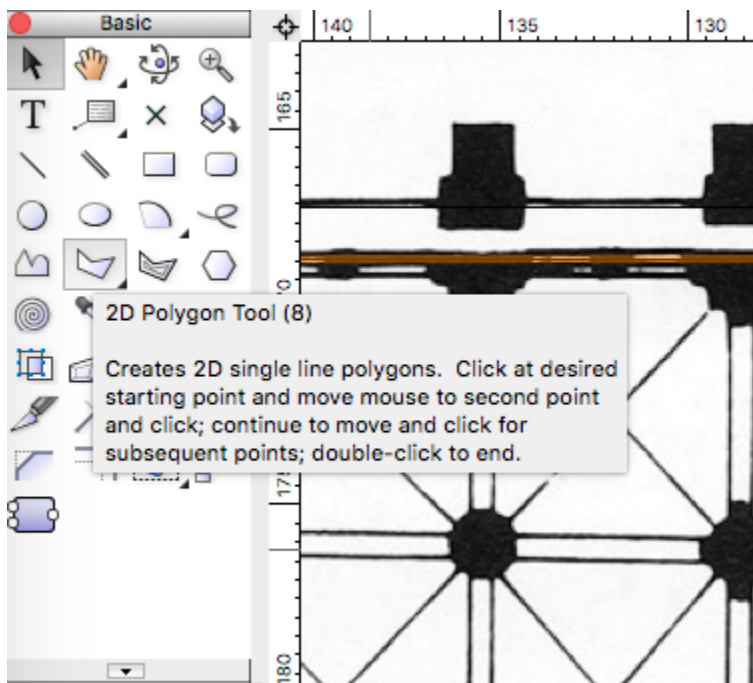
## Step 6. Create the Apse

1. Create the outline of the inner wall of the ambulatory first, by using the “Circle by Three Points” mode of the **Circle** tool. Then, add the circle to the inner wall of the nave.

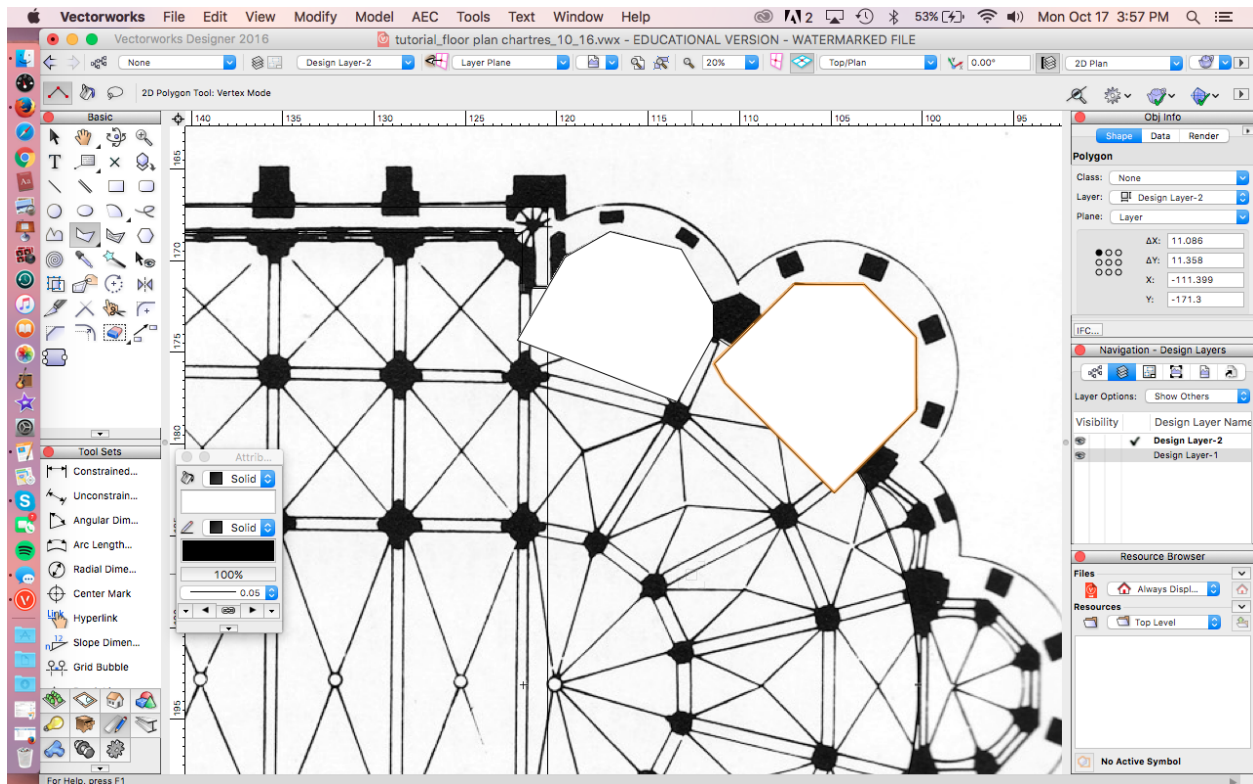




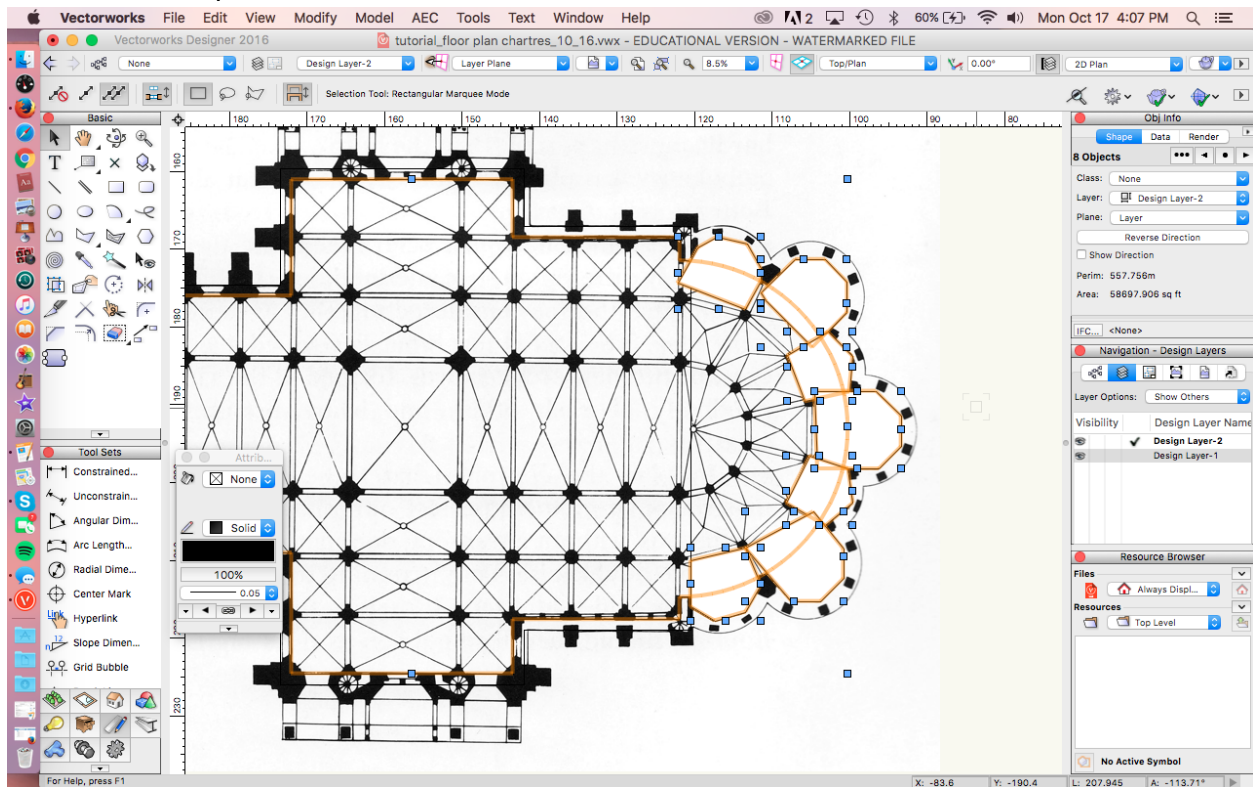
2. Now create the inner walls of the radiating chapels, which are irregular polygons. Use the **2D Polygon** tool to trace the inner walls. Zoom in to be as accurate as possible. make sure your shapes overlap the main circle of the apse by more than just one point to enable add surface.

