



LilyTool™ Instructions

Introduction

The LilyTool provides for a convenient and simple way to transfer the cut pattern for a LilyPad to a sheet of plywood. This document describes how to use the LilyTool in combination with hand tools to make a LilyPad.

A manufacturing file for the LilyTool is available for download at the website of FIRST Robotics Team 2468 at frc2468.org/lilytool. The file is provided for teams who have access to laser cutters and can manufacture their own. The file is distributed as a PDF. Development of the LilyTool was done on our team's GlowForge laser.

Please contact lilypad@frc2468.org to acquire a LilyTool if you are unable to manufacture your own.

Supplies you will need

1. 3/4 inch thick plywood, we recommend sanded birch wood or any kind of high-quality finished or sanded plywood
2. Sand paper, fine
3. Primer, water based (latex house paint in light colors works well)
4. Paints, acrylic
5. Paint brushes
6. Sealant, water-based polyurethane
7. Creativity

Tools you will need

1. LilyTool

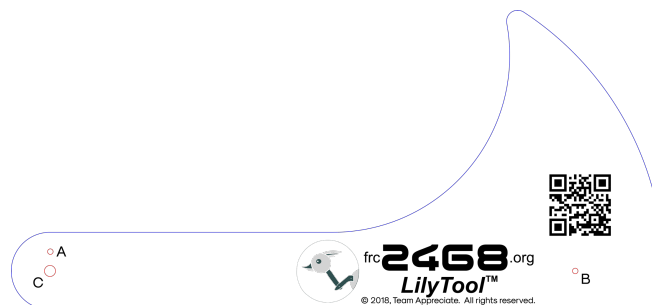


Figure 1 LilyTool

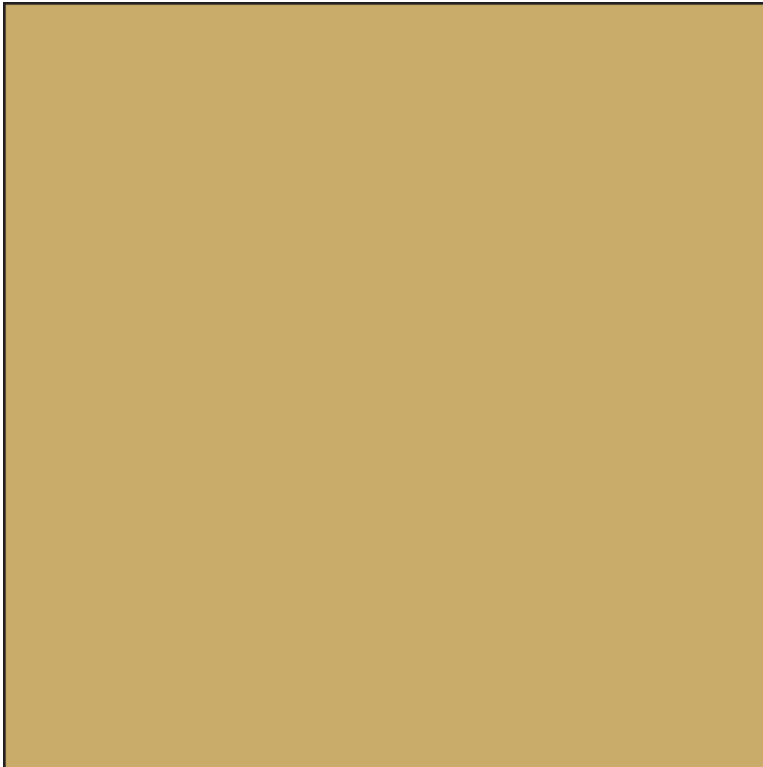
2. Two (2) pencils, sharpened
3. Hand drill
4. Hole saw, with a 1¾ inch saw bit and a ¼ inch drill bit
5. One of: jigsaw, scroll saw, or bandsaw to cut the perimeter
6. Router with a ⅜ inch half-moon bit for the rounding the edge



