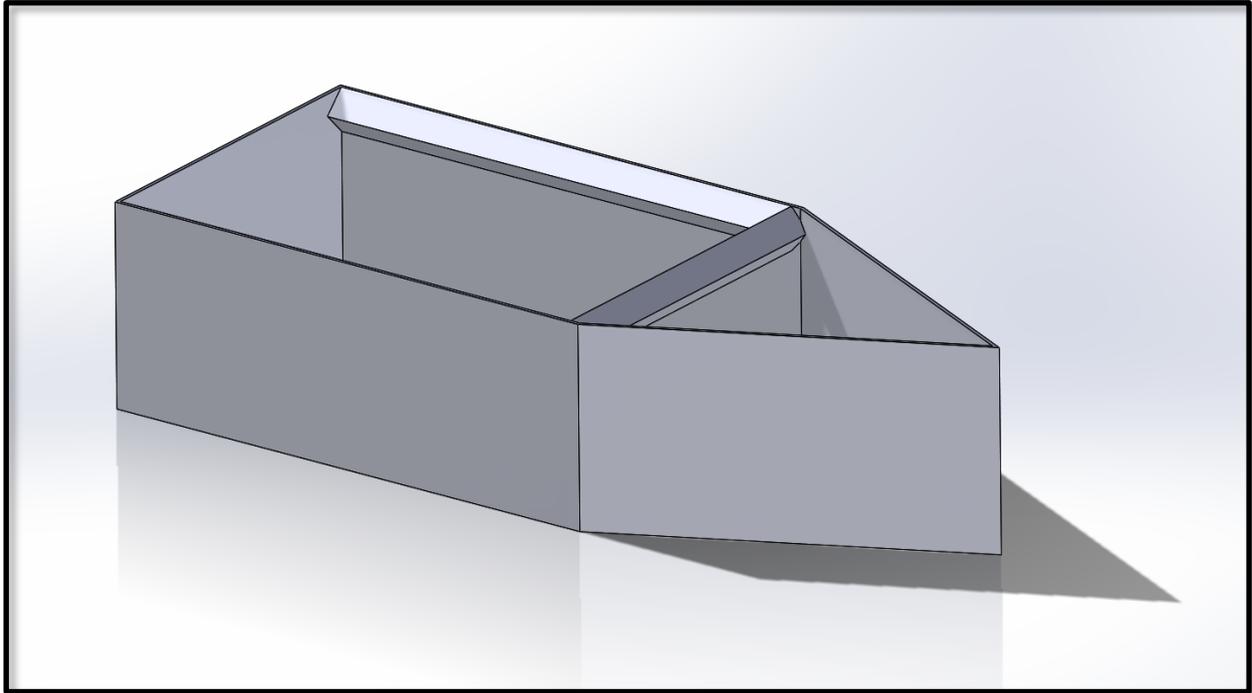
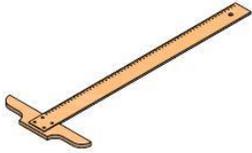


Building the Basic Cardboard Boat

By Kendall Hansen



Supplies Needed:

	<p>One (1) pencil, pen, marker, or writing tool. You will need one to mark lines on your cardboard.</p>		<p>One (1) T- Square. This will help to make straight, square lines and cuts.</p>
	<p>One (1) measuring tape to measure the length of lines and features.</p>		<p>One (1) sheet of 70" x 100" cardboard (51# SS 8251BC) It is approximately 1/4" thick. (.25")</p>
	<p>One (1) utility knife to make cuts in your cardboard.</p>		<p>Five (5) 45 yard rolls of duct tape.</p>

NOTE:

The basic cardboard boat was designed to hold up to **two people** with a combined weight of **approximately 260 lbs.**

(However, the boat may hold more or less depending on the quality of craftsmanship)

If you think you will need to redesign for more weight, you may consider making the base of the boat a few inches wider or longer. Be aware of how much cardboard you have when resizing your boat. You will only be supplied with one sheet of cardboard. You will need to supply any extra cardboard you need to use.