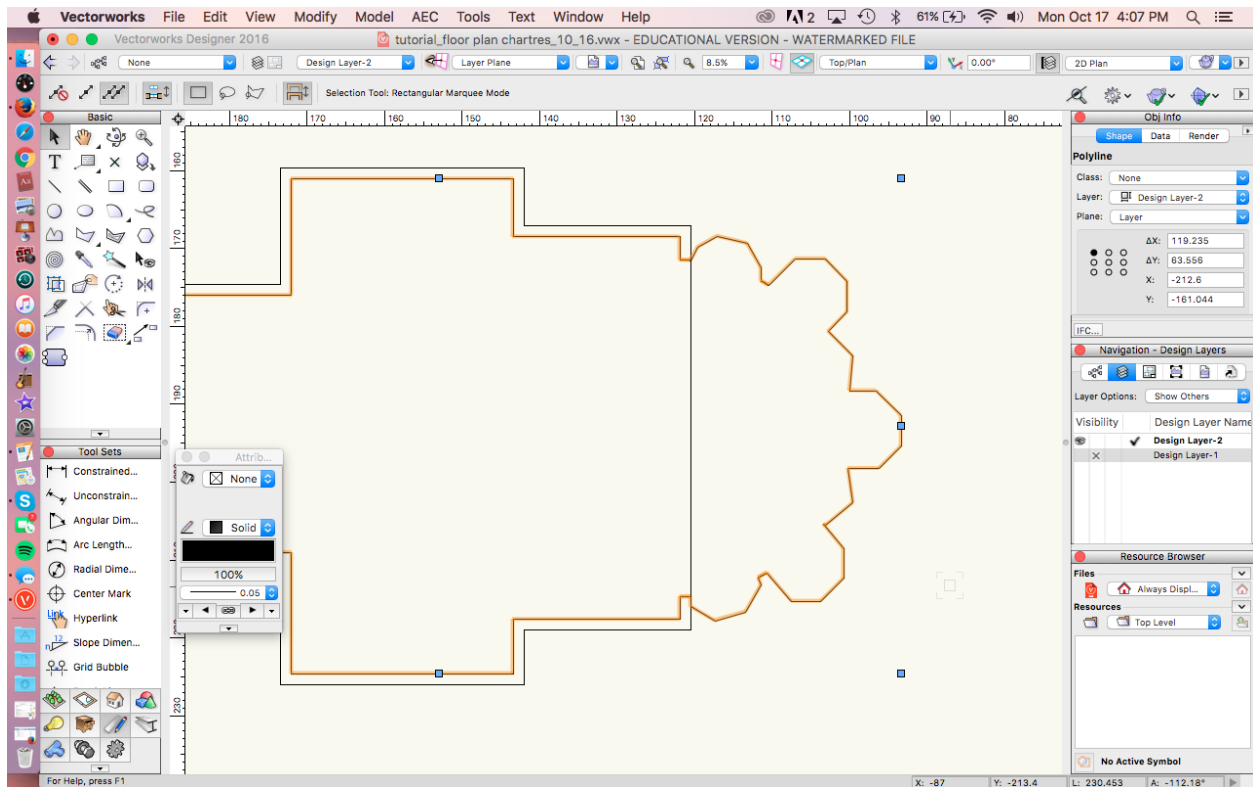




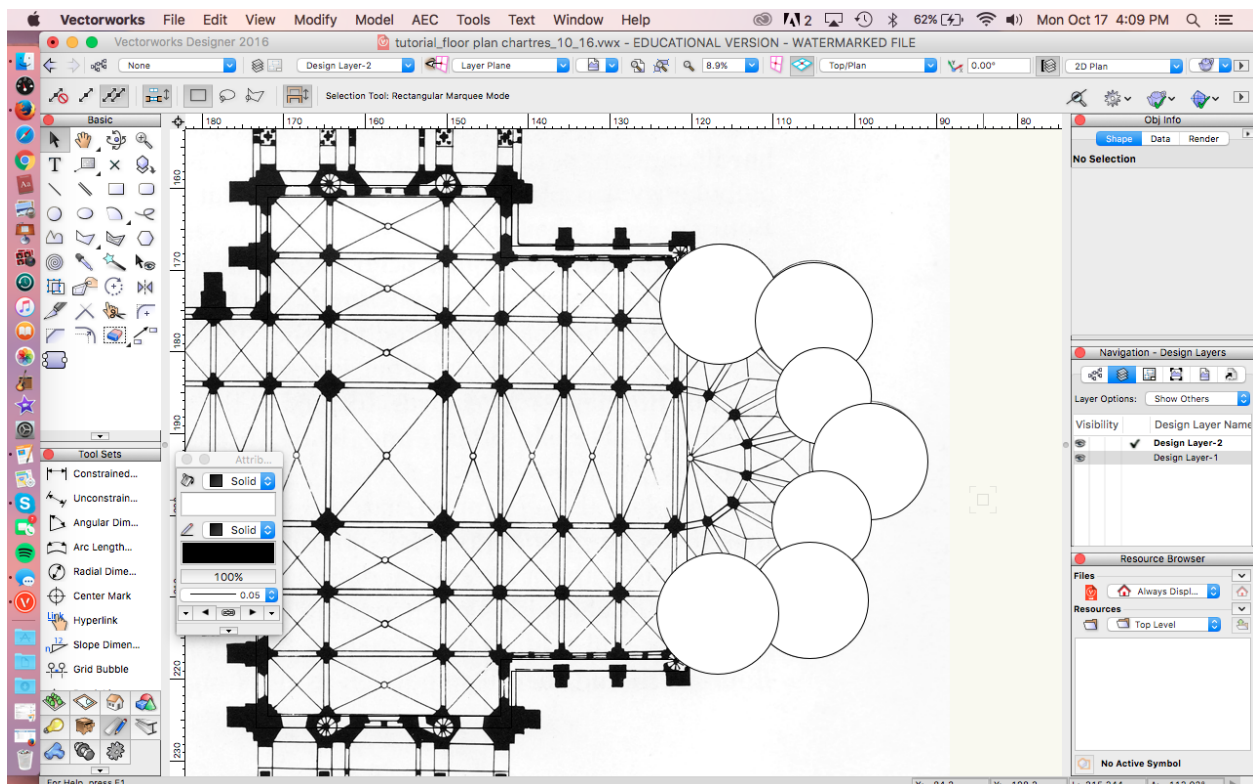


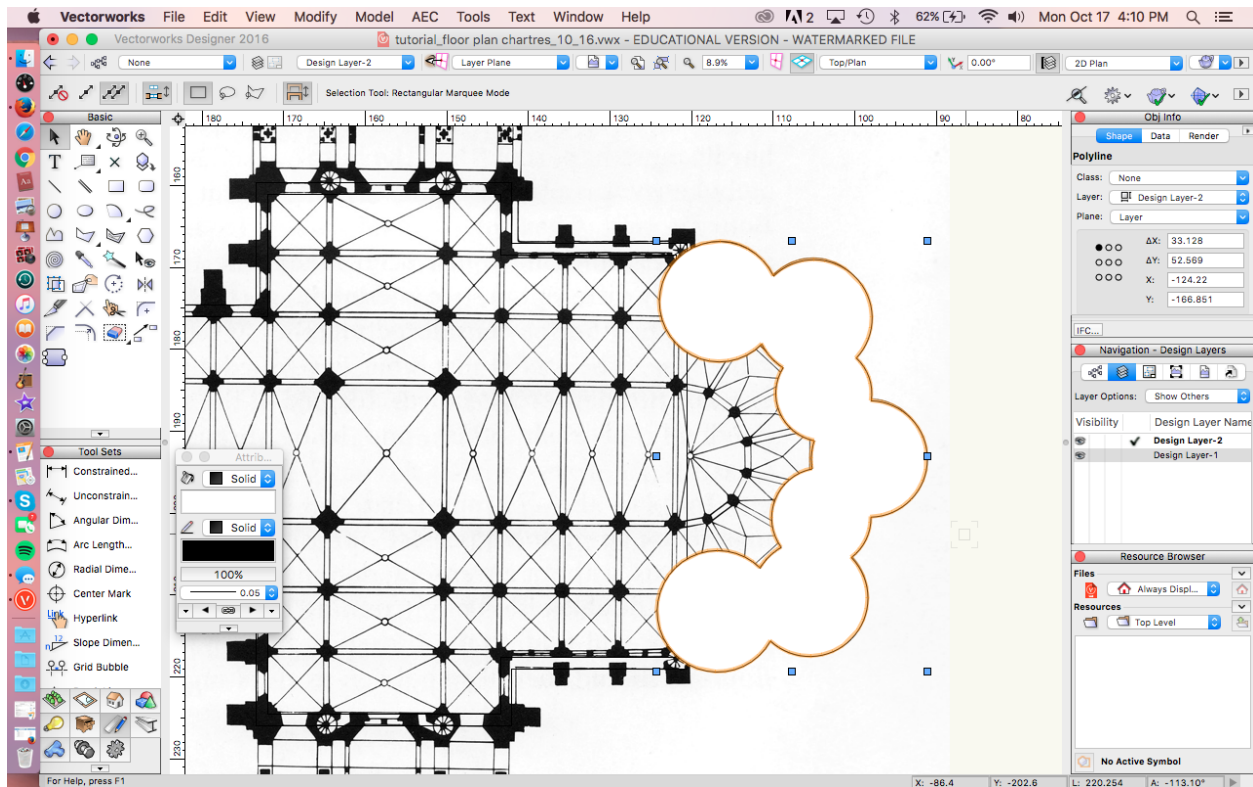
3. Once you have done all 5, join them to the apse using **Modify > Add Surface** to become part of the inner wall.



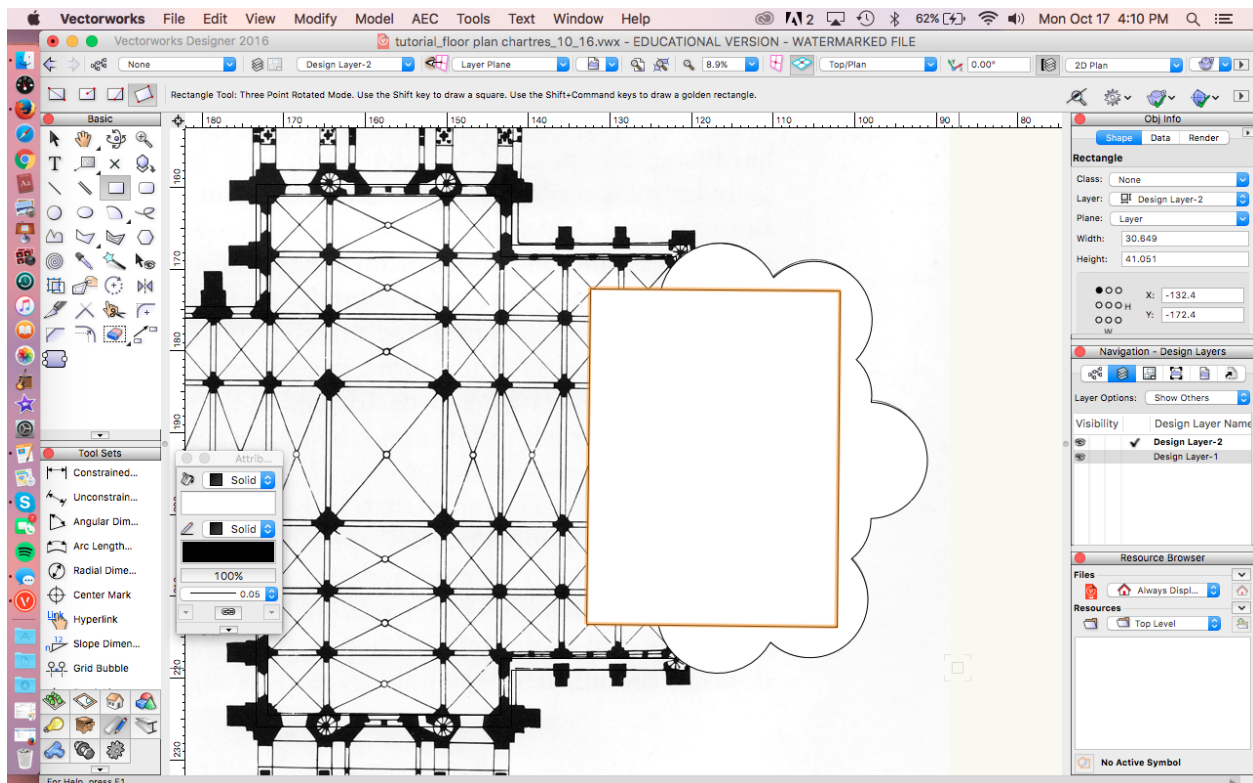


4. The outer walls are circular, so simply draw a series of overlapping circles. Select the circles, and go to **Modify > Add Surface**.



