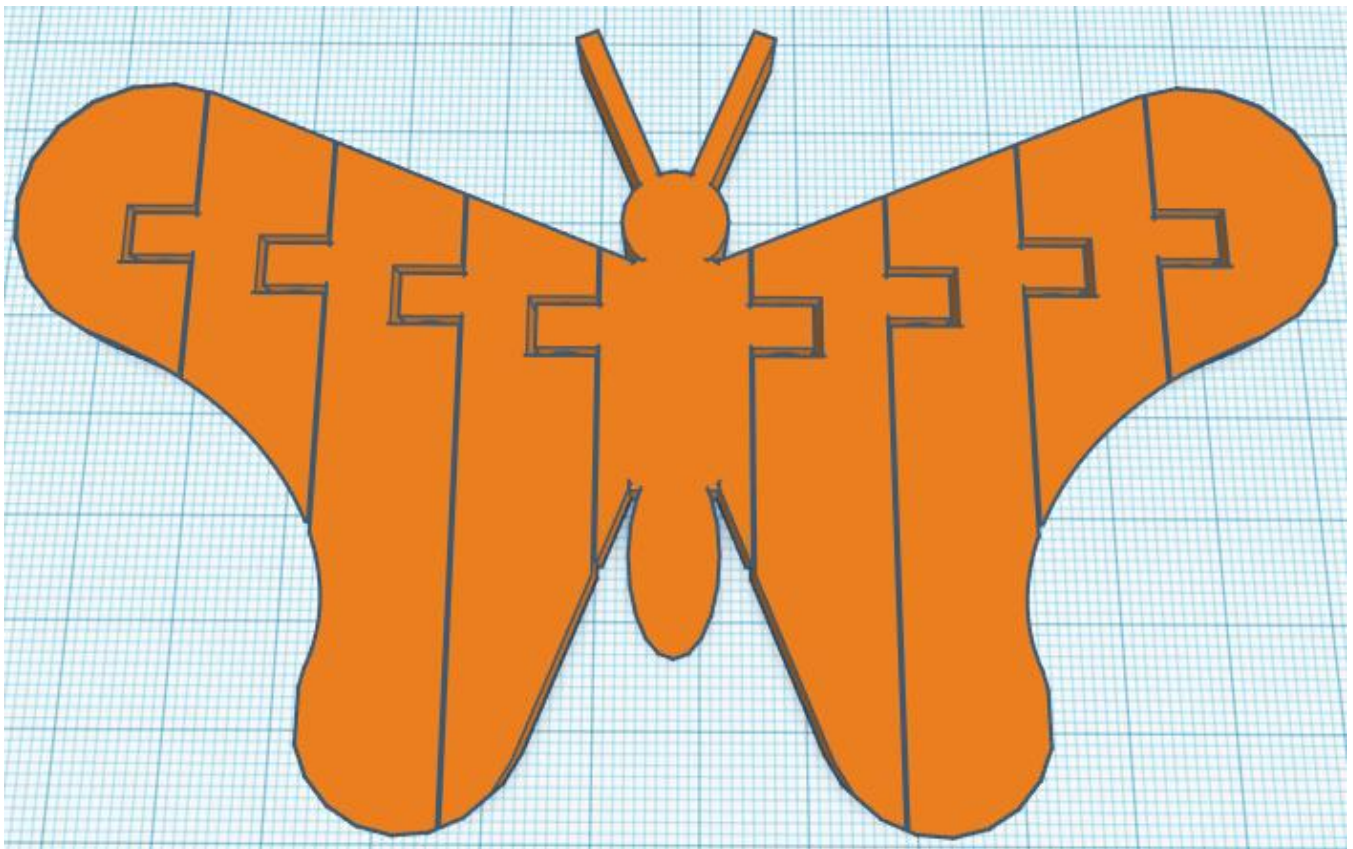




Articulated Butterfly Project

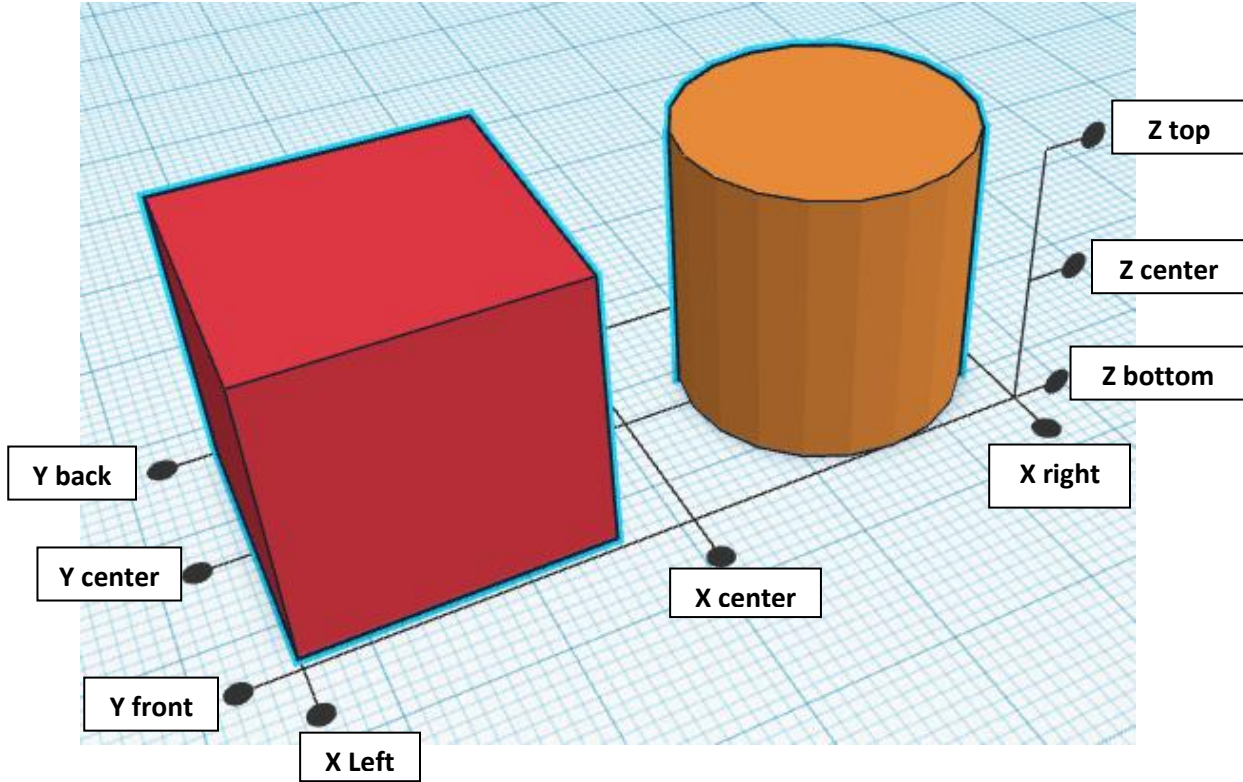


Reference to Aligning, Flip direction, Move direction, and Rotate direction.

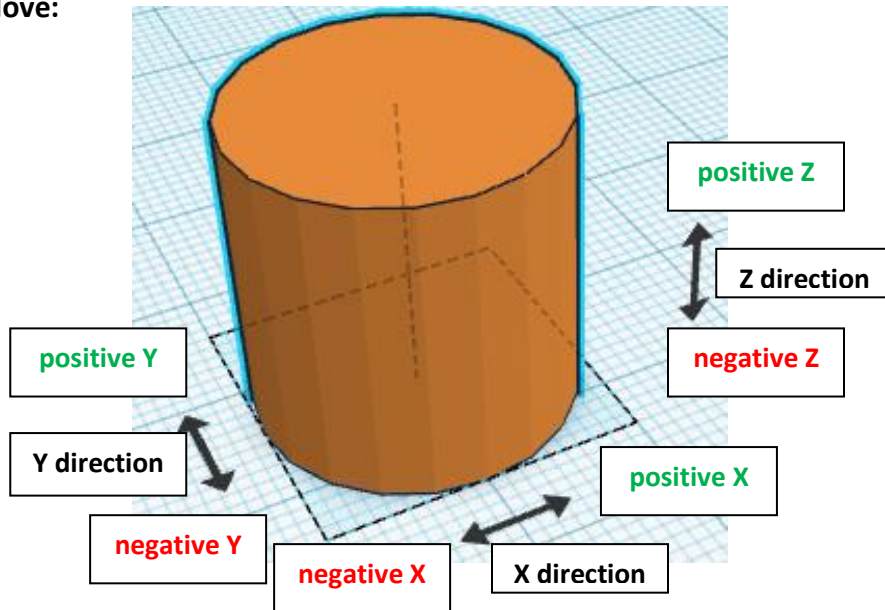
Always be in the "home view" when doing any of these!!!



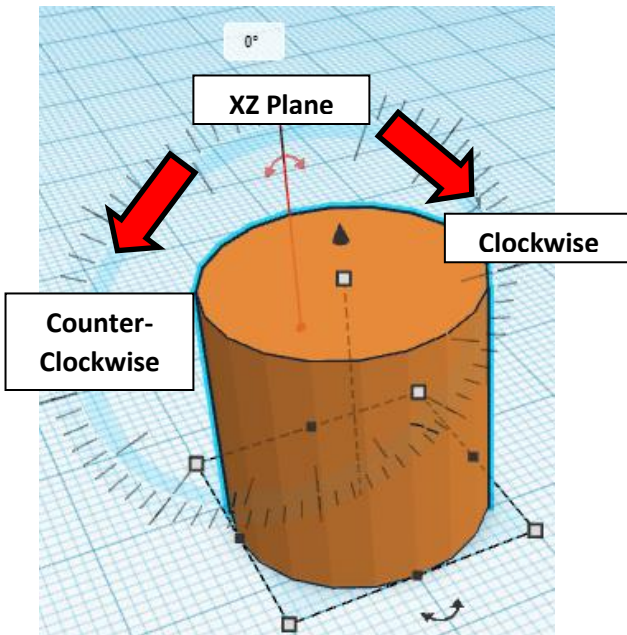
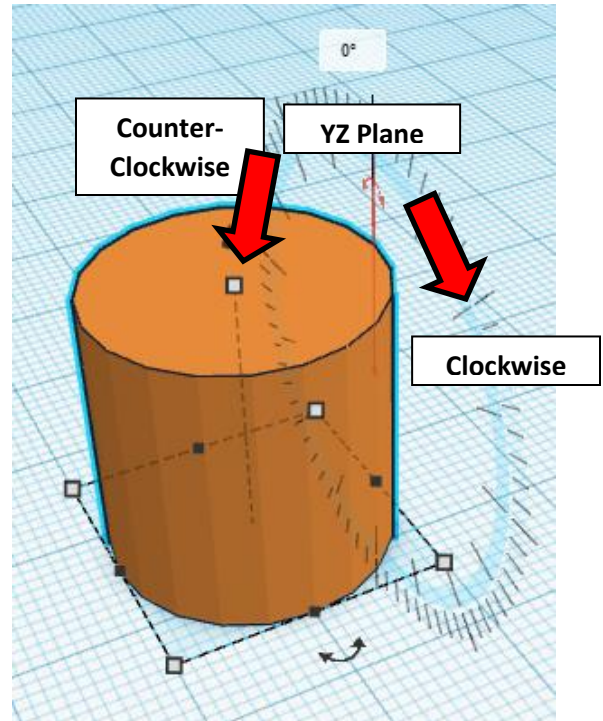
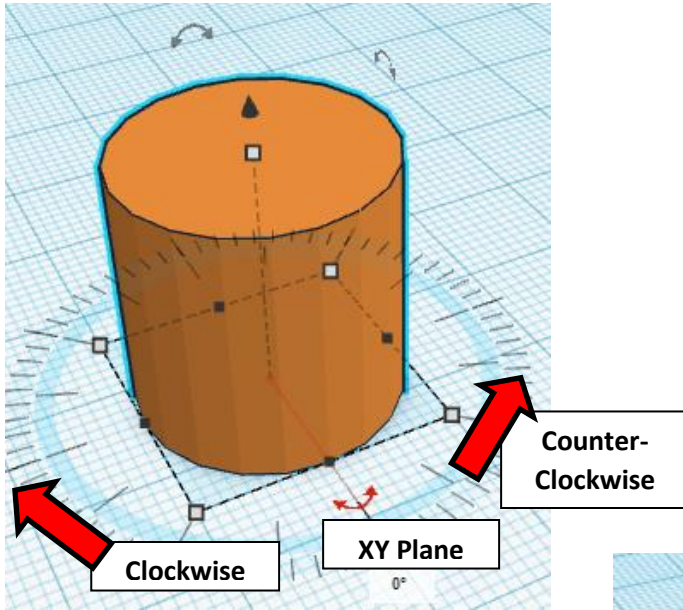
Aligning:



Flip or Mirror and Move:



Rotate:

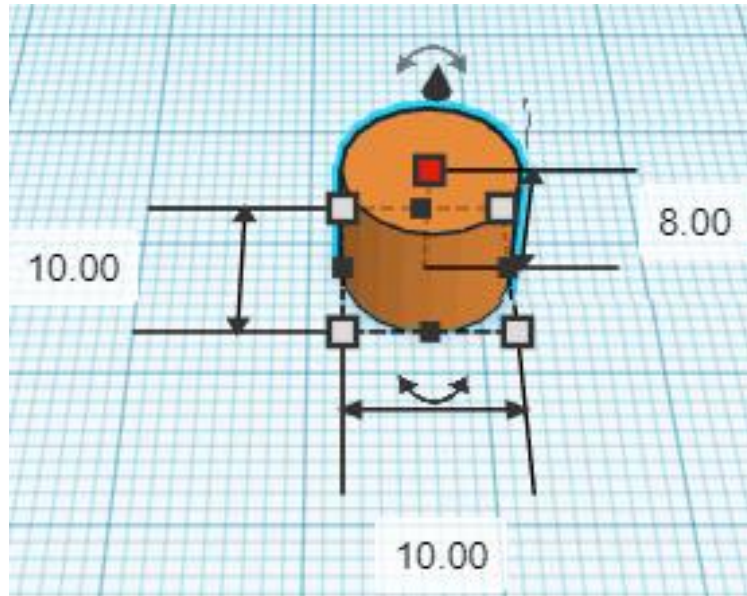


Articulated Butterfly:

Head:

Bring in a Cylinder, located in Basic Shapes on the right 2 shapes down.
From now on this will be called the **Head**.

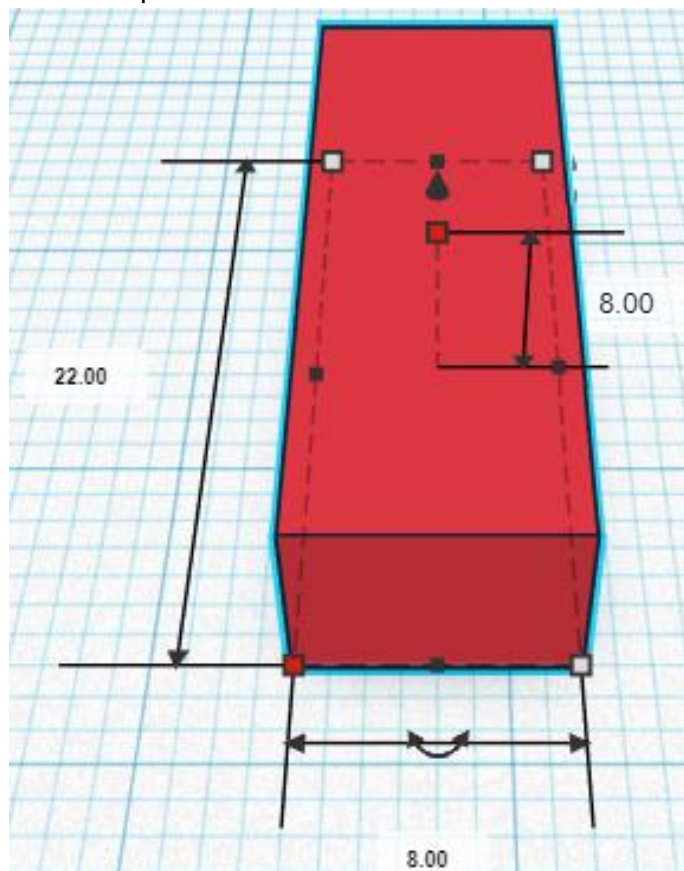
Change the dimensions to
10mm X direction,
10mm Y direction, and
8mm Z direction.