B = Buoyant Force

B must equal the combined weight of the boat and passengers to stay afloat

We have used **275 pounds** for total weight. (260 lbs passengers + 15 lbs boat)

This is where your boat may slightly differ.

Buoyant Force is defined by the weight of fluid (in this case, water) that is displaced by an object
[B = W_d]

W_d = Weight of the water that is displaced by the boat

W_d = Unit weight of water multiplied by the volume of displaced water

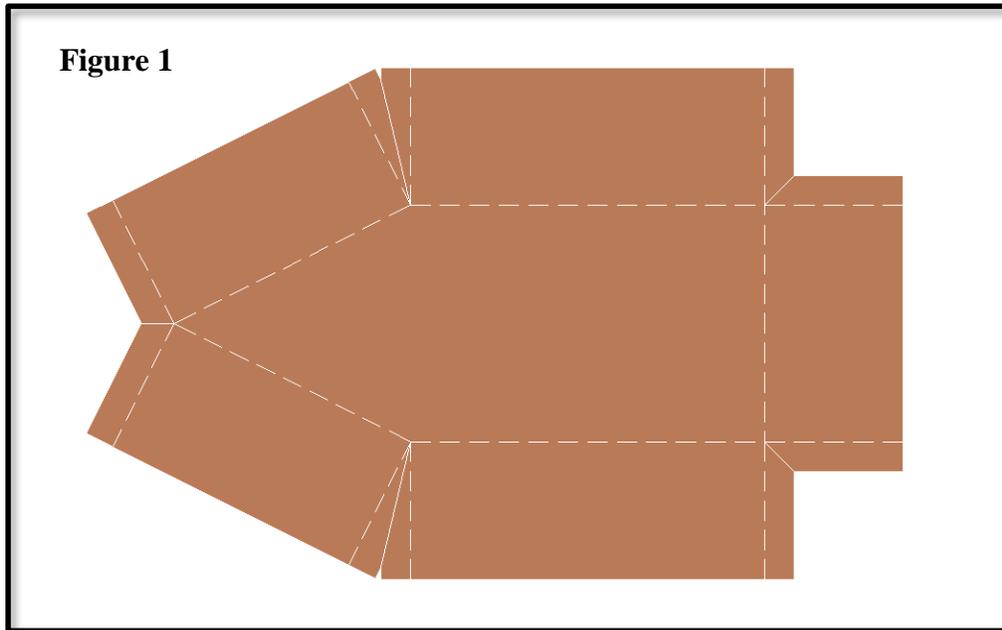
$$W_d = (62.4 \text{ lb/ft}^3) \times (\text{Area of base of boat} \times \text{depth of displacement}) \quad \text{[Equation 1]}$$

We know that W_d is already defined in this equation as 275 lbs.

This leaves the area of the base of the boat and the depth of displacement as variables. These are variables you can define. The current dimensions of the boat are a great starting point to start working from if you'd like to alter the dimensions.

Current working equation, referencing Equation 1: $275 \text{ lbs} = (62.4 \text{ lb/ft}^3)(8 \text{ ft}^2 \times 0.55 \text{ ft})$

The boat pattern is made up of a **main body** (Figure 1) and four (4) **reinforcing beams** (Figure 2).

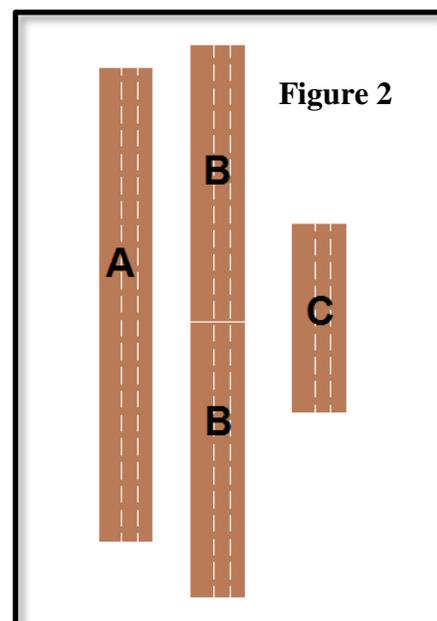


There are different sizes of reinforcing beams:

One (1) long beam, labeled **A**.

