

Mealworm Farm Prototype Schematics and Assembly Instructions

Developed for the University of Wisconsin Climate Quest Competition

By Tiny Farms Inc.
on behalf of Valerie Stull and Rachel Bergmans / MIGHTi
November 2014 - January 2015

Bill of Materials

Tools:

staple gun
hammer
drill (hand drill)
3/32" drill bit
miter saw
clamps (like C clamps)
scissors
felt tip marker
pencil
rags
coddle (see instructions below)
yard stick / tape measure

Materials:

wood glue
wood sealant - such as polyurethane, finishing wax, or a hard finish high gloss paint
staples (~175 per tray)
1 1/4" wood screws (flat head profile to fit flush with wood)
packing or duct tape
plastic sheeting (31 5/8" x 47 3/8")
woven polypropylene sand/grain bag 14 1/2" x 26 1/2" (~4x per tray)
sandpaper (coarse and medium grit)
petroleum jelly

Coddle

wood glue

Lumber Cut List:

1x2

2x - 8"

Tray

wood glue

175x - staples

~28x - 1 1/4" wood screws

1x - plastic sheet

4x - woven polypropylene sand/grain bag 14 1/2" x 26 1/2"

Lumber Cut List:

1x2

1x3
2x - 15 $\frac{3}{4}$ "

2x - 39 $\frac{3}{8}$ "

2x - 25"

4x - 2 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " isosceles right triangles

1x6

2x - 25"

Stand

Wood glue

18x - 1 $\frac{1}{4}$ " wood screws

Lumber Cut List:

1x2

3x - 22 $\frac{1}{8}$ "

6x - 22"

2x - 32 $\frac{9}{32}$ "

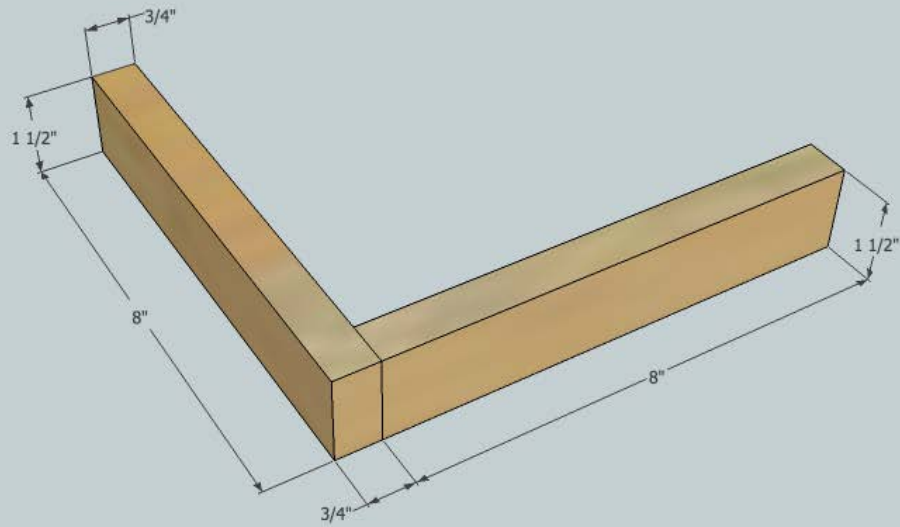
1x3

1x - 22 $\frac{1}{8}$ "

2x - 23 $\frac{5}{8}$ "

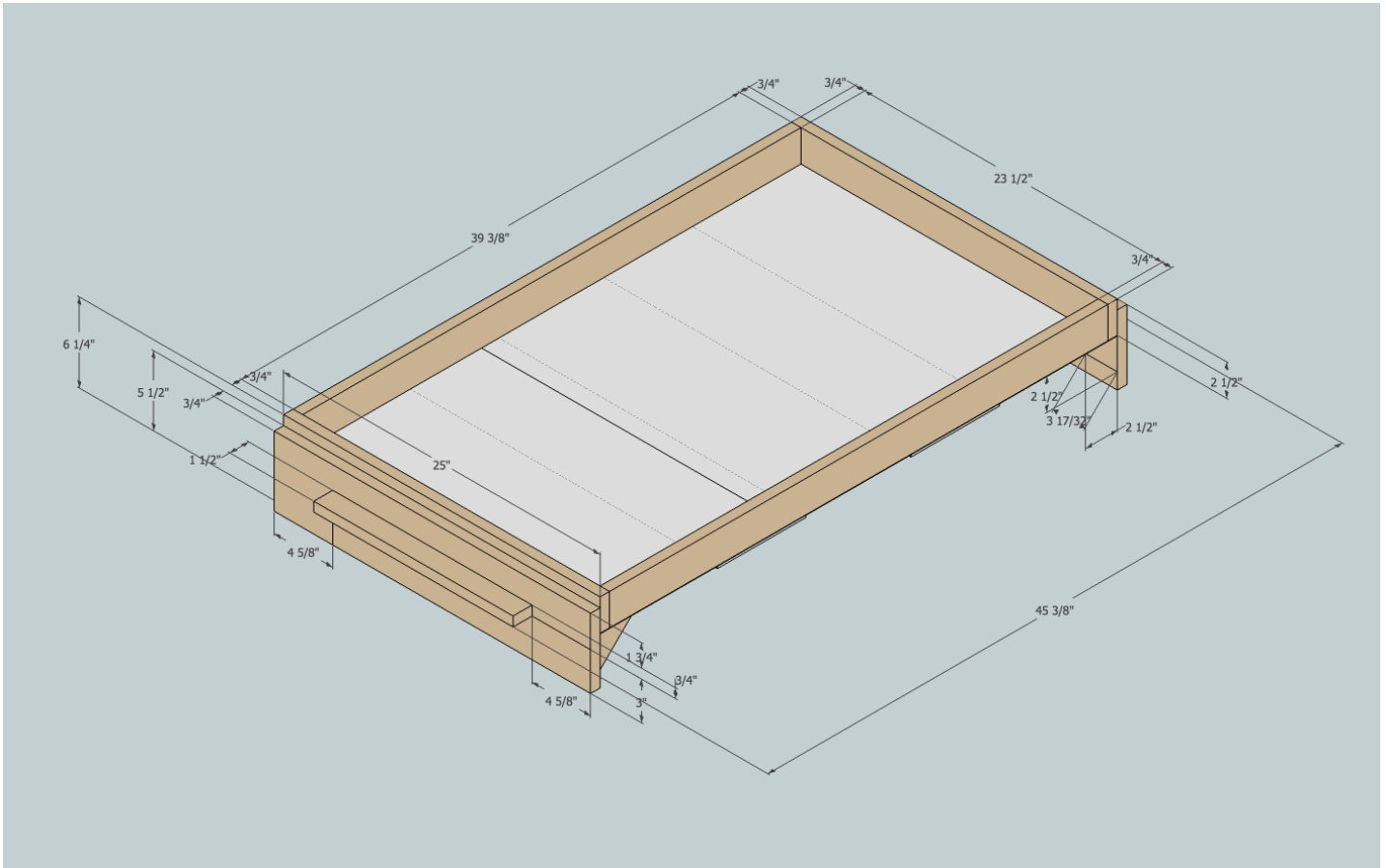
2x - 30 $\frac{25}{32}$ "

Coddle



1. Liberally apply wood glue to the end of one of the 8" segments of 1x2
2. Position glue covered end against the tall side of the other 8" segment of 1x2 to form a 90 degree L shape. Hold the pieces of wood together with tape or a C clamp and allow glue to dry thoroughly.
3. Remove tape or clamp and sand any excess glue from the outside seam on the L