Body:

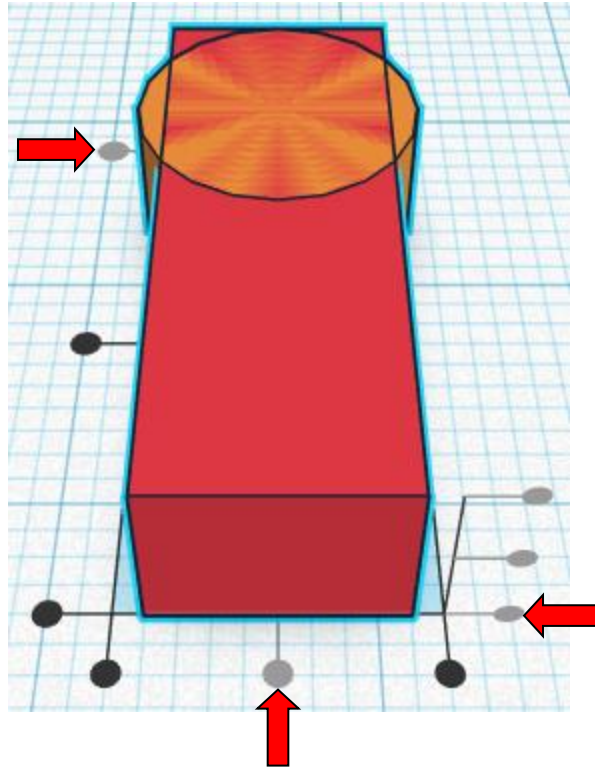
Bring in a Box, located in Basic Shapes on the left 2 shapes down.
From now on this will be called the **Body**.

Change the dimensions to
8mm X direction,
22mm Y direction, and
8mm Z direction.



Align Head and Body

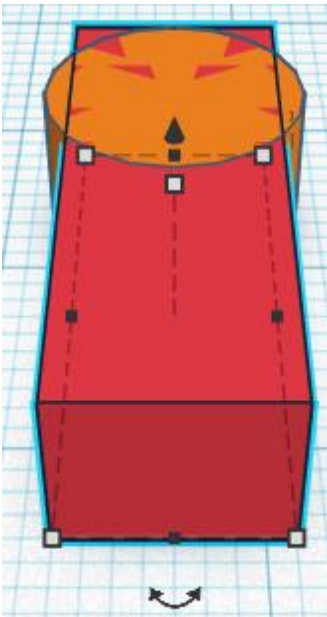
centered in X direction,
back of Y direction, and
bottom of Z direction.



Move Body (Must be in home view for this to work!)
move forward in negative Y direction 9mm

Hint: Select Body and push down arrow key 9 times.

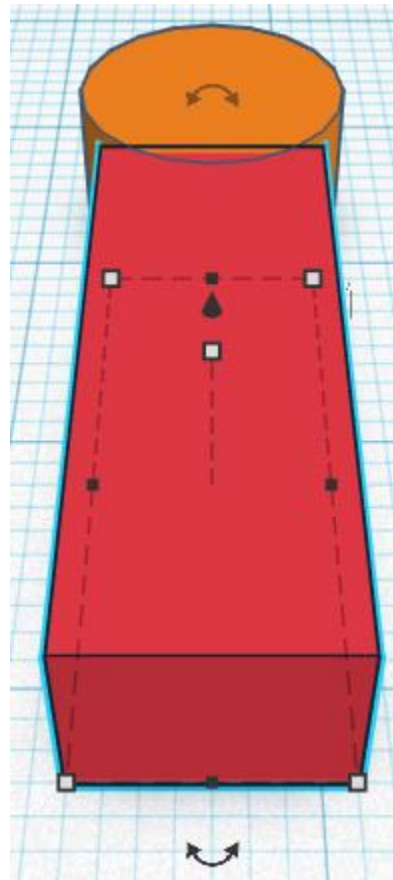
Before



9mm
forward



After



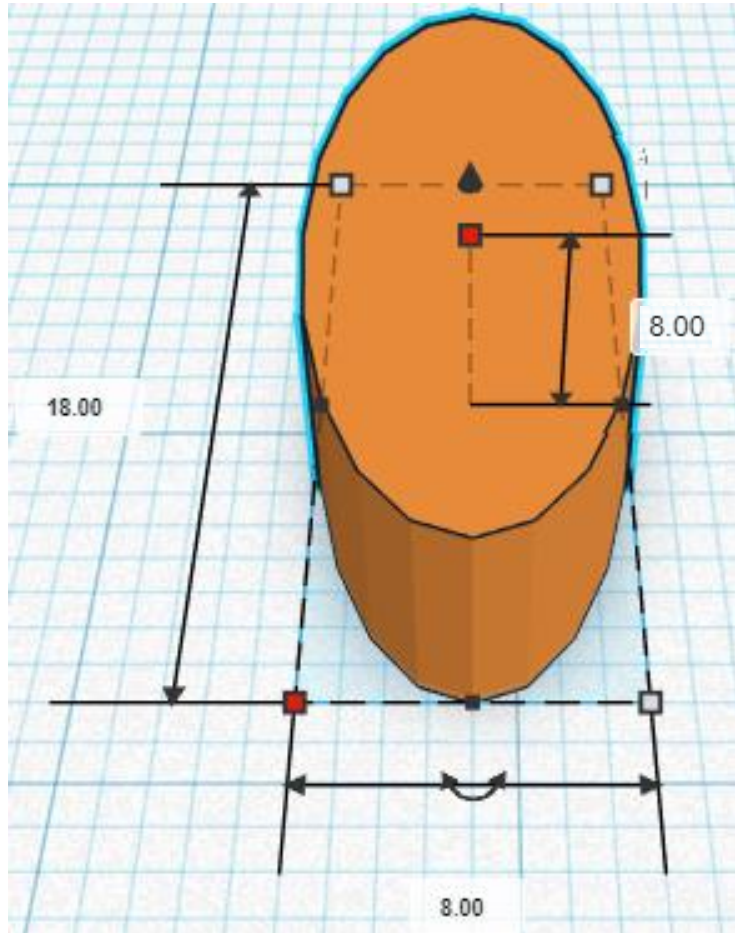
Group Head and Body

From now on this will be called the **Body**.

Tail:

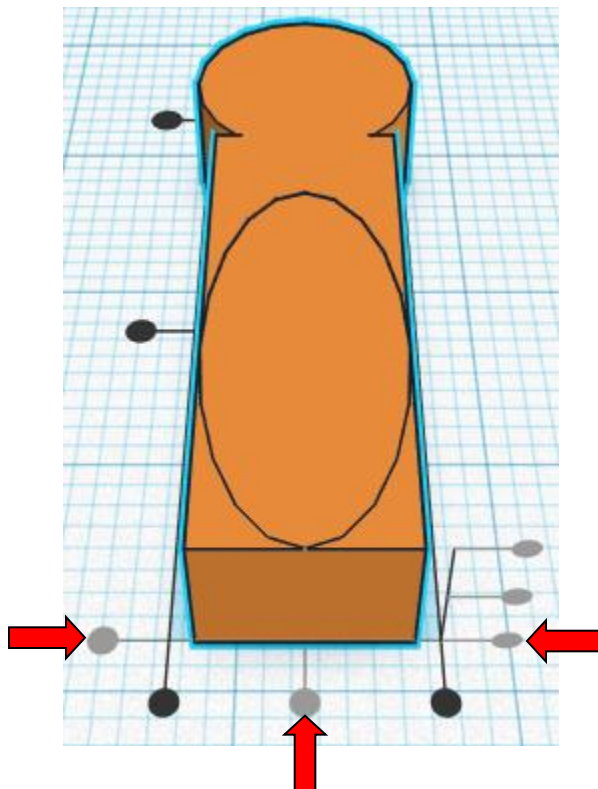
Bring in a Cylinder, located in Basic Shapes on the right 2 shapes down.
From now on this will be called the **Tail**.

Change the dimensions to
8mm X direction,
18mm Y direction, and
8mm Z direction.



Align Tail and Body

centered in X direction,
front of Y direction, and
bottom of Z direction.



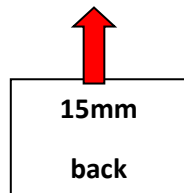
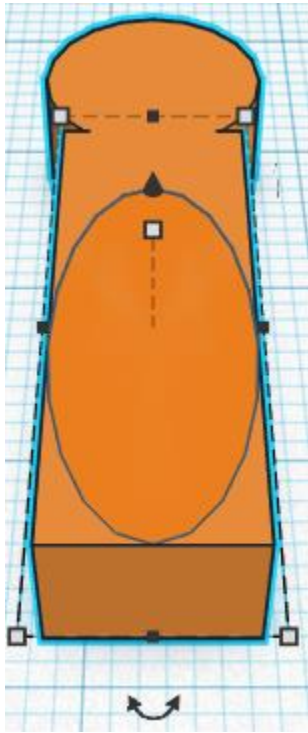
Move Body (Must be in home view for this to work!)

move back in positive Y direction 15mm

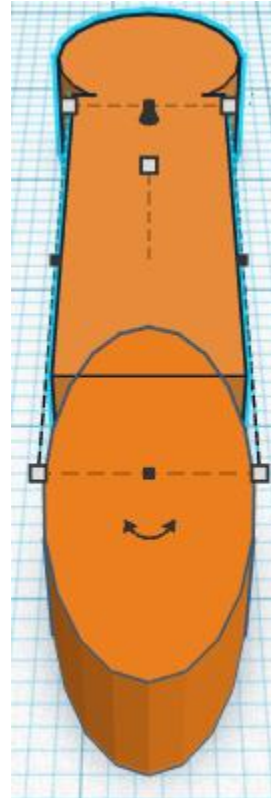
Hint: Select Body and push up arrow key 15 times.

Or hold down shift and push up arrow 1 time and release shift and push up arrow 5 times.

Before



After



Group Tail and Body

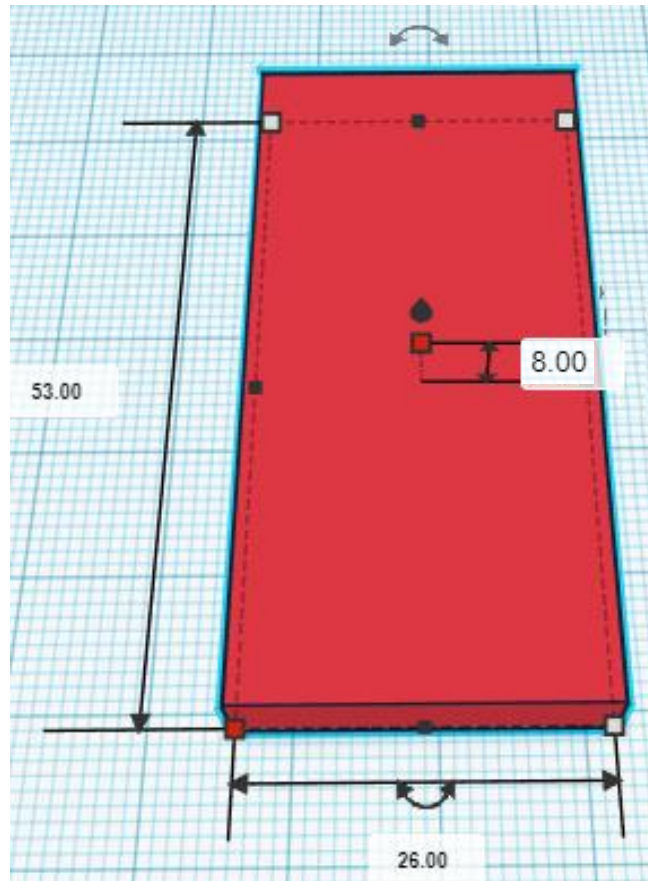
From now on this will be called the **Body**.

Set the body off to the side for now.

Top Wing Section:

Bring in a Box, located in Basic Shapes on the left 2 shapes down.
From now on this will be called the **Top Wing Section**.

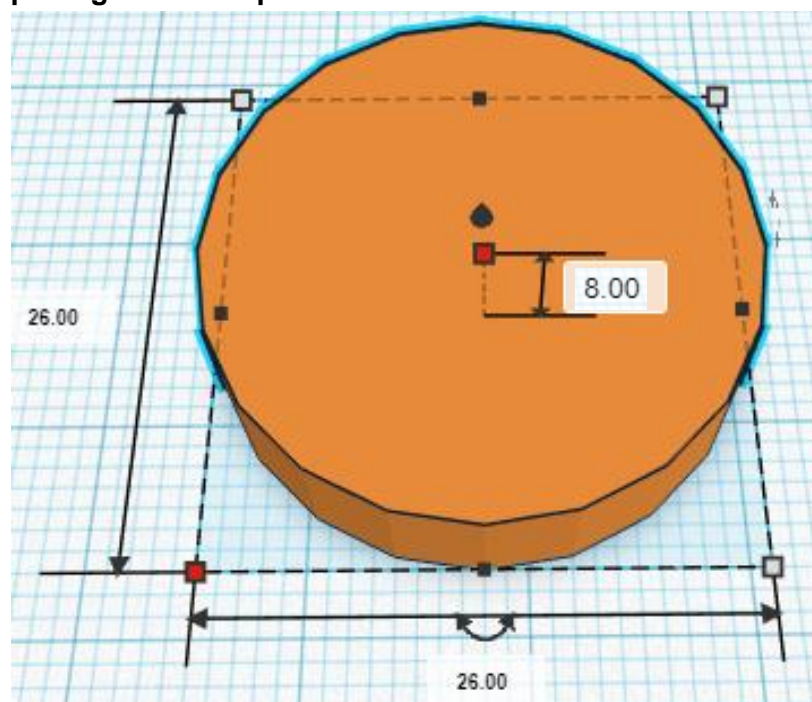
Change the dimensions to
26mm X direction,
53mm Y direction, and
8mm Z direction.



Top Wing Section Tip:

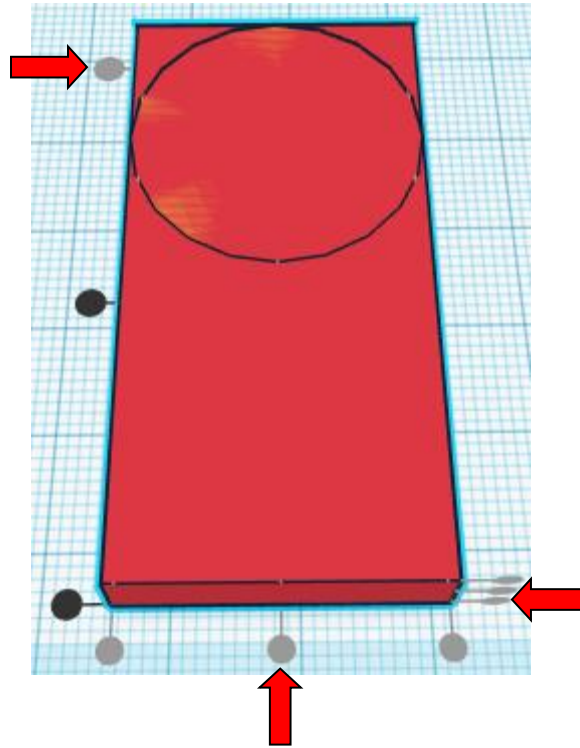
Bring in a Cylinder, located in Basic Shapes on the right 2 shapes down.
From now on this will be called the **Top Wing Section Tip**.