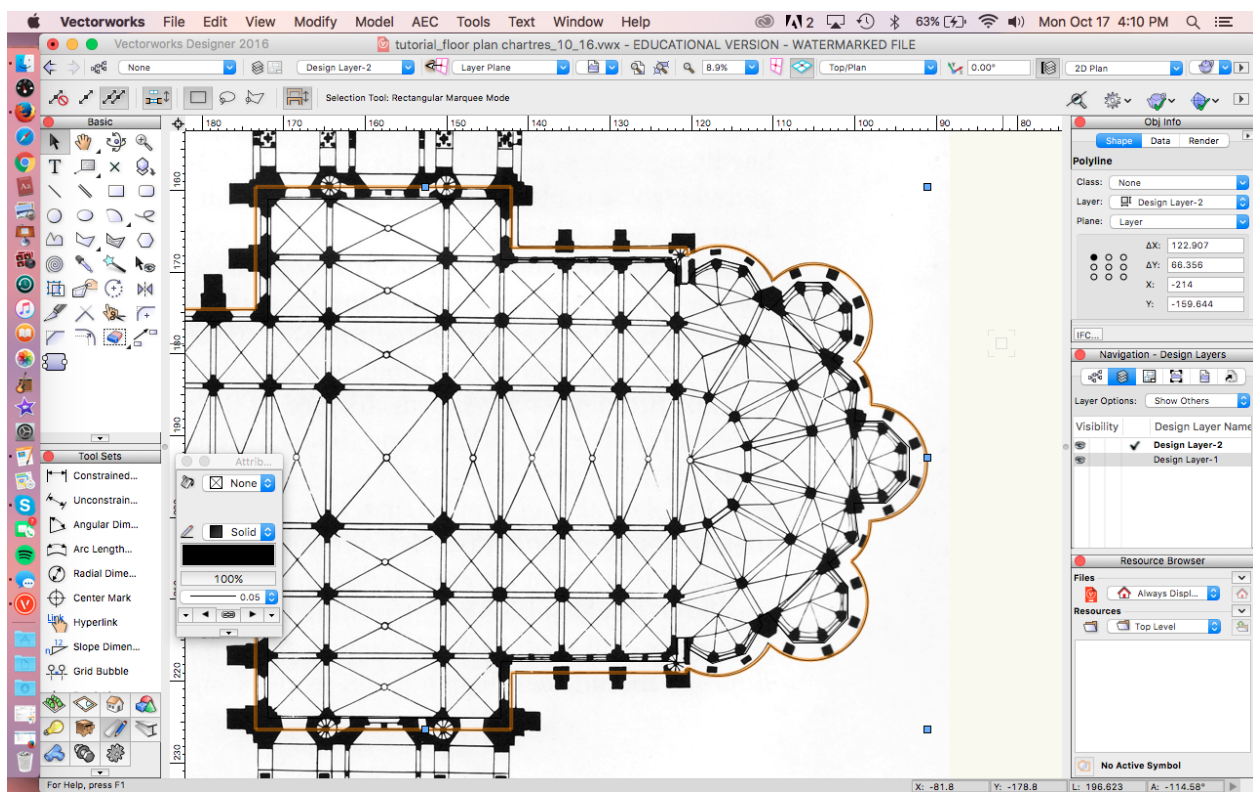
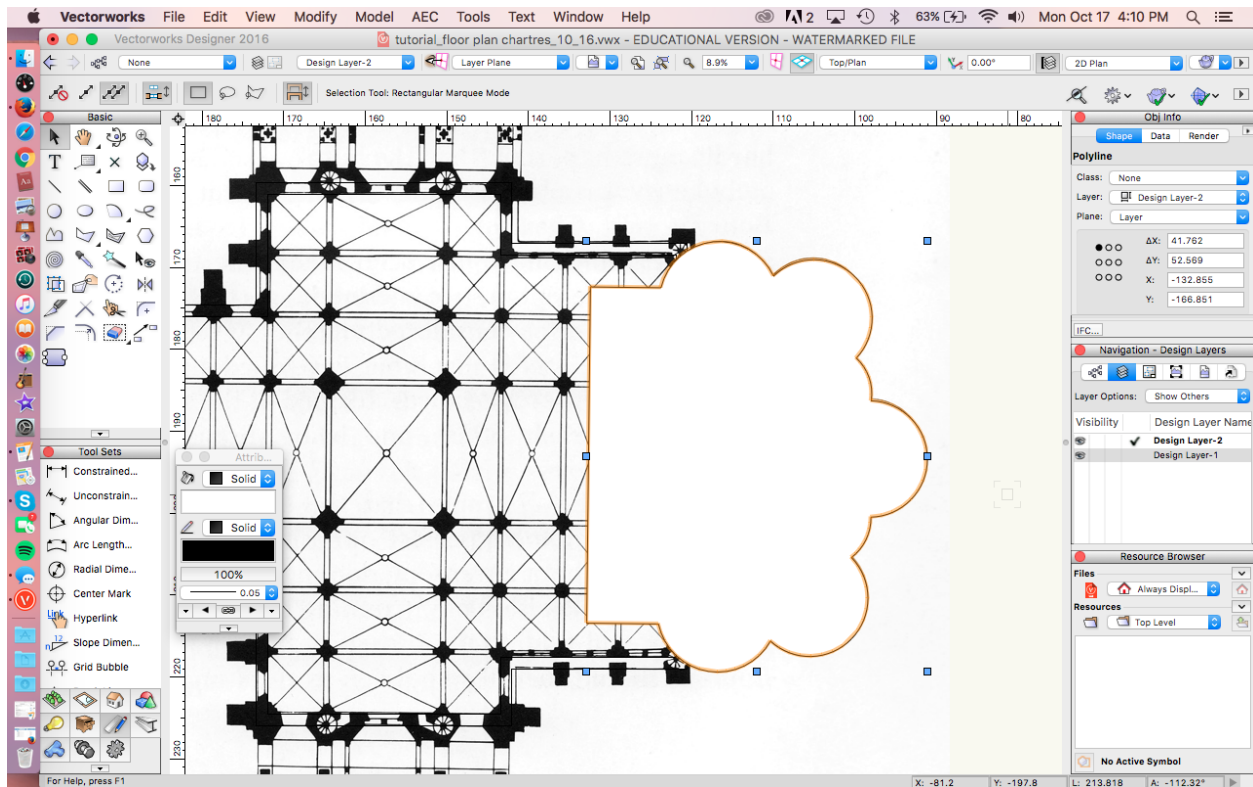


- Join the chevet form to the outer wall of the nave, draw a rectangle that overlaps the outer wall line and join it to the outer wall of the apse. Finally, join the outer wall of the apse to the outer wall of the nave.



