How to Build a Hexagonal Picnic Table

I will be showing you how to build a 6 seat, hexagonal picnic table using mostly 2x4 and 2x6 dimensional lumber- took 3 days to complete, and I'm very pleased with the way it turned out I decided to use standard, untreated boards because the person I built it for was on a bit of a budget, and seal the wood with an exterior waterproofing stain; but if you can afford the extra cost, I would recommend using redwood, cedar, or another naturally rot-resistant wood to increase the life of the table.

Supplies:

Here are the tools and materials you will need to complete this project...

Tools:

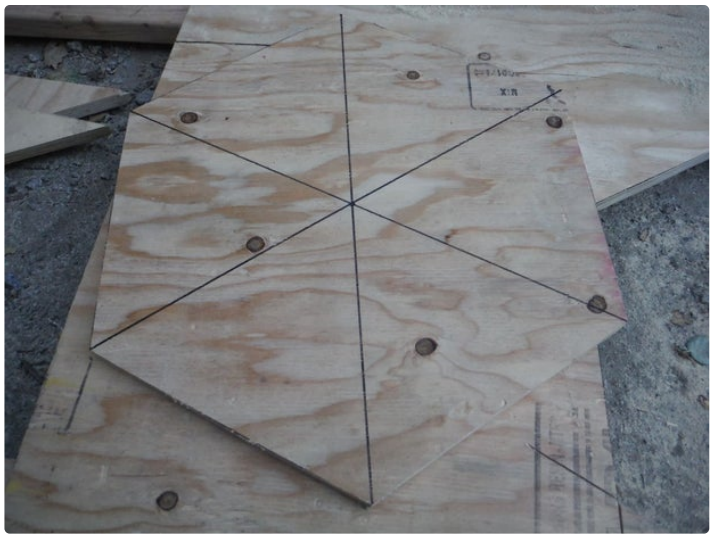
- Miter Saw
- Table Saw (optional)
- Circular Saw
- Random Orbital Sander
- Impact Driver (optional)
- Drill
- Clamps
- Tape Measure
- Straightedge
- Tile Blade (optional)
- 1" Hole Saw (optional)
- Compass
- Protractor or Roofing Square
- 80 and 150 grit sanding discs

Materials:

- 2x4x8' - 28 pieces
- 2x4x10' - 1 piece
- 2x6x10' - 2 pieces
- 2'x4' sheet of 3/4" plywood
- 2" Deck screws - 36
- 2 1/2" Deck screws - about 3 lbs
- 3" Deck screws - about 3 lbs
- 3 1/2"x3/8" galvanized hex bolt - 12
- 3/8" galvanized hex nut - 12
- 3/8" galvanized washer - 24
- Plexiglass 18" x 18" x 3/8" (optional)
- Tile 18" x 18" x 3/8" (optional)
- Exterior paint, stain, or sealant (optional)

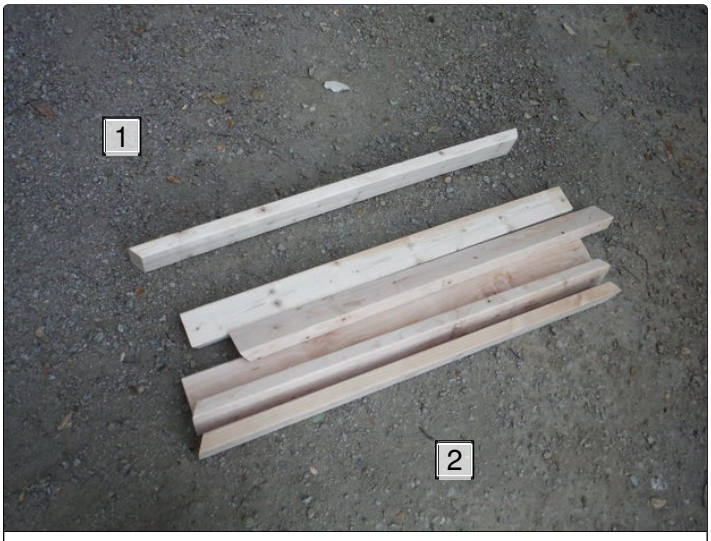
Step 1: Cut Gusset Plates

First, you will need to draw and cut two hexagonal gusset plates out of 3/4" plywood which will be used to assemble and strengthen the leg braces for the table. The size of the gussets will never change, no matter what size table you build. Each side of both hexagons is 10" long. To construct your hexagons, set a compass to draw a circle with a 10" radius and draw two full circles on the plywood. Then, pick a point on each circle, mark it, and without adjusting the compass, draw an arc from the point so that it intersects the edge of the circle on either side of your point. Now move the compass to each intersection point and draw another arc at each point across your circle. Move the compass to the new intersection points once again, and draw more arcs. If you've done it correctly, you should end up with 6 points where the arcs intersect the original circles. Use a straightedge to draw and connect the 6 points on each circle, forming the outlines of your hexagons. Extend the lines to the edges of your piece of plywood to make it easier to figure out where to start your cuts (don't draw lines through the insides of the hexagons though). Now use a circular saw to cut them out. Finally, use a straightedge to mark guidelines on the hexagons (draw on whichever side is uglier, as it will not be visible), dividing each into 6 equilateral triangles. Don't cut the hexagons into triangles though, we need them whole!



Step 2: Cut Leg Braces

Cut 6 48" 2x4 pieces (measured on long side) with the ends cut vertically to form 60 degree angles (set the miter saw to 30 degrees, as 0 degrees on the miter saw is a 90 degree angle cut; and place the 2x4 with the thick side against the fence). Cut the end angles opposite each other (if you were to draw lines outward following the cut angles, they would eventually intersect each other and form an equilateral triangle with the 2x4 as one of the edges.