Change the dimensions to
26mm X direction,
26mm Y direction, and
8mm Z direction.



Align Top Wing Section and Top Wing Section Tip

centered in X direction,
back in Y direction, and
bottom of Z direction.



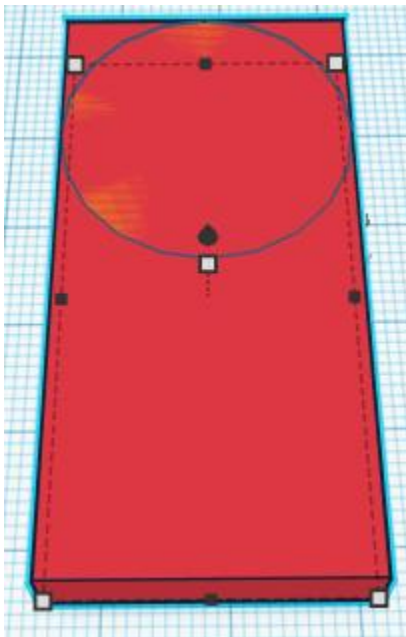
Move Top Wing Section (Must be in home view for this to work!)

move forward in negative Y direction 13mm

Hint: Select Top Wing Section and push down arrow key 13 times.

Or hold down shift and push down arrow 1 time and release shift and push down arrow 3 times.

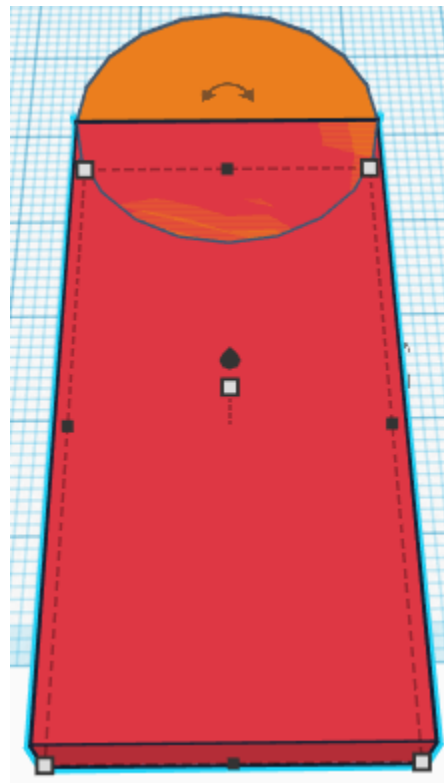
Before



13mm
forward



After



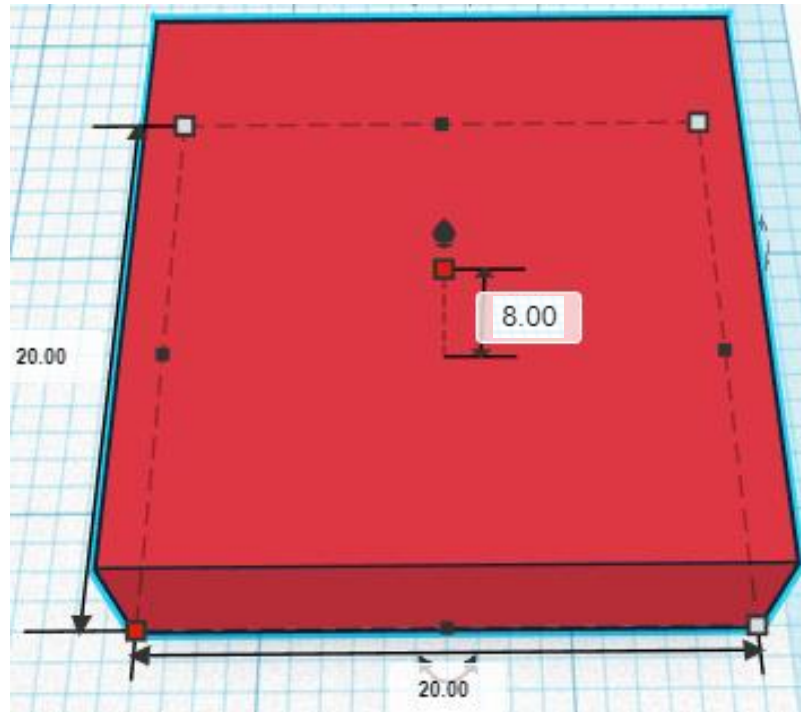
Group Top Wing Section and Top Wing Section Tip
From now on this will be called the **Top Wing Section**

Set the Top Wing Section off to the side for now.

Bottom Wing Section:

Bring in a Box, located in Basic Shapes on the left 2 shapes down.
From now on this will be called the **Bottom Wing Section**.

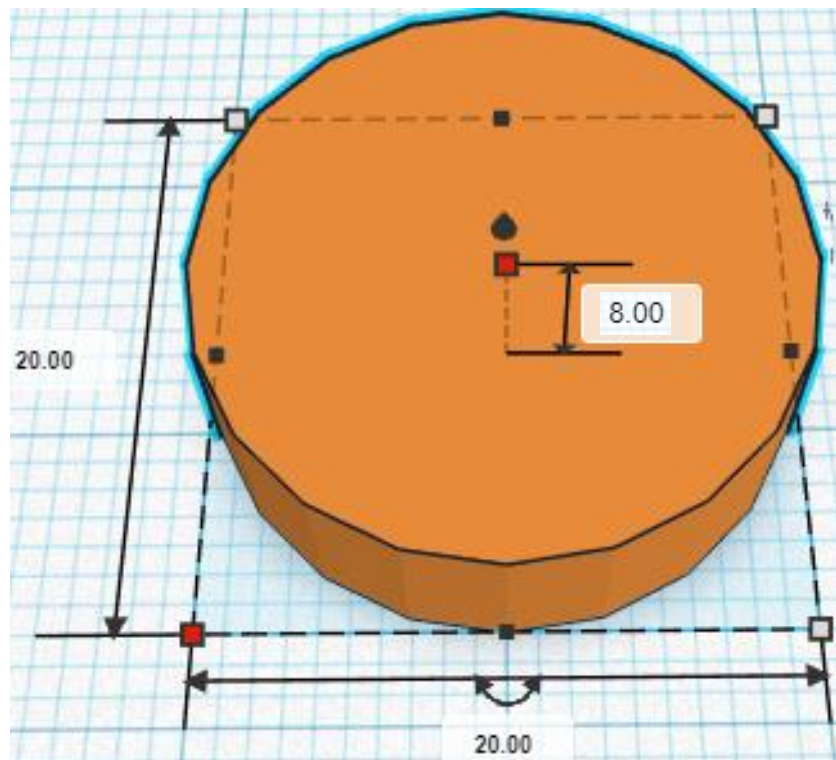
Change the dimensions to
20mm X direction,
20mm Y direction, and
8mm Z direction.



Bottom Wing Section Tip:

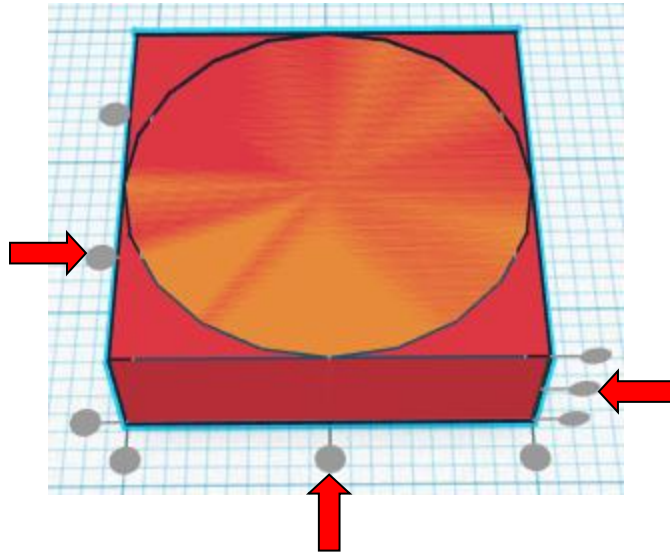
Bring in a Cylinder, located in Basic Shapes on the right 2 shapes down.
From now on this will be called the **Bottom Wing Section Tip**.

Change the dimensions to
20mm X direction,
20mm Y direction, and
8mm Z direction.



Align Bottom Wing Section and Bottom Wing Section Tip

centered in X direction,
centered in Y direction, and
centered of Z direction.

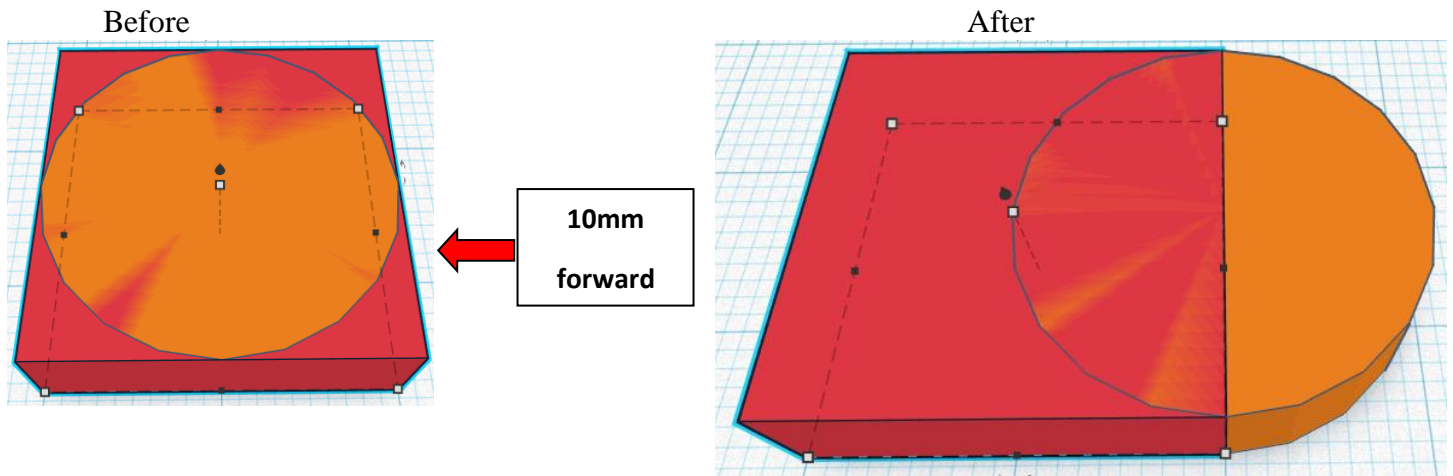


Move Bottom Wing Section (Must be in home view for this to work!)

move left in negative X direction 10mm

Hint: Select Bottom Wing Section and push left arrow key 10 times.

Or hold down shift and push left arrow 1 time.

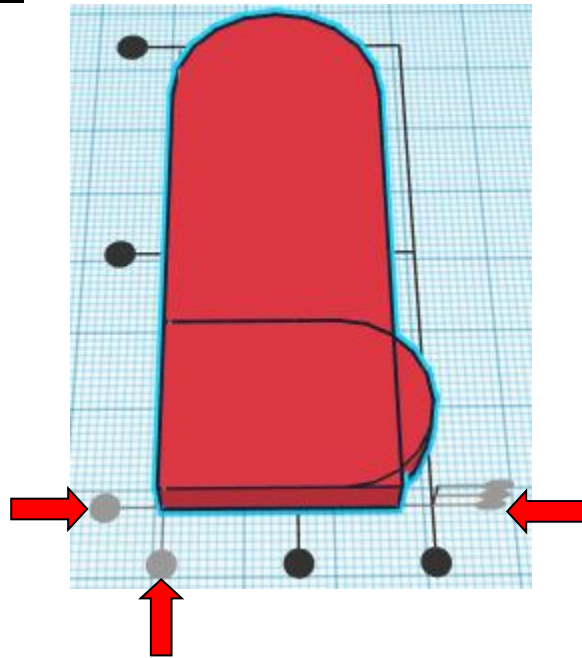


Group Bottom Wing Section and Bottom Wing Section Tip

From now on this will be called the **Bottom Wing Section**

Align Top Wing Section and Bottom Wing Section

Left in X direction,
Forward in Y direction, and
Bottom of Z direction.



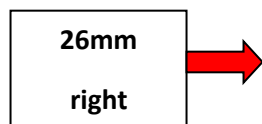
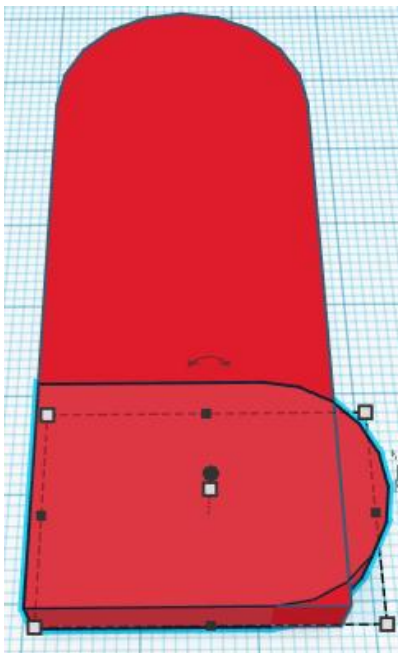
Move Bottom Wing Section (Must be in home view for this to work!)

move right in positive X direction 26mm

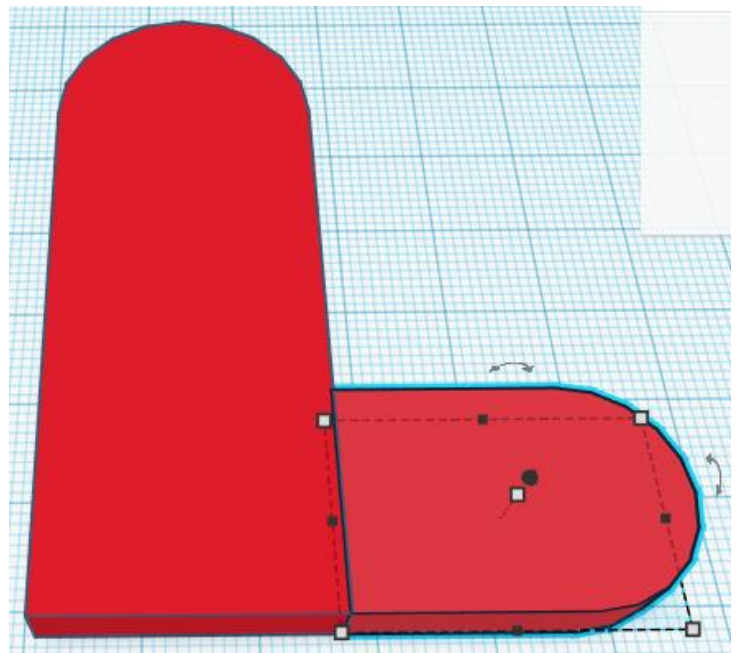
Hint: Select Bottom Wing Section and push right arrow key 26 times.

Or hold down shift and push right arrow 2 time and release shift and push right arrow 6 times.