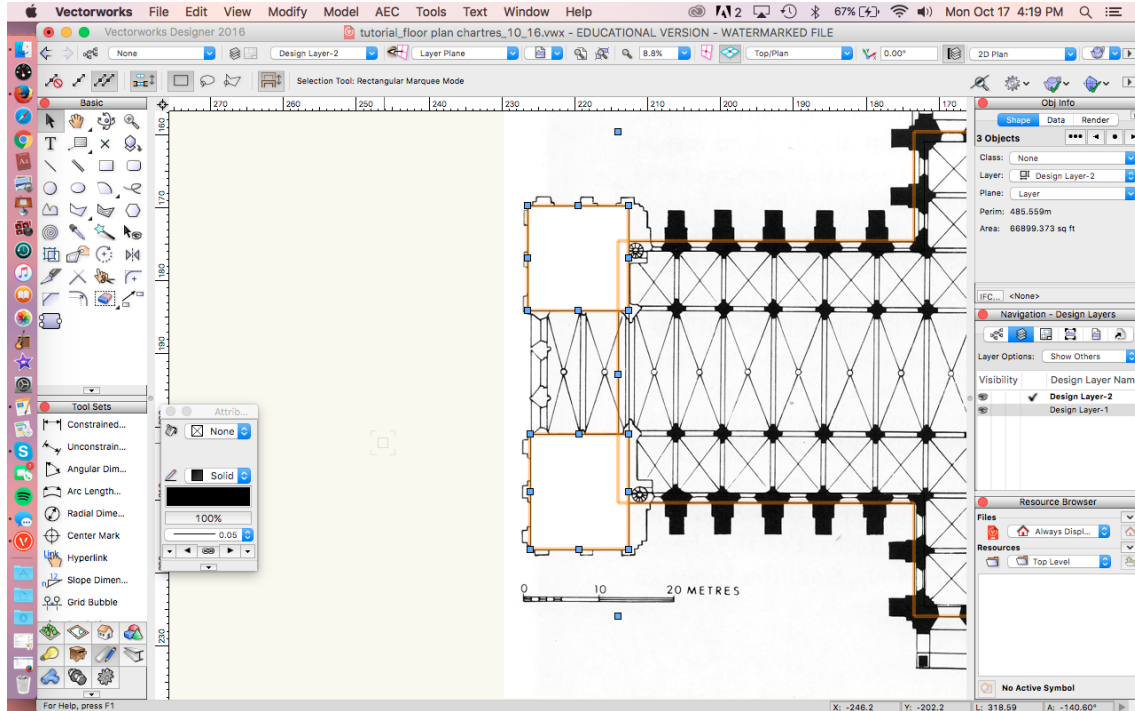


## Tutorial: Digital Gothic—AH C117B (Winter 2019)

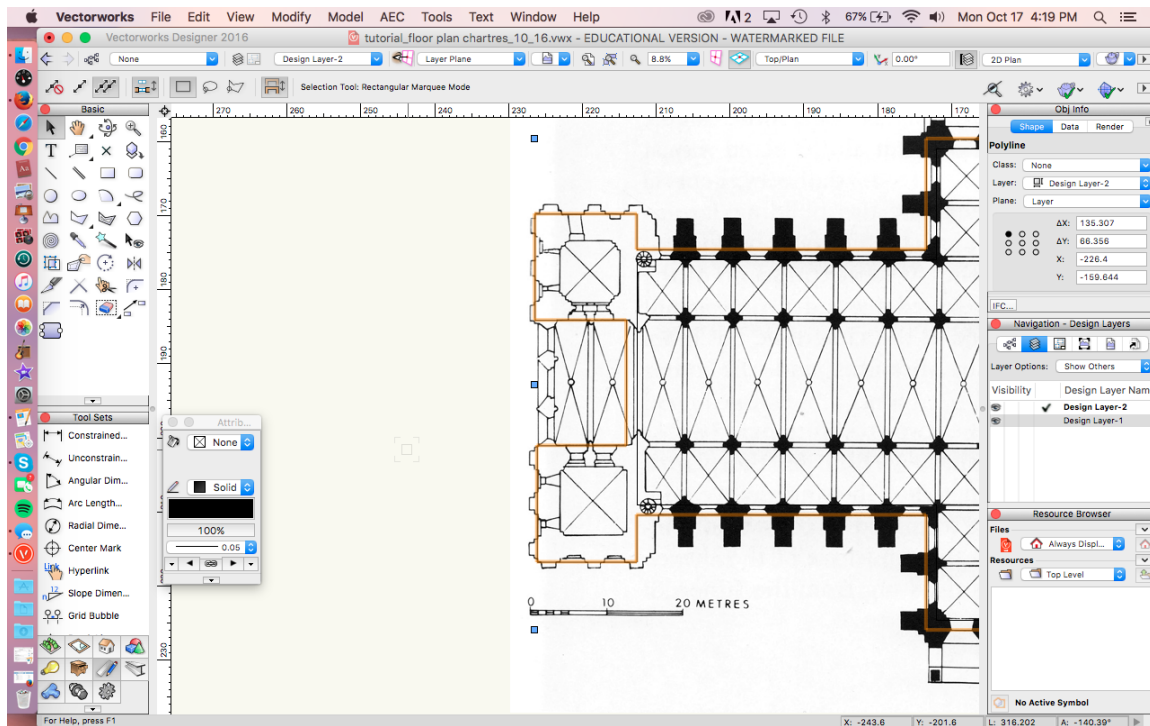


## Step 7. Create the west towers and narthex

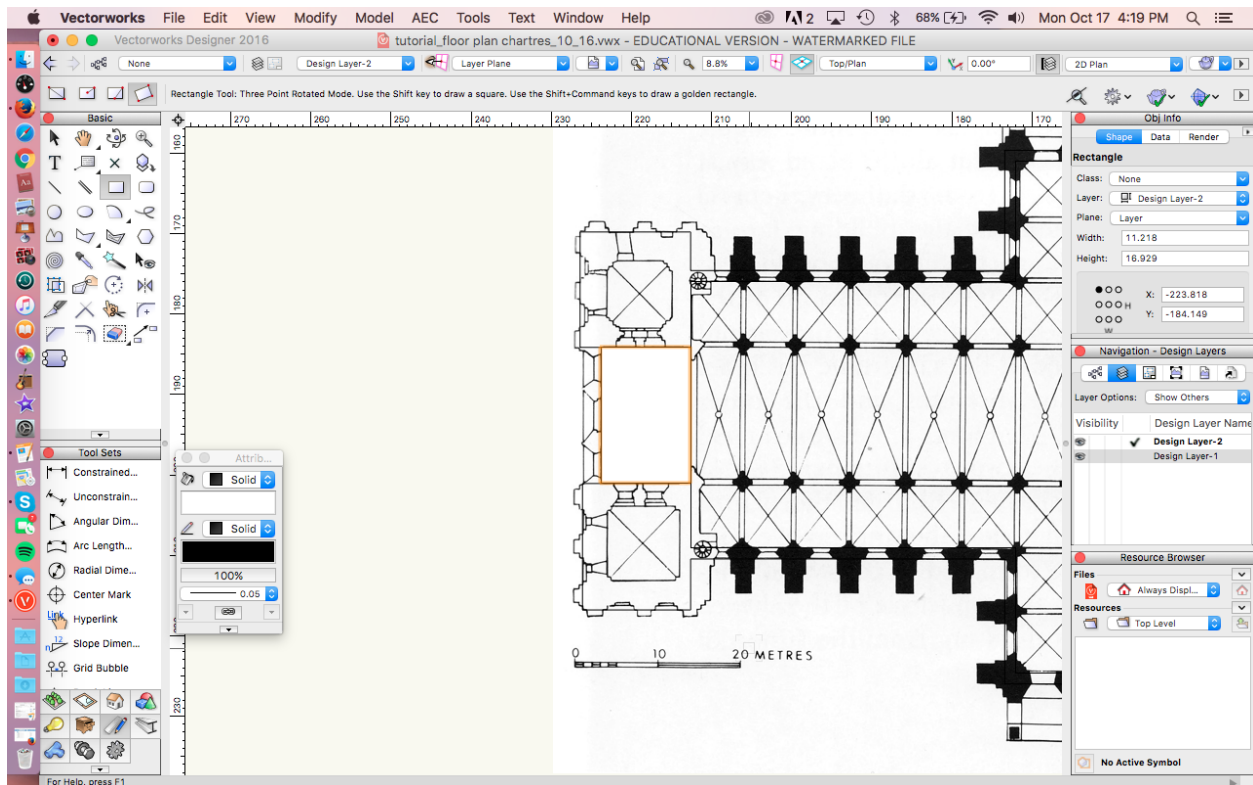
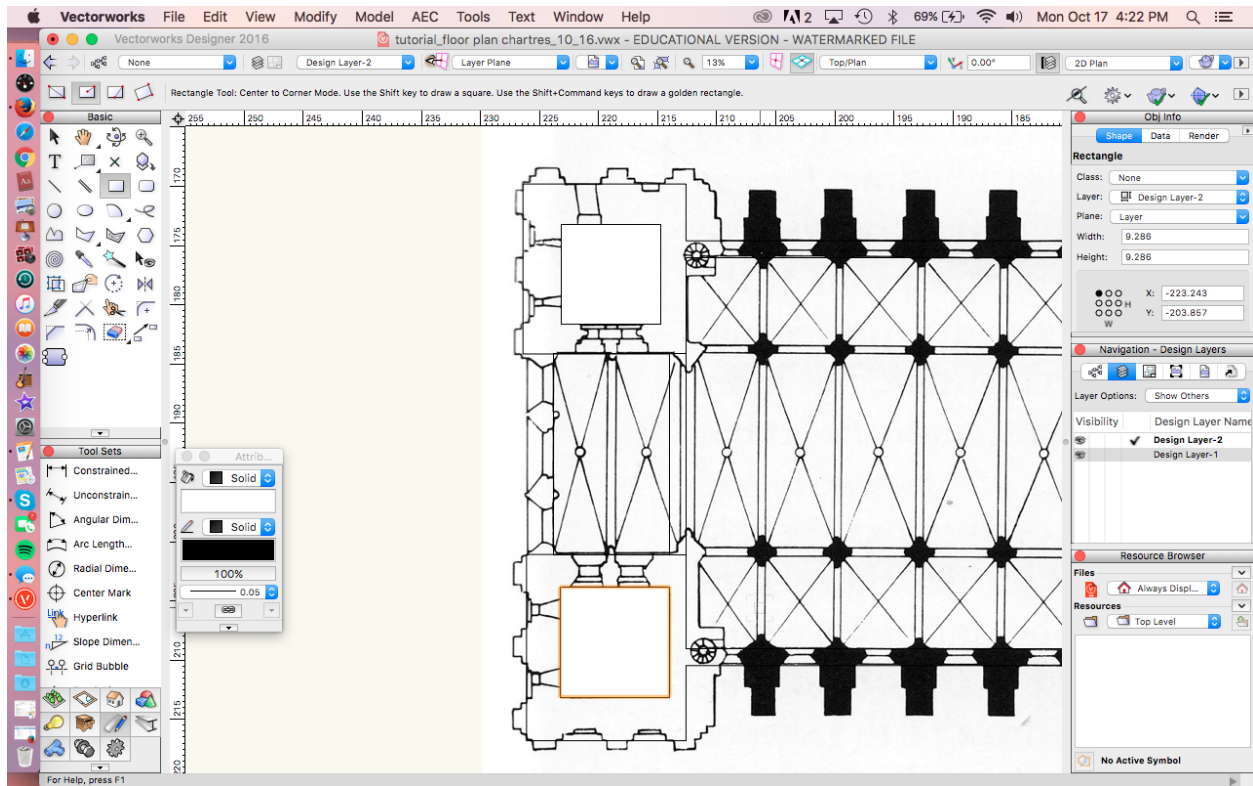
1. For the purposes of this tutorial, we will focus only on the rectangular forms of the west towers and narthex. We will not draw the buttresses at the cathedral's west end. To create the outer walls of the west towers, use the “Center to Corner” mode of the **Rectangle** tool.



2. Join the outer walls of the towers to the outer wall of the nave using **Modify > Add Surface**.



3. Outline the inner wall of the west towers and the narthex using the **Rectangle** tool. Then change to no fill.

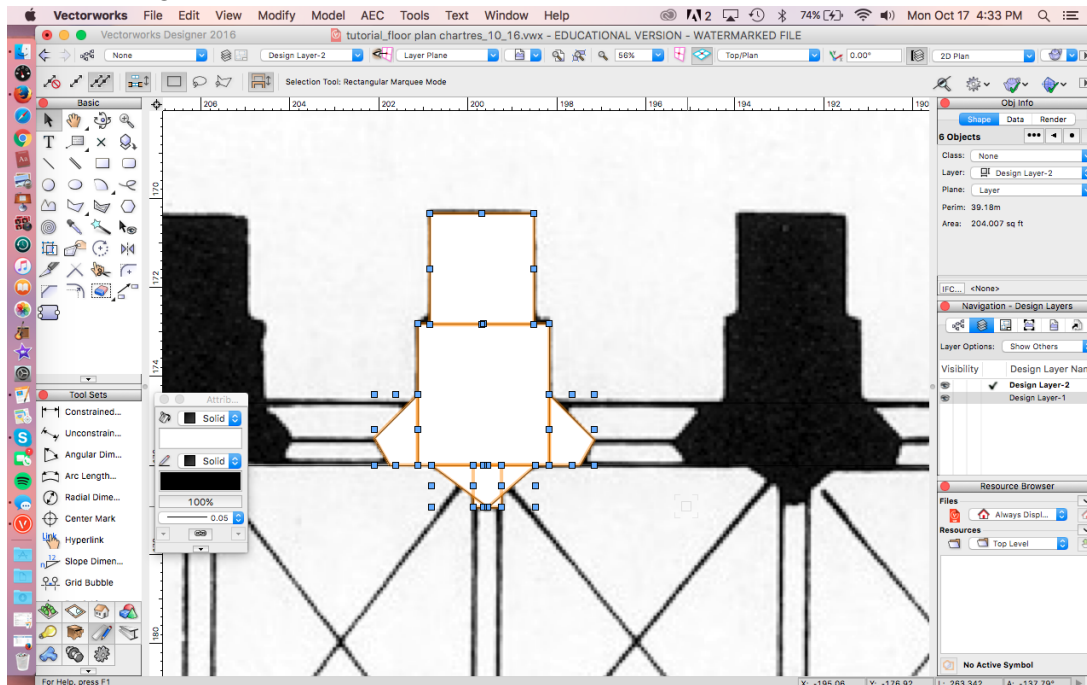




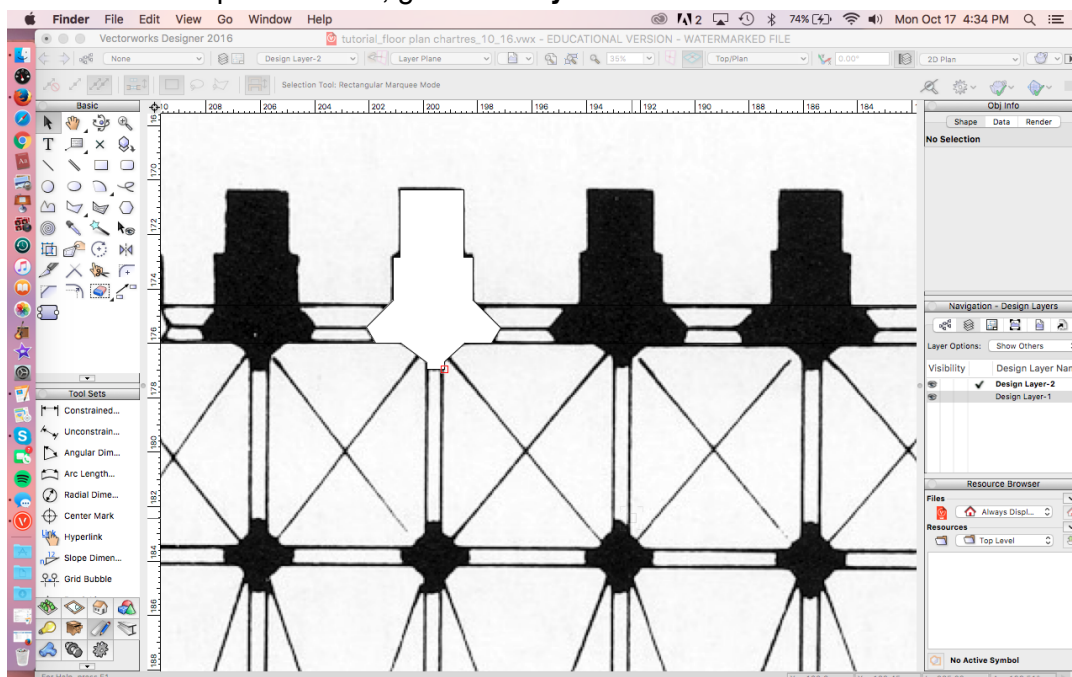
## Step 8. Create Buttresses

In creating an idealized plan, you can normalize the shape of buttresses and average the width of the bays. In future tutorials, you will focus on building the 3rd, 4th, and 5th bays of Chartres. Therefore, you will only need to build the buttresses west of the transept. There are 6 bays and 10 buttresses total for the nave.

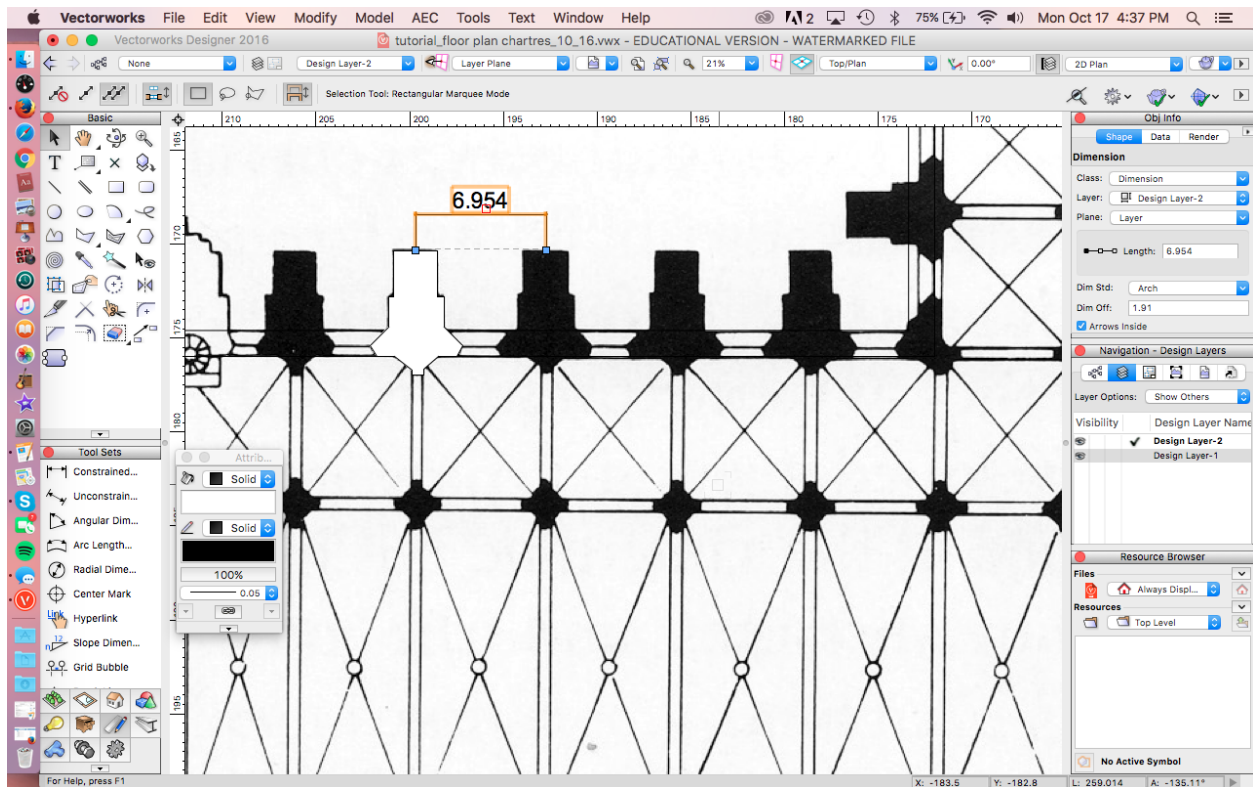
1. Use the shape of the 2nd buttress as a model for all nave buttresses. Trace the shape using the **Rectangle** and **2D Polygon** tools.