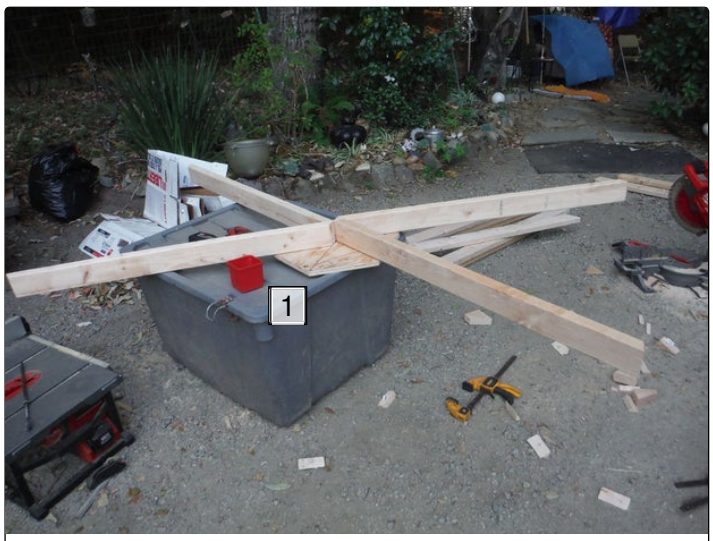


1. make sure to cut the angles opposite each other, if you imagine lines going through the 2x4 at those angles, they will intersect, forming an equilateral triangle
2. the intersection point of the imaginary lines would be somewhere around here

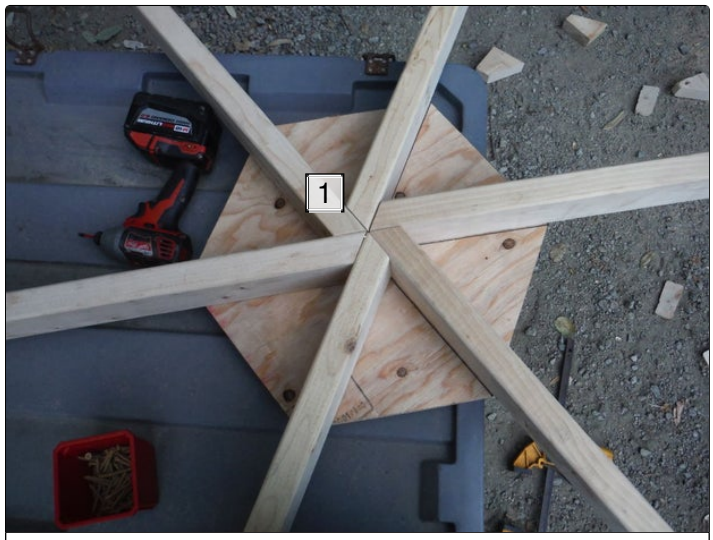
1. set miter saw to 30 degrees

Step 3: Assemble Leg Braces

Clamp one of the 48" 2x4s against one of your hexagonal plywood gussets as shown in the first image. The 60 degree angle should line up with the center of the gusset, and the long edge of the 2x4 should follow the edge of one of the equilateral triangles which you marked on the gusset. Flip the pieces over and attach the gusset to the 2x4 with 3 2" deck screws (image 2). Now, flip the assembly again and add the second 2x4 opposite from the first one (images 3 and 4). Continue clamping and attaching 2x4s until you have attached all 6. I found that it was helpful to place the entire assembly on top of a small table (or in this case, a random plastic bin which was sitting nearby) 2 or 3 feet off the ground. This way, instead of constantly flipping the assembly back and forth as you add more 2x4s and make it heavier and heavier, you can just sit down and drive the screws in from underneath. You will eventually have to elevate and support the table later when it comes time to add the legs, so you might as well do it now and save yourself some trouble. Once you have attached all 6 leg braces to the first gusset plate (images 8 and 9), position the second gusset plate on the other side of the 2x4s. I found that drilling a small 1/4" hole in the center of the second gusset was extremely helpful in properly aligning and centering it. Just look through the hole and position it over where all the 2x4s meet in the middle, then rotate the gusset till it lines up with the first one, clamp it in place, and drive in more 2" screws to secure it to the rest of the brace assembly (images 10, 11, and 12).



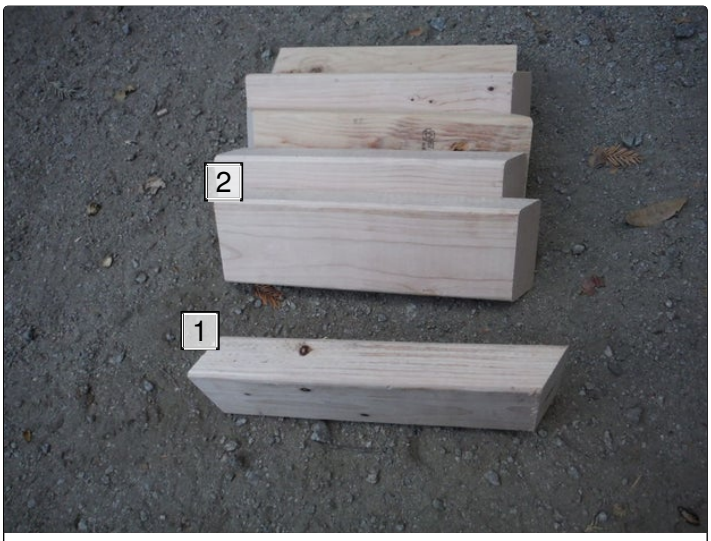
1. place the assembly on a raised platform and attach screws from underneath to save time



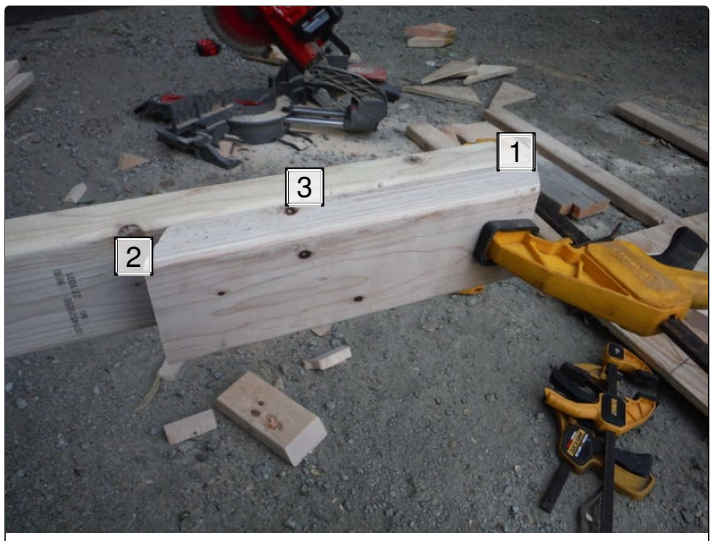
1. so pretty...

Step 4: Cut and Assemble Seat Blocking

Cut 6 11" 2x4s (measured on either side) with both ends cut vertically to form 60 degree angles parallel to each other (unlike the previous cuts, if you imagine lines extending from the cut angles, these lines will never intersect) as shown in the first image. Then, clamp and attach the blocking pieces to the ends of the leg braces with 2 1/2" screws (images 2 and 3). Make sure the top faces of the blocking pieces are level with the tops of the leg braces, or your seats will look bad. Attach all 6 blocking pieces in the same manner (image 4).