Before



After



Group Top Wing Section and Bottom Wing Section

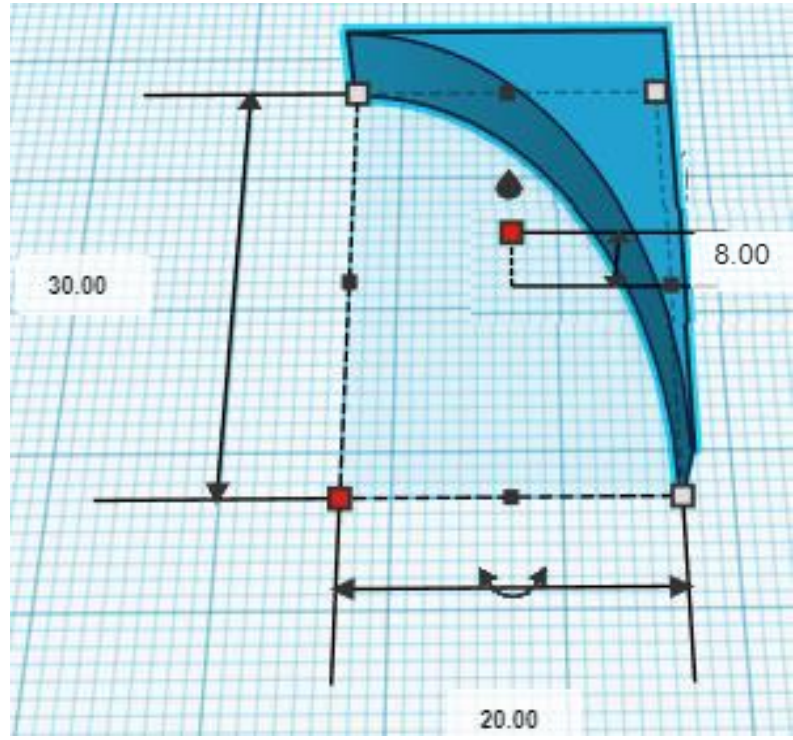
From now on this will be called the **Wing Section**

Curved Wing Section:

Bring in a MetaFillet, located in All, (things in All move each time that TinkerCad adds items to All), this was last seen on page 11, on the bottom left.

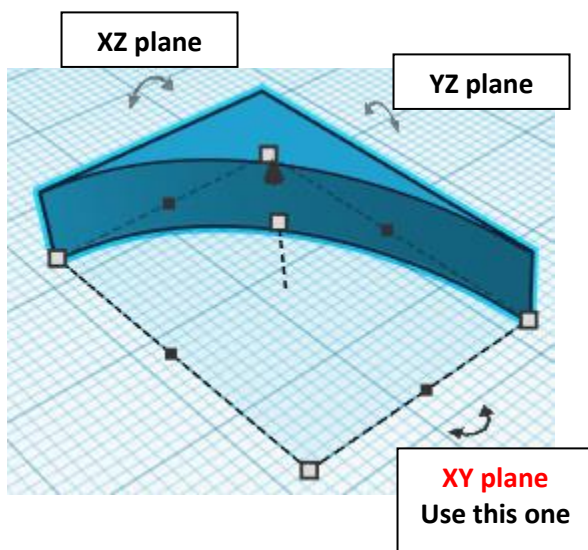
From now on this will be called the **Curved Wing Section**.

Change the dimensions to 20mm X direction, 30mm Y direction, and 8mm Z direction.

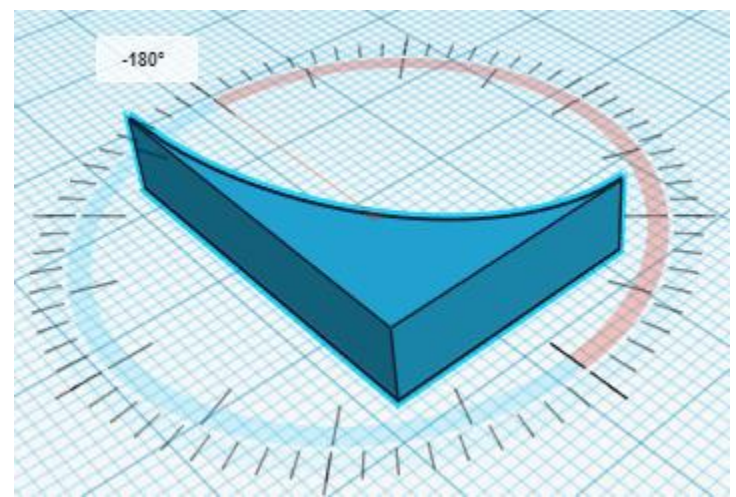


Rotate the Curved Wing Section clockwise 180 degrees in XY plane.

Before

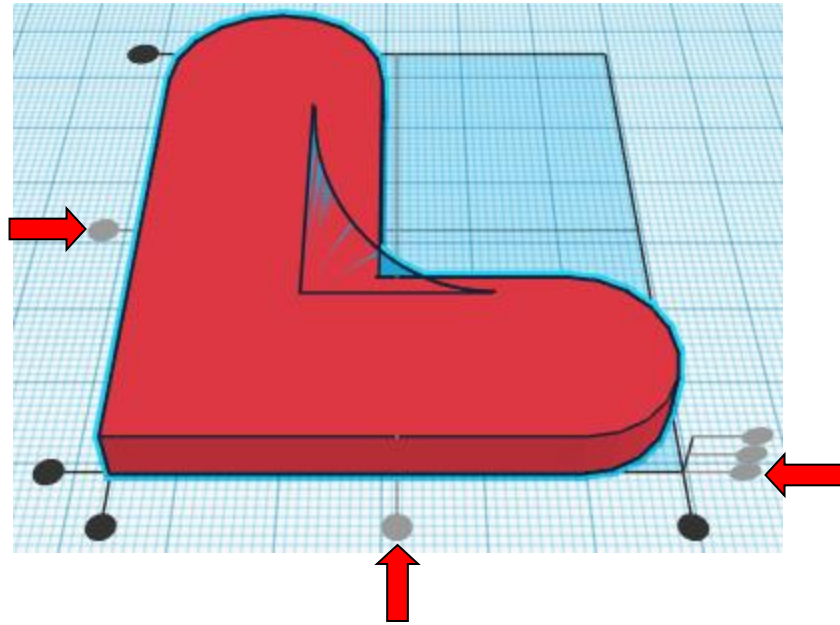


After



Align Wing Section and Curved Wing Section

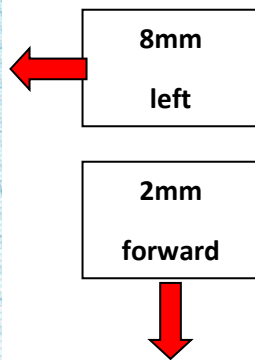
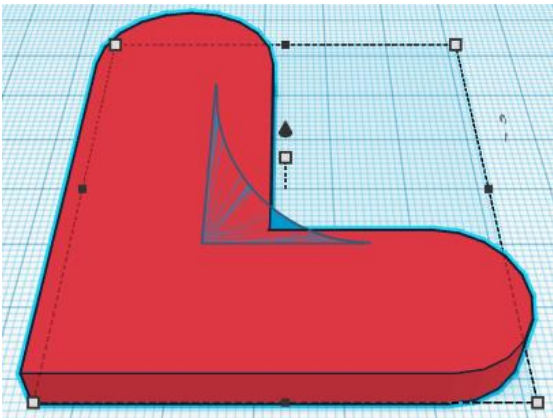
centered in X direction,
centered in Y direction, and
bottom of Z direction.



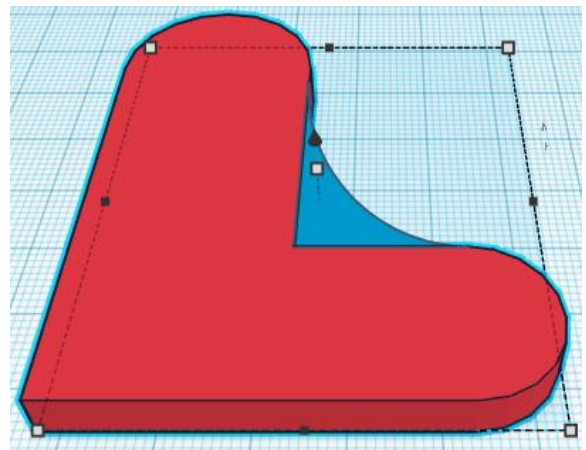
Move Wing Section (Must be in home view for this to work!)

move left in negative X direction 8mm and
move forward in negative Y direction 2mm

Before



After

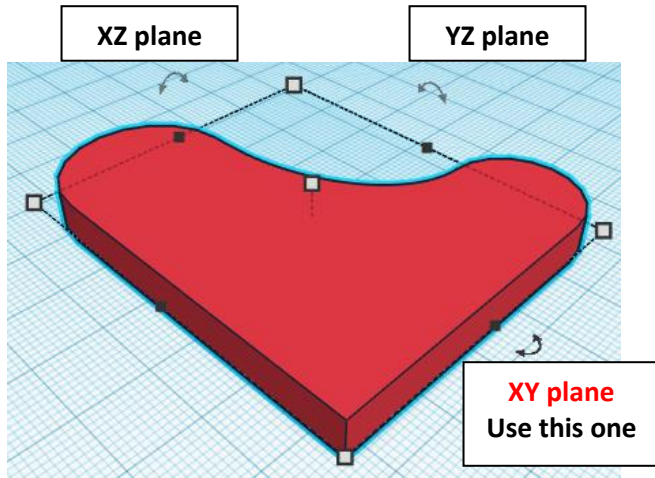


Group Wing Section and Curved Wing Section

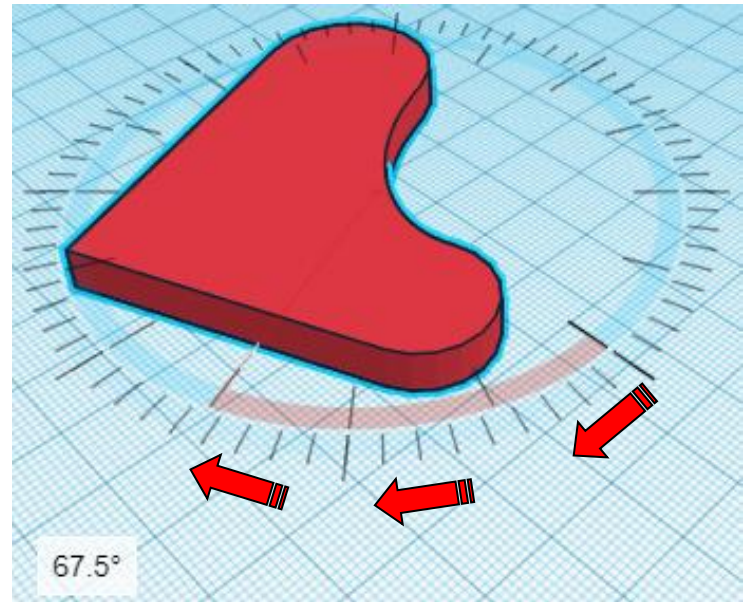
From now on this will be called the **Right Wing**

Rotate the Right Wing clockwise 67.5 degrees in XY plane.

Before



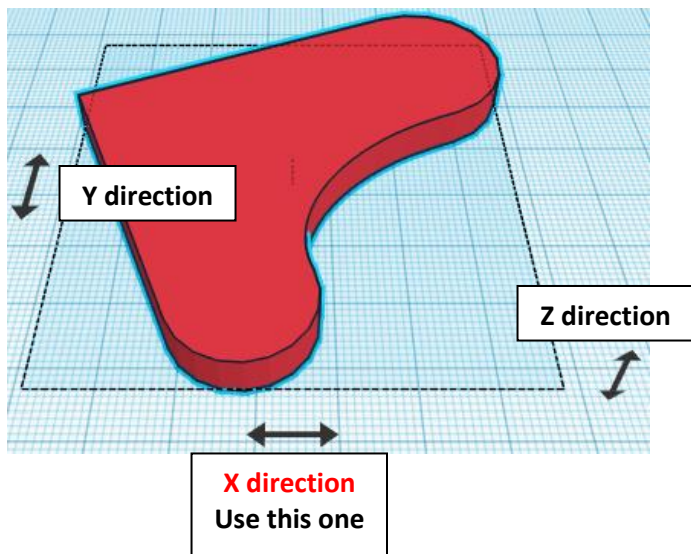
After



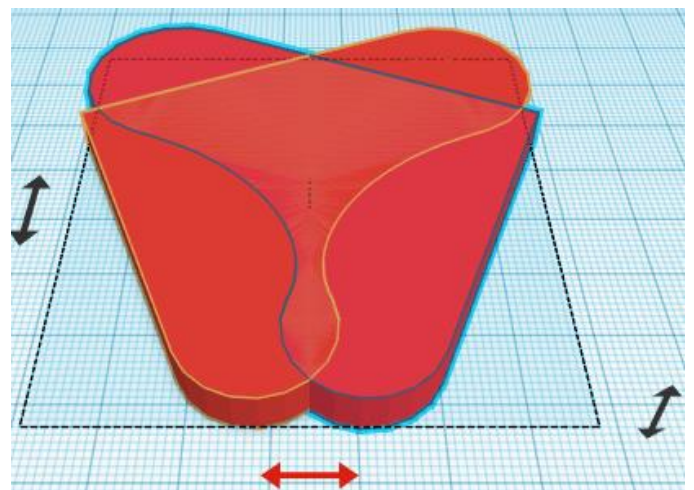
Duplicate Right Wing

Flip Right Wing in x direction.