Two (2) medium beams, labeled **B**.

And one (1) short beam, labeled **C**.



While one group of students is working on the main body, another group can start building the reinforcing beams.

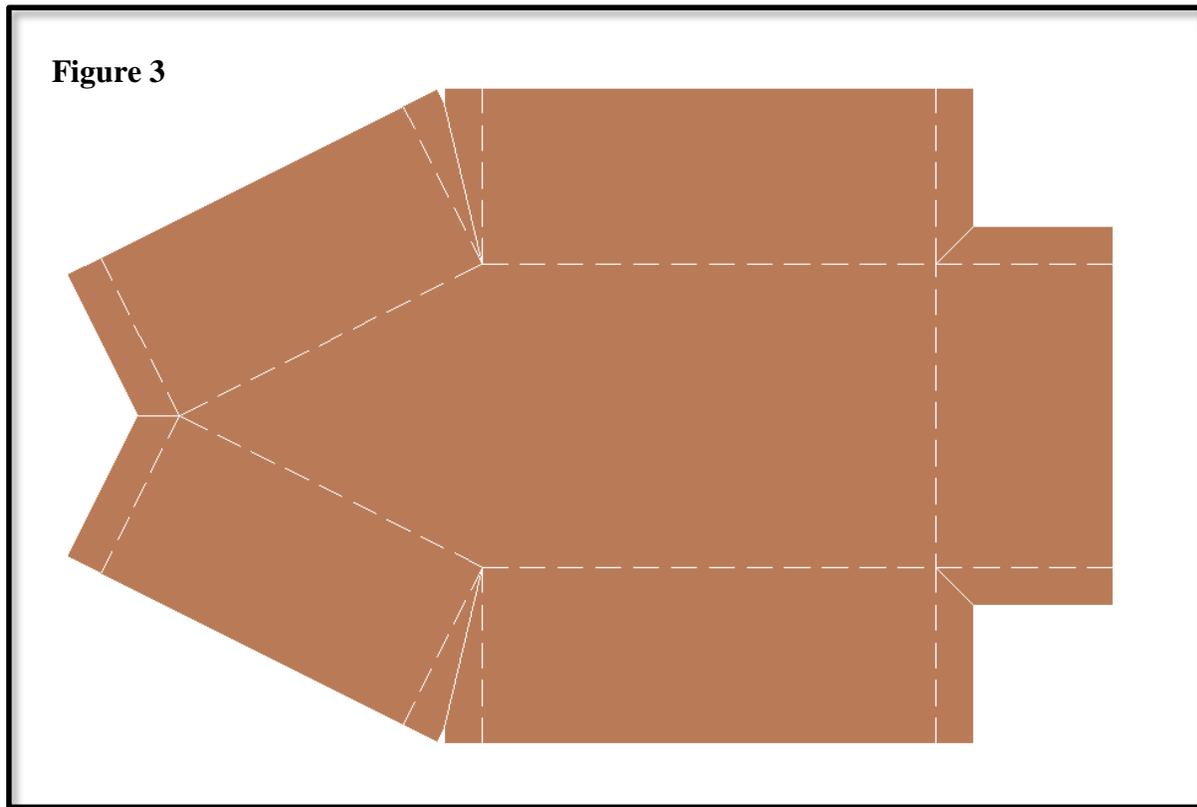
Main Body

On the flat pattern provided, there are solid lines (———) and there are dashed lines (- - - - -) that make up the shape of the boat.

1. Use the given dimensions and a measuring tape to copy the lines onto your cardboard with a pencil, pen, or marker.
2. Use the T-Square to achieve straight, square lines.
3. **CUT** along the solid lines (———) with your utility knife



