

# THE CAT CAVE

## Problem

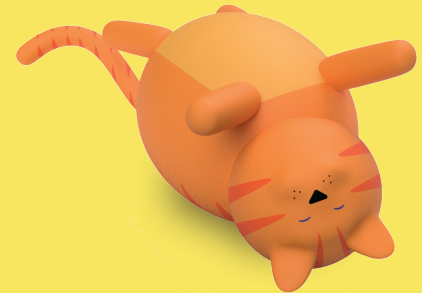
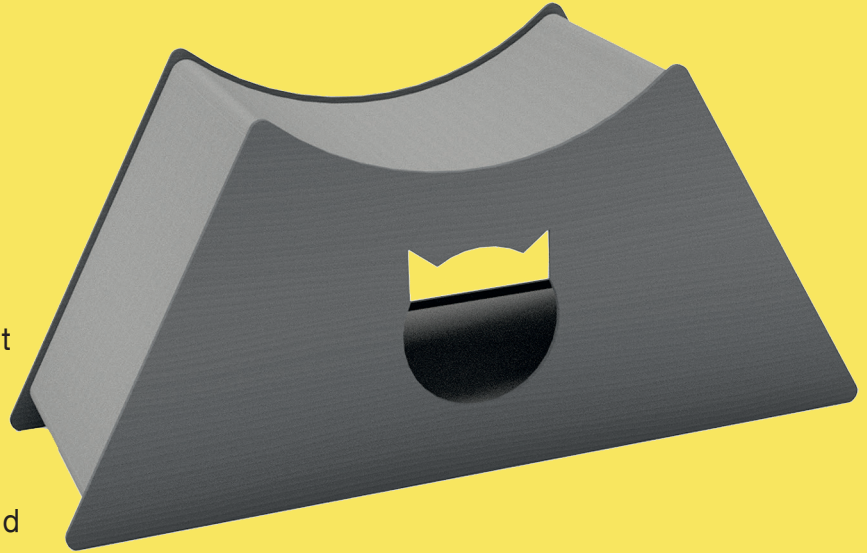
Cats enjoy destroying your upholstered belongings.

### Protecting the Human Furniture

Damaged furniture is often the tipping point for some people when deciding whether to get a cat. They might like cats just fine, but not enough to justify having their furniture torn up or covered in fur. If you find yourself with a roommate like this and it is preventing you from having a cat, just follow this foolproof plan and you should have no further issues in adopting a fuzzy friend:

Get a new roommate. Your current one clearly exhibits poor decision-making skills.

If you are unable to do this for whatever reason, then you can move on to . . .



# Solution

1. Add some cat furniture to your living room so the human furniture won't be torn up.
2. Make sure the cat furniture is awesome. In this case, a dual-function cat scratcher and lounge chair made from plywood.

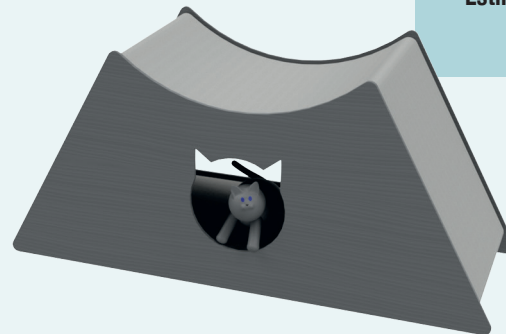
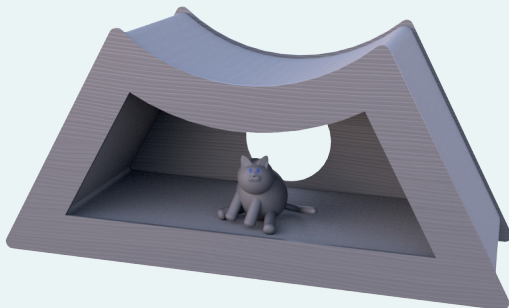
*“But how will I be sure the cat will scratch the cat furniture and not the human furniture?”* you ask. First of all, doesn't your cat have a name? He might be scratching up your stuff so much because you show him disrespect by referring to him as “the cat.”