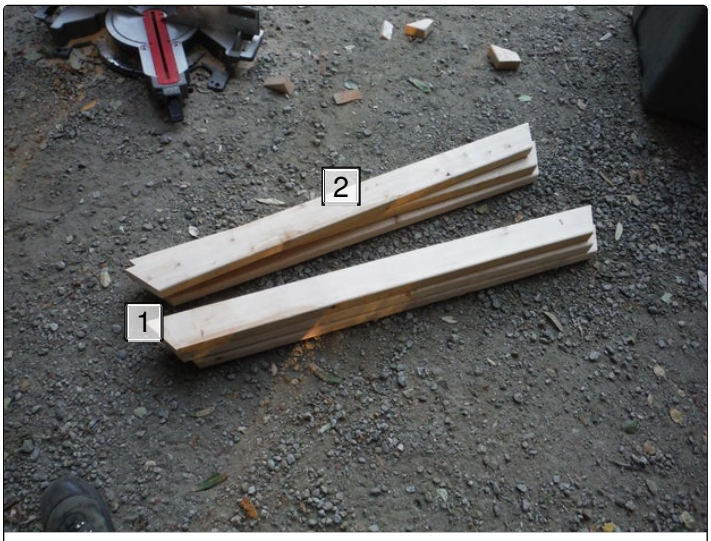
1. end angles cut parallel to each other
2. sides are 11" long



1. vertex inward
2. vertex outward
3. tops level

Step 5: Add Outer Seating Ring

Cut 6 48" 2x4s (measured on long side) with the ends cut horizontally at 60 degree angles facing opposite each other (miter saw set to 30 degrees, 2x4 with thin side against the fence). Place the first 2x4 on the leg braces with the long side facing out and line the angles and edges up (images 2 and 3). Drive 2 3" screws through each end of the 2x4 (4 screws total) and into the leg braces and blocking. Place the second 2x4 with the angles lined up to make one corner of a hexagon and secure it with more screws (image 5). Continue working your way around the outer edge until you complete all 6 sides (images 6 and 7).



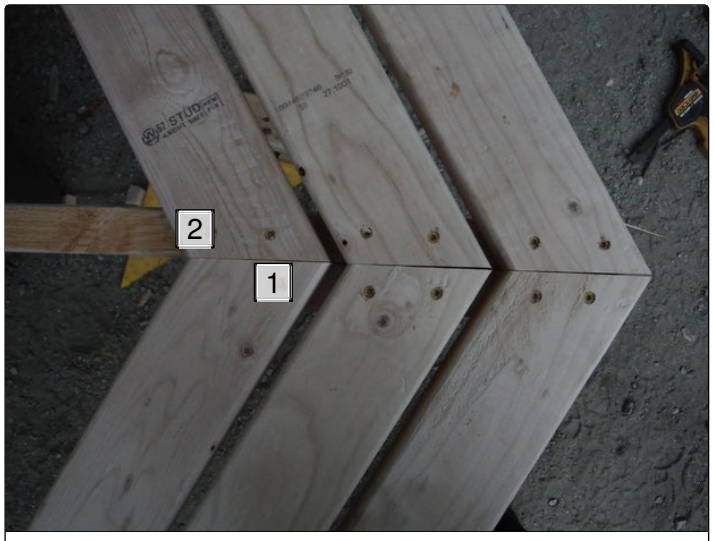
1. angles facing opposite each other
2. 48" on long side

Step 6: Add Inner Two Seating Rings

Cut 6 43 1/2" 2x4s the same way you cut the previous 6. The only thing that changes is the length. Now, line up each side of the first 2x4 with the crack between the blocking pieces and leg braces (image 2). Drive in screws as you did previously, and work your way around the table until all 6 are attached (images 3, 4, and 5). Now cut 6 39" 2x4s, once again cutting the same angles on the ends. Assemble them in the same manner you have done for the last 2 rings, except this time, only drive in one screw on the side over the blocking piece, as it is not long enough to drive 2 screws into (this is on purpose, to leave room for the table legs) without missing the blocking with the inner screw. You can still drive 2 screws into the side which does not fall on the blocking (image 8). Work your way around the table once again, until all 6 2x4s are in place (image 9).