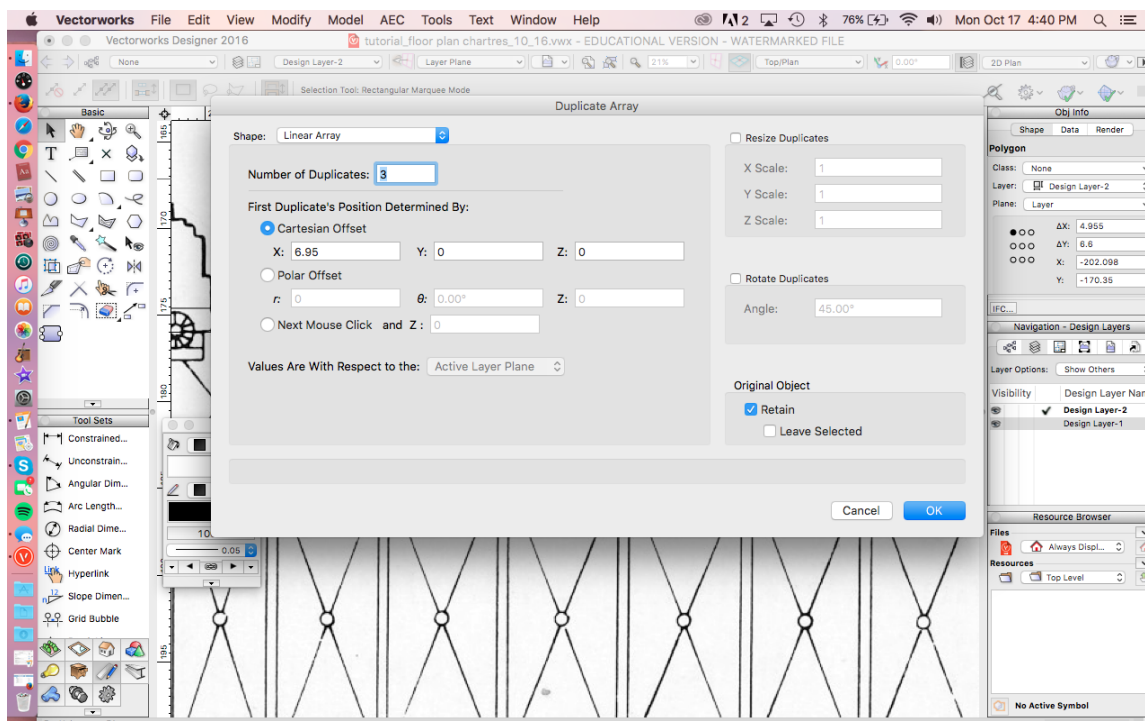
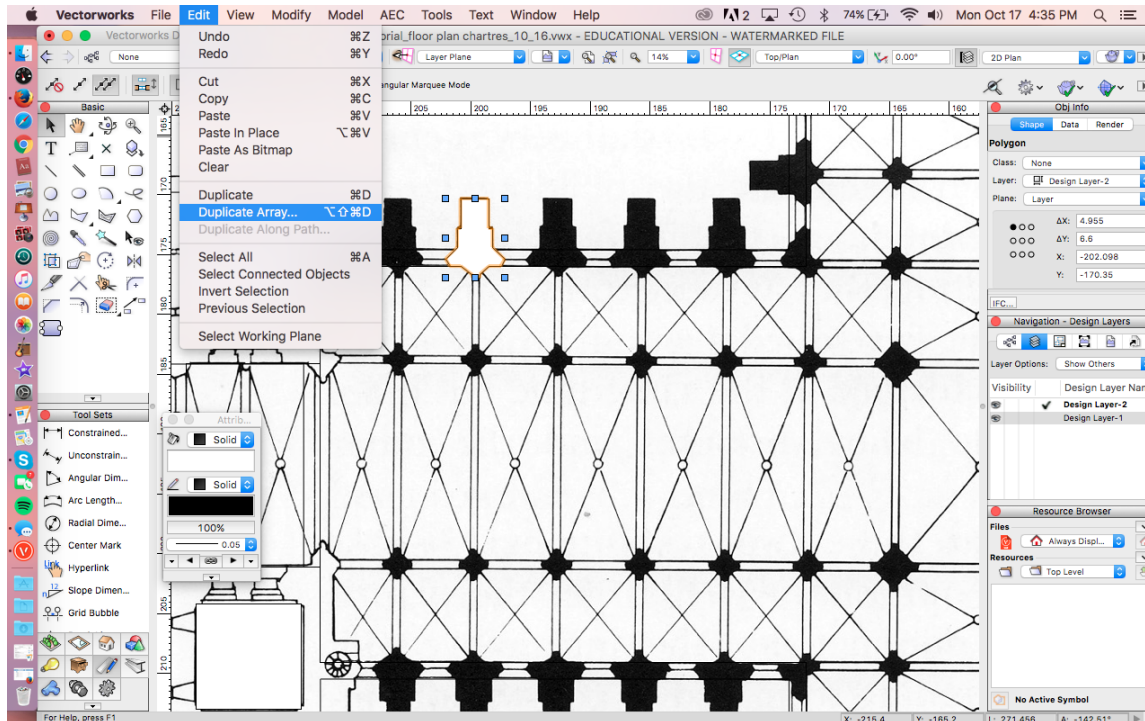
2. With shapes selected, go to **Modify > Add Surface**.



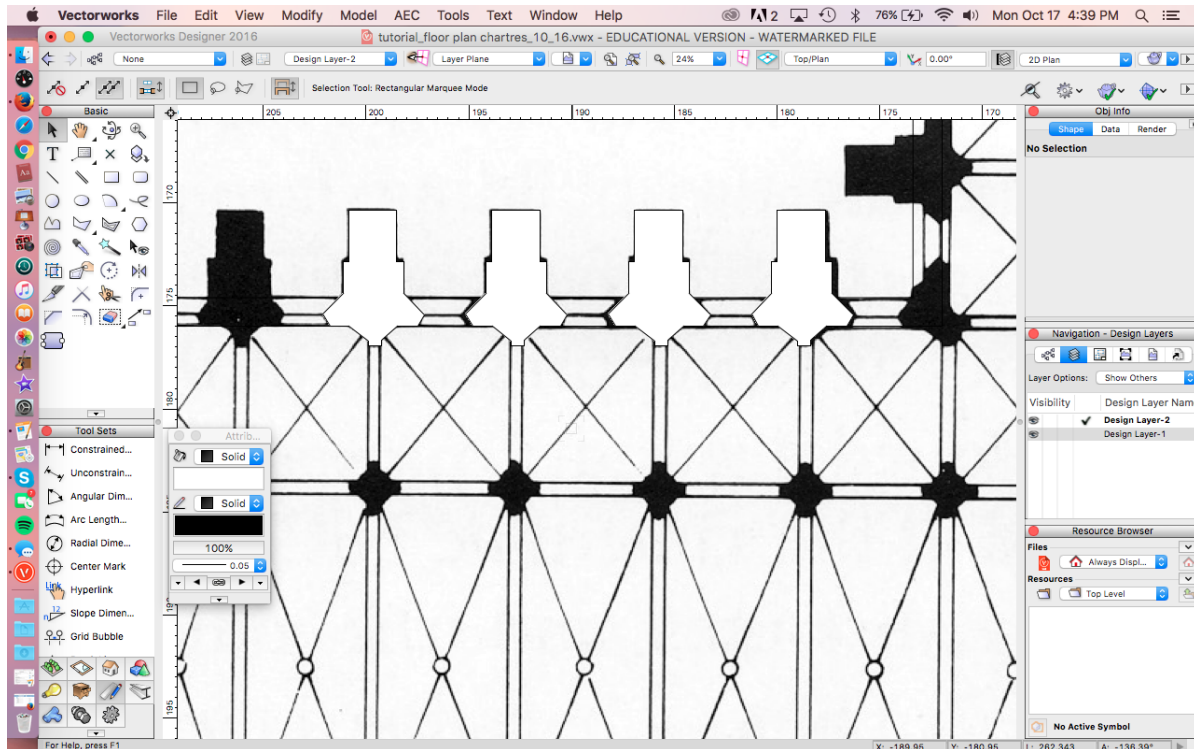
3. To create the rest of the buttresses, start by measuring the widths between the center points of the buttresses. You will find that the widths between buttresses 2,3,4 and 5 are very close, while the distance between 1 and 2 is much narrower. Take the average of 2, 3, 4, and 5, which should be about 6.95m.



- Because the bays are now equal widths, we can use the **Duplicate Array** function to quickly copy the buttress. Go to **Edit > Duplicate Array**. In the pop-up window, select **Linear Array**. Input 3 duplicates and put 6.95 m in the “X” box under Cartesian offset, which will create 3 duplicates that are each 6.95 m apart. Make sure that “Retain” is selected in the **Original Object** portion of the dialogue box.