Second, refer to Step 2: *Make sure the cat furniture is awesome.* You have to provide furniture that “the cat” will *prefer* to nap on and scratch. The choice of what to scratch will always include your sofa, so the goal is to provide a more favorable alternative.

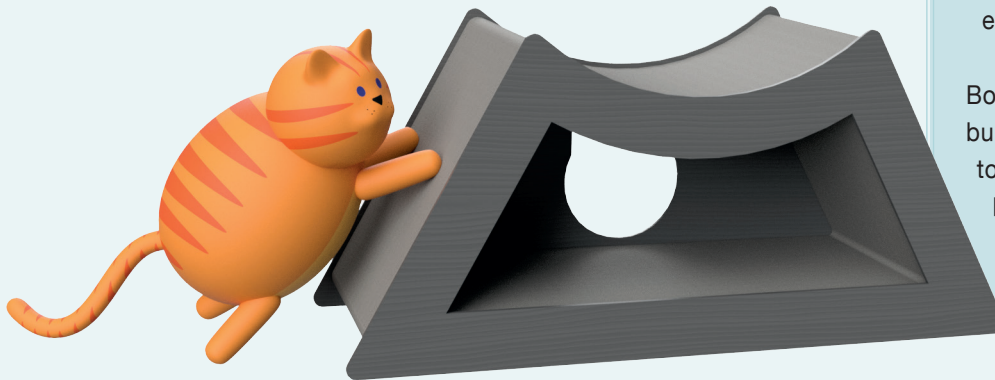
**Cost: Medium**

**Difficulty: Medium**

**Estimated Build Time:  
6 to 8 hours**



Cats seem to choose what to scratch partially out of habit—scratching the same spot every day can be part of a routine that makes them feel at home. If you are building this cat cave to help protect an already-scratched sofa, then it might take a little encouragement for your cat to make the switch. Temporarily putting tape over the spots on the couch that are often scratched can help him break the habit. If that doesn't work, then I recommend lounging in the cat cave yourself until your cat gets jealous and switches over just to spite you. (OK, filling it with delicious treats might work, too.)



## FEATURES OF THE CAT CAVE

- Angled surfaces for optimal scratching
- Curved top for ergonomic lounging
- Carpeted interior for protected napping
- Escape route out back for emergency exits

Bonus: Can serve as a nice bunker where a cat can go to feel protected without being isolated in a closet or under a bed.

# ENGINEERING 101

## Composite Materials

Over the last several decades, composite materials such as carbon fiber have seen a rapid growth of applications. These materials, made up of layers of fabric infused with a liquid polymer (basically plastic), can be stronger than steel while remaining incredibly lightweight.

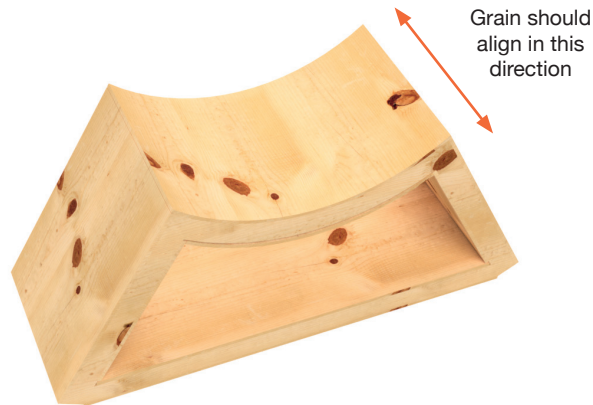
These can be expensive to manufacture and are really used only where weight is a strong design requirement, such as in rockets or airplanes. Although this cat cave does not directly use these advanced composite materials (yet), some concepts of the material science are applicable in two important steps. So after constructing this project, make sure that your new résumé includes composite material manufacturing.