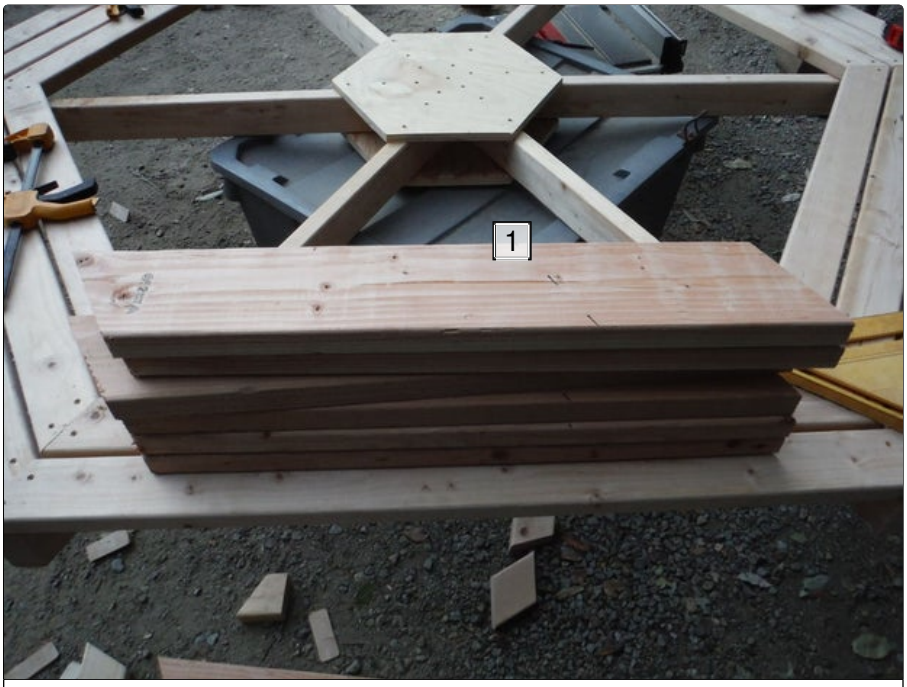



1. one screw here
2. 2 screws here

Step 7: Cut and Attach Table Legs

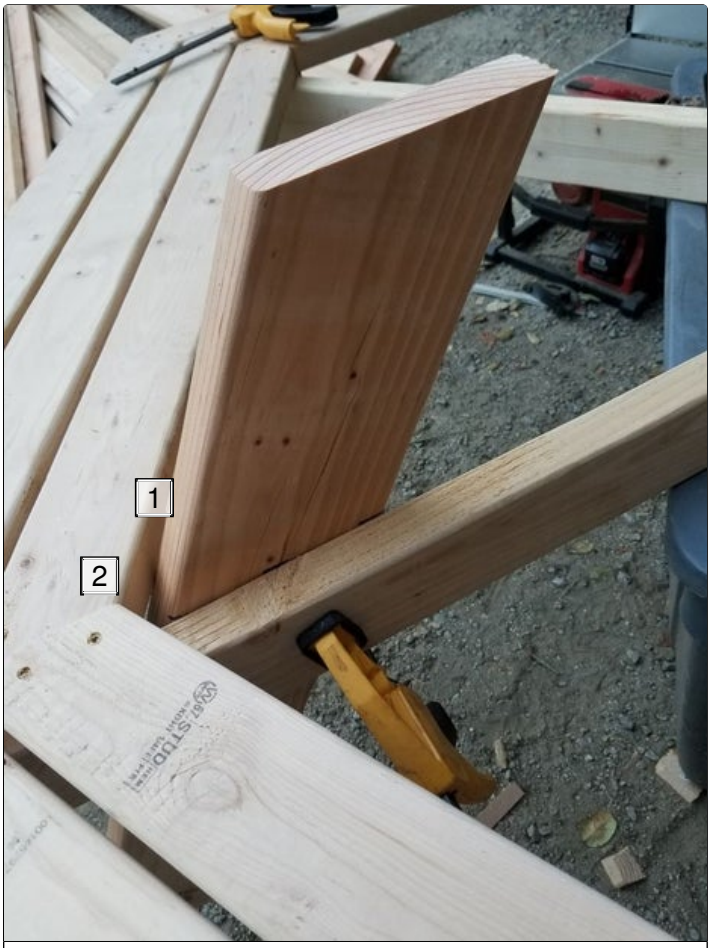
Cut 6 31 1/2" 2x6s with ends cut at 60 degree angles parallel to each other. Mark a line 20 1/2" from one end of each 2x6, parallel with the end cuts (image 2). If you haven't done this already, find something to support the table from the center, such that the seating ring is raised 2 to 3 feet off the ground. Clamp a 2x6 to one of the leg braces so that the line you marked on the side lines up with the top of the leg brace, and push it as far outward as it will go against the seating ring (image 3). Attach each 2x4 with 2 2 1/2" screws.

Once you have secured all 6 table legs to their respective braces, go back around the table and drill 2 additional 7/16" holes all the way through each leg and brace, and insert a 3/8" x 3 1/2" galvanized hex bolt with a washer into each hole. Fasten each hex bolt in place with another washer and a nut. Tighten them down until the washers begin to bite into the wood just a little bit. Once you've finished tightening the hex bolts, you can set the table on the ground again.

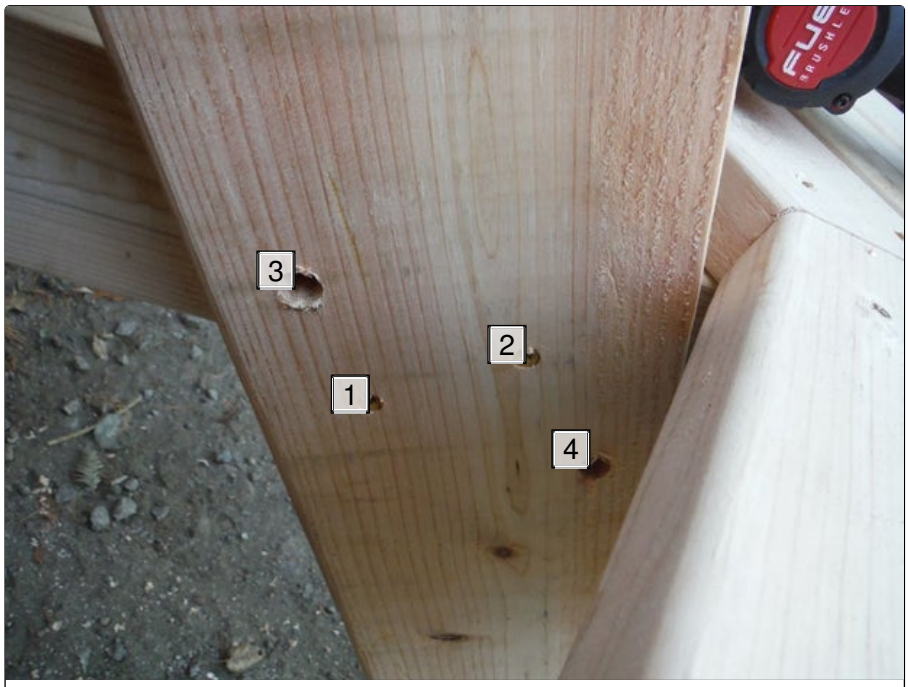


1. mark a line 20 1/2" from the bottom and parallel with the cut ends on each leg