Before

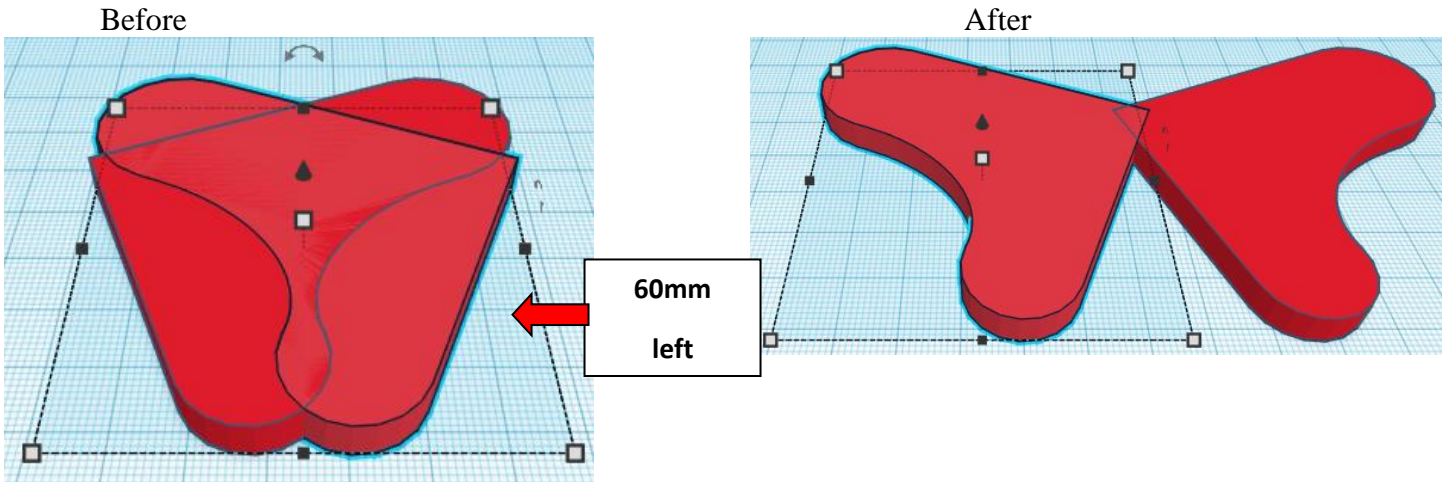


After



From now on this new flipped part will be called the **Left Wing**

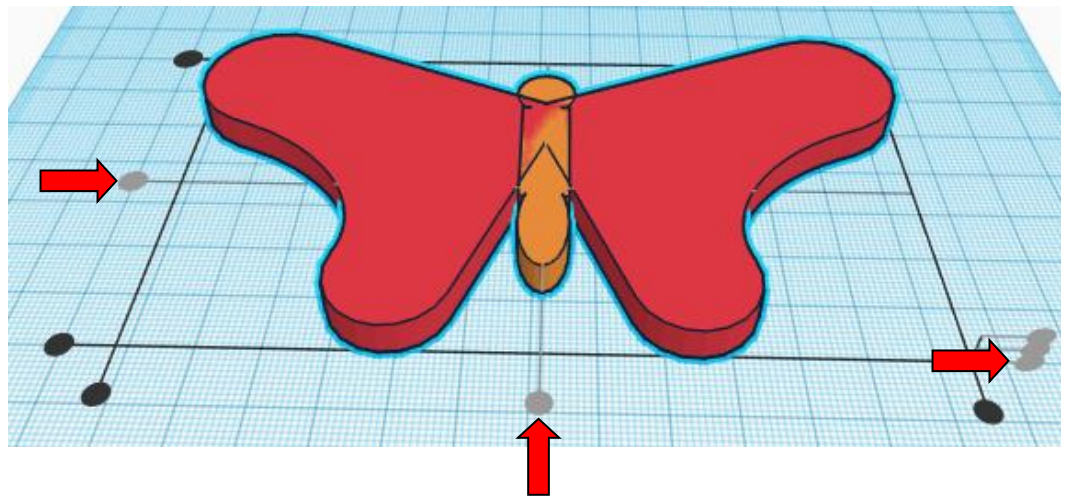
Move Left Wing (Must be in home view for this to work!)
move left in negative X direction 60mm



Group Right Wing and Left Wing
From now on this will be called the **Wings**

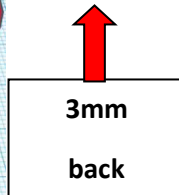
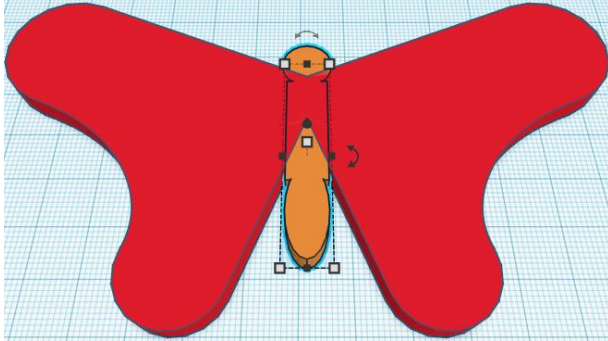
Align Wings and Body

centered in X direction,
centered in Y direction, and
bottom of Z direction.

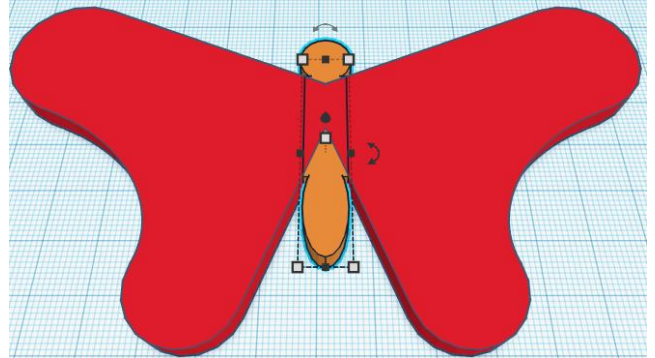


Move Body (Must be in home view for this to work!)
move back in positive Y direction 3mm

Before



After



Group Wings and Body

From now on this will be called the **Butterfly**

Congratulation! You have built the Butterfly.

Set the Butterfly off to the side.

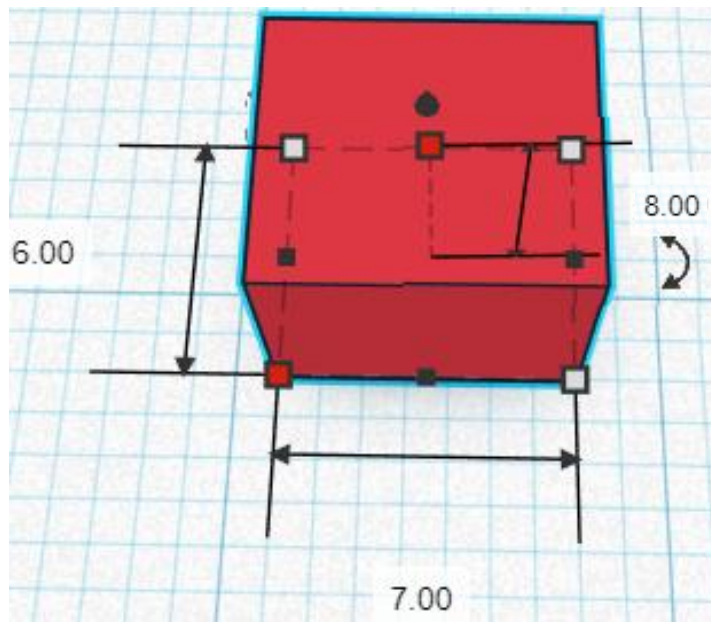
The next section will show you how to construction the joints for the butterfly.

Hinge Assembly:

Hinge Box:

Bring in a Box, located in Basic Shapes on the left 2 shapes down.
From now on this will be called the **Hinge Box**.

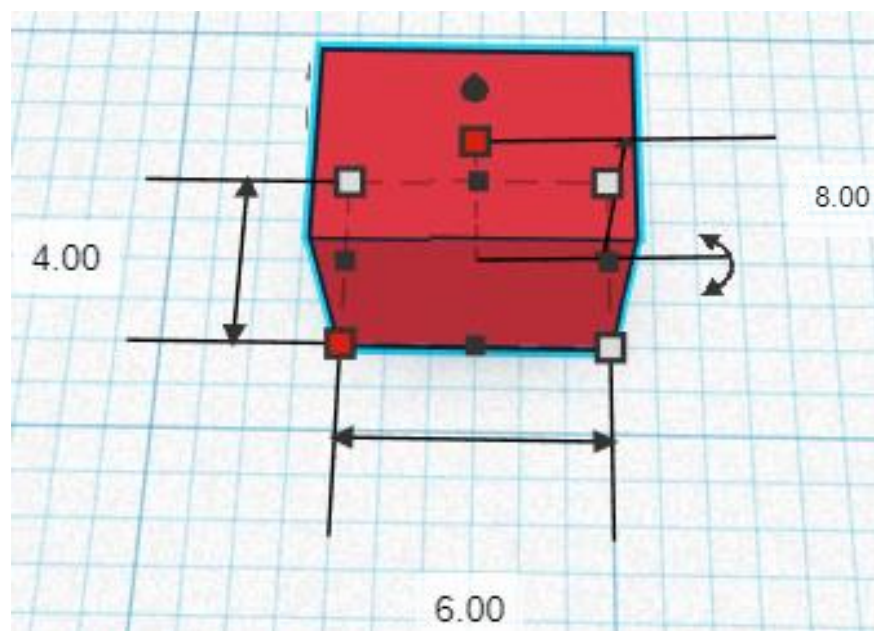
Change the dimensions to
7mm X direction,
6mm Y direction, and
8mm Z direction.



Hinge Box Cutout:

Bring in a Box, located in Basic Shapes on the right 2 shapes down.
From now on this will be called the **Hinge Box Cutout**.

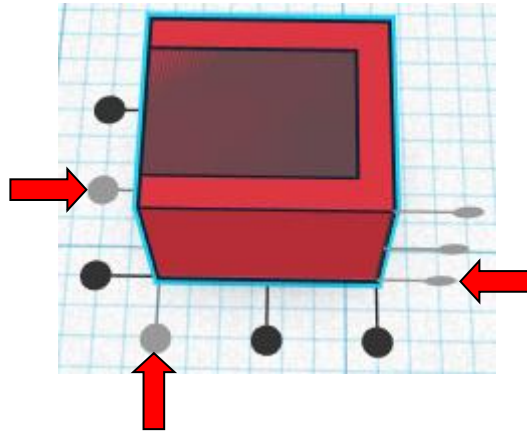
Change the dimensions to
6mm X direction,
4mm Y direction, and
8mm Z direction.



Change Hinge Box Cutout to **Hole** by selecting Hinge Box Cutout and typing "h".

Align Hinge Box and Hinge Box Cutout

left in X direction,
centered in Y direction, and
bottom of Z direction.



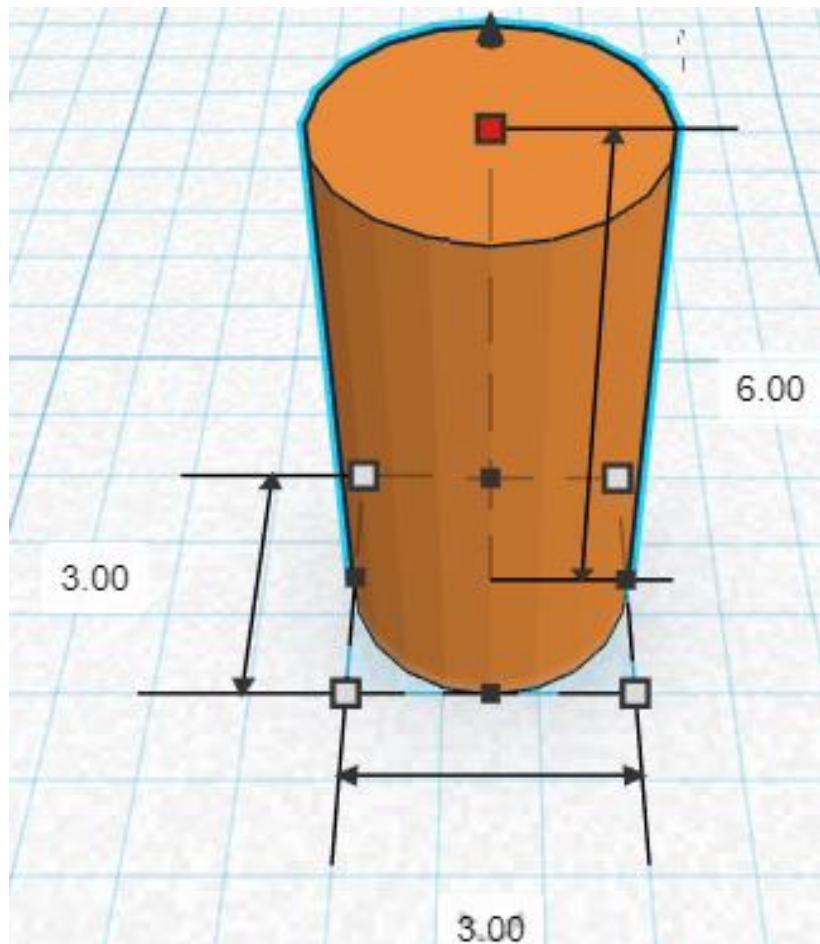
Group Hinge Box and Hinge Box Cutout

From now on this will be called the **Hinge Box**

Pin:

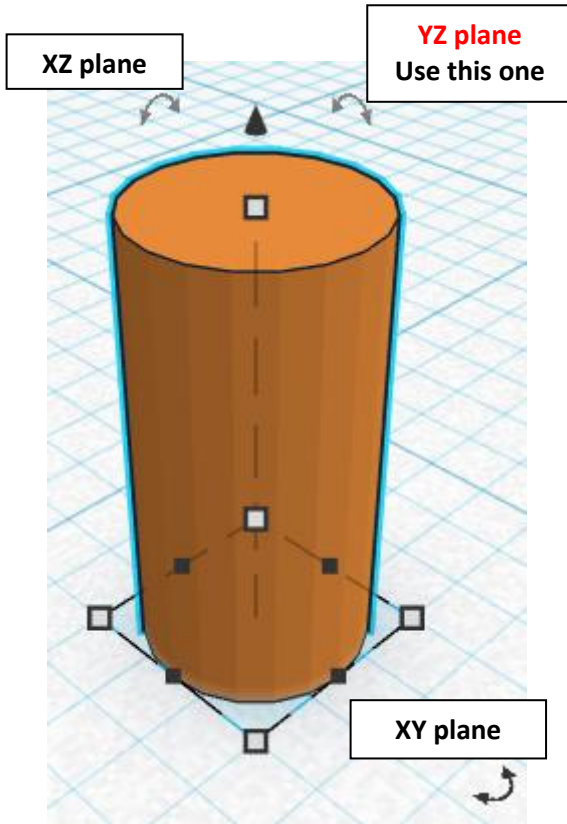
Bring in a Cylinder, located in Basic Shapes on the right 2 shapes down.
From now on this will be called the **Pin**.

Change the dimensions to
3mm X direction,
3mm Y direction, and
6mm Z direction.

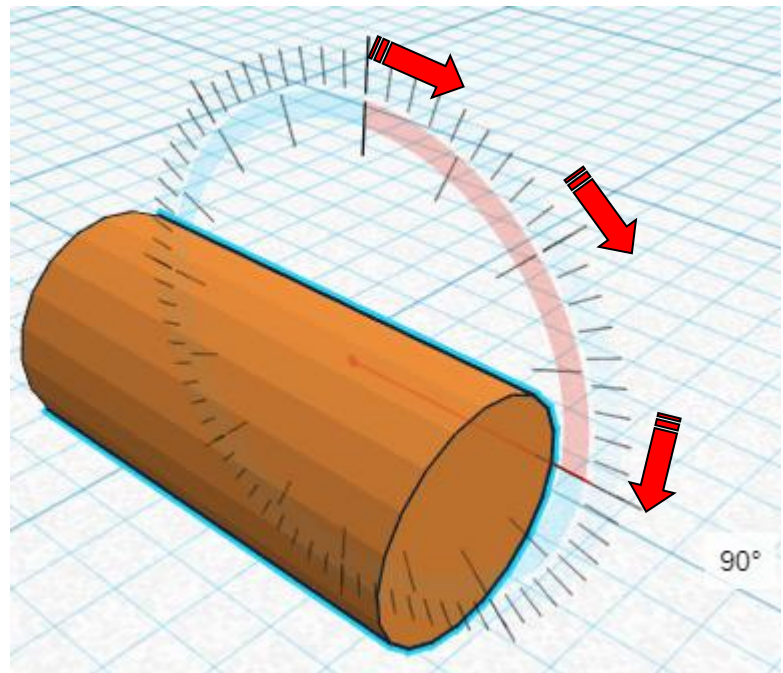


Rotate the Pin clockwise 90 degrees in YZ plane.