## Fiber Direction

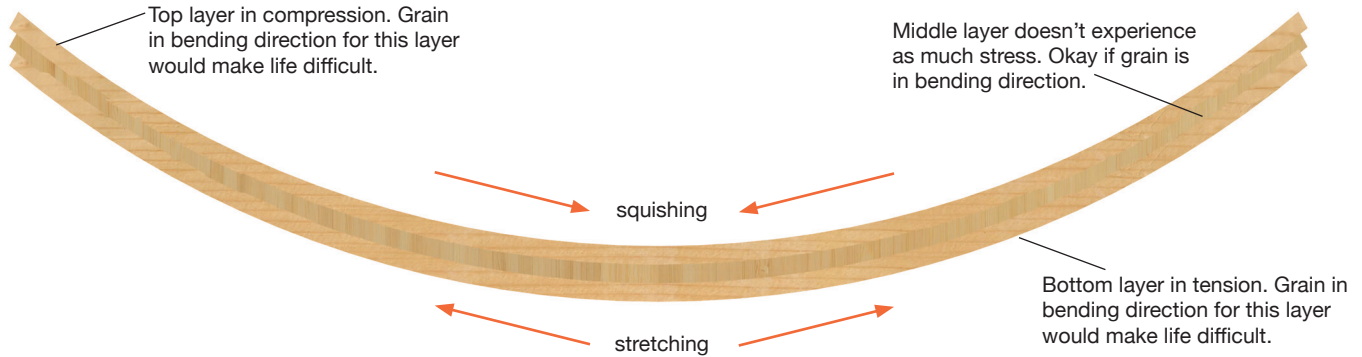
The strength of carbon fiber reinforced polymers (or CRFPs) is not consistent in every direction. The material is strongest in the direction in which the fibers run, but if loaded in other directions it mainly relies on the polymer

material for strength. This is why several layers of fabric are usually stacked on top of each other, with the fibers of each layer in different directions. This same principle applies to the nonadvanced composite material that is used in the cat cave: plywood. Plywood consists of several layers of wood with the grain running in different directions. Taking advantage of the grain direction will make construction much easier.

The  $\frac{1}{4}$ " plywood used on the frame of the cat cave will likely be made up of three layers of wood. For the flat pieces on the sides and bottom of the cave, it doesn't really matter which way the grain is oriented. For the two pieces that cover the top, however, the grain will need to be oriented correctly in order for it to easily form to the curvature of the cave.



## 68 | Engineering for Cats



When the wood is bent as shown (see above), the top layer will want to get shorter (loaded in compression), the bottom layer will want to get longer (loaded in tension), and the middle layer won't change much. To allow the wood to bend, the grain should be running side to side. If the grain is in the bending direction, the wood will build up larger internal stresses when bent. This could lead to cracking, screws popping out, and increased frustration.

### Fabric Placement

Composite materials can be used to make parts of all shapes and sizes. All of these parts, however, start out with a flat sheet of fabric, and that fabric has to be formed into the shape of the part. Misaligned fibers, wrinkles, or

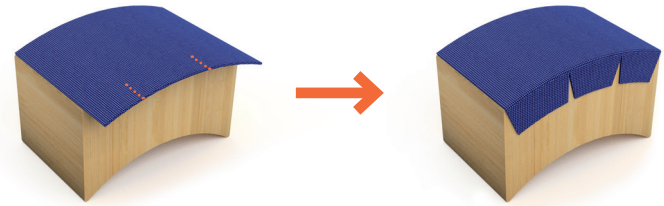
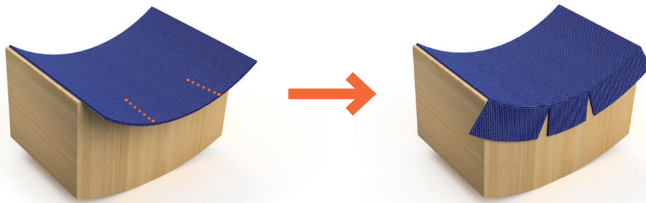
gaps will reduce the strength of the part and can render it unusable. To make sure that the fabric cooperates, engineers use strategies that originated in the world of sewing. (If you see a position posted for "senior engineer," this is typically reserved for elderly ladies who can consult on the fabric working of composites, although they can't say that in the job description for legal reasons.)