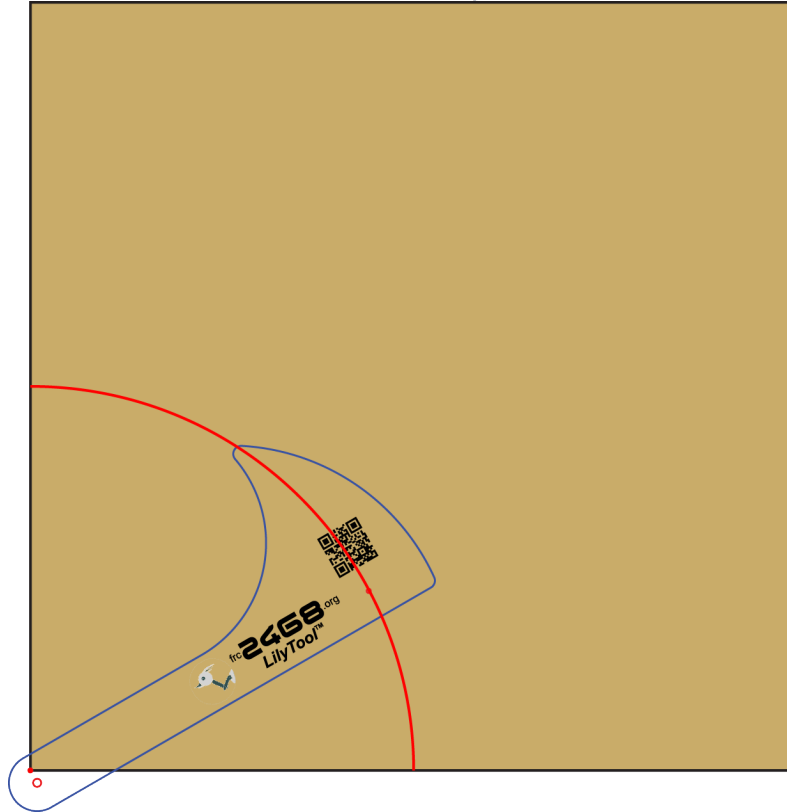
Method

In the following instructions, the description of most steps are followed by a diagram to illustrate the operation performed with the LilyTool.

1. Acquire a sheet of 3/4 inch thick plywood. Your local Home Depot or Lowes often sells 2x4 foot sizes and may be willing to cut one in half for you. It is easier to start with a board 2x2 feet since it fits on a bandsaw easier when there is less excess on the sides (if you're going to use a bandsaw).

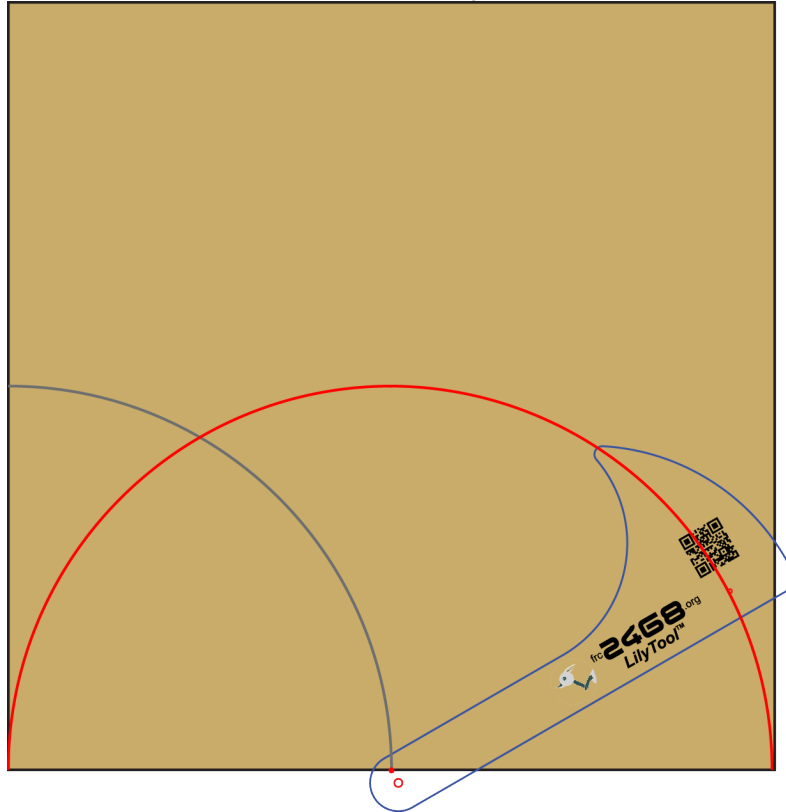


2. Transfer the pattern to the plywood.
 - a. Place pencil through hole A and place in a corner of the plywood. Place pencil in hole B and rotate pencil in hole B from one edge of the wood to the other edge of the wood. The pencil in hole B should have drawn a 90-degree arc on the plywood centered in the corner and going from the middle of one edge to the middle of the adjacent edge.