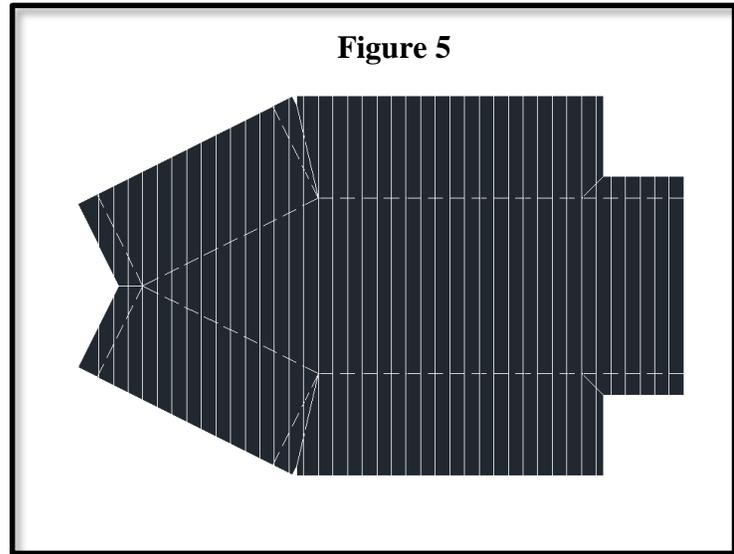
Once your flat pattern is cut out, it should look like Figure 3.



4. **FOLD** along the dashed lines (- - - - -) to create a crease in the cardboard.
5. Lay it flat again.
6. Now you will cover the entire pattern in duct tape.



Try to create a ¼” (.25 inch) overlap on each piece of duct tape, as show in Figure 4.



Orient the duct tape to run across the boat from side-to-side, as illustrated in Figure 5.

BOTH sides need to be completely covered. This is your waterproofing layer.

Once both sides are covered, you will add some of the reinforcing beams to the boat (before you fold it up).

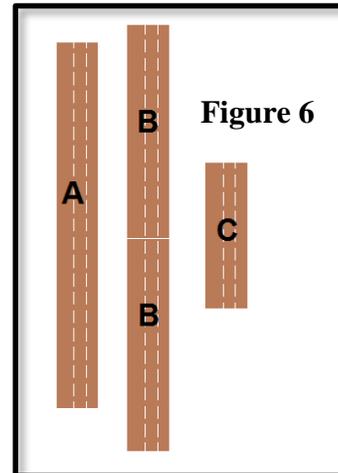
Reinforcing Beams

When you cut out your reinforcing beams, make sure that the length of the beam runs with the “grain” or corrugation of the cardboard. This will ensure your beams are as strong as possible.

1. **CUT** along the solid lines (———) with your utility knife



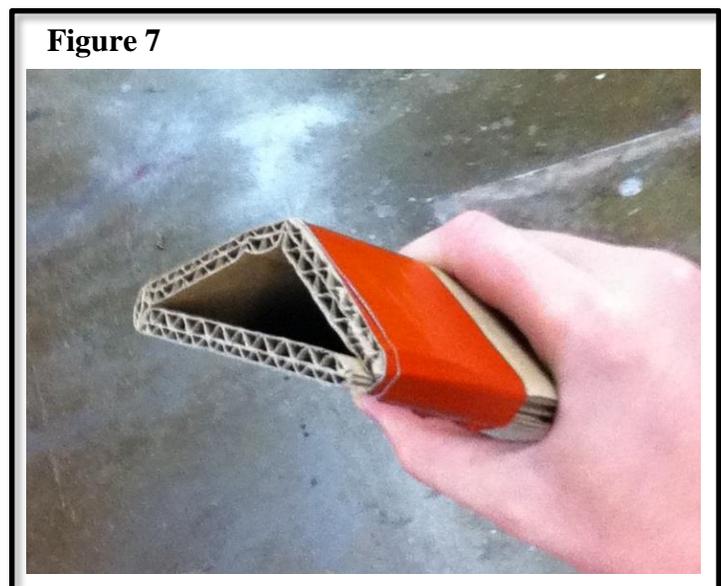
Once the beams are cut out, they should look like Figure 6.