For the cat cave, we can make use of the same techniques to make sure that the carpet lies flat all the way around. A strong attachment is critical to survive the onslaught of claws and aggressive napping that will take place on the completed project. Note that "grandmother" isn't listed in the required tools list, but it should be assumed that having one handy would always be useful.

## Technique 1

### Placing carpet around an inside curve

When folding around an inside curve, the material will want to pull apart; you need to make a few straight cuts in the material hanging off the edge, so that it will lay flat. The industry term for these cuts is *darts*.



## Technique 2

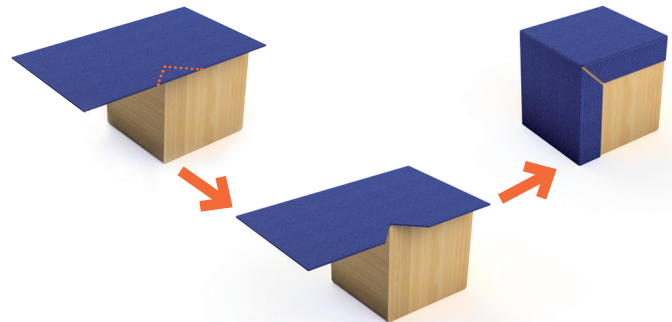
### Placing carpet around an outside curve

For an outside curve, the material will want to fold up on itself. To allow it to lie flat, cut out a few triangles in the material hanging off the edge. These would be referred to as *V-darts*.

## Technique 3

### Turning the carpet around an outer edge

To turn a corner, cut out another triangle over the corner, as shown. It's okay if it overlaps a little bit, but you don't want to bulk up the side, because the end piece will be placed on top of these folds (see Step 9 of the Cat Cave instructions).



## Tools

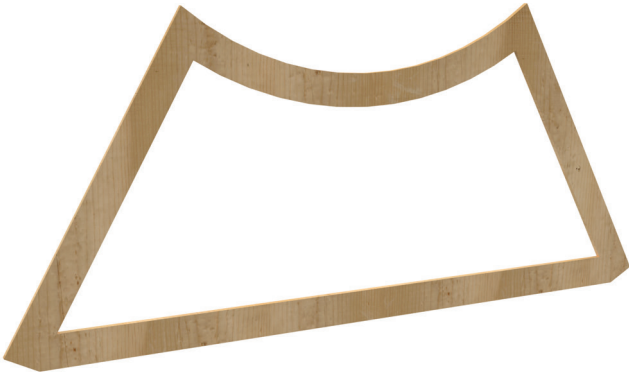
| #  | Description   | Potential Alternative                     |
|----|---|---|
| T1 | Drill and drill bits  | -   |
| T2 | Jigsaw  | None (this one requires a lot of cutting) |
| T3 | Staple gun  | Hammer and tacks                          |
| T4 | Scissors  | Box cutter                                |
| T5 | Finishing materials<br>(sandpaper, and nontoxic paint or stain, as desired) | -   |