1. mark 20 1/2" from the bottom, parallel to the cut



1. position line at top of leg brace
2. leg brace touches seating ring at corner



1. screw
2. screw
3. 7/16" hole
4. 7/16" hole

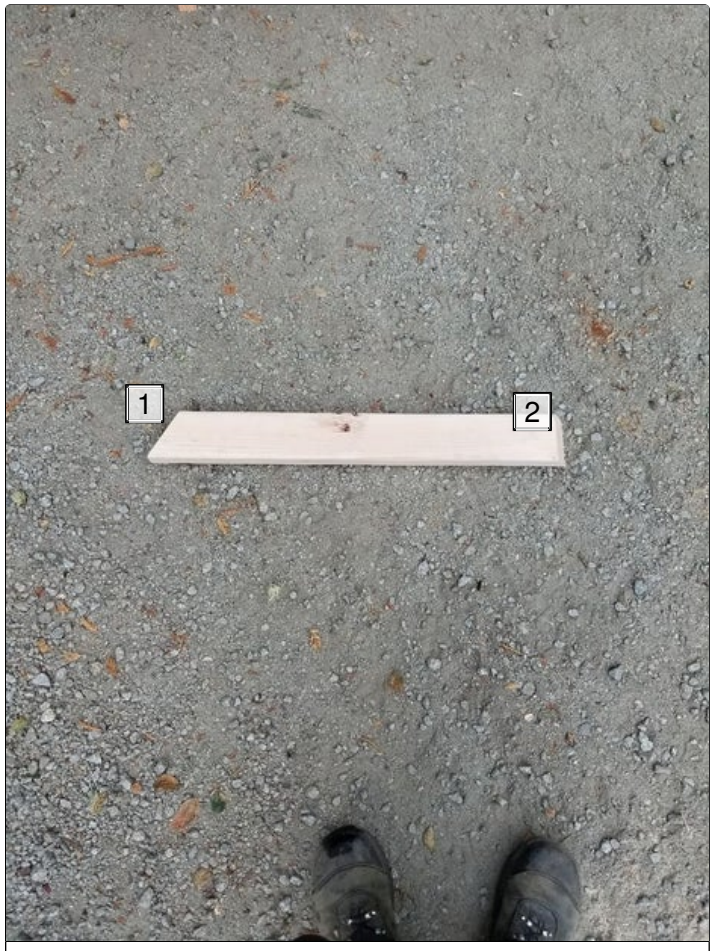
Step 8: Add Tabletop Base (part 1)

Cut 2 55 1/4" 2x4s (measured on long side) with ends at 60 degree angles opposite each other. Clamp the 2x4s to the tops of 2 of the legs spanning across the center of the table (images 2 and 3). Drive 2 2 1/2" deck screws through each 2x4 and into the table legs, then fasten the 2 2x4s to each other with more 2 1/2" screws spaced every 8" or so. Finally, measure and mark a line at the center of the 2x4s (image 6).

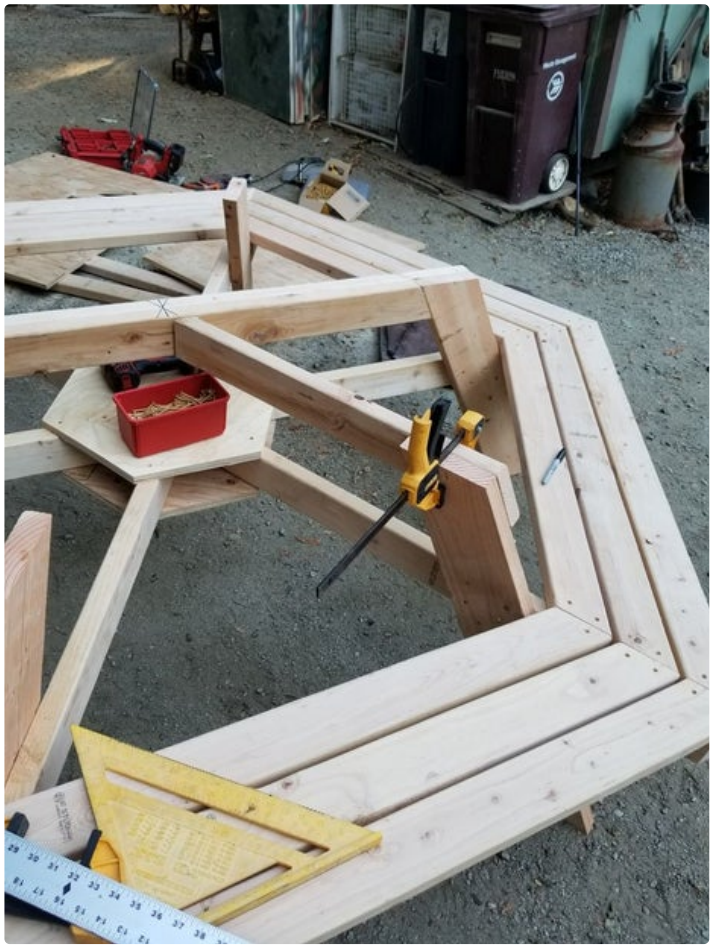
Step 9: Add Tabletop Base (part 2)

Cut 2 29" 2x4s (longest side) with one end cut horizontally at a 60 degree angle, and the other end cut vertically at a 60 degree angle. If you place the board with the short side facing up and the horizontal cut end facing toward you, the vertical angle needs to have the vertex on the left side (image 1). Before you start attaching the 2x4s to the table, it is extremely helpful to draw a small guide on the 2x4s you added in the previous step. All you need to do is draw an "X" mark across the exact center of the boards. The lines should be 30 degrees from the center mark you made at the end of the previous step (image 3). Now you can begin adding the 2x4s. Clamp a 2x4 to the top of one of the table legs to the left of the legs with 2x4s already attached (image 2) and line it up with one leg of the "X" mark. Note that it will not be lined up with the centerline, but rather offset about an inch (image 3). If all the boards used to build the table were perfectly straight and not warped or twisted in any way, and all of the measurements and cuts were perfectly accurate, we wouldn't even need the guide marks; but this is wood we're dealing with here, and tiny inaccuracies start to add up after a while, so that's never going to happen. As a result, you may have to force the boards into position a little bit. Drive 2 3" screws to secure the board to the center, and 2 more 2 1/2" screws at the leg. Repeat for the other side of the table.

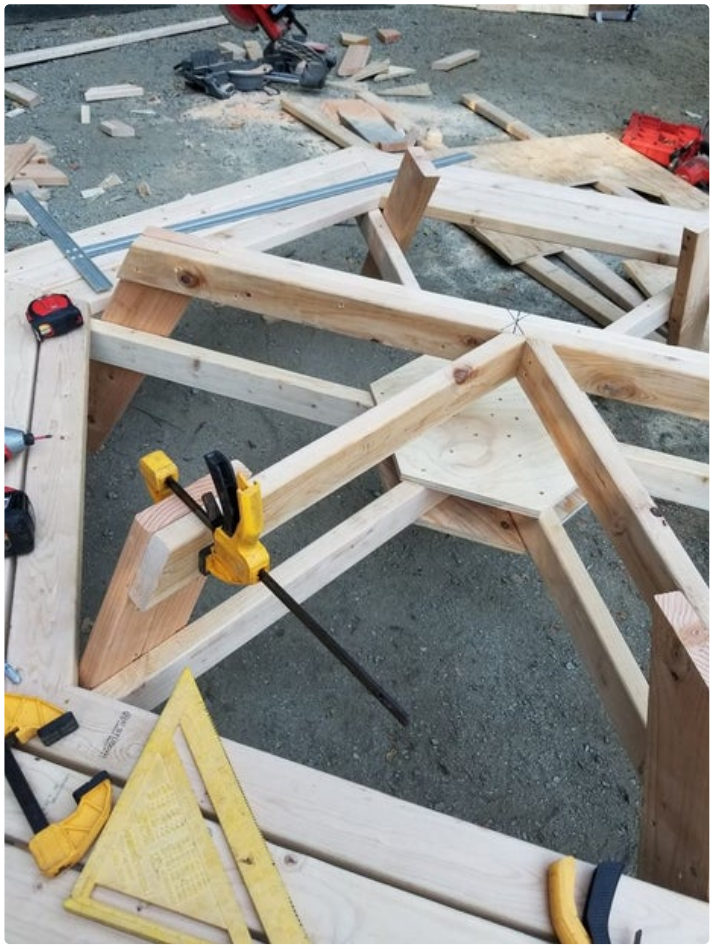
Now cut 2 more 29" 2x4s with one end cut horizontally at a 60 degree angle, and the other end cut vertically at a 60 degree angle, but this time, cut the vertical angle with the vertex on the opposite side. Clamp and attach it in the same manner as the previous one (images 6 and 7). Repeat for the opposite side (image 8).