2. **FOLD** along the dashed lines (- - - - -)



Once folded, tape the ends of the beam to hold it in place, as shown in Figure 7. Make sure the tape wraps completely around the beam, overlapping at the ends. (This is your waterproofing layer)

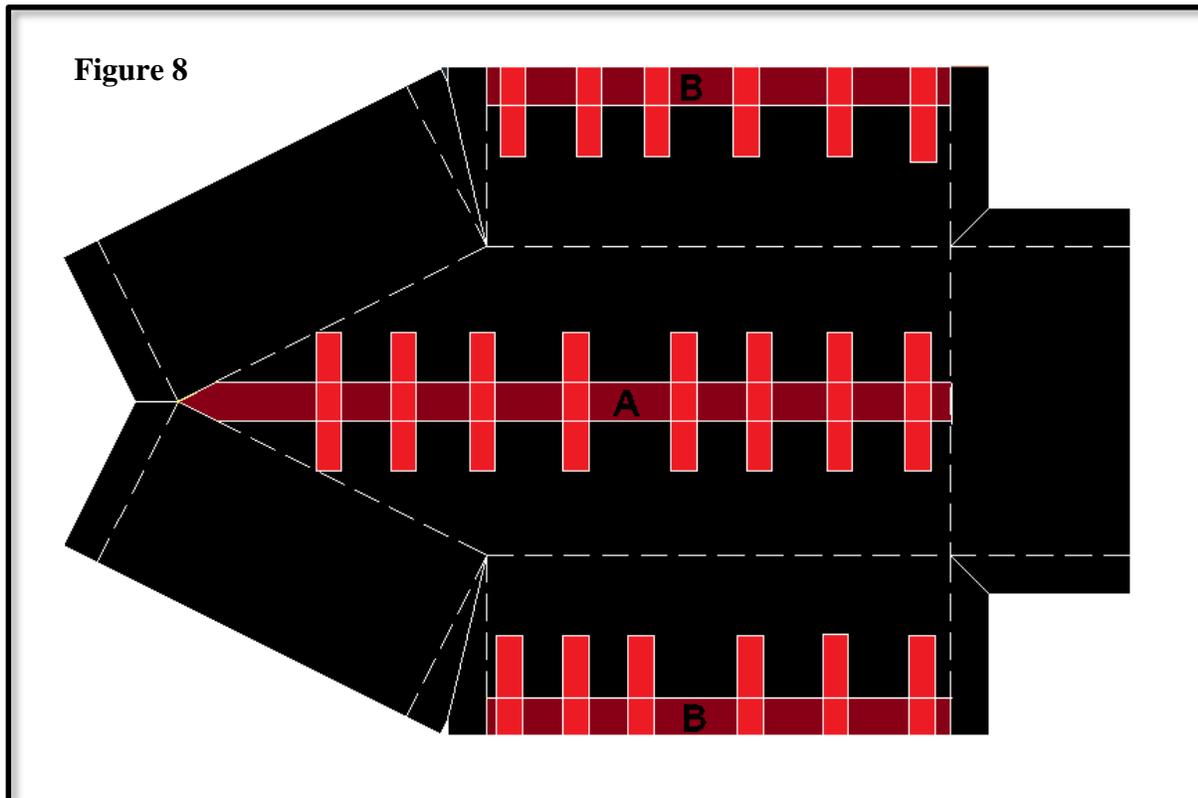


Tape off the ends of the beams to waterproof them further. You should have 4 complete beams.

Assembling the Boat

Tape the long beam (A) and the two medium beams (B) onto the flat pattern, similar to Figure 8.

Leave approximately $\frac{1}{2}$ " between the ends of the medium beams (B) and the fold lines for the tabs.

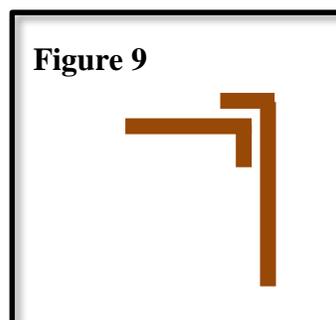


You can use any method of taping you find appropriate, this is only a suggestion.