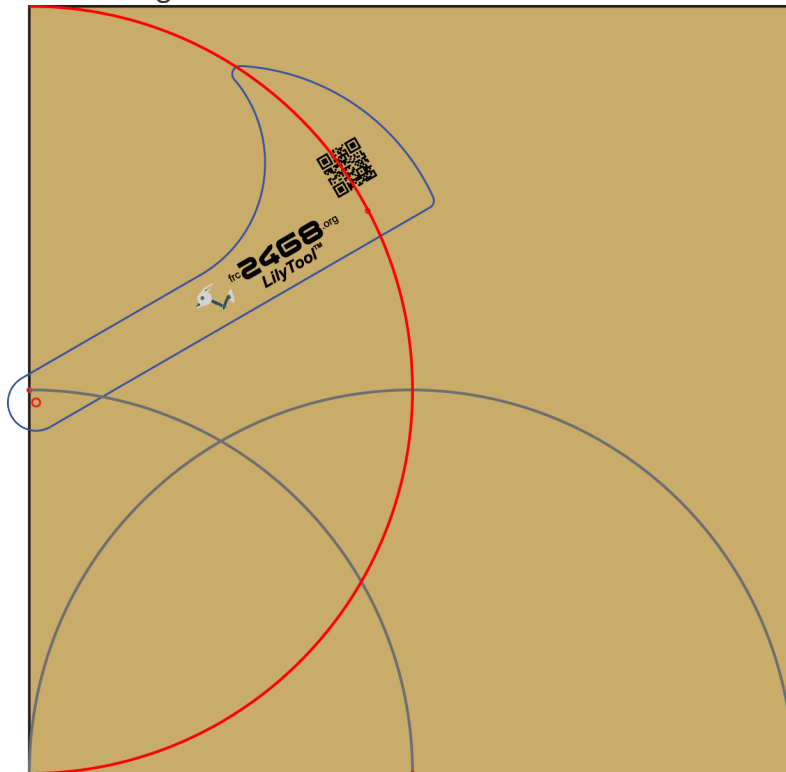


(Note: In each picture, the red line indicates the mark being made)

- b. Place pencil through hole A and place on the intersection of edge of the plywood and one of the marks made by the pencil in step (2). Place pencil in hole B and rotate pencil in hole B from one edge of the wood to the other edge of the wood. The pencil in hole B should have drawn a 180-degree arc on the plywood centered in the middle of one edge and going from one corner of the plywood to the other corner on the same side.

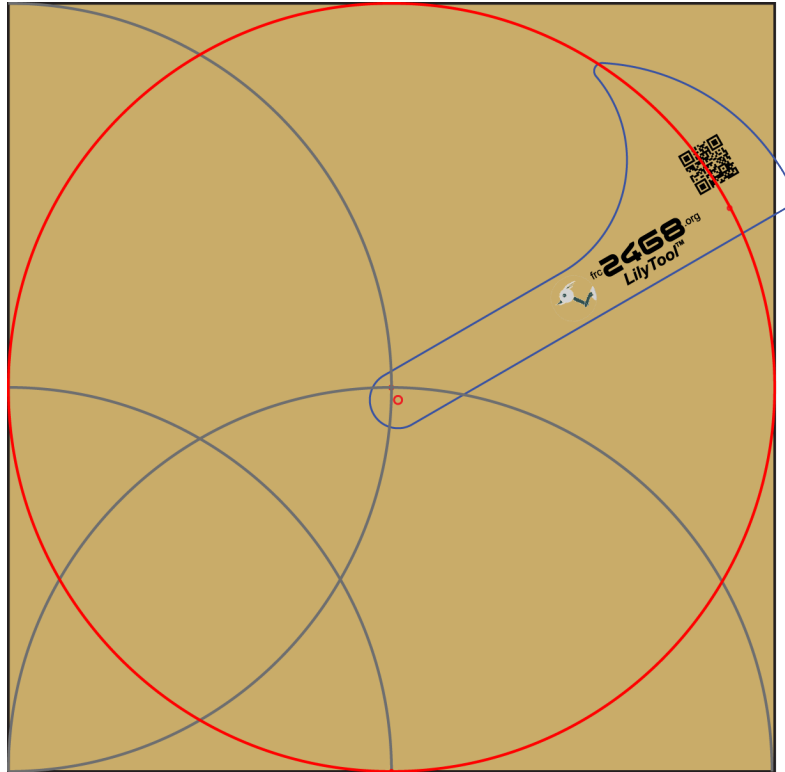


- c. Repeat step (3) for the other end of the arc created in step (2). You should have two 180-degree arcs that intersect at the center of the board (if 2x2 feet).