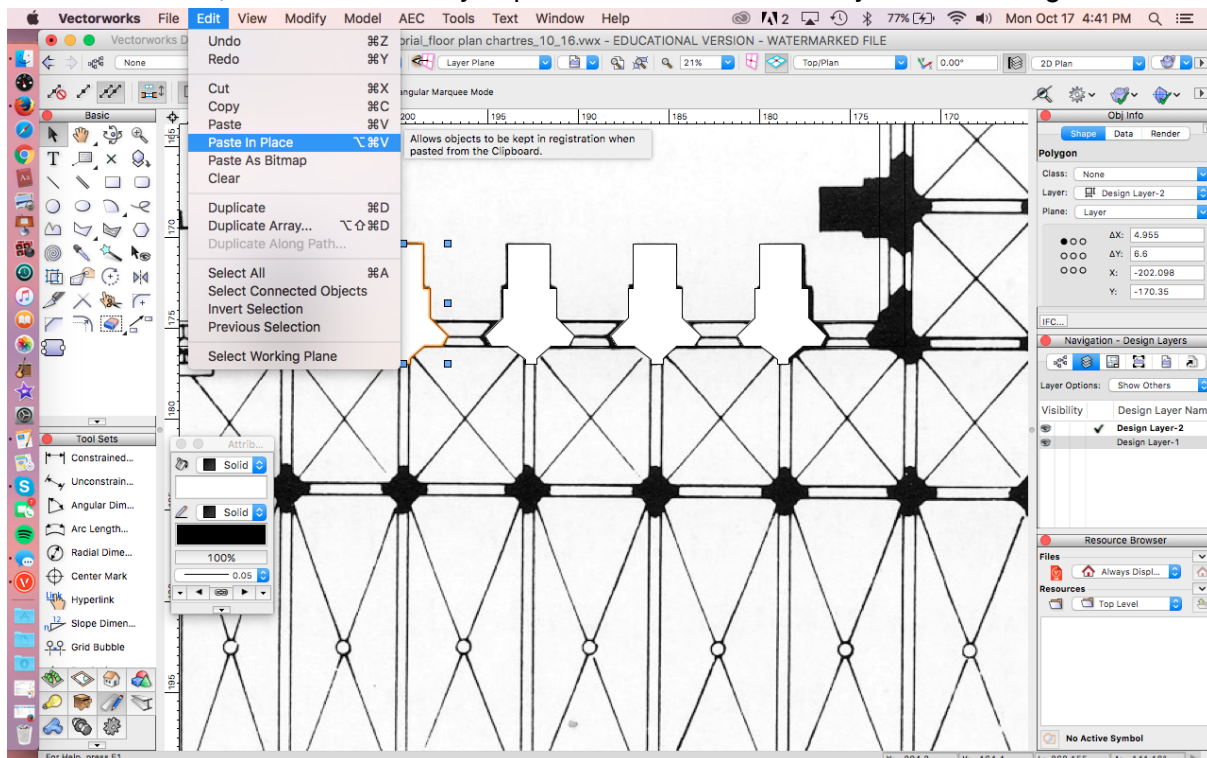


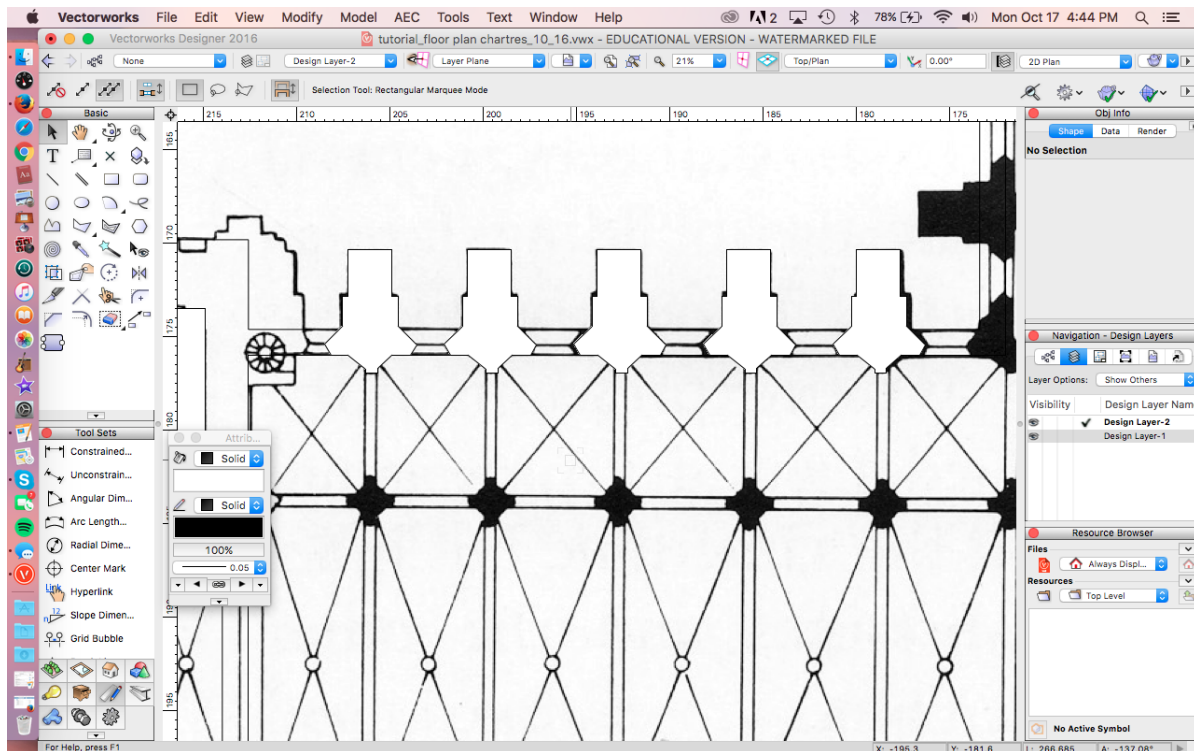


5. Select the second buttress and go to **Edit > Paste in Place**. Then move the copy of the second buttress over to line up with the first buttress.

Note: Using the **Paste in Place** function assures that the object is copied in the same plane. This doesn't matter when drawing in 2D because there's only one plane.

However, it will become very important in the future when you are working in 3D.

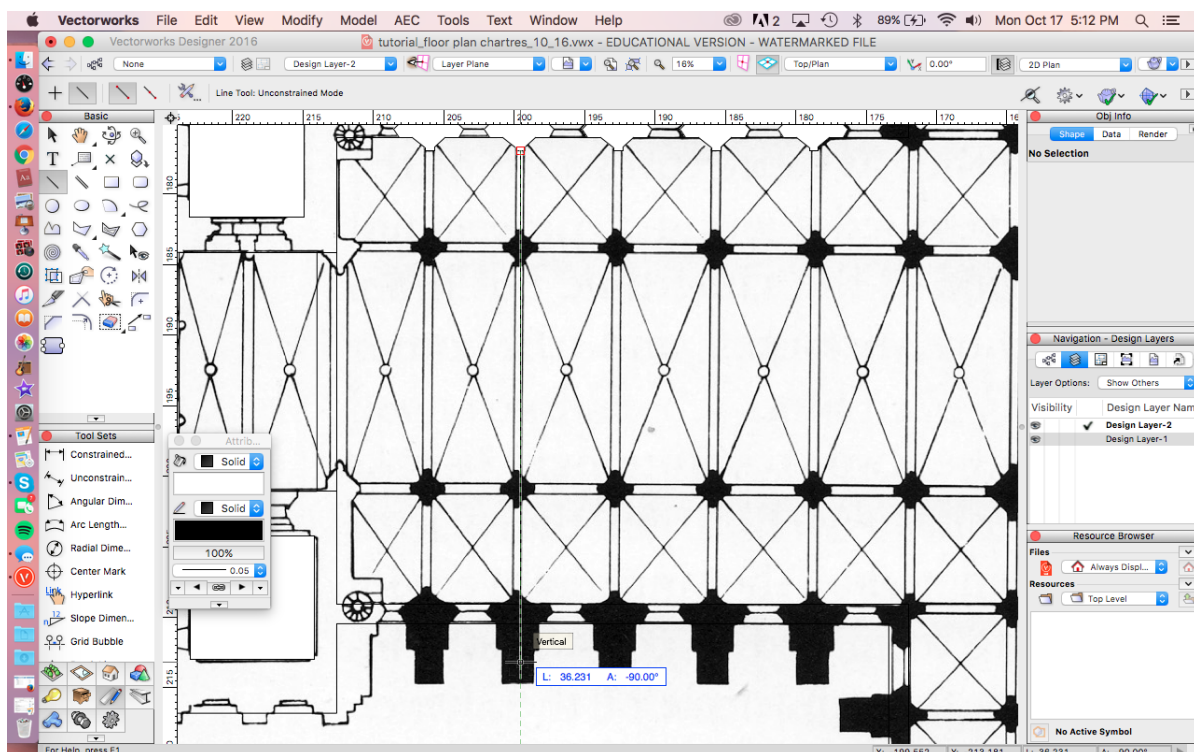




6. Now that you have a complete set of north buttresses, you need to create the south buttresses.

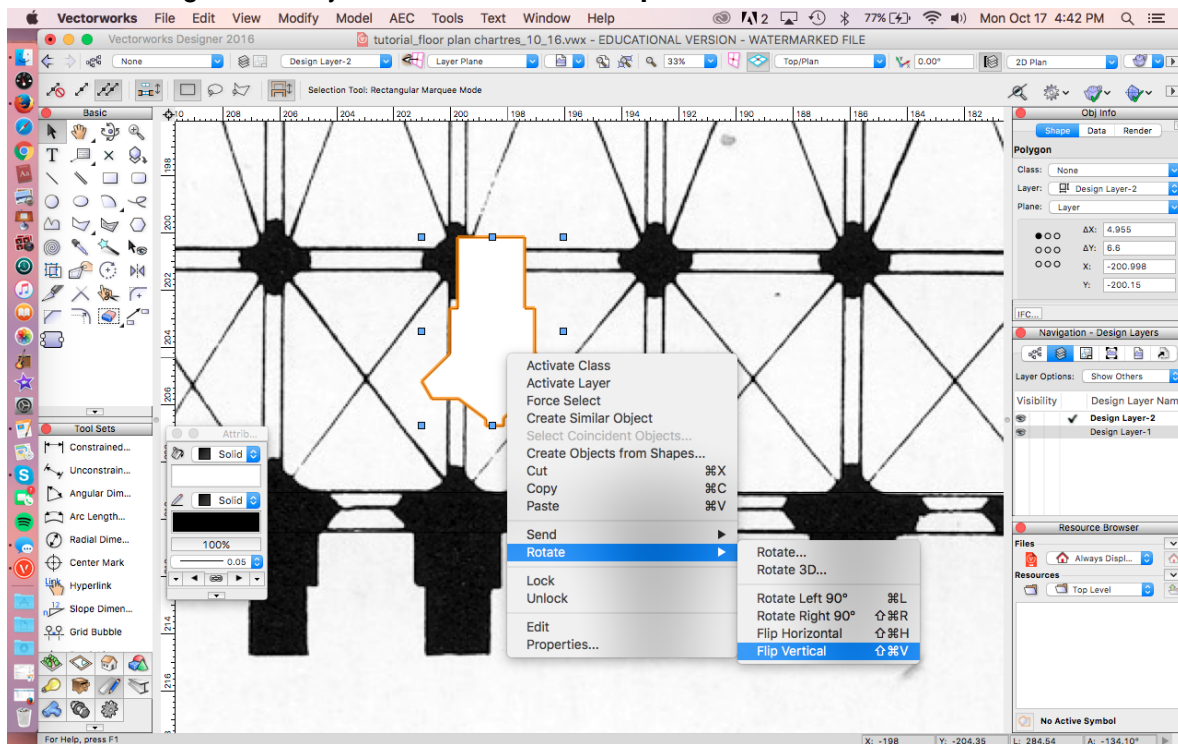
To ensure that the bays are symmetrical, you will need to create a reference line.

Using the **Line** tool, draw a vertical line down from the center of the second buttress to opposite wall. As you are drawing the line, it will indicate whether the line is vertical.