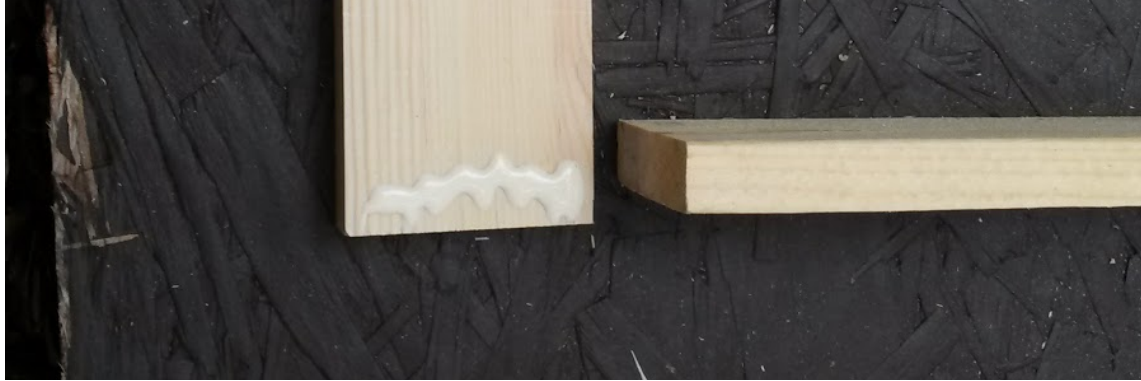
Tray



1. Assemble the frame:

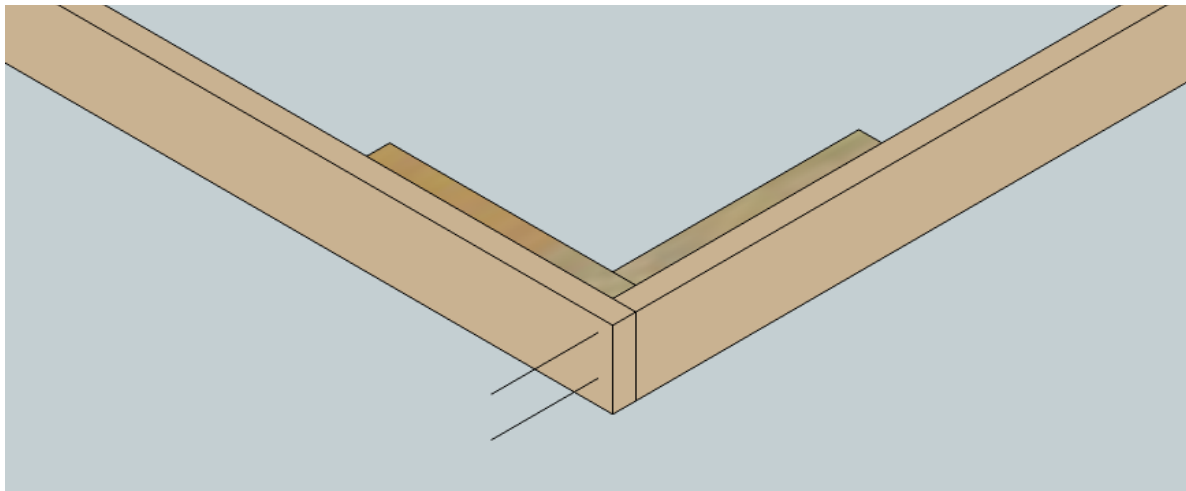
- line up the 25" and 39 3/8" 1x3 segments as seen in the diagram above, with the long sides abutting the inside edges of the short sides.

-starting with one corner of the frame, liberally apply wood glue to the adjoining surfaces of the frame segments.



-place the coddle inside the corner junction, nestled tightly into the corner, and use C-clamps to clamp the frame segments to the coddle. This will hold the glued corner tightly in place while it is screwed together

-use the drill to drill two pilot holes through the short segment into the end of the adjoining long segment, positioning indicated in the diagram below



-screw a screw into each pre-drilled hole, firmly connecting the frame segments

-unclamp the coddle from within the corner

-repeat the previous steps for the remaining 3 corners to assemble the tray's frame

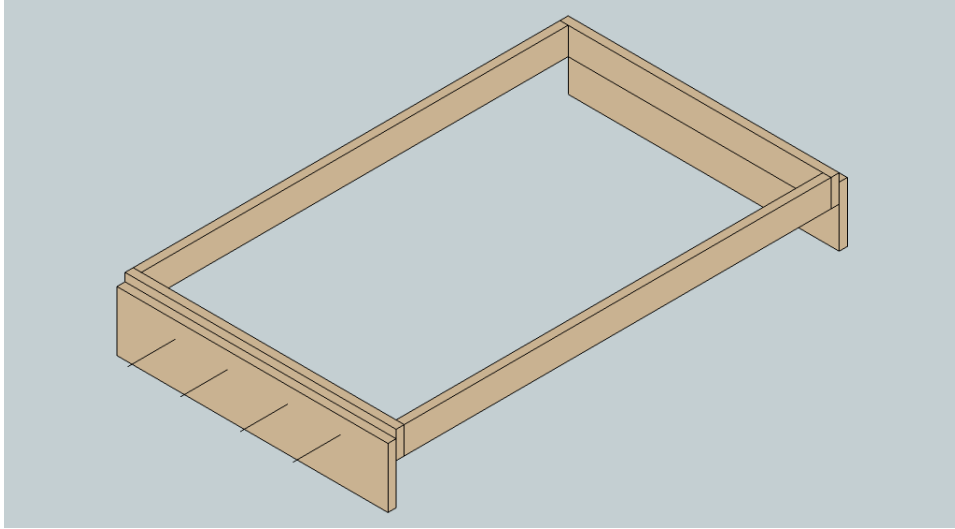
2. Install the stacking edges:

-with the tray frame lying flat, place a $\frac{3}{4}$ " high piece of wood along one of the short edges - this will be a guide for mounting the side board at the appropriate height. *NOTE the side the the frame contacting the ground at the step will be the top of the frame once the side boards are attached.*

-Liberally apply wood glue along a 2" wide strip of the surface of one of the 1x6 end boards (as shown in the picture below)

- with the $\frac{3}{4}$ " piece in place against the end of the frame, squarely place the glued surface of the sideboard against the end of the frame, and clamp in place
- drill 4 pilot holes evenly spaced down the adjoined length of the side board and screw the sideboard to the side of the frame
- repeat on the other short edge of the frame





3. Install the handles:

-place some 2 ½" high pieces of wood along the sideboards. These will be guides for installing the 1x2 handle segments.

-set the 15 ¾" handle segment centered against the sideboard, the 15 ¾" x ¾" face in contact with the sideboard.

-center the handle by measuring 4 ⅝" (11 ¾ cm) in from one end

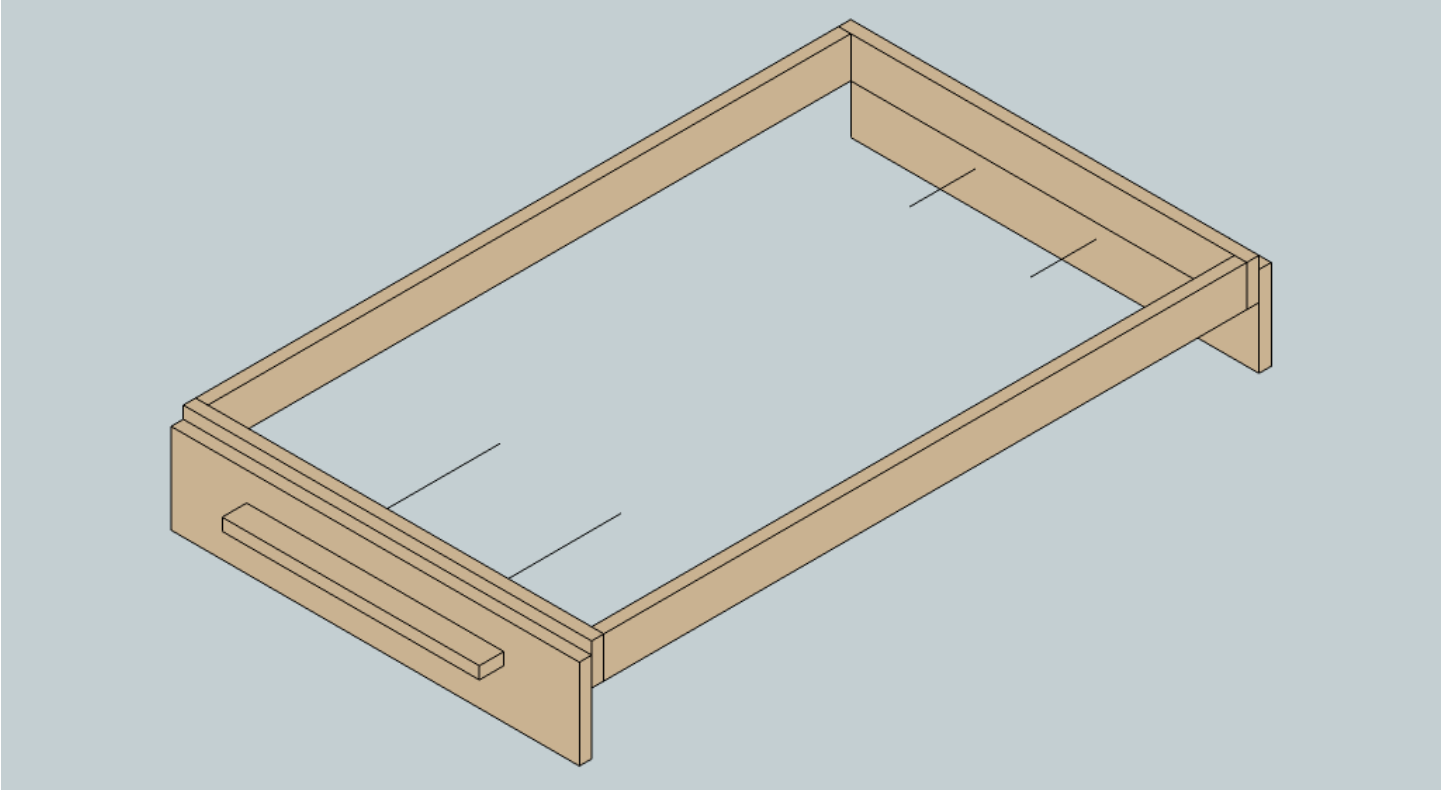




- liberally apply glue along the face of the 1x2 handle that contacts the sideboard and firmly press into place
- clamp the glued handle in place, or let sit until glue has dried completely, bonding the handle in place