Before

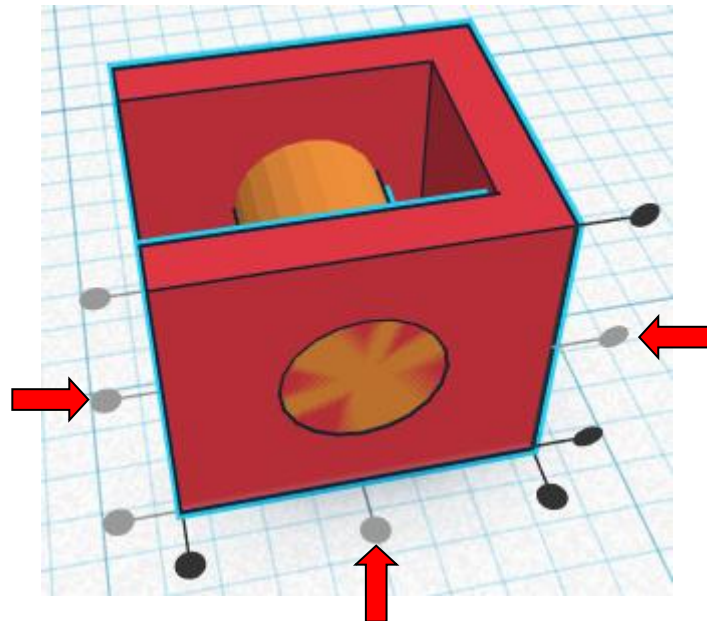


After



Align Hinge Box and Pin

centered in X direction,
centered in Y direction, and
centered of Z direction.



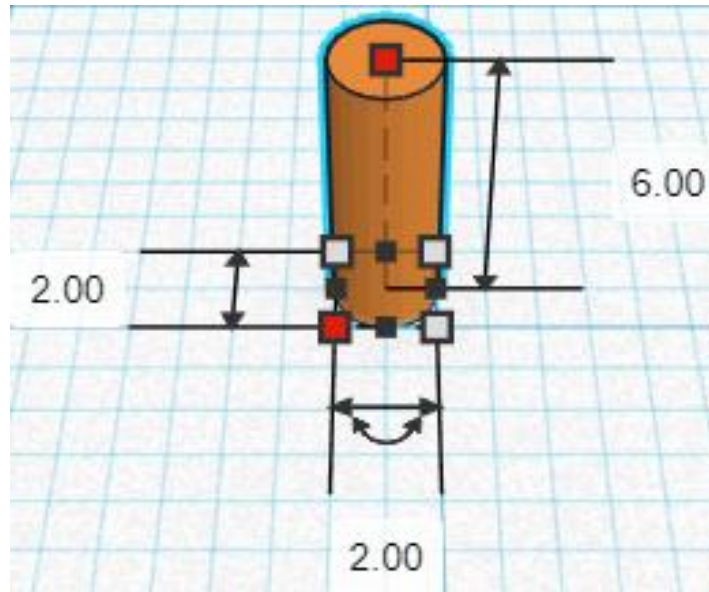
Group Hinge Box and Pin

From now on this will be called the **Hinge Box**

Pin Cutout:

Bring in a Cylinder, located in Basic Shapes on the right 2 shapes down.
From now on this will be called the **Pin Cutout**.

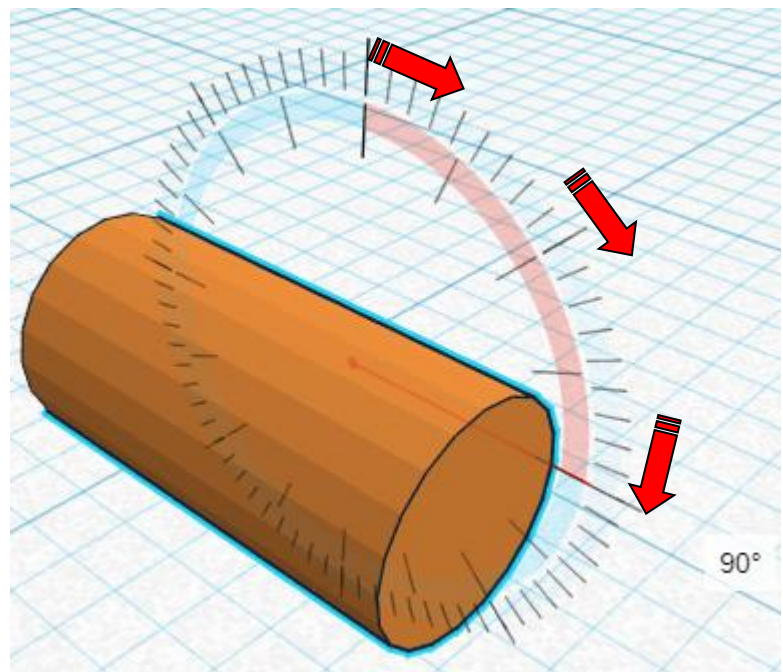
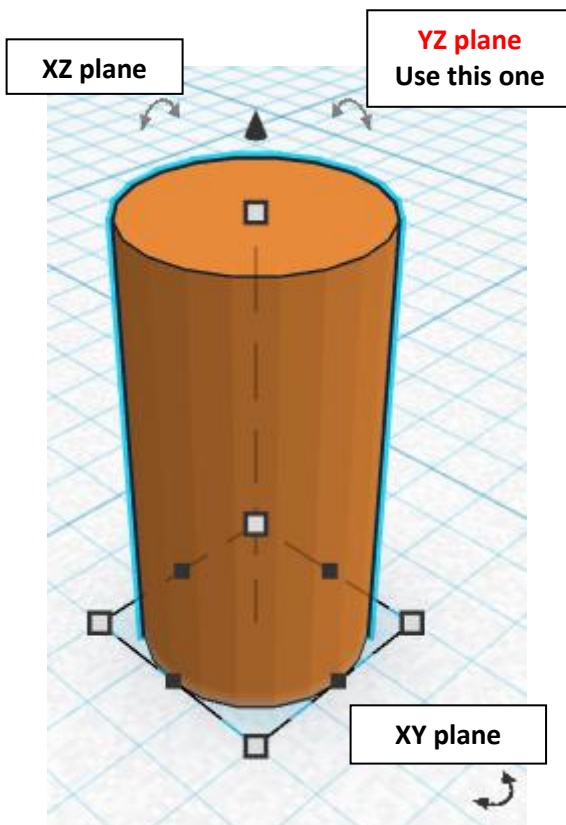
Change the dimensions to
2mm X direction,
2mm Y direction, and
6mm Z direction.



Rotate the Pin Cutout clockwise 90 degrees in YZ plane.

Before

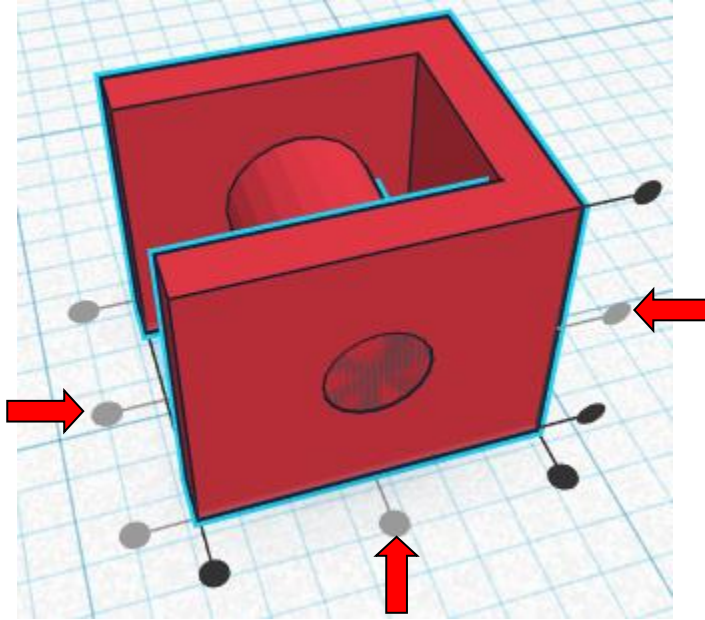
After



Change Pin Cutout to **Hole** by selecting Pin Cutout and typing "h".

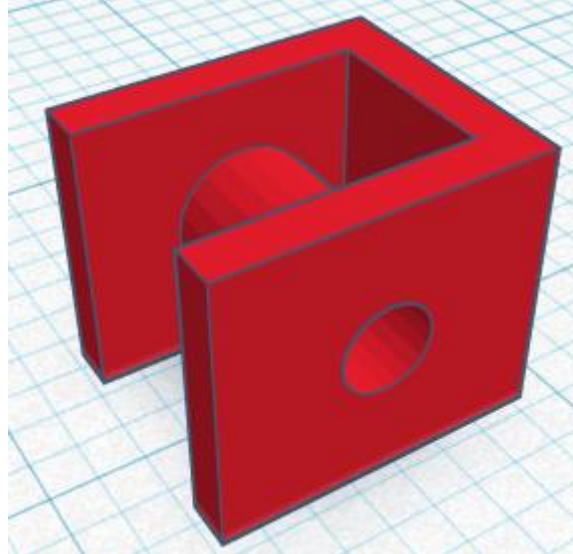
Align Hinge Box and Pin Cutout

centered in X direction,
centered in Y direction, and
centered of Z direction.



Group Hinge Box and Pin Cutout

From now on this will be called the **Hinge Box**



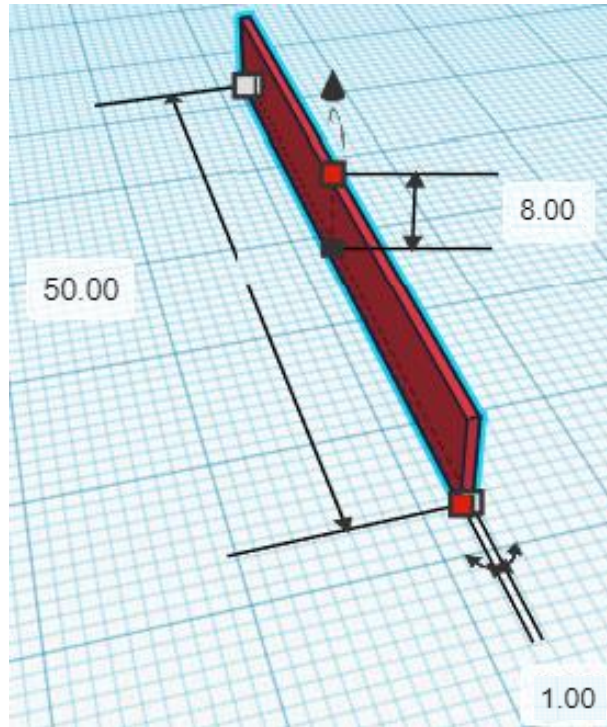
This is the basic Hinge Box, which later you will change to a Hole and put your hinges in. This can be applied to many different designs.

The next part is custom to what you are adding the hinge to.

Bottom Box Cutout:

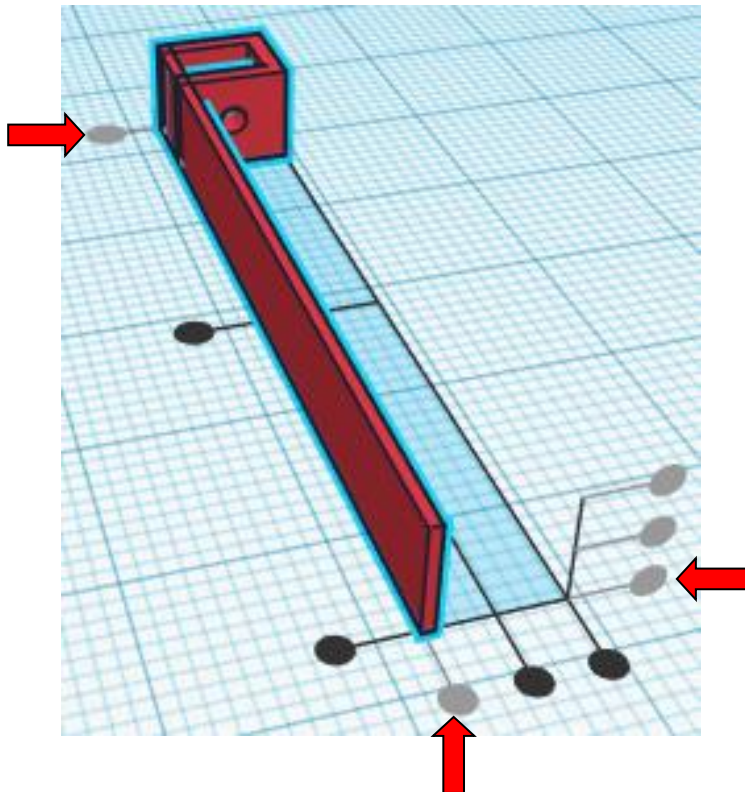
Bring in a Box, located in Basic Shapes on the left 2 shapes down.
From now on this will be called the **Bottom Box Cutout**.

Change the dimensions to
1mm X direction,
50mm Y direction, and
8mm Z direction.

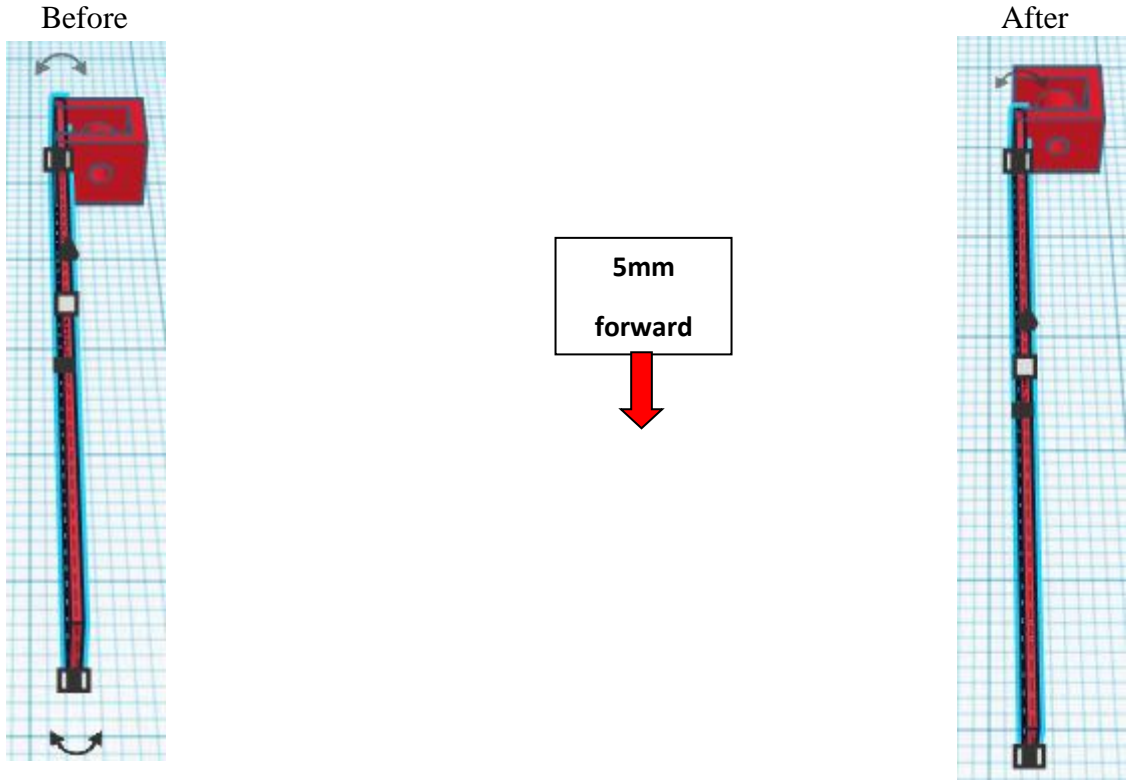


Align Hinge Box and Bottom Box Cutout

left in X direction,
back in Y direction, and
bottom of Z direction.