## Materials

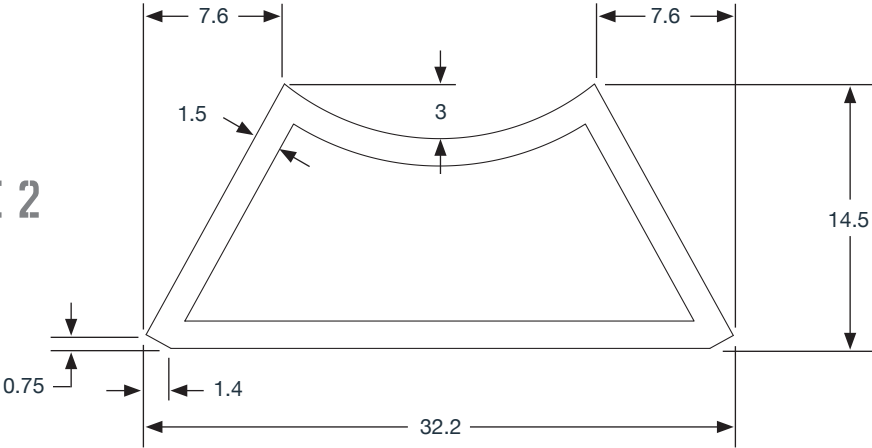
| #  | Description        | Size   | Quantity                  |
|----|--------------------|--|---------------------------|
| P1 | 1/4" plywood       | 4' x 8'  | 1                         |
| P2 | 3/8" plywood       | 4' x 4'  | 1                         |
| P3 | 2 x 4 stud         | 8' long  | 2                         |
| P4 | Wood screws        | 1 1/4" long  | 1 package<br>(≈100 count) |
| P5 | Staple gun staples | 3/8"   | 1 pack                    |
| P6 | Carpet             | Area rug 5' x 7' or 6' x 8'. Make sure it is durable enough not to be pulled apart by cat claws. | 1                         |
| P7 | Carpet tape        | 1 roll, 2" wide  | 1 roll                    |

Dimensions are in inches. Drawings are not to scale.

**Step 1** Cut out two ends from the 1/4" plywood to support the frame.



**MAKE 2**

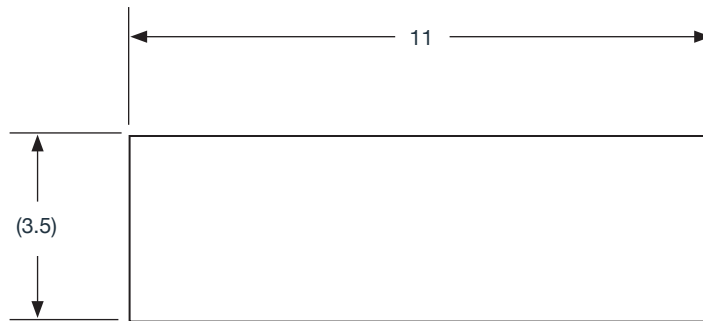


Tools: T2  
Materials: P1



72 | Engineering for Cats

**Step 2** Cut twelve support beams out of the 2 × 4 studs for the frame.

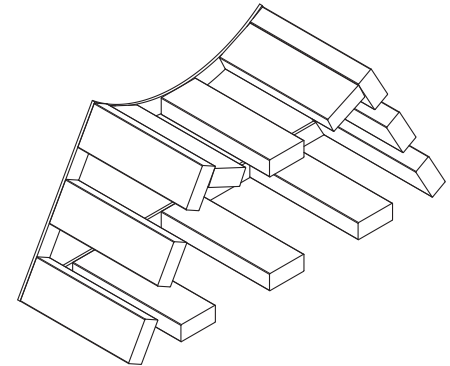
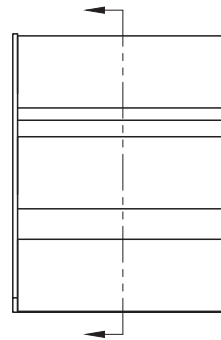
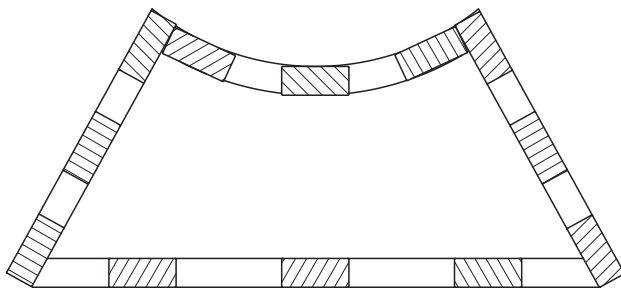