- With the handle secured against the sideboard, drill two pilot holes through the back side of the sideboard into the handle and screw the handle to the board from the back side (inner side) of the sideboard



4. Seal the frame:

- Per the usage instructions for the wood sealant at hand, fully seal the assembled frame, sideboards and handles
- allow sealant to dry completely before continuing with assembly

5. Attach the bottom tray liner protection:

- cut two polypropylene sand bags first down one side and then along the bottom so that they open into large rectangular panels
- cut one of the large panels down the middle
- place the remaining full large panel over the bottom of the frame and tack in place with staples so that it covers about $\frac{2}{3}$ of the frame. There should be an inch or so of overhang along the three sides that cover segments of the frame
- fold the overhang back over and staple every few inches along the edge of the frame, pulling the material taut as you go
- place one of the half panels so that it covers the remaining $\frac{1}{3}$ opening of the frame and tack in place with staples
- as before, fold the overhang and staple the small panel in place while pulling the material taut
- with both panels in place, reinforce with more staples, pulling the material taut between the current staples and adding a new staple. In the end there will be ~70-75 staples used around the perimeter
- use a hammer to drive in any staples that are not fully embedded



6. Install support straps:

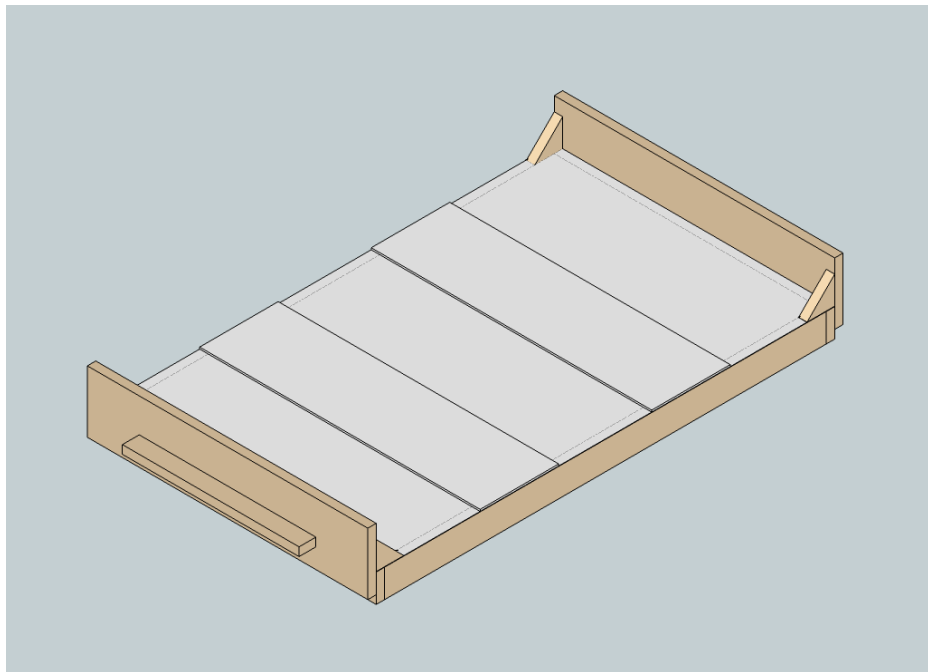
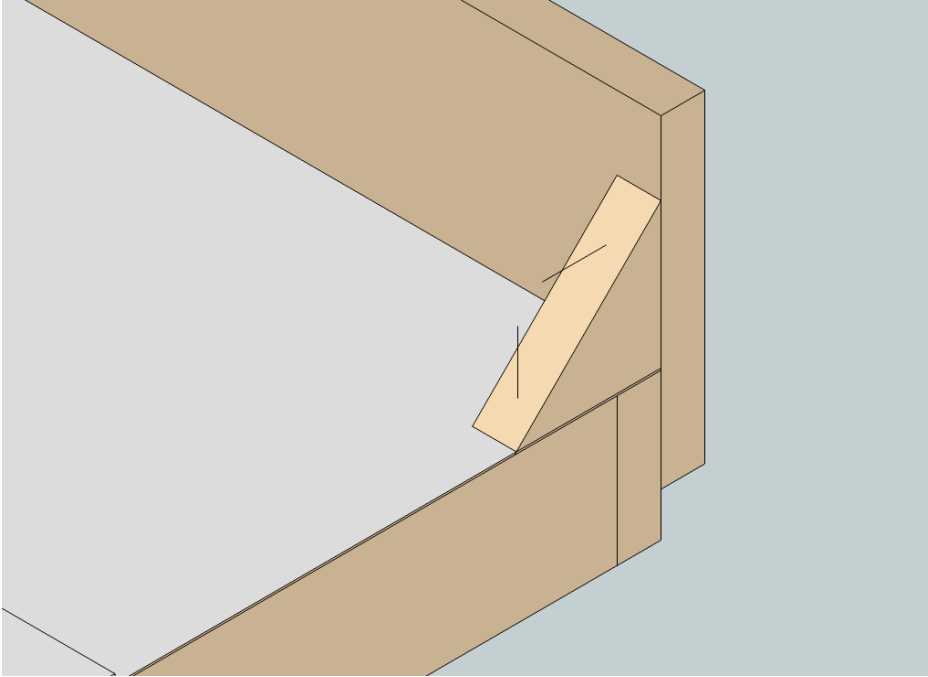
-attach 2 or 3 additional sandbags (folded lengthwise) to the bottom of the tray as support straps. Initially line up the folded bag so there is about an inch of extra length overhanging the edges of the tray and tack in place with a single staple (pulling taut when tacking the second staple). Then fold the overhang back over and staple in place for a strongly reinforced connection to the frame.

-use a hammer to drive in any staples that are not fully embedded



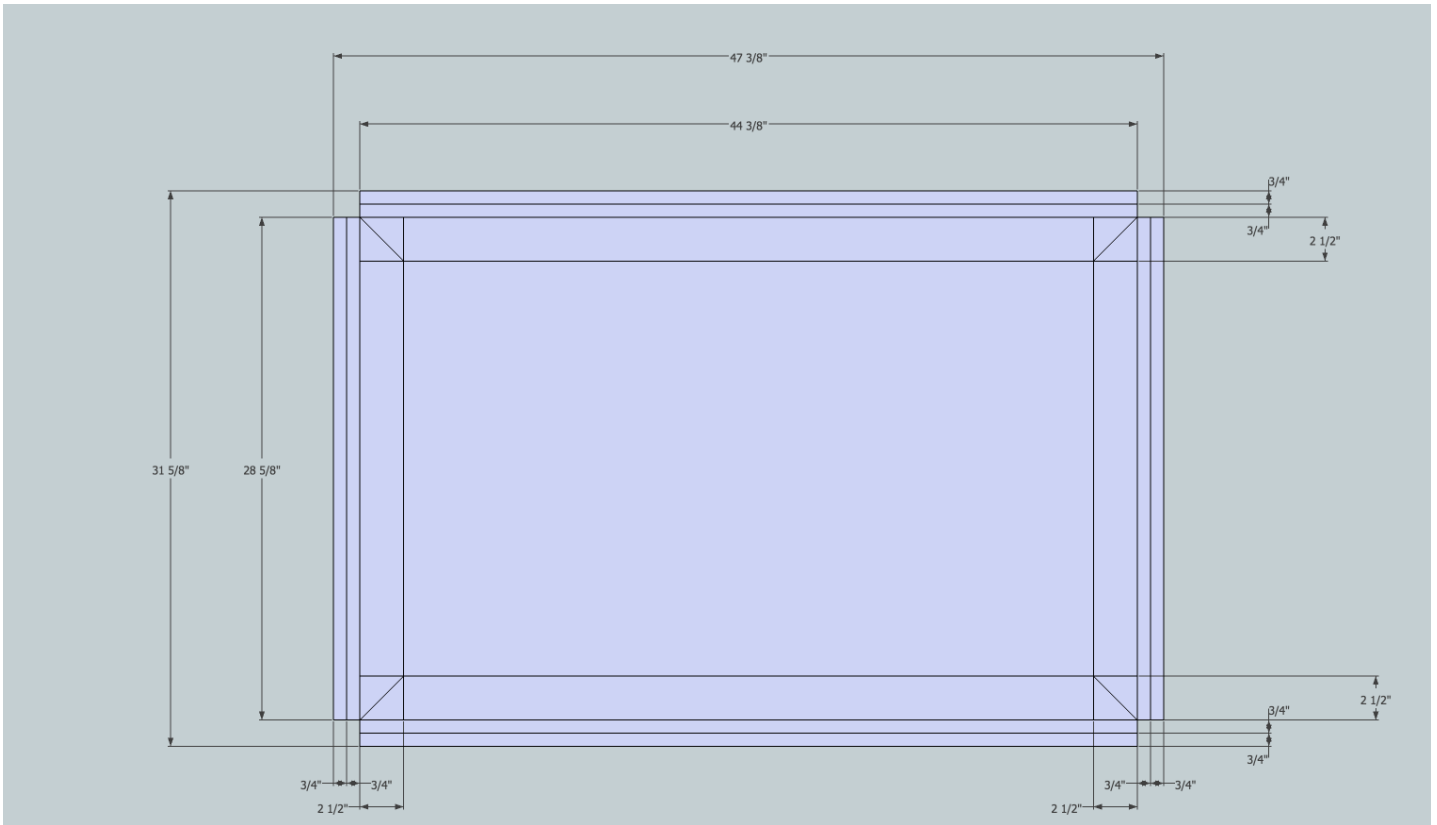
7. Install the corner braces:

-With the tray still laying flat upside down (sideboards sticking up), place one of the triangular pieces into the corner. Clamp or have an assistant hold the brace in place and drill pilot holes to toe-nail into the frame, then screw the brace into place. Repeat in each corner

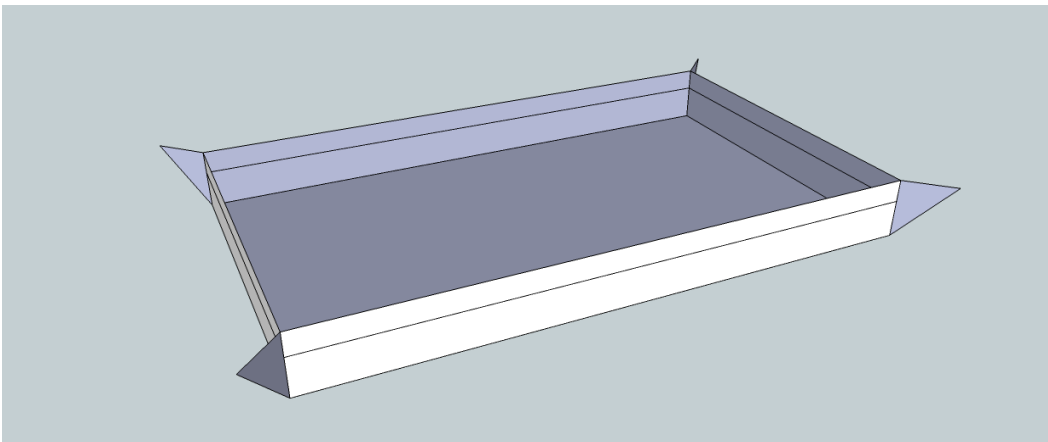


8: Install the tray liner:

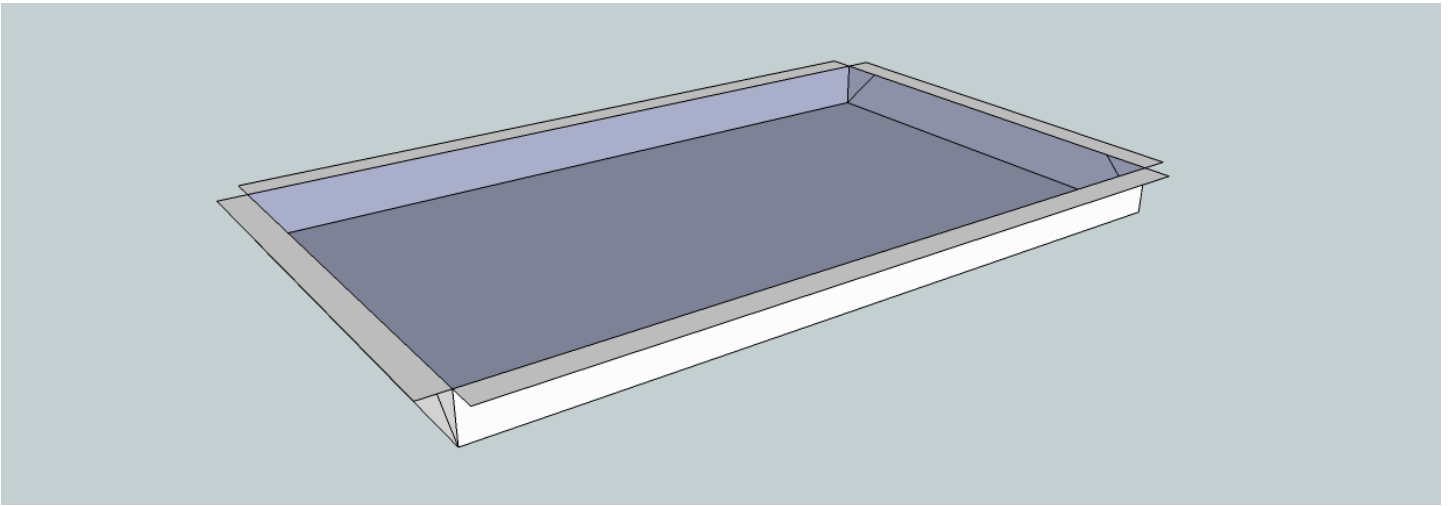
- using the felt-tipped marker and a straight edge (such as a yard stick or tape measure), draw a border $1\frac{1}{2}$ " in from the edge of the plastic sheet (measuring $47\frac{3}{8}$ " x $31\frac{5}{8}$ ")
- draw a line parallel to each side of this border, inset by $2\frac{1}{2}$ " to form the inner border with overlapping corners forming squares
- optionally draw a diagonal line connecting the inner corner of each square to the opposite outer corner



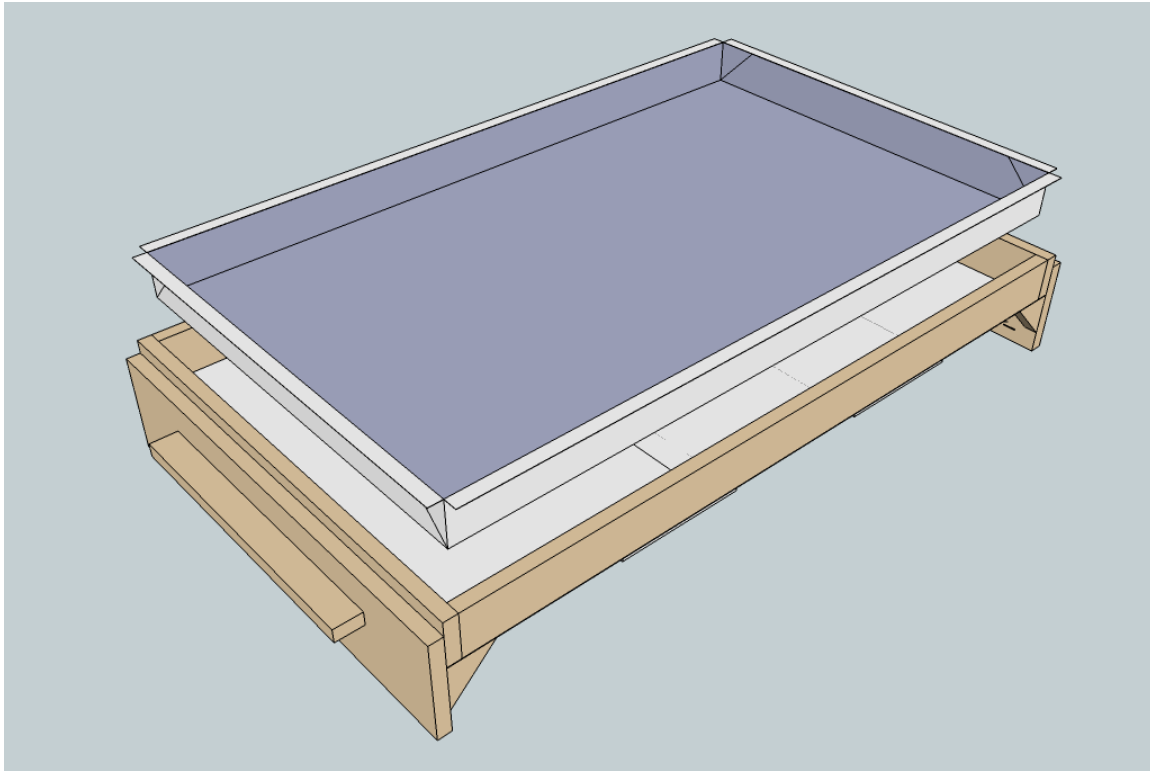
-fold the corners along the diagonals of the squares to raise the sides of the tray liner