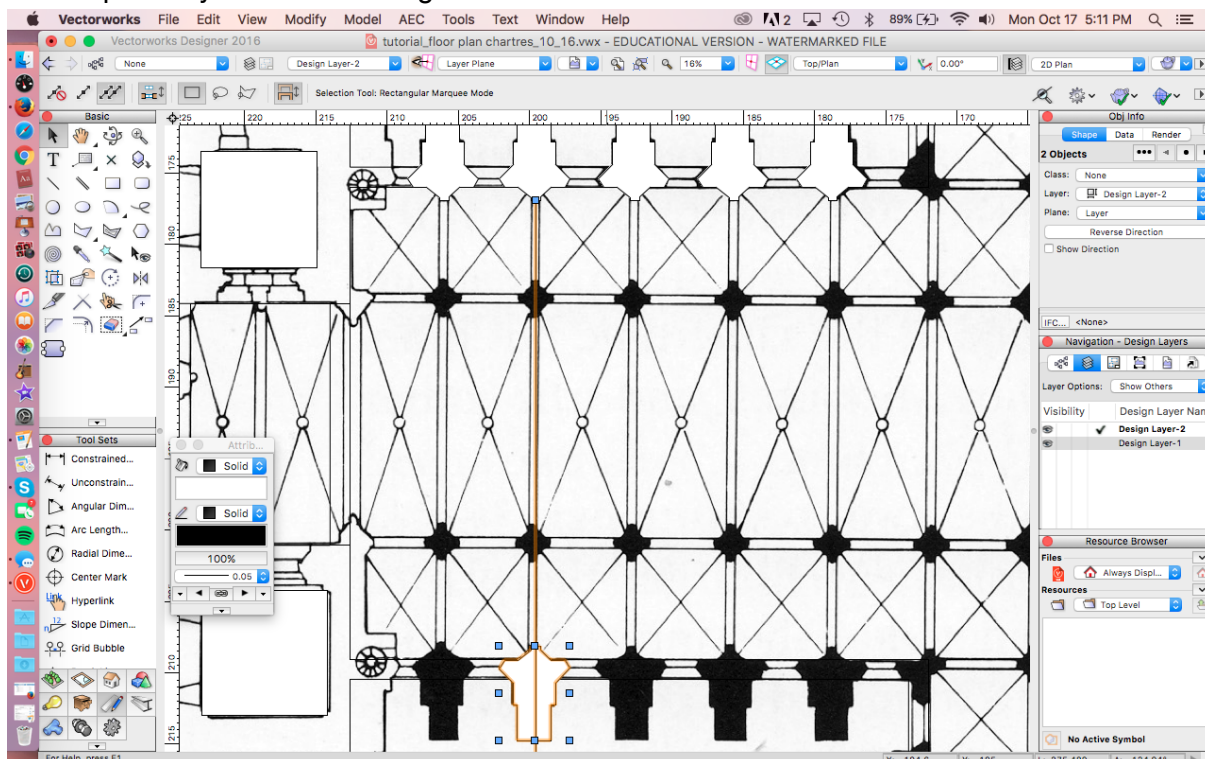




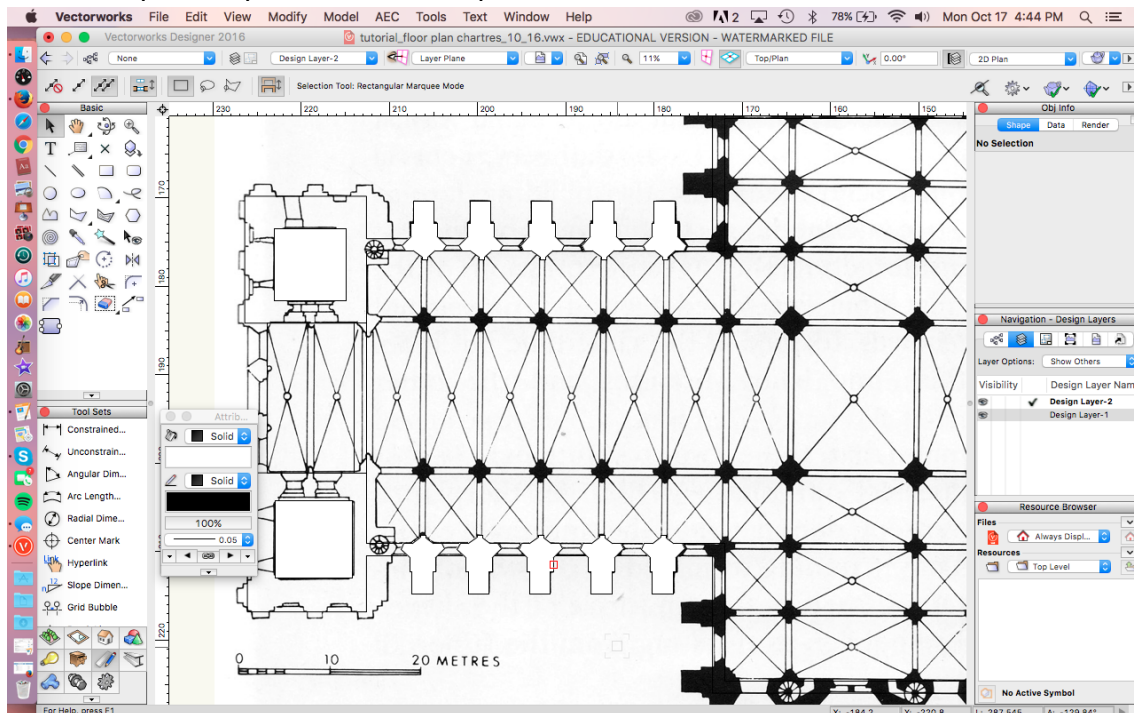
7. Select the second buttress and go to **Edit > Copy > Paste in Place**. With the copy of selected, nudge the copy down to the south wall and rotate the shape vertically by right clicking on the object. Select **Rotate > Flip Vertical**.



8. Snap the center of the south buttress to the reference line. It's OK if it doesn't line up perfectly with the drawing.



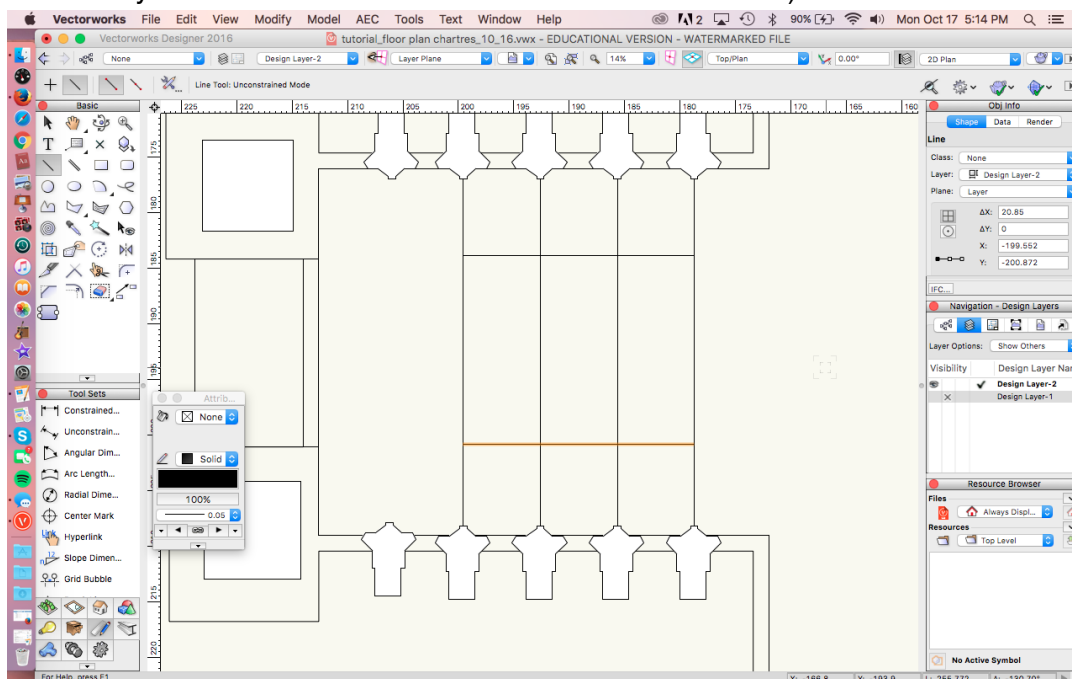
9. Repeat steps 4 and 5 to complete the buttresses on the north side.



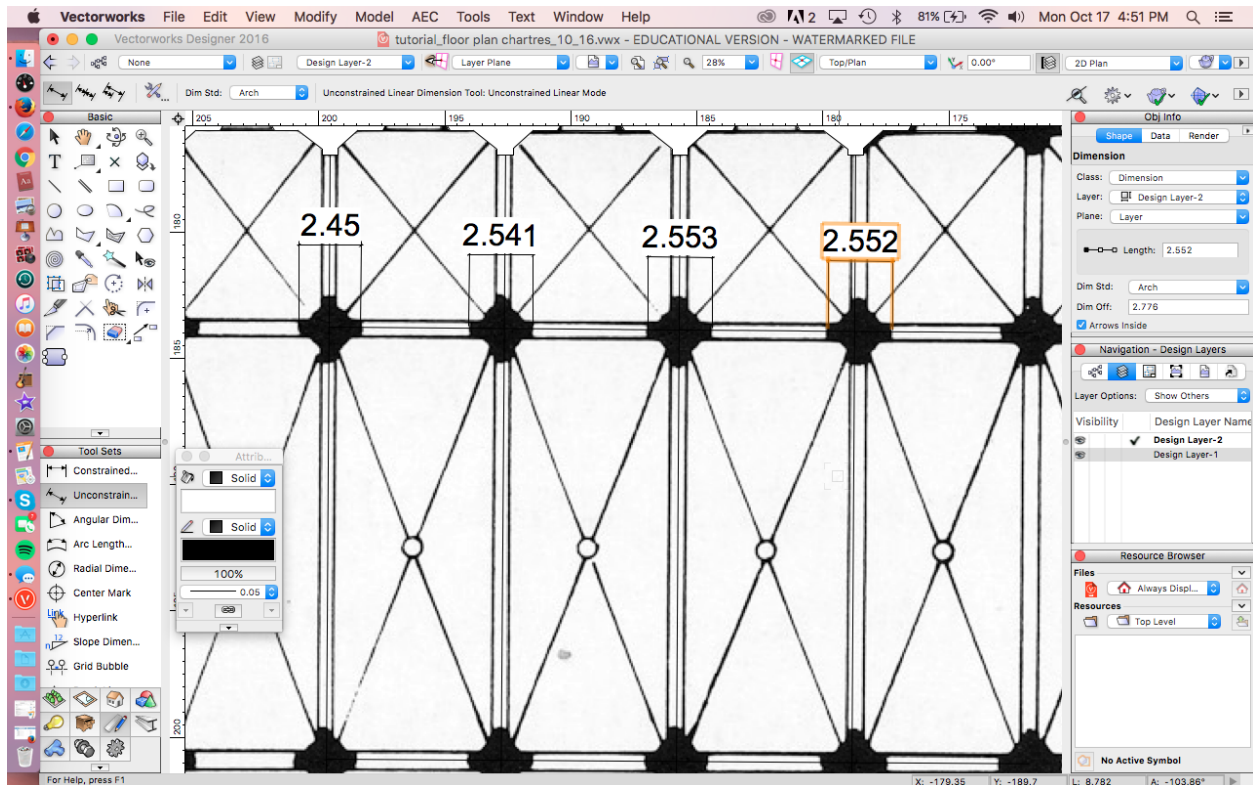
**Step 9. Create the Pier Bases**

1. First, create reference lines to clearly define the bays. Trace reference lines between the center of one buttress to the center of the opposite. They do not need to follow the lines in the drawing exactly. It is more important that your bays be symmetrical than that they exactly follow the plan.

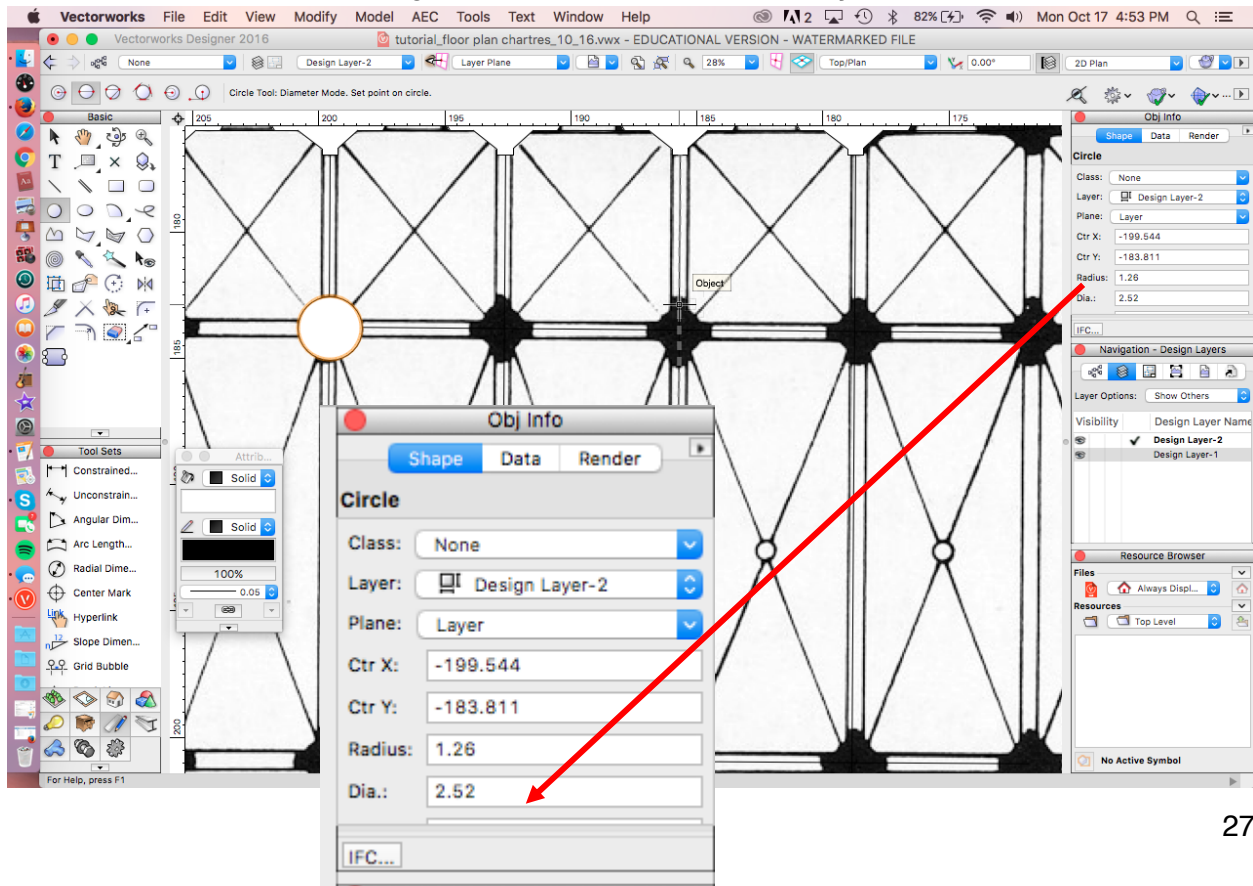
Create horizontal reference lines by tracing a line from the first to fifth pier. (Design Layer 1 is turned off here to show the reference lines).