1. horizontal 60 degree cut
2. vertical 60 degree cut



1. draw an "X" to show where to line up the boards

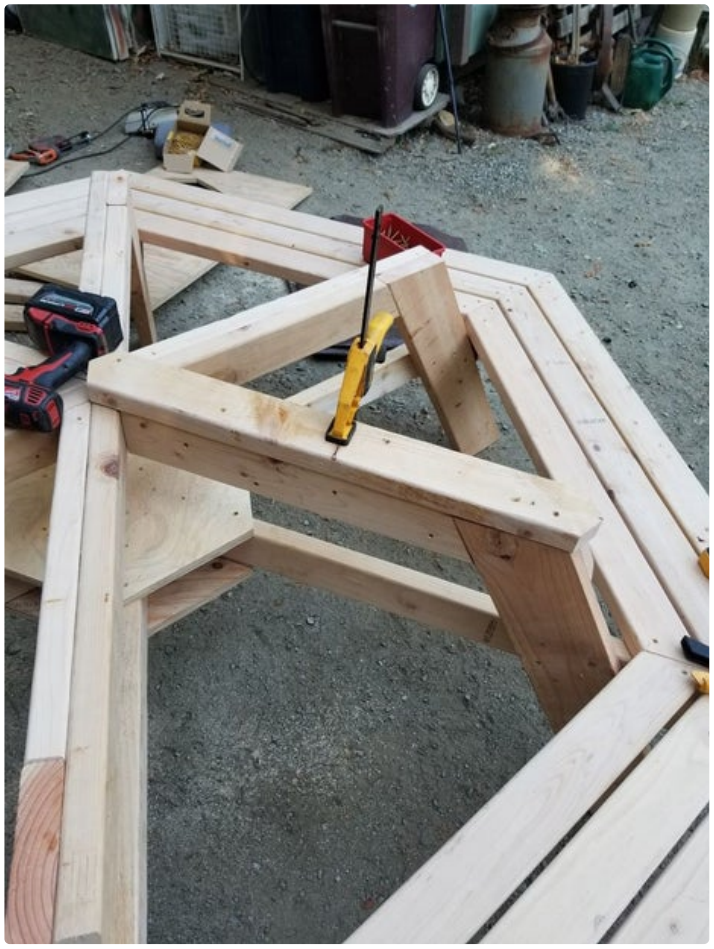


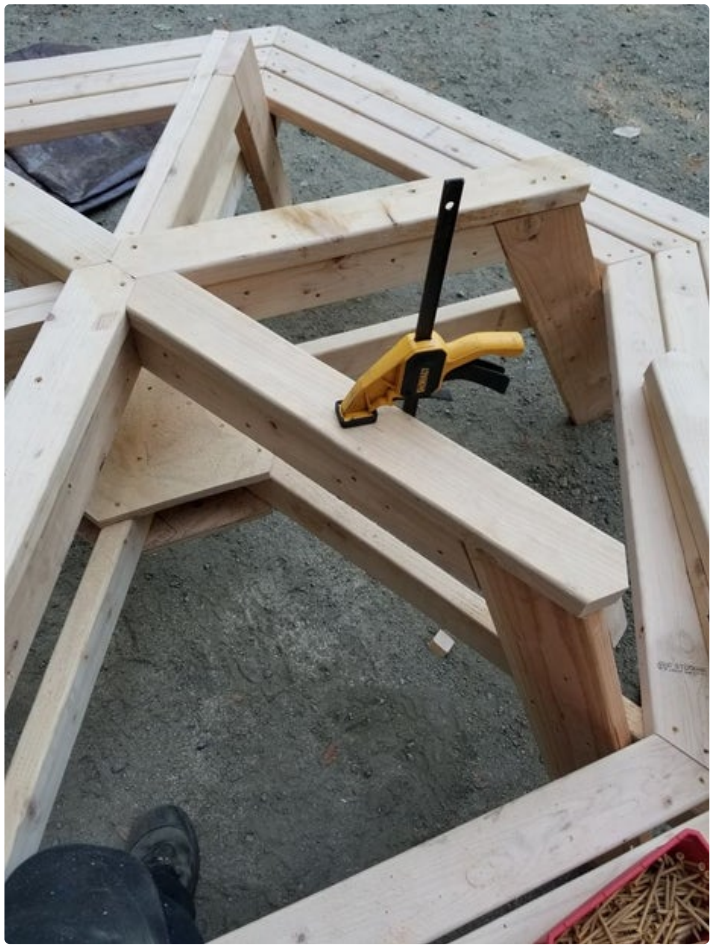
Step 10: Add Tabletop Base (part 3)

Cut 4 22 5/8" 2x4s with one end cut horizontally at a 60 degree angle, and the other end cut vertically at a 60 degree angle. When you place the board with the long side down and the horizontally cut end facing you, the vertex of the vertical angle should be to the right. Clamp the 2x4s and attach with 4 2 1/2" screws (images 1 and 2). Repeat for the remaining sections (image 3).

Step 11: Add Tabletop Base (part 4)

Cut 3 30" 2x4s with the ends cut at 120 degree angles. To cut these, measure in 1 3/4" at each end of the board and make a mark; this will be halfway across the board. Set the miter saw to 30 degrees and cut up to the halfway point, then flip the board and do the same for the other half. Place each 2x4 on top of every other spoke of the table, such that it divides the table into thirds, clamp them, and attach them with 4 3" screws (images 2, 3, and 4). Now cut 3 28" 2x4s with the ends cut at 120 degree angles in the same manner as the previous 3. Clamp and attach them to the 3 remaining spokes (images 6, 7, 8, and 9).