- Fold the corners flat against the short sides of the tray liner and secure in place with the packing or duct tape
- cut the corner down 1 ½” to the border line and fold out the top edges

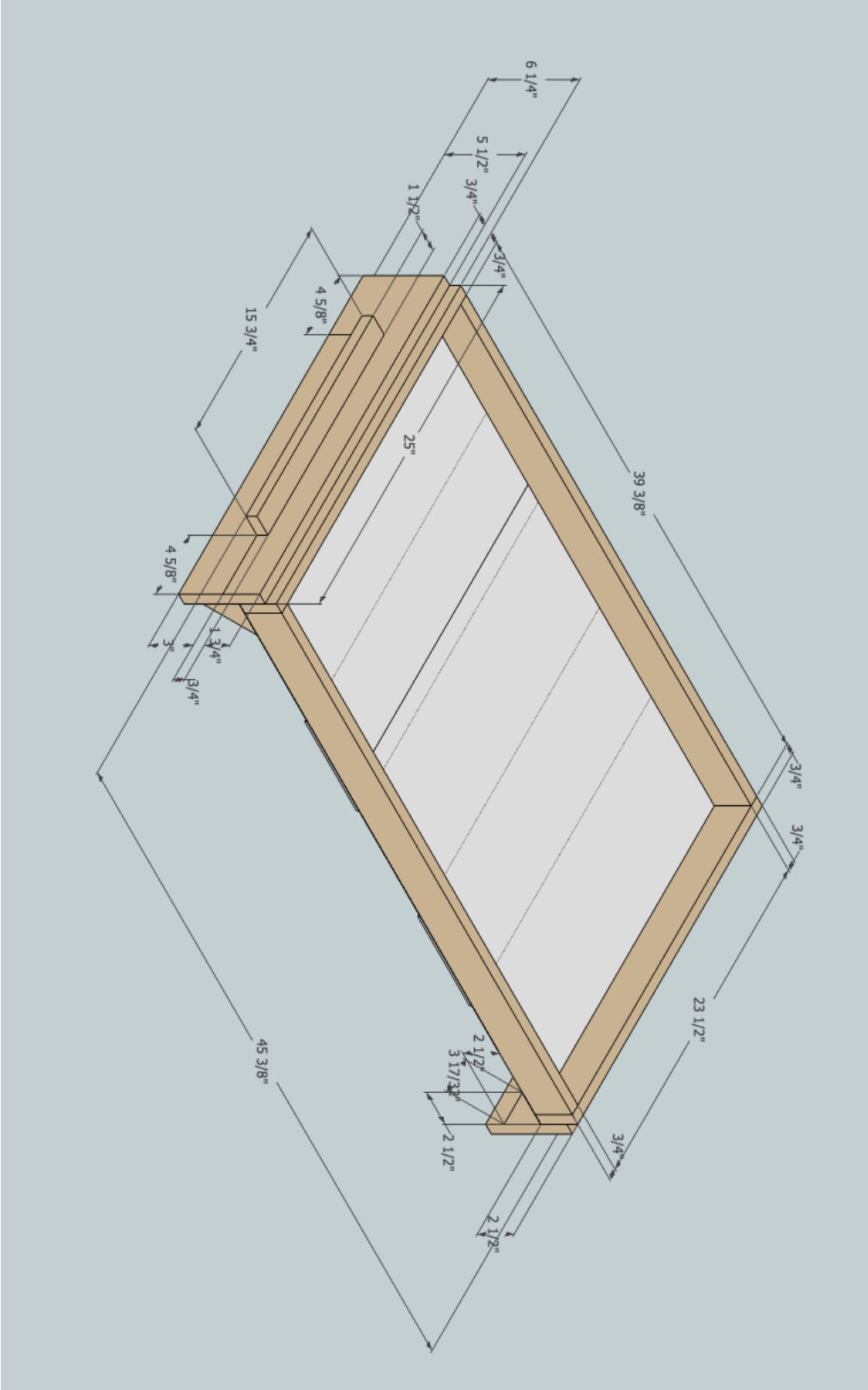


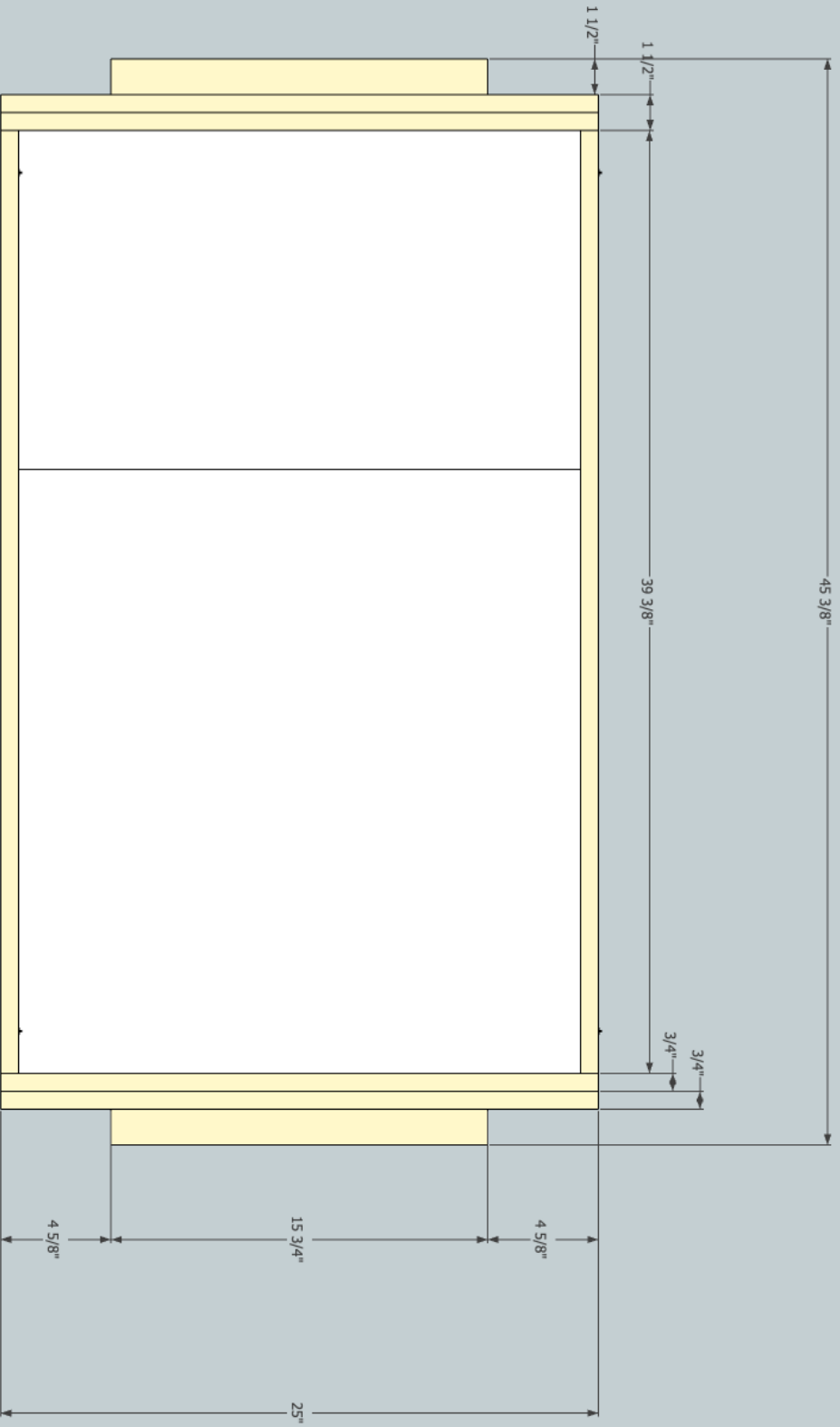
- set the liner in the tray and fold the overhang of the top edges back over the tray frame edges