**MAKE 12**

Tools: T2  
Materials: P3

**Step 3** Screw the beams to the ends of the frame with wood screws, using two screws on each end of each beam.

Locate beams approximately as shown.



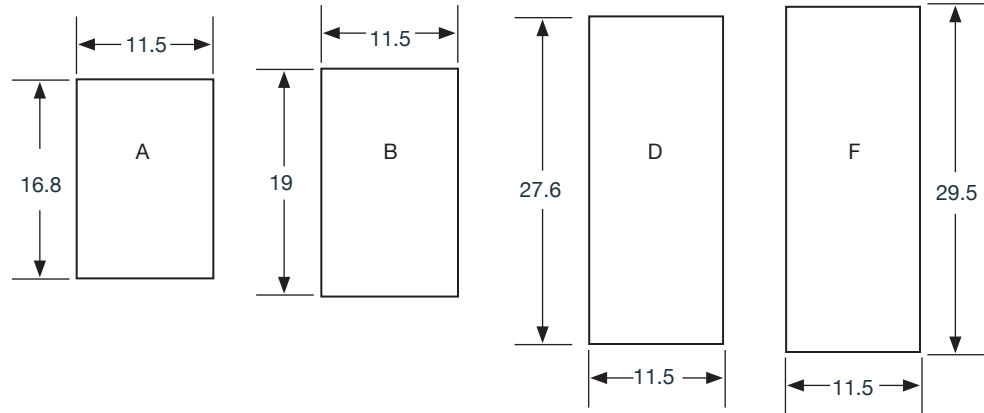
Tools: T1  
Materials: P4

## Step 4 Measure the frame that you made in Step 1 and cut the ¼" plywood to fit each section.

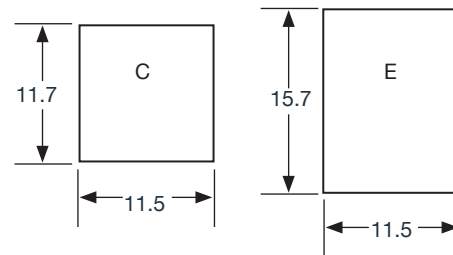
Dimensions may vary depending on how your frame came out, so use the measurements below only as a guide.

Before you cut, reference the Fiber Direction section on page 67 to make sure the grain direction of the plywood is set correctly. Then cut out the pieces.

MAKE 1 EACH



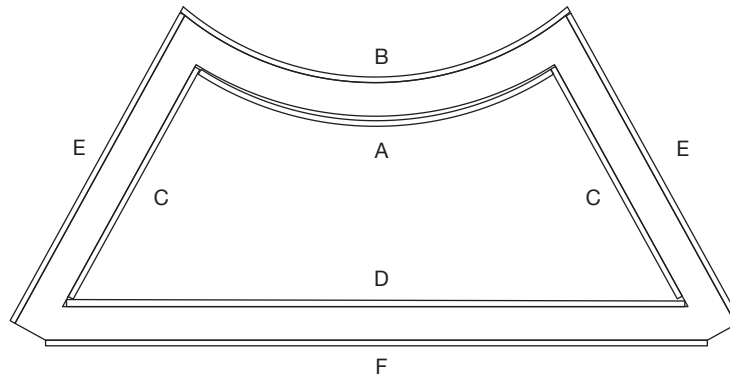
MAKE 2 EACH



Tools: T2  
Materials: P1

## Step 5 Attach the panels to the frame with wood screws.

Do not worry about perfection—these screws will be covered with carpet, so small gaps are acceptable.