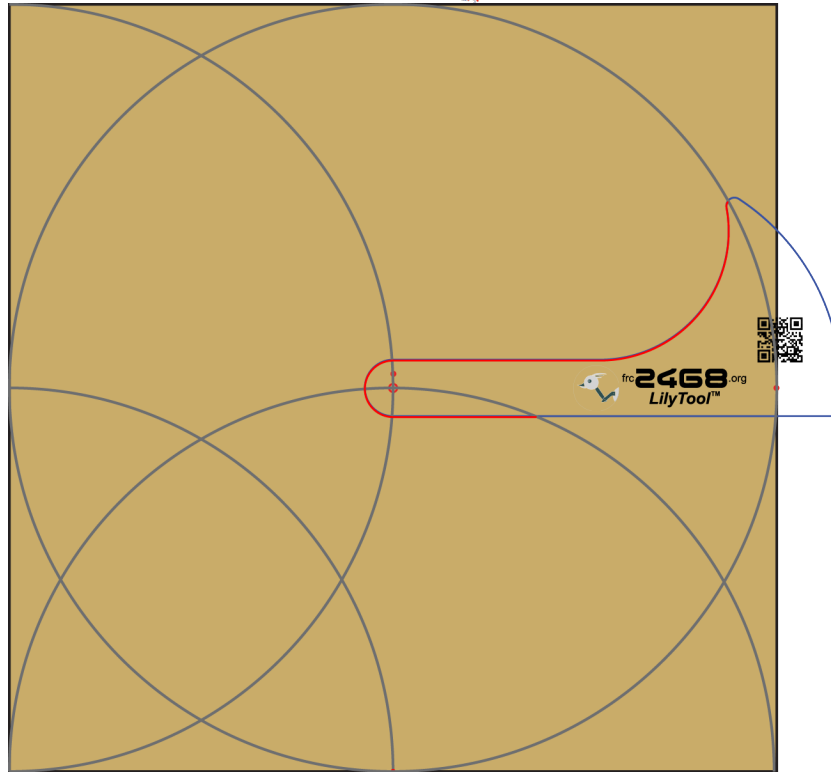




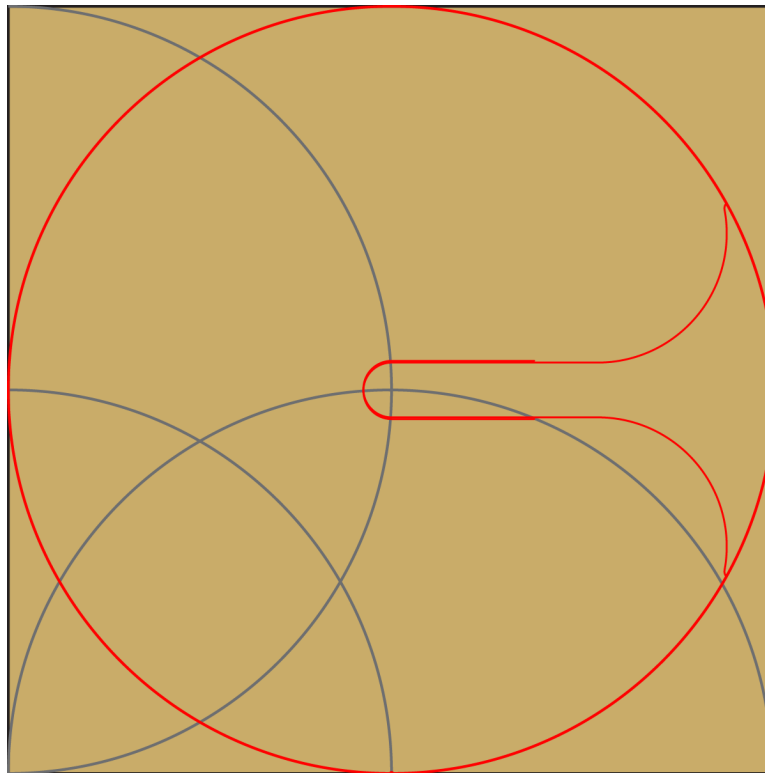
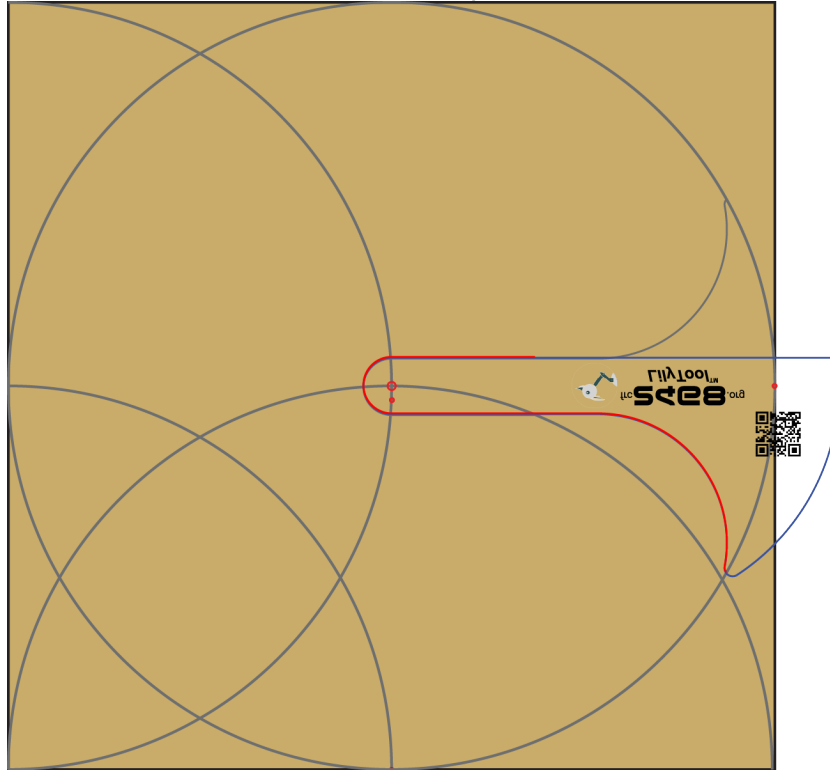
- d. Place pencil through hole A and place on the intersection of the two arcs at the center. Place pencil through hole B and rotate LilyTool 360 degrees. This marks the circumference of the final LilyPad.



- e. Using the hand drill and $\frac{1}{4}$ inch bit, drill a hole through the center mark.
- f. Remove the $\frac{1}{4}$ inch bit and insert through the hold just drilled. Expose the non-cutting end of the bit up so it doesn't cut other things. Place the LilyTool on the plywood with the exposed drill bit going through hole C. Holding the LilyTool in place, trace the perimeter with a pencil around the shaded edge of the LilyTool.



- g. Remove the LilyTool from the plywood, flip over, re-insert drill bit through hole C and line up the LilyTool with the pencil marks from step (7). Holding the LilyTool in place, trace the perimeter with a pencil around the shaded edge of the LilyTool in the opposite direction to step (7). This completes the pencil marks.



3. Put the drill bit into the hole saw and drill through the center point, creating a $1 \frac{3}{4}$ inch hole in the center of the board.



4. Using a jig/scroll/band saw, cut the perimeter of the LilyPad shape and then cut the neck of the LilyPad.
5. Round the edges with the router, both top and bottom.
6. Sand the LilyPads, both top and bottom.
7. Prime the LilyPads with the water-based primer after removing the dust from sanding.
8. Paint the LilyPad with a fun, creative design that will bring joy to the children.
9. Seal the LilyPad with three layers of clear polyurethane. Allow the paint and each layer of sealant to dry before applying the next layer.

LilyPad Pictures

The following are a collection of LilyPad pictures that provide some insight into the manufacturing process (automated CNC), decoration, and donation.



Figure 2 LilPads Being Cut Out on CNC



Figure 3 Completed LilyPad Blanks (After CNC and Edge Rounding)



Figure 4 LilyPads Being Primed After Sanding



Figure 5 Completed LilyPads



Figure 6 Donated LilyPads (Huntsville Hospital for Women and Children)



Figure 7 Demonstrating for the Hospital Staff



Figure 8 The Point of It All (Why We Do This)