2. You will create the pier base later, so for now you need a placeholder. Zoom in and measure the diameter of the 2nd to 5th piers. Take the average, which should be about 2.52.

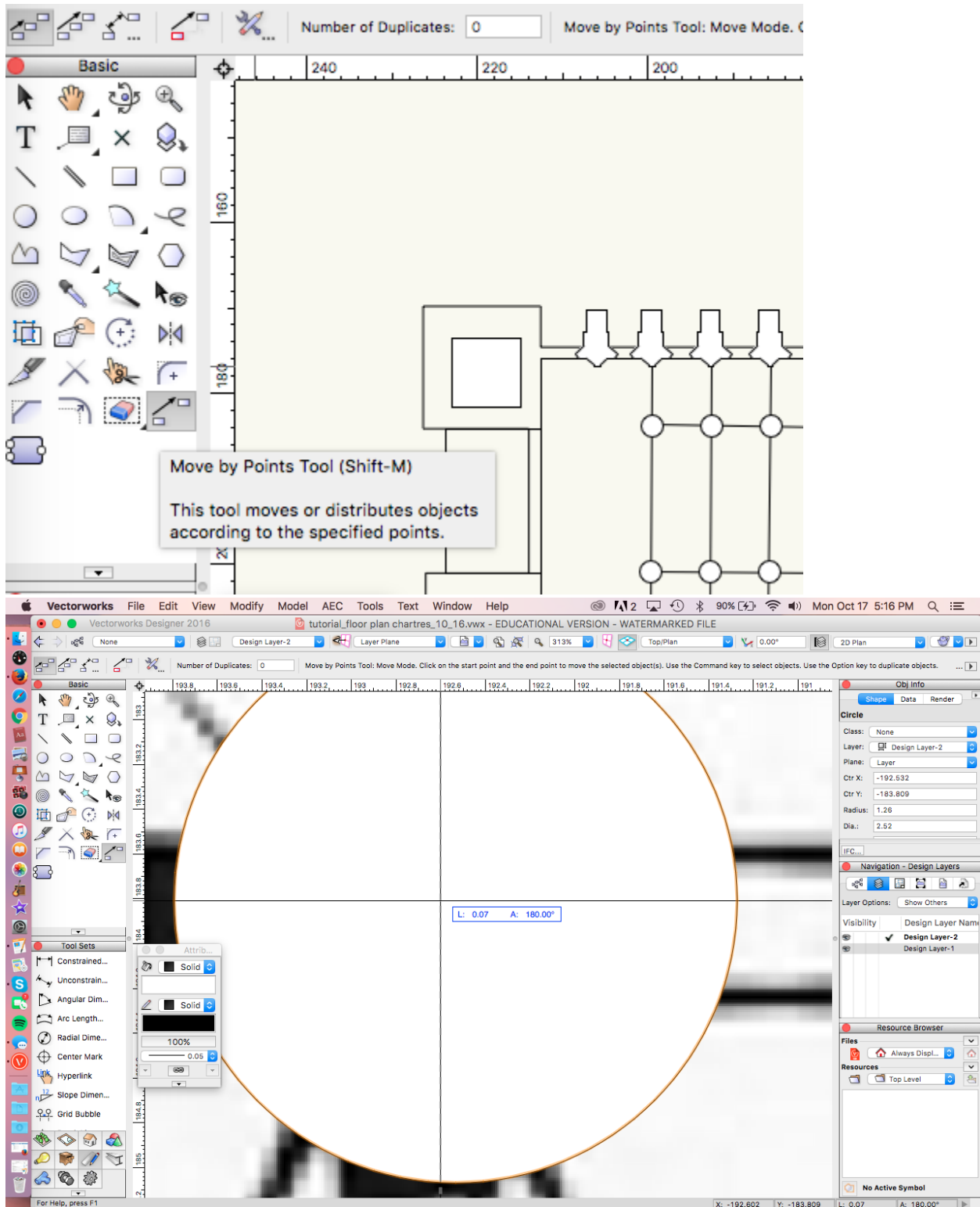


3. Draw a circle, and change the diameter to 2.52 in the **Object Info** palette.



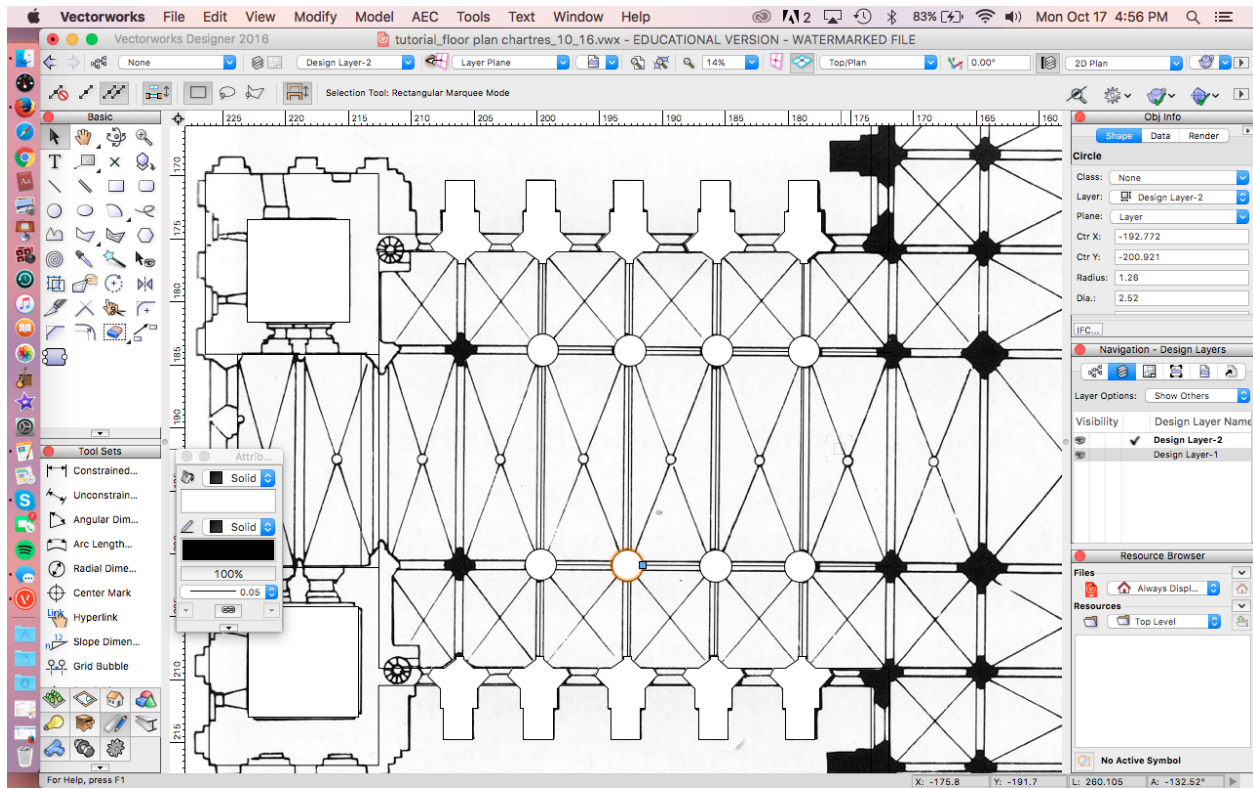


4. Snap the center of the circle to the intersection of the reference lines. If it doesn't snap, then you can right click on the circle, and under **Send** click **Send Backward** so that the circle appears under the reference lines. This way, you can zoom in and get the center as close to the intersection as you can. Use the **Move by Points** tool in "Move" mode to make this easier (make sure Number of Duplicates is 0).

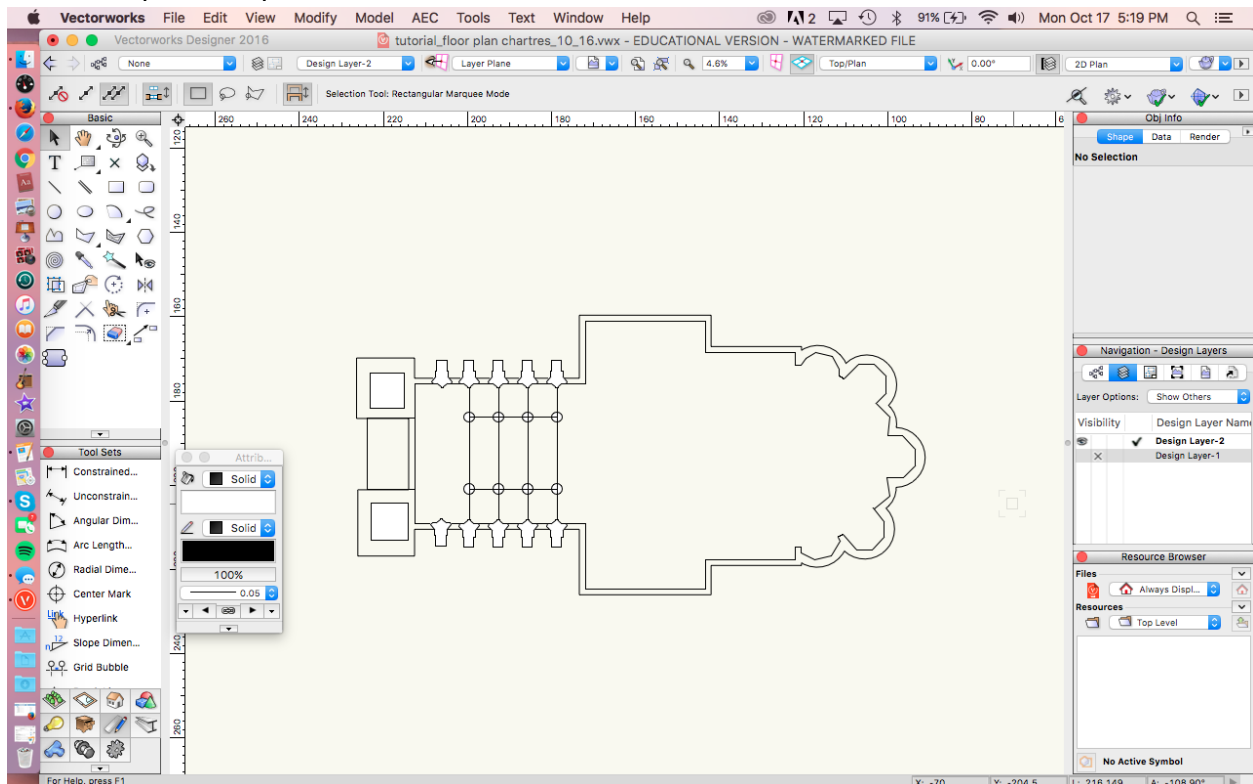




5. Copy the circle and paste in place (**Edit > Copy > Paste in Place**), then repeat step 4 until all the piers are in place.



Your floor plan complete!



**Recap:**

To create the floor plan, you:

- Imported and scaled an image of the plan
- Organized your work into layers
- Created 2D objects using various tools in the **Basic Tools** palette
- Created walls and buttresses using the
  - Add Surface tool
  - Offset tool
  - Duplicate Array tool