Tools: T1  
Materials: P4

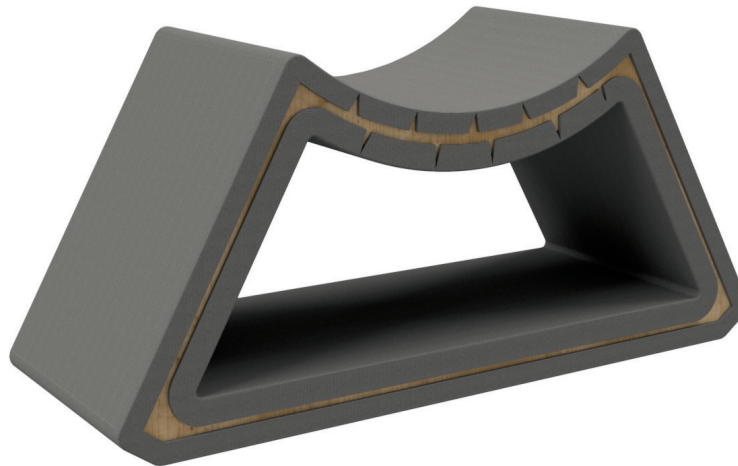
76 | Engineering for Cats

## Step 6 Cover the frame in carpet.

Use one piece for the outside and another for the inside. The seam can be hidden on the bottom for the outer piece and in one of the upper corners for the inner piece.

Lay two to three strips of carpet tape on the panels of each side before attaching the carpet. Staples should be needed only on the sides and a few at the seam.

Techniques to get the carpet to lay evenly are detailed in the introduction of this project (detailed cuts needed are not shown).

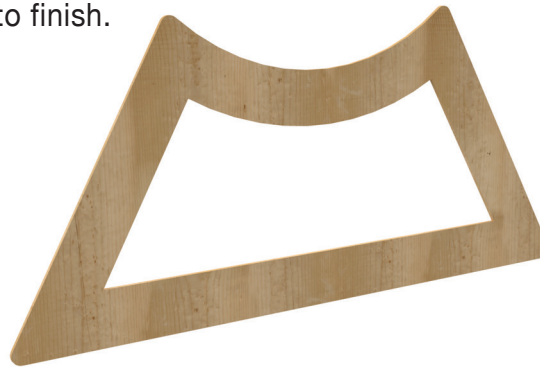


Tools: T3, T4  
Materials: P5, P6, P7

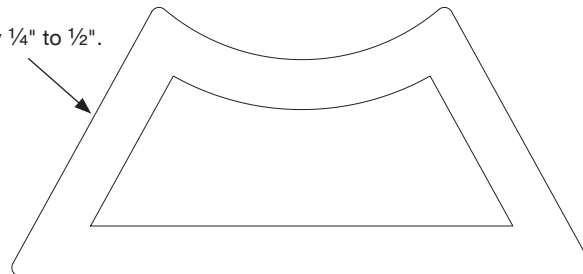
## Step 7 Cut out the first end piece of the cave.

Trace the inner and outer edges of the frame onto  $\frac{3}{8}$ " plywood, and offset the line  $\frac{1}{4}$ " to  $\frac{1}{2}$ ". This will mean that the end piece will form a small lip on the inner and outer edges of the structure.

Sand and paint the end piece to finish.



Offset from the frame by  $\frac{1}{4}$ " to  $\frac{1}{2}$ ".