Move Bottom Box Cutout (Must be in home view for this to work!)
move forward in negative Y direction 5mm

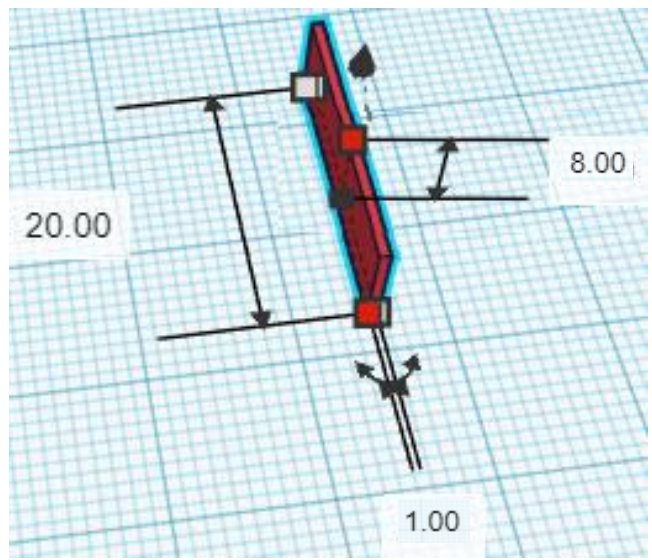


Group Hinge Box and Bottom Box Cutout
From now on this will be called the **Hinge Box**

Top Box Cutout:

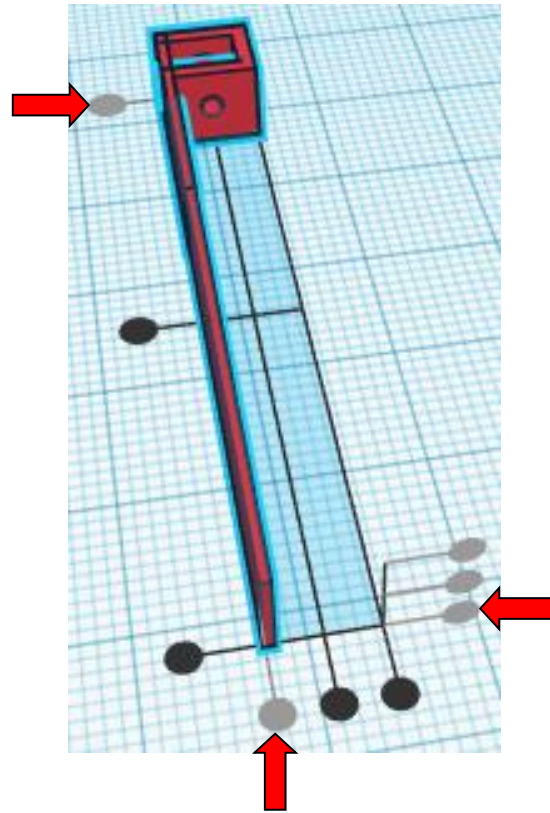
Bring in a Box, located in Basic Shapes on the left 2 shapes down.
From now on this will be called the **Top Box Cutout**.

Change the dimensions to
1mm X direction,
20mm Y direction, and
8mm Z direction.



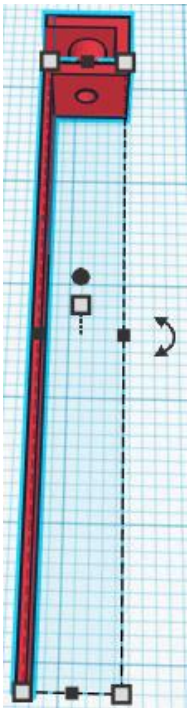
Align Hinge Box and Top Box Cutout

left in X direction,
back in Y direction, and
bottom of Z direction.



Move Bottom Box Cutout (Must be in home view for this to work!)
move forward in negative Y direction 19mm

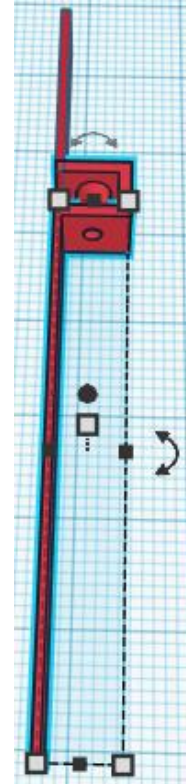
Before



19mm
forward



After



Group Hinge Box and Bottom Box Cutout
From now on this will be called the **Hinge Box**

Duplicate Hinge Box

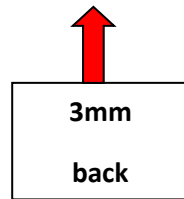
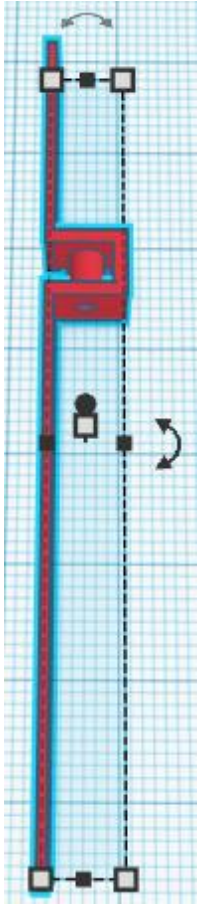
Move Hinge Box (Must be in home view for this to work!)

move right in positive X direction 13mm

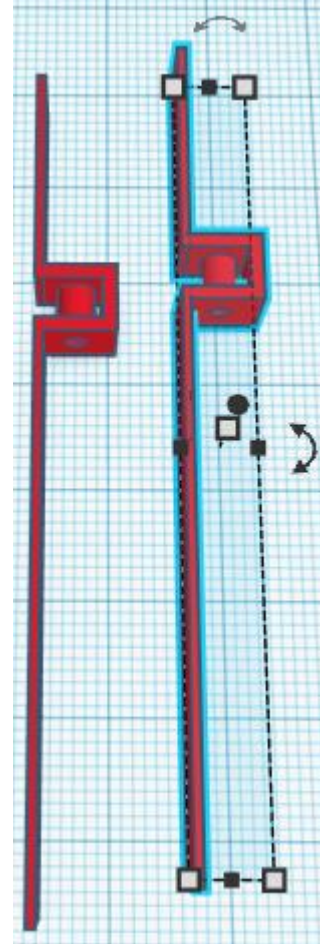
and

move back in positive Y direction 3mm

Before



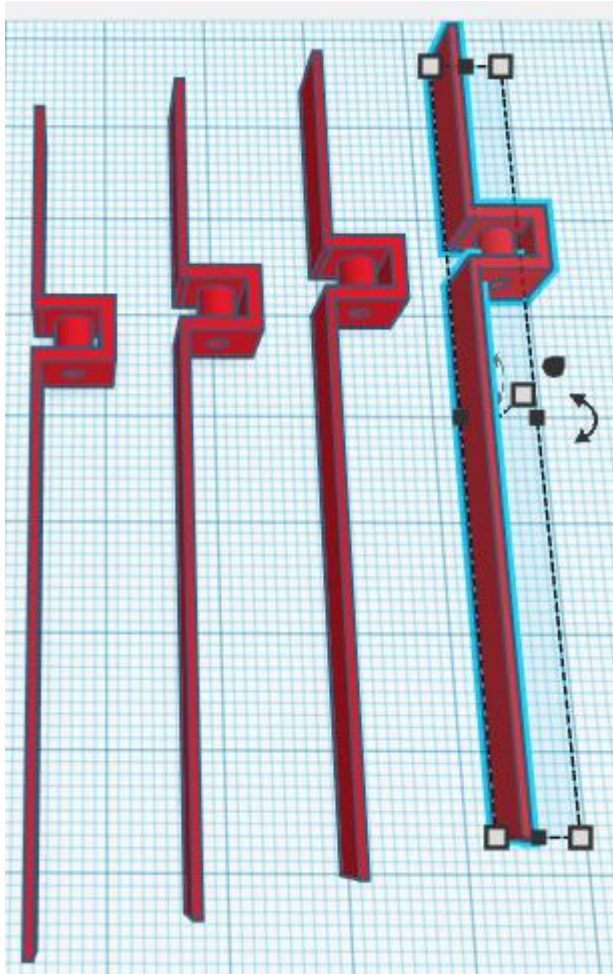
After



Duplicate Hinge Box 2 more times

When you immediately do duplicate after a move or rotate then TinkerCAD will do the duplicate and the action from the last object moved or rotated.

You should see this after:



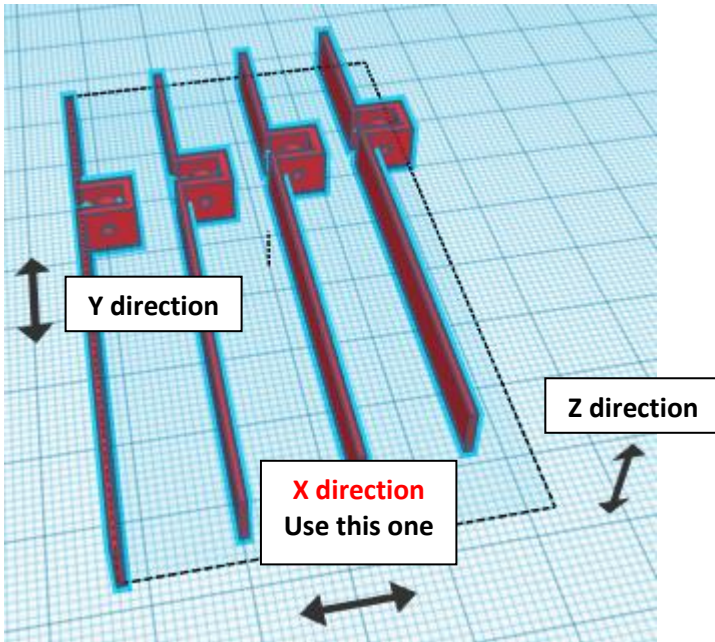
Group all 4 Hinge Boxes

From now on this will be called the **Right Hinge Box Set**

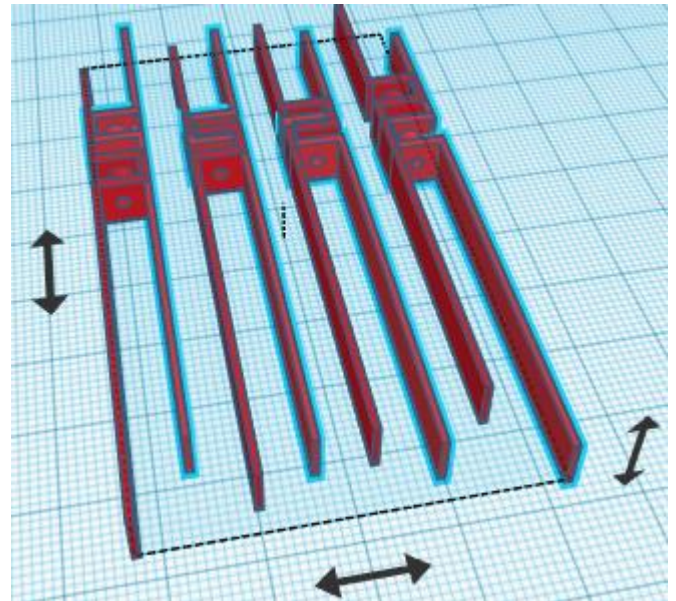
Duplicate Right Hinge Box Set

Flip Right Hinge Box Set in X direction.

Before



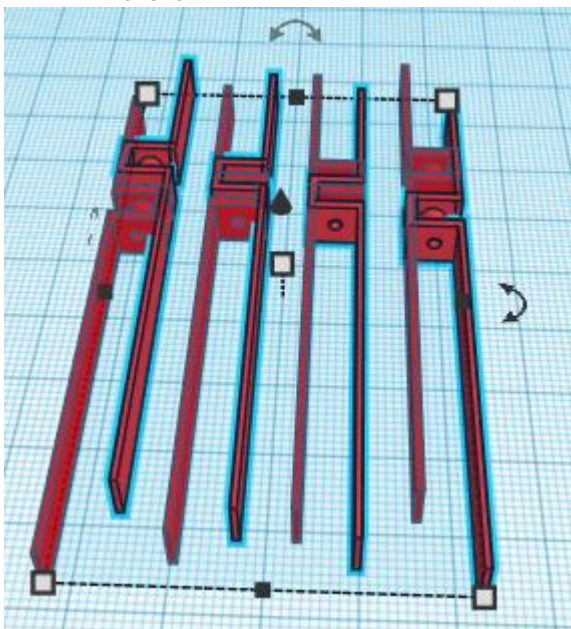
After



From now on this new flipped part will be called the **Left Hinge Box Set**

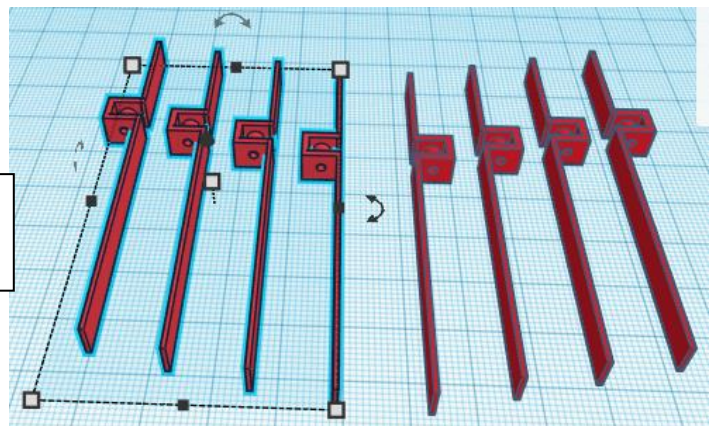
Move Left Hinge Box Set (Must be in home view for this to work!)
move left in negative X direction 60mm

Before



60mm
left

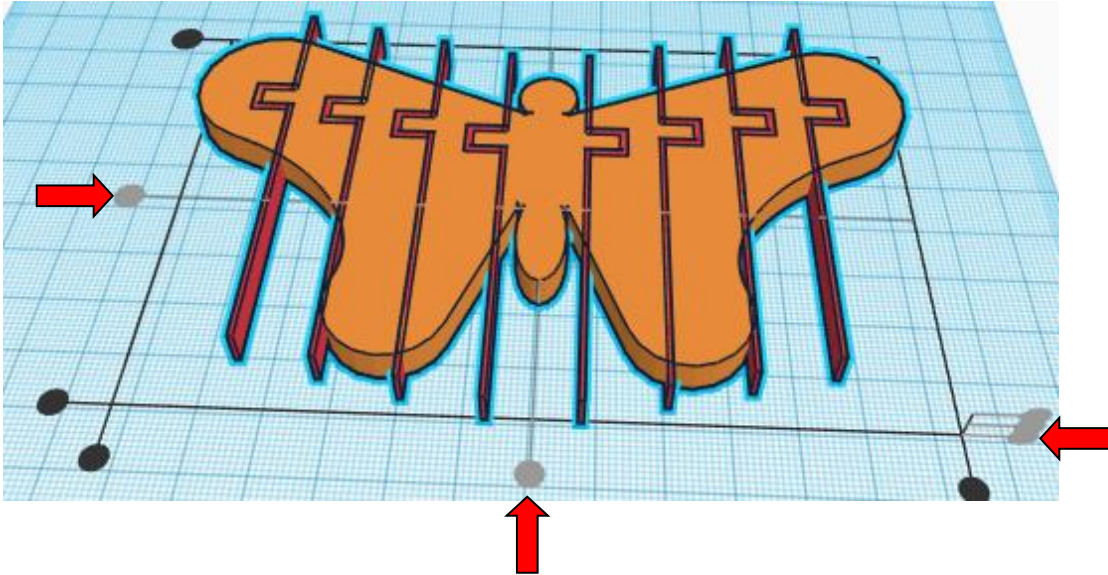
After



Group Left Hinge Box set and Right Hinge Box Set
From now on this will be called the **Hinge Box Set**

Align Hinge Box Set and Butterfly

centered in X direction,
centered in Y direction, and
bottom of Z direction.