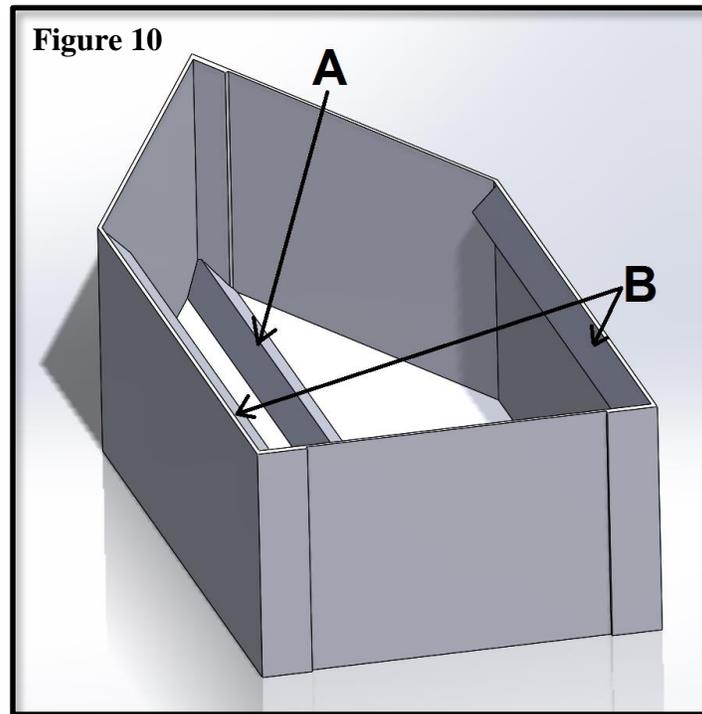
Just make sure the beams are **securely** attached to the body of the boat!

The long beam (A) may need to be cut and reshaped at the front to fit the shape of the boat.

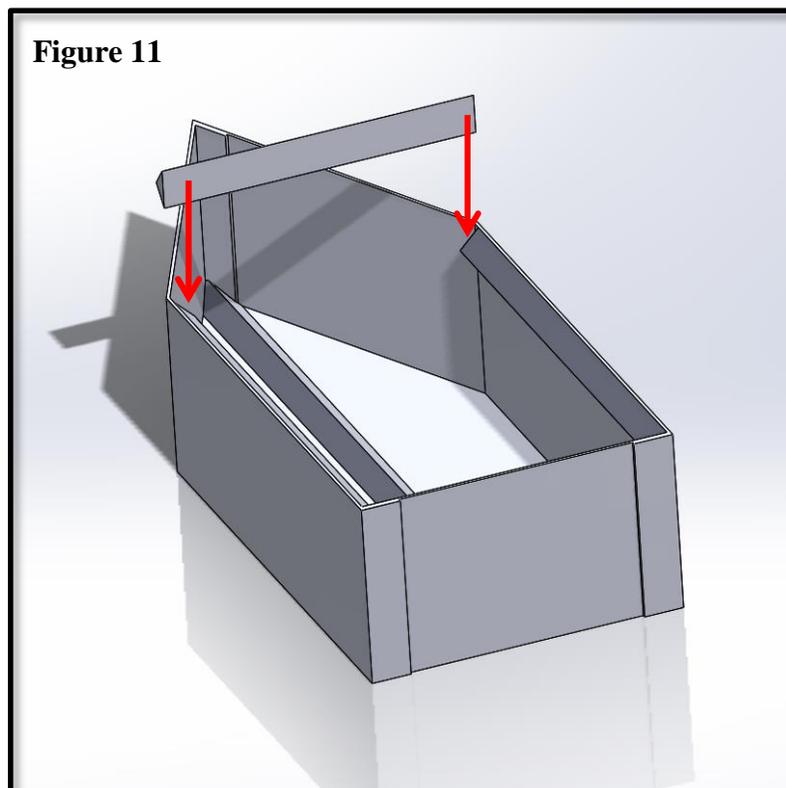
Fold the boat into shape and securely tape the joints. The 3" tabs will help to strengthen joints and provide an easy place to tape for assembly. One tab should be on the inside and one on the outside of each joint, as illustrated in Figure 9.