Tools: T1, T2, T5  
Materials: P2

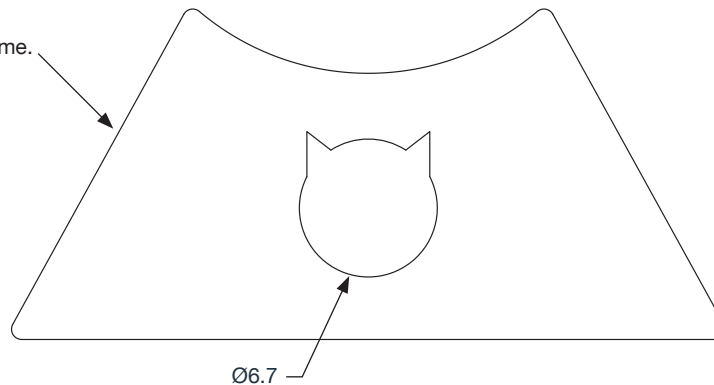
**Step 8** Cut out the second end piece, matching the dimensions of the outer edge to the first end piece.

Sand and paint to finish.

**Note:** The hole I used for the cat cutout was about 6.7" in diameter, and my slightly husky cats (seventeen and twenty pounds) have no issues fitting through this opening. If you have cats of a different size, you might want to adjust the hole.



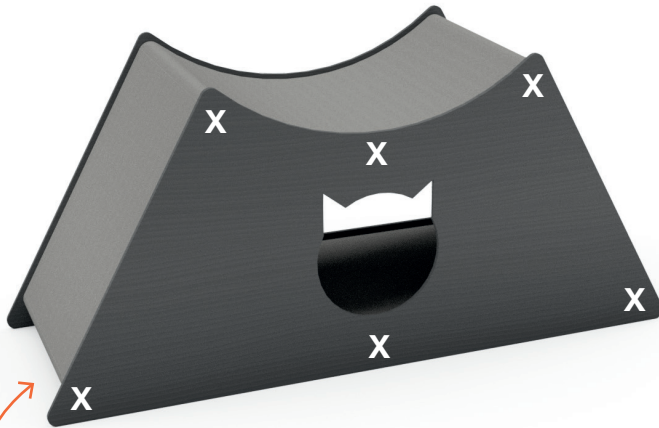
Offset 1/4" to 1/2" from frame.



Tools: T1, T2, T5  
Materials: P2

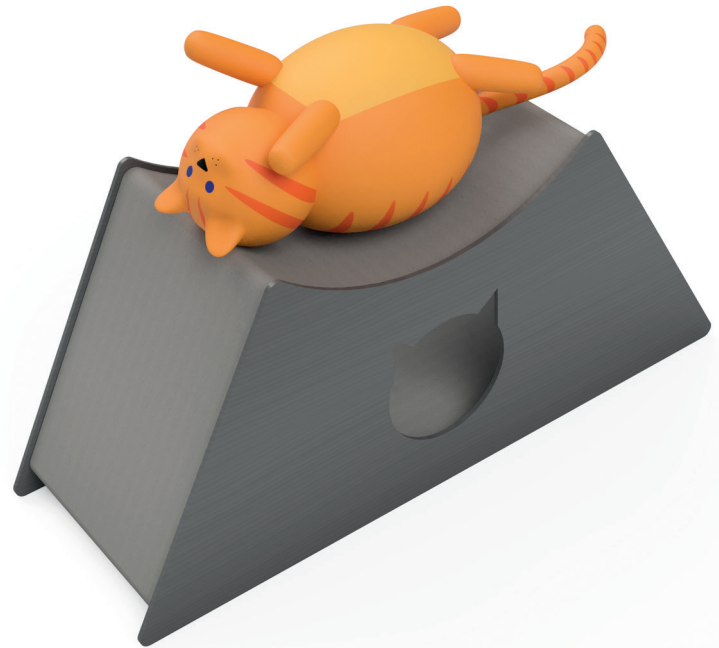
## Step 9 Attach the end pieces to the frame.

To make sure the structure will sit on the end pieces evenly, sit the frame on a scrap piece of plywood before screwing the end pieces on each side.



Place scrap plywood underneath before screwing in the sides.

Tools: T1, T5  
Materials: P4



# Complete!