- Staple the folded over edges of the tray liner in place, with a staple every couple inches, about 50 staples around the perimeter

Tray Schematics

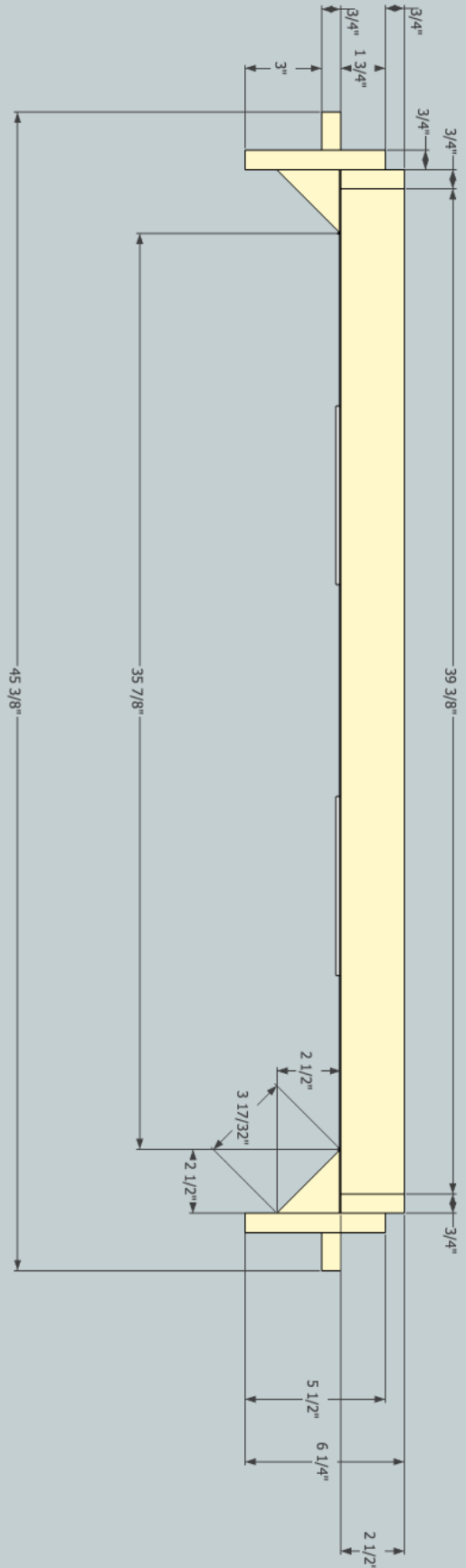




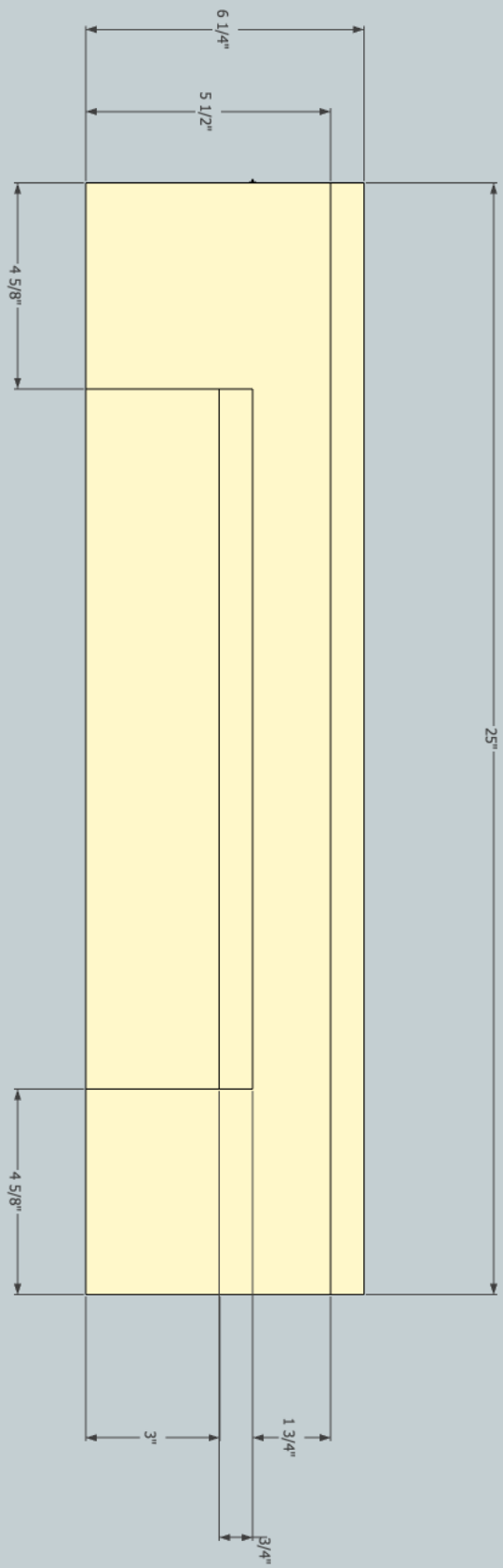
Top



Bottom

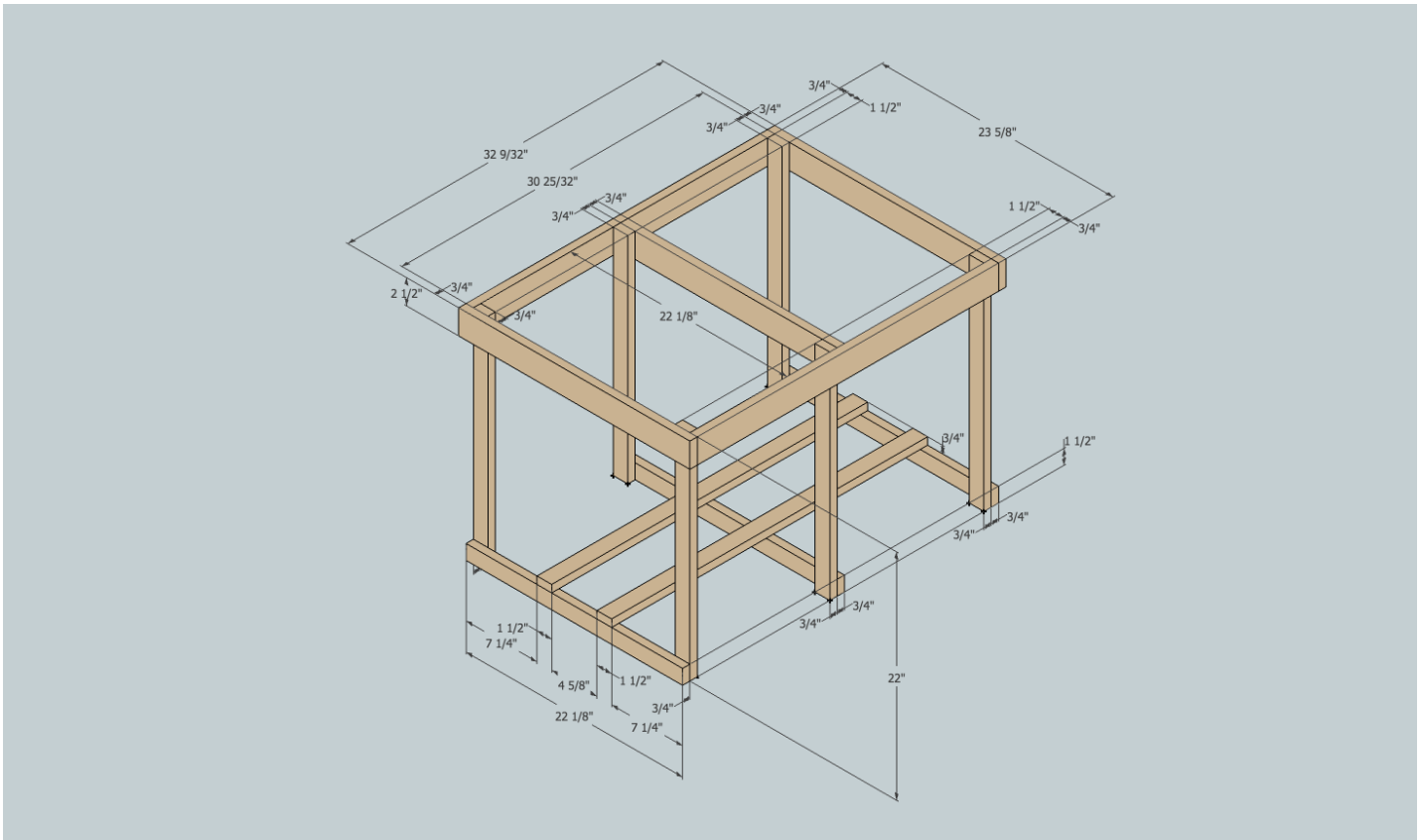


Front



Side

Stand



1. Assemble the top frame:

-Assemble the top outer frame for the stand with the 32 9/32" and 23 5/8" segments of 1x3 following the same method used to assemble the tray frame, applying wood glue, clamping in place with the coddle, pilot drilling and then using two screws in each junction.