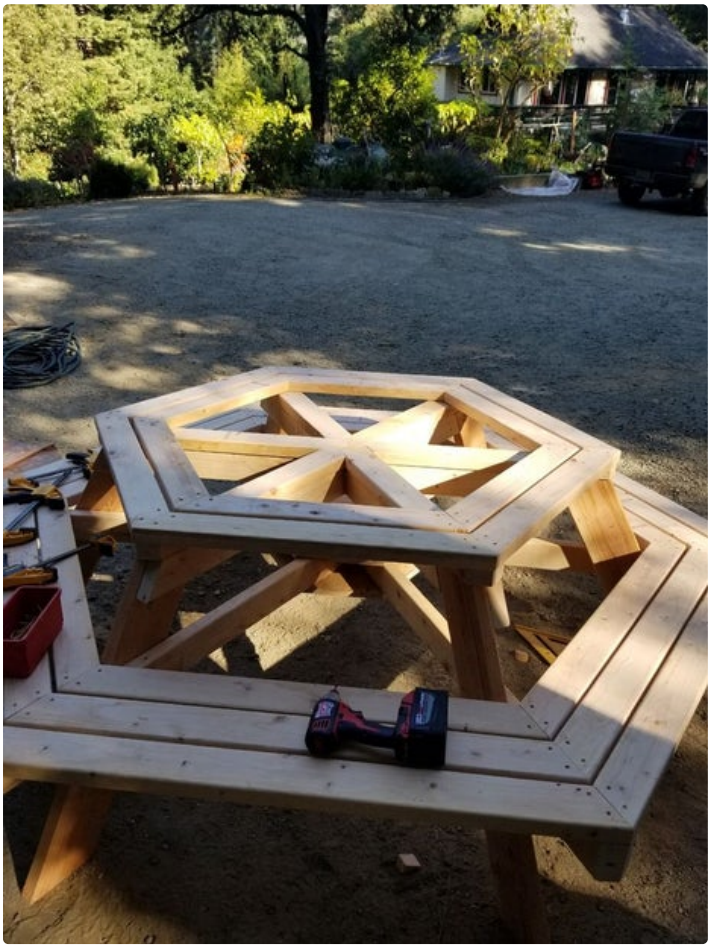


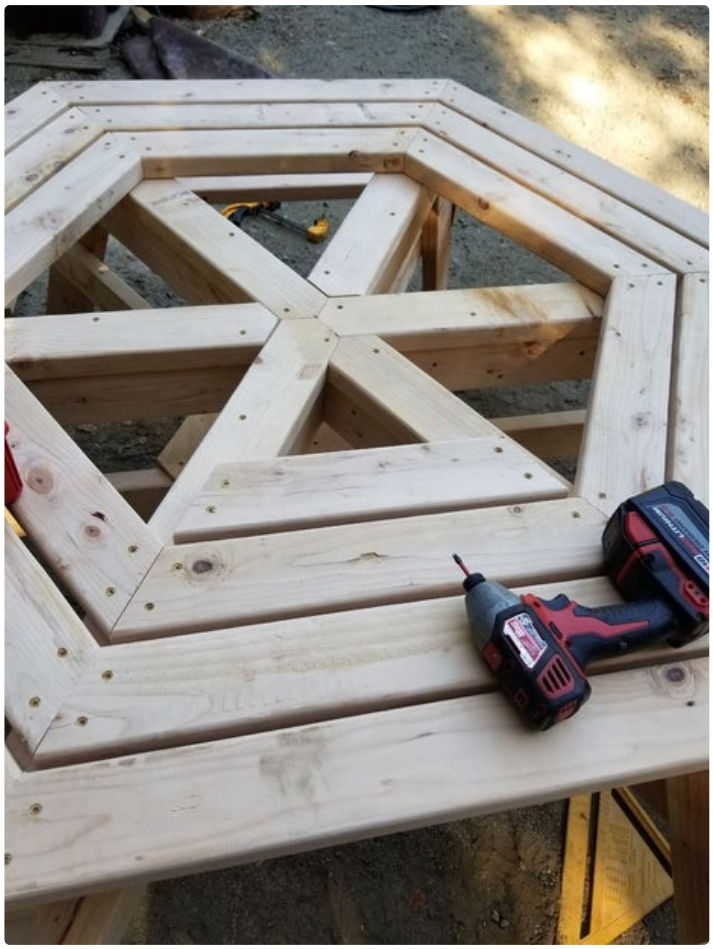
Step 12: Add Outer Tabletop Ring

Cut 6 30" 2x4s with ends cut at 60 degree angles opposite each other. Line up the first 2x4 so that the angled end cuts line up with the ends of each support spoke. Drive 2 3" screws into each end to secure it in place (image 2). Work your way around the table until you have attached all 6 2x4s (images 3 and 4). You may have to apply some sideways pressure to the support spokes in order to make them line up properly due to twisted or warped wood.

Step 13: Add Remaining Tabletop Rings

Cut 24 more lengths of 2x4, 6 pieces each at 25 1/2", 21", 16 1/2", and 12", with the ends cut at opposing 60 degree angles just like the outer ring. Work your way in from the outside, adding one smaller ring at a time in the same manner as the first ring. When you get to the innermost ring, instead of driving 2 screws into each end of each board, use only one screw per end. Once you have added 4 inner rings, you have several options: you can either cut and install 2 more rings with measurements of 7 1/2" and 3" per board and continue the pattern all the way to the center of the table, or you can inset a piece of plexiglass in the middle to show off the cool pattern of the support spokes meeting in the center of the table. You can also inset a piece of tile in the center so you can place a tabletop flame heater in the center. I chose to show off the center supports with a plexiglass centerpiece, if you would rather continue the pattern all the way to the center, use only 1 screw per board on the tiny central ring, and pre-drill all the way through the top 2x4s with a 1/8" drill bit before driving in the screw. If you do not pre-drill, you risk cracking the pieces of the final ring.