Change Hinge Box Set to **Hole** by selecting Hinge Box Set and typing “h”.

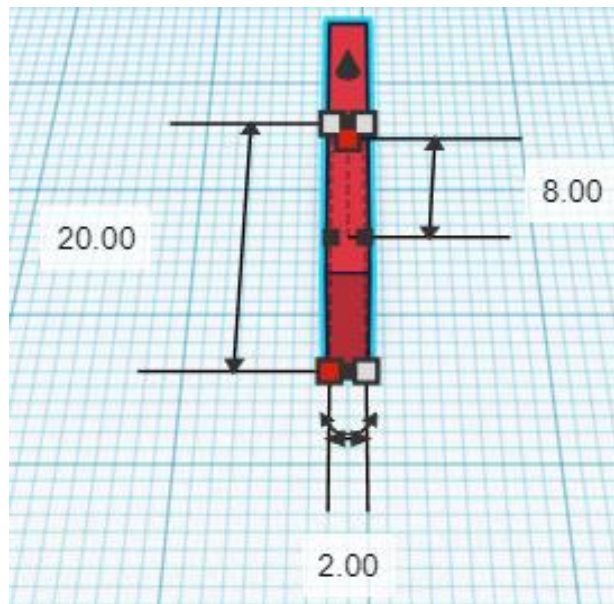
Group Hinge Box Set and Butterfly

From now on this will be called the **Butterfly**

Right Antenna:

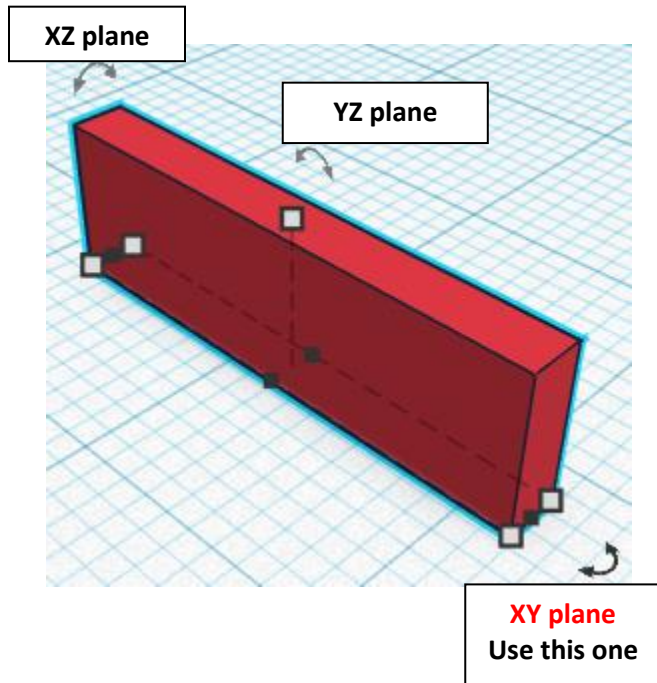
Bring in a Box, located in Basic Shapes on the left 2 shapes down.
From now on this will be called the **Right Antenna**.

Change the dimensions to
2mm X direction,
20mm Y direction, and
8mm Z direction.

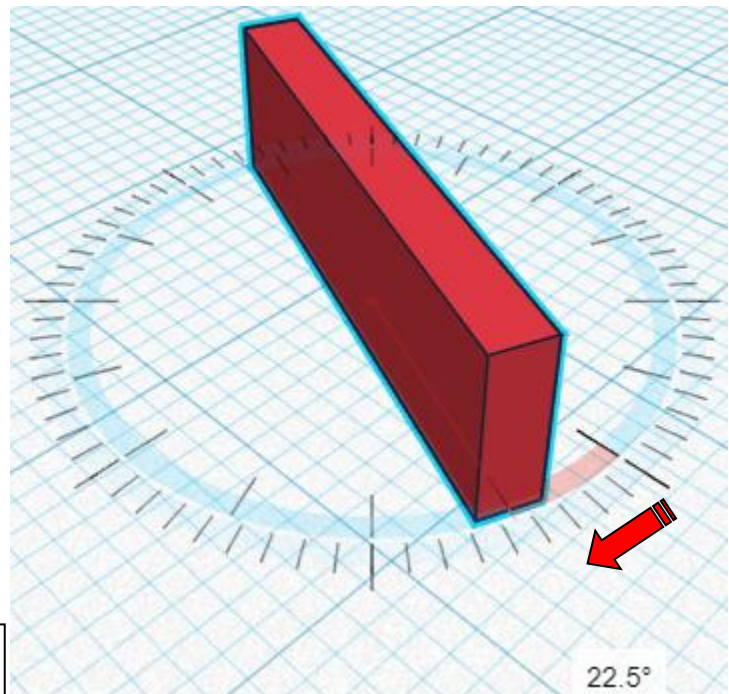


Rotate the Right Antenna clockwise 22.5 degrees in XY plane.

Before



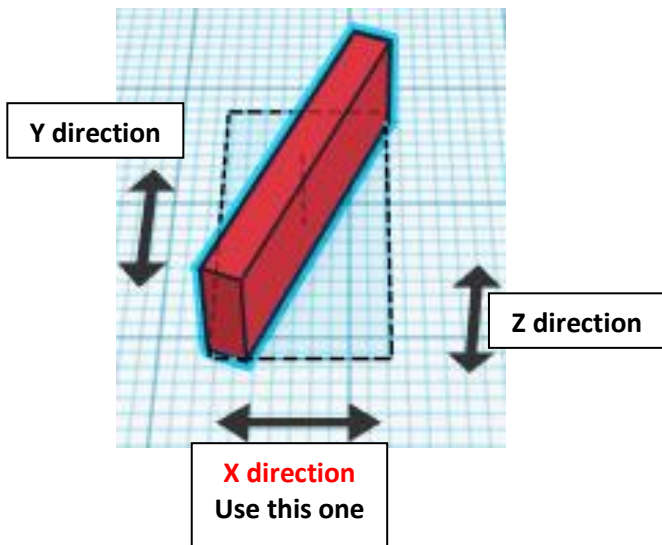
After



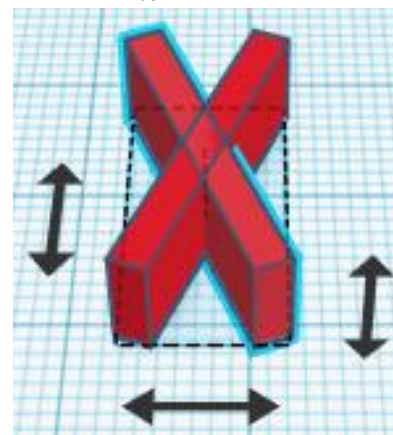
Duplicate Right Antenna

Flip Right Antenna in X direction.

Before

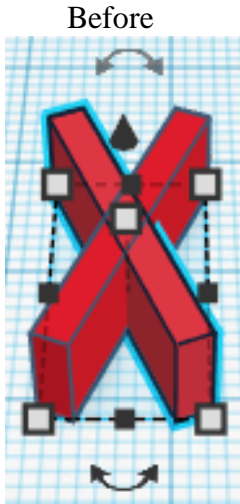


After

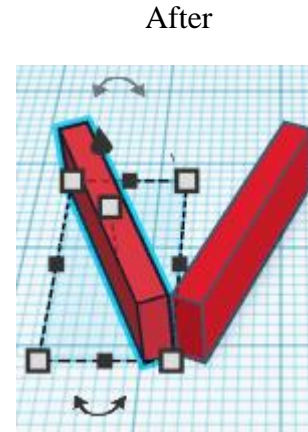


From now on this new flipped part will be called the **Left Antenna**.

Move Left Antenna (Must be in home view for this to work!)
move left in negative X direction 10mm



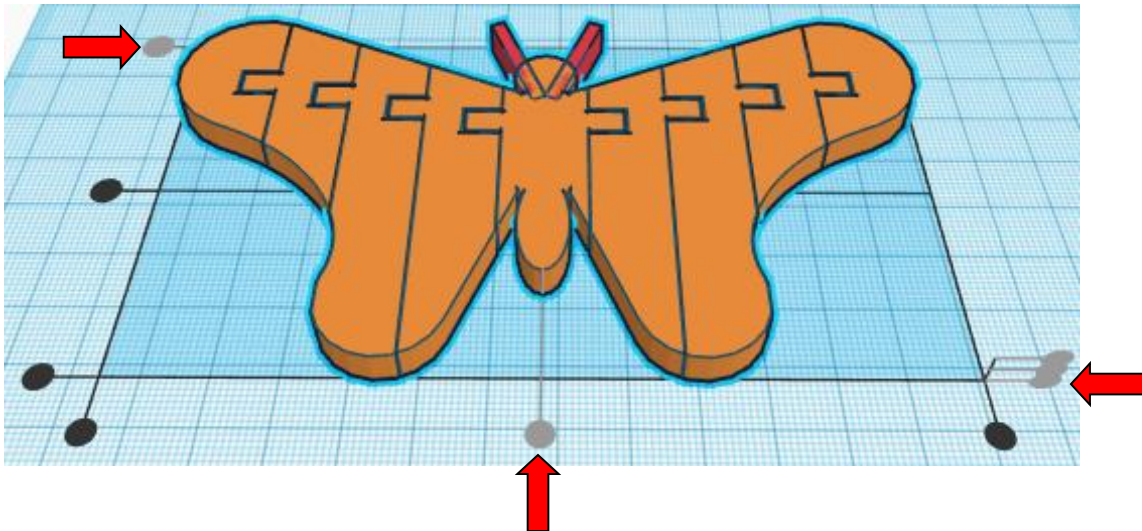
←
10mm
left



Group Left Antenna and Right Antenna
From now on this will be called the **Antennas**

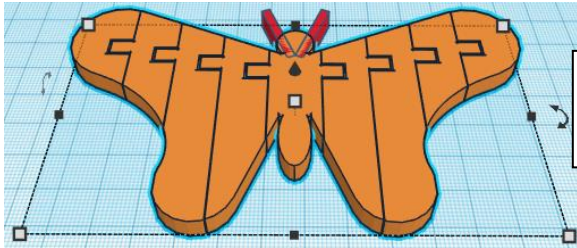
Align Antennas and Butterfly

centered in X direction,
back in Y direction, and
bottom of Z direction.




Move Butterfly (Must be in home view for this to work!)
move forward in negative Y direction 6mm

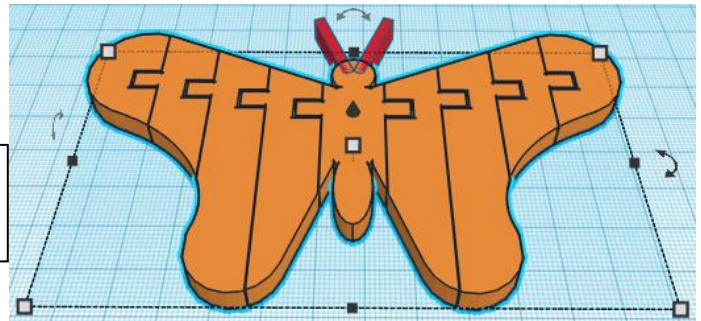
Before



6mm
forward



After



Group Antennas and Butterfly

From now on this will be called the **Articulated Butterfly**

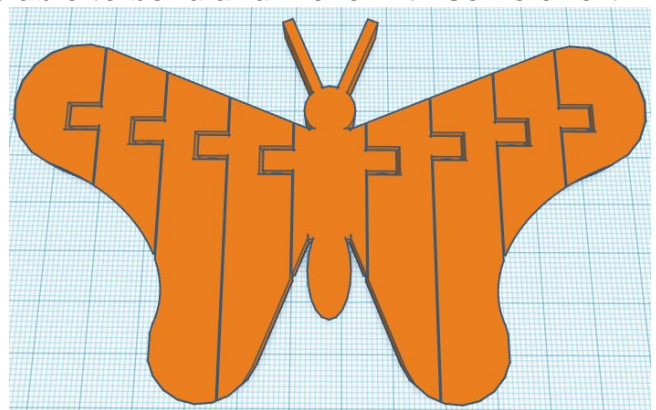
Congratulation! You have built the Articulated Butterfly.

Print the butterfly.

Removed butterfly and gently bend each hinge.

Each hinge may be somewhat stuck but should be able to bend and move with some effort.

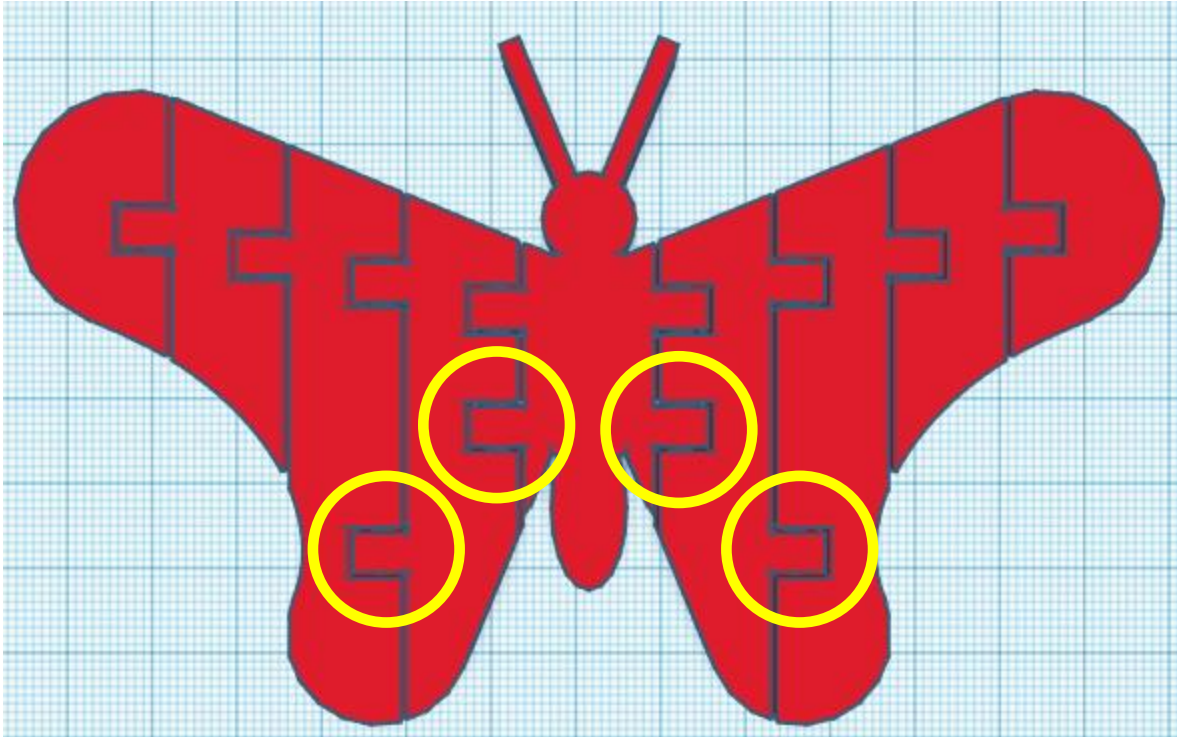
Enjoy and have fun playing with your butterfly.



Advanced students continue to the next page...

Advanced Students project:

Add the four hinges as shown on your own.



Good Luck and have fun.