-To fasten the 22 1/8" middle cross bar, apply glue to both ends and fit it into the frame, roughly centered. use the coddle to clamp one end of it in place and pilot drill and screw from the outside of the frame. Repeat on the other side

2. Assemble the legs:

-lay two of the 22" 1x2 leg segments in parallel with 19 1/8" space between them. Measure the space at the top and bottom and use a straightedge to square them.

-line up a 22 1/8" 1x2 segment across the ends of the parallel legs

-apply wood glue to the touching faces of the legs and cross bar, then clamp in place, pilot drill and screw together. The result will be a square U shaped leg assemble

-repeat to assemble the remain two leg sections.

3. Attach legs to stand:

-with the stand top laying flat, fit one of the leg assemblies into the inside of one of the shorter sides of the stand's top frame. The leg assembly should be oriented so that the opening of the "U" is facing downward and is fit into the frame, and the cross bar at the bottom of the "U" should line up directly parallel with the short edge of the frame. Glue and clamp the leg assembly to the frame then drill and screw in place.

-repeat for the remaining two leg assemblies, so one is attached to each of the short ends of the frame, and one to the middle cross bar.

4. Attach the base boards:

-flip the stand over so that it stands on the three leg assemblies

-place the 32 2/32" 1x2 lengths in parallel running the length of the stand, across the bases of the leg assemblies.

-measuring at both ends, ensure the base boards have a 4 5/8" space between their inner edges. There should be 7 1/4" distance from the outer edge of each baseboard to the outer edge of the leg assembly

-glue, clamp, drill, and screw the baseboards to each of the leg assembly cross beams

5. Seal the stand:

-Per the usage instructions for the wood sealant at hand, fully seal the assembled stand

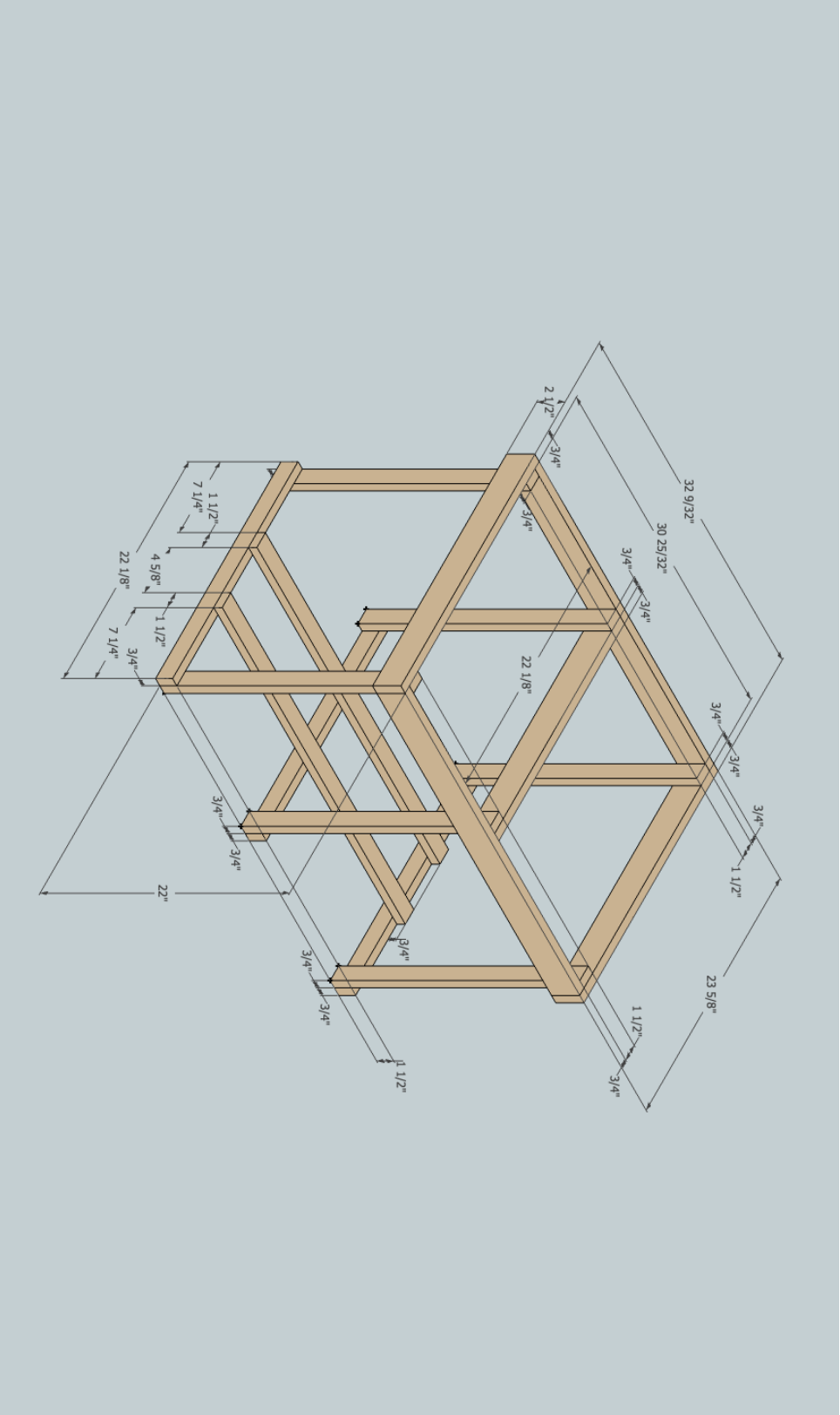
-allow sealant to dry completely before using

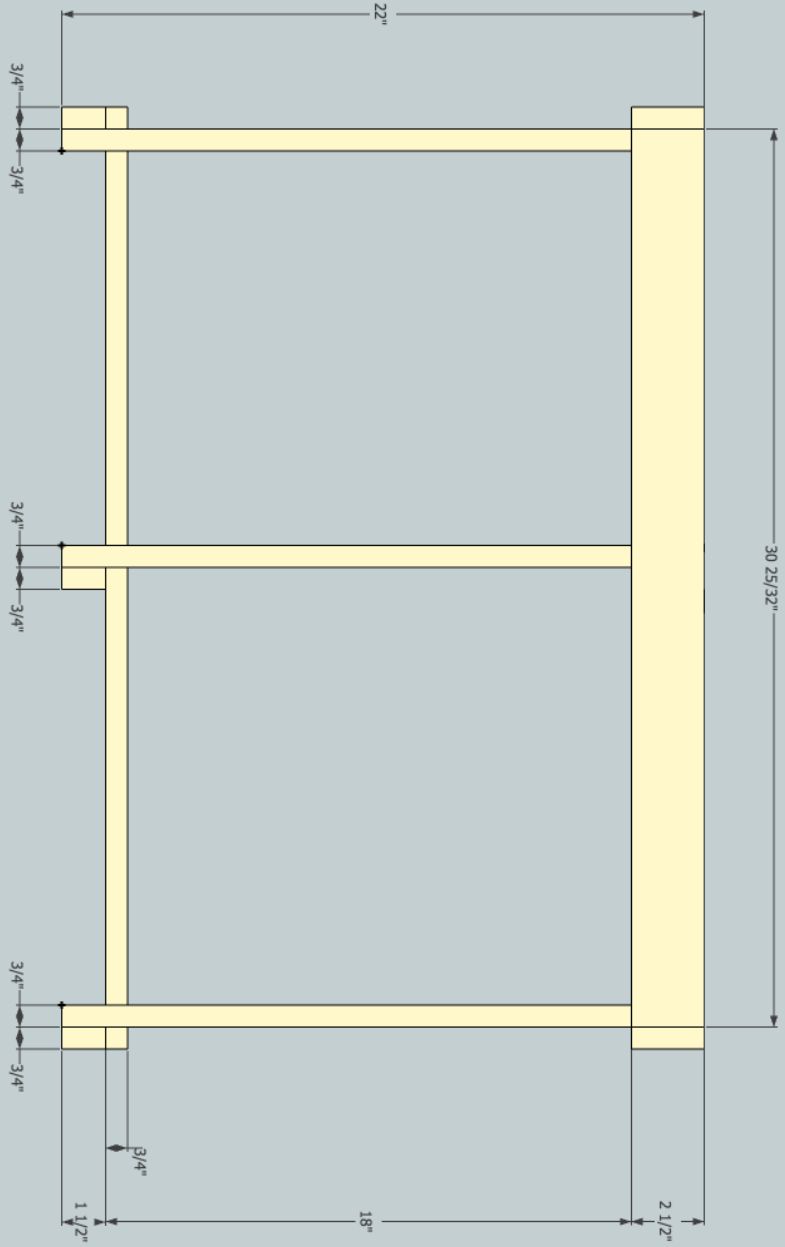
6. Prep for use:

-Before stacking trays on the stand, be sure to weigh it down by stacking bricks along the baseboards

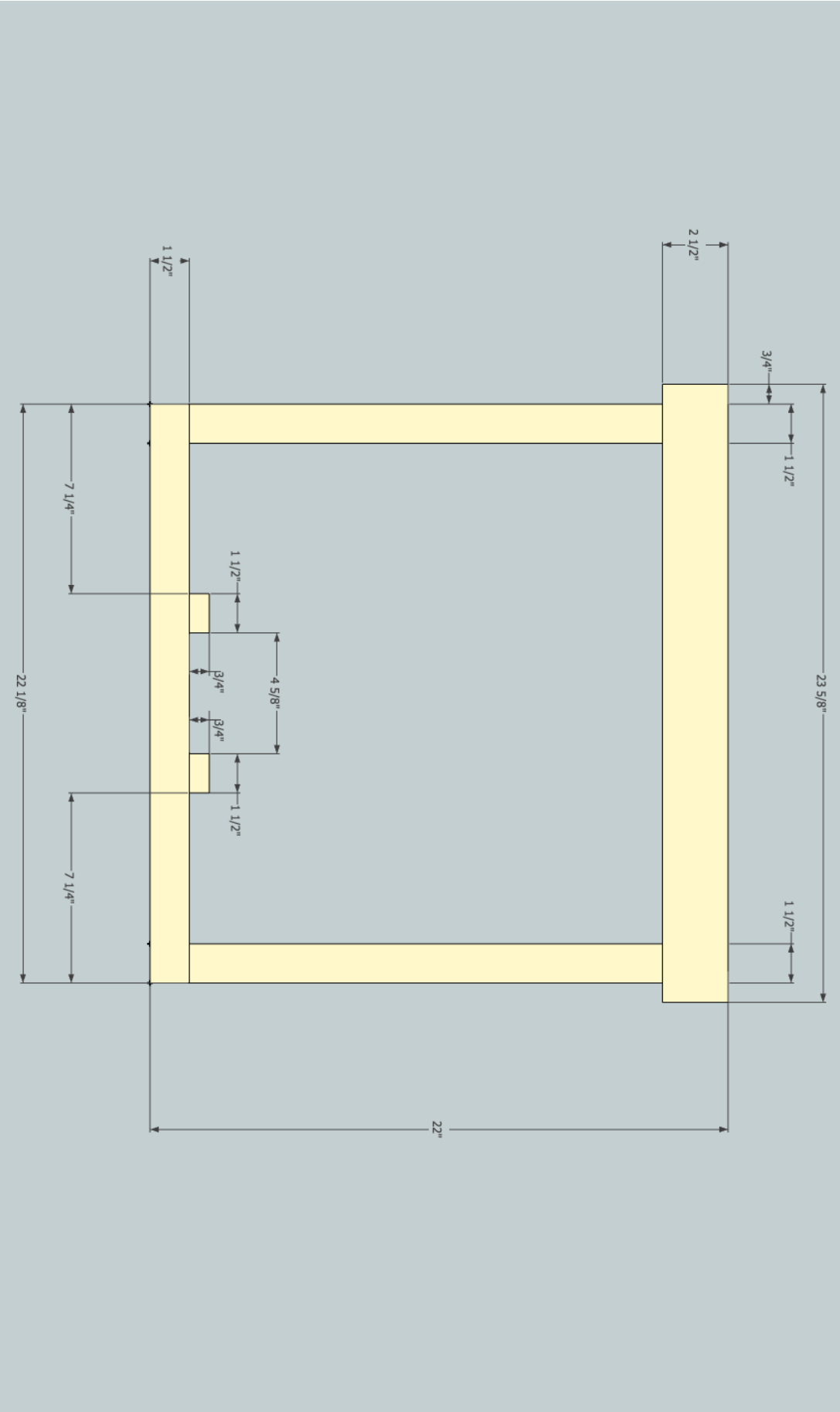
-To protect the trays from ants and small rodents, apply a band of petroleum jelly about 6 inches wide around each of the upright legs of the stand (starting 6-8 inches up from the ground so that a small rodent will not simply reach over the band)

Stand Schematics:

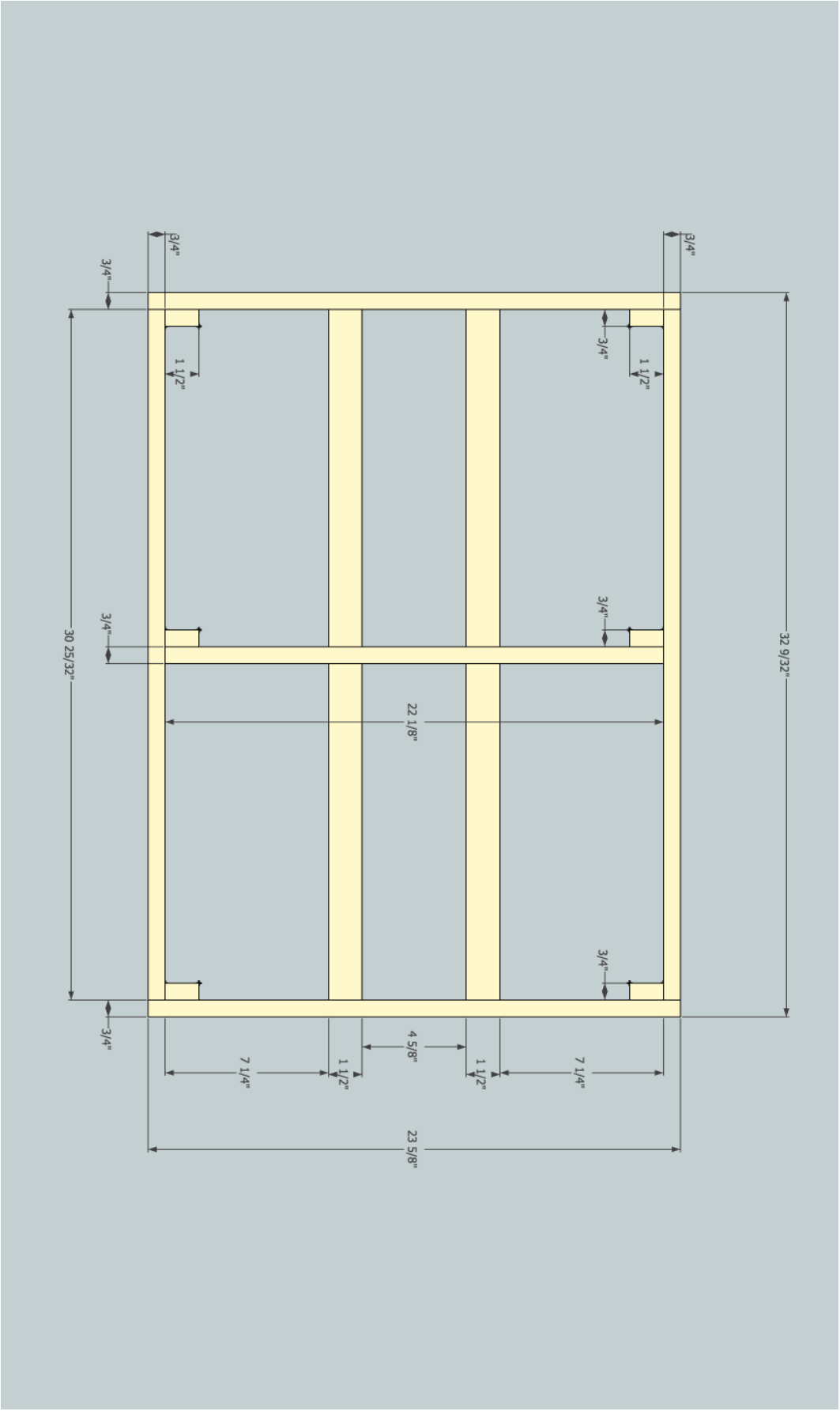




Front



Side



Top/Bottom