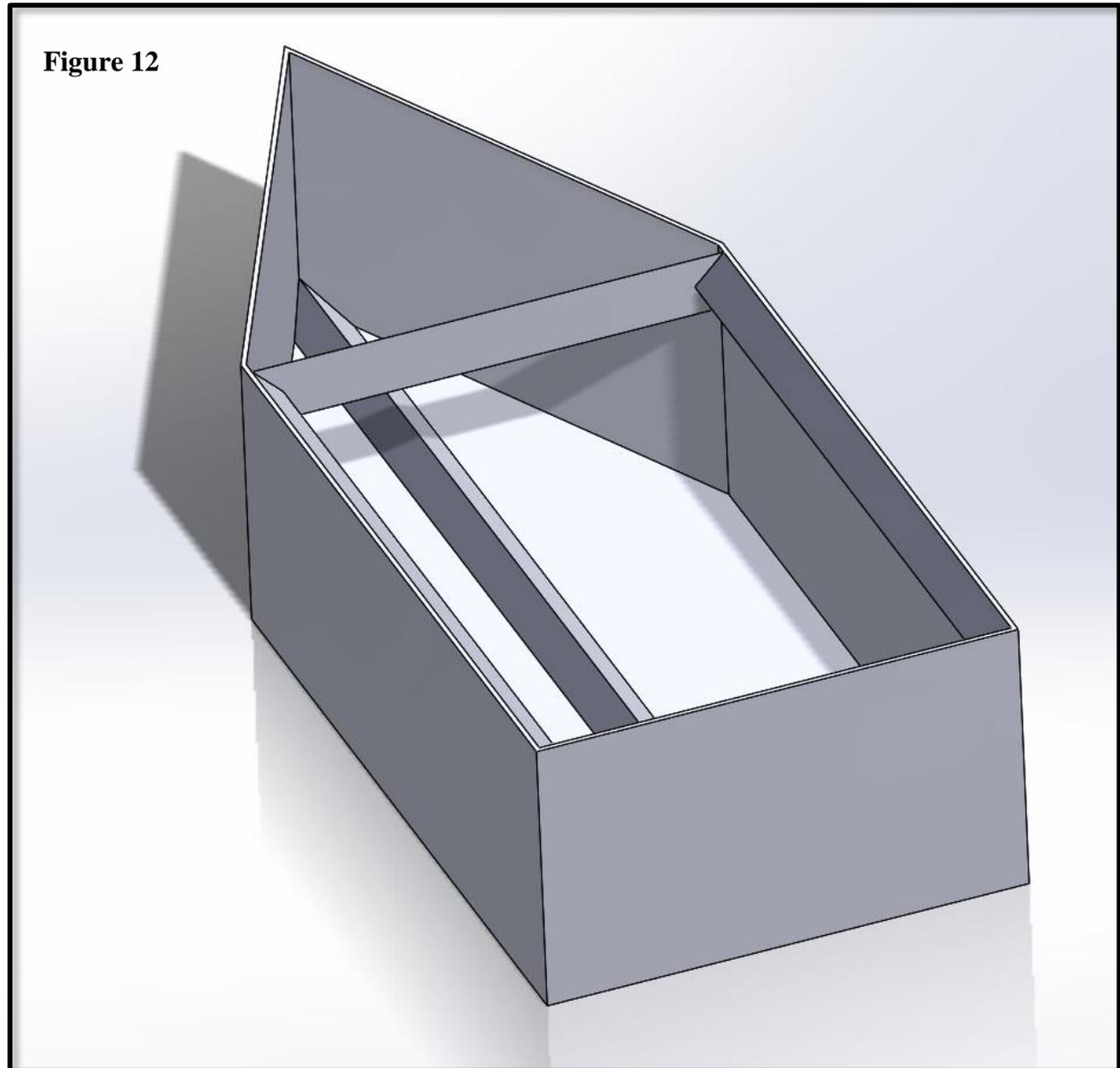
Once folded and taped, your boat should resemble Figure 10. Beams A and B should already be in place.



Add the short beam (C) to span from the front end of one medium beam (B) to the front of the other, as shown in Figure 11.



Tape the short beam (C) in place. (It may need to be slightly cut or reshaped at the ends to fit the shape of the folded boat.) Your completed boat should look similar to Figure 12.



At this point, you may add any additional features to your boat if you wish to do so. Your basic cardboard boat is complete!

Good luck and have fun!