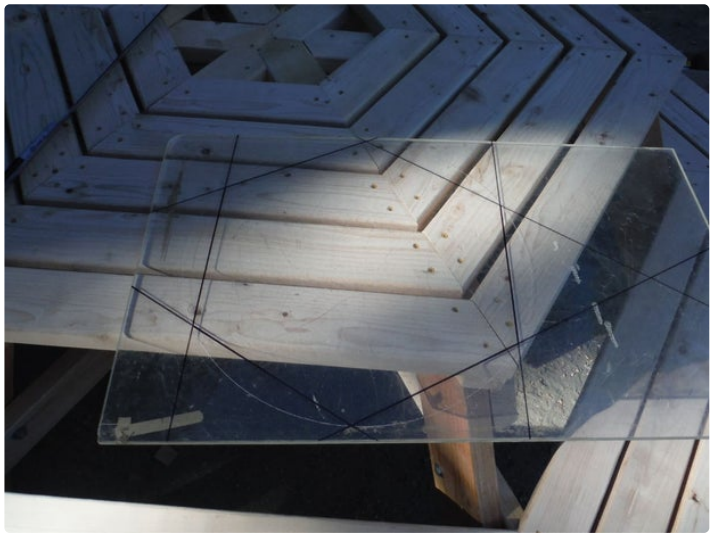


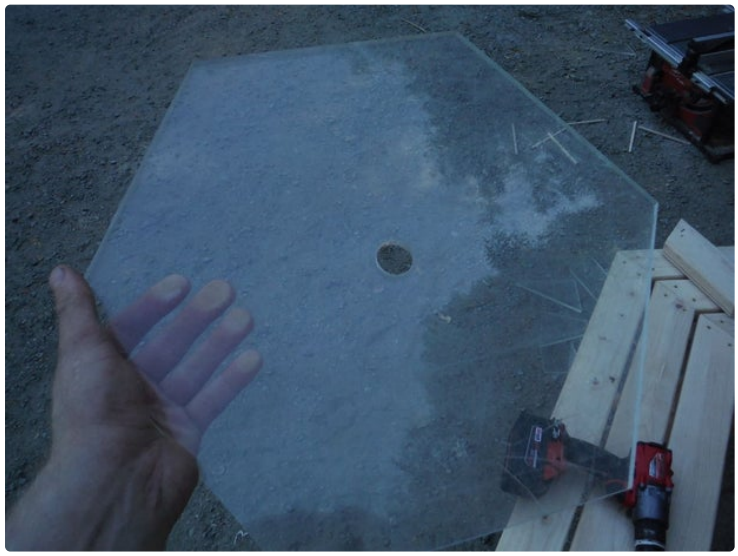
Step 14: Sand Seats and Tabletop

Use a random orbital sander to smooth the entire top surface of the seats and tabletop, and any other particularly rough spots. Pay special attention to the seams between boards at the corners of each ring, as you will occasionally get a defective 2x4 which has been cut slightly thick or thin, and by sanding the seams you can smooth out any abrupt height differences which may result from this. Start with 80 grit discs and then do a second round of sanding with 150s. You can progress to even finer grits if you like, but I found that 150 made the wood nice and smooth to the touch while still removing material quickly enough that the sanding process didn't take forever. If you want to be meticulous about sanding, you may have to sand by hand in some of the hard-to-reach areas where a power sander can't fit. If you've chosen to continue the pattern all the way to the center, skip the next 2 steps.

Step 15: Mark and Cut Plexiglass (optional)

On a piece of 3/8" thick plexiglass, use a compass to scribe a circle with an 8 1/2" radius and construct a hexagon in the same way that you constructed the ones for the gusset plates in step 3. Extend the sides of the hexagon all the way to the edges of the plexiglass. Use a table saw or handheld circular saw to cut out the hexagon; make sure to use a very sharp blade and take your time to avoid chipping the plexiglass. Finally, use a 1" hole saw to cut out a circle in the center of the plexiglass hexagon for hooking your finger into for easy removal. If you chose to do a tile hexagon, use a diamond grit hole saw and tile cutting blade instead.



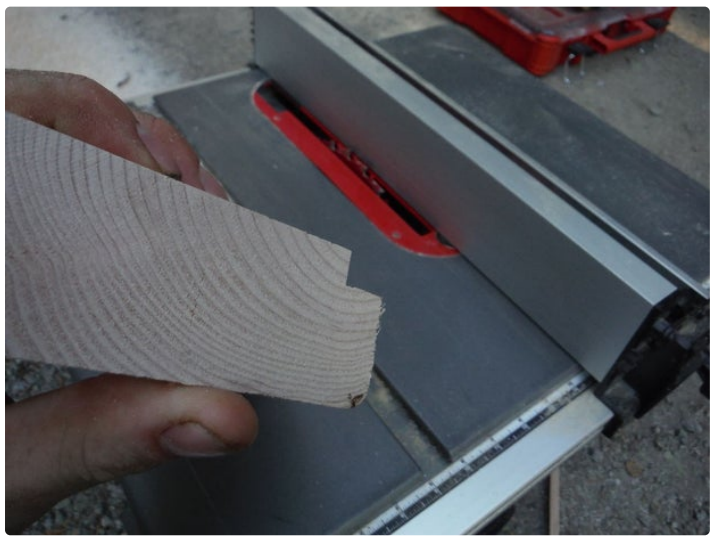


Step 16: Cut Insets Into Tabletop Center (optional)

Remove the pieces of the innermost ring of the tabletop, numbering the backs so that you can put them back in the same order. Use a piece of scrap plexiglass or tile to set the cut depth of your table saw to exactly the height of the plexiglass or tile (image 2), and set the fence to 3/8" (image 3). If you are planning on both plexiglass and tile inserts, use whichever piece is thicker to set the cut depth. Run each piece of the inner ring through the table saw with the numbered side facing up and the short side against the fence. Then, raise the blade by whatever the width of your blade is, and move the fence closer to the blade by the same amount. In my case, I had to adjust each by 1/8". Now, run each ring piece through the saw again, this time with the non-numbered side against the fence and the short side down. You should end up taking a small rectangular piece out of the inner top corner of each ring piece (images 8 and 9). Re-attach the pieces to the tabletop, and place the plexiglass or tile hexagon into the center (image 10).








Step 17: Stain, Seal, or Paint Table (optional)

If you wish, you can stain, seal, or paint the table with whatever exterior grade sealants, stains, or paints you like; this will extend the life of the table, especially if you didn't use a rot-resistant wood such as cedar or redwood. If you are using a nice-looking wood like cedar or redwood, I would recommend using only a clear sealant to preserve the natural beauty of the wood.

Step 18: Enjoy Your New Table!

That's it, you're done! Enjoy your new picnic table!