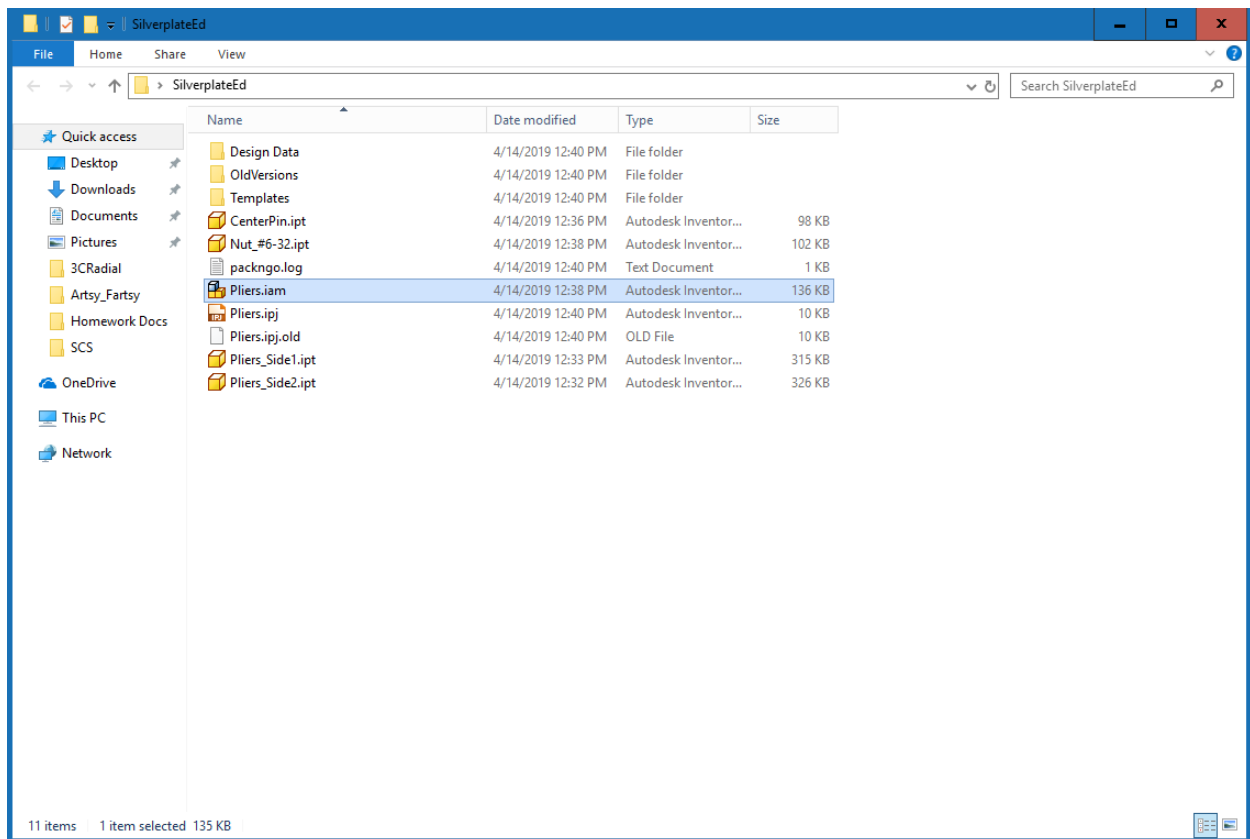


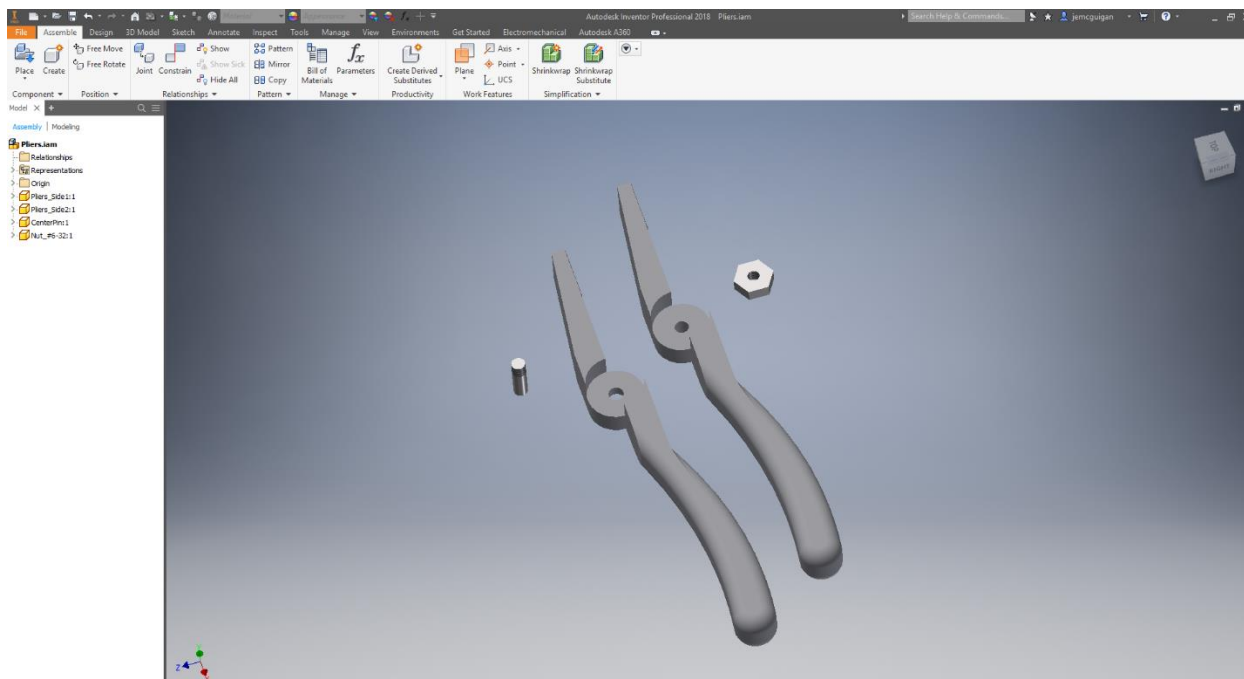
Phase One: Building the base case

Begin by opening the “Pliers.iam” file in your “SilverplateEd” folder.

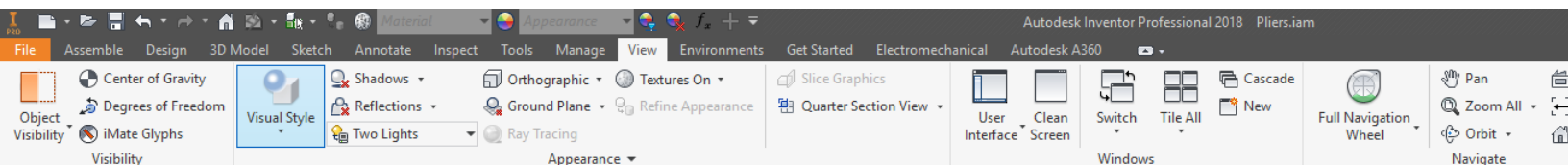


This folder will start out as a zipped folder, so make sure you extract the contents to a known location on your computer first.

When you first open the file, you should see something that looks like the picture below:



Before we start, let's quickly make sure everything is set up to give us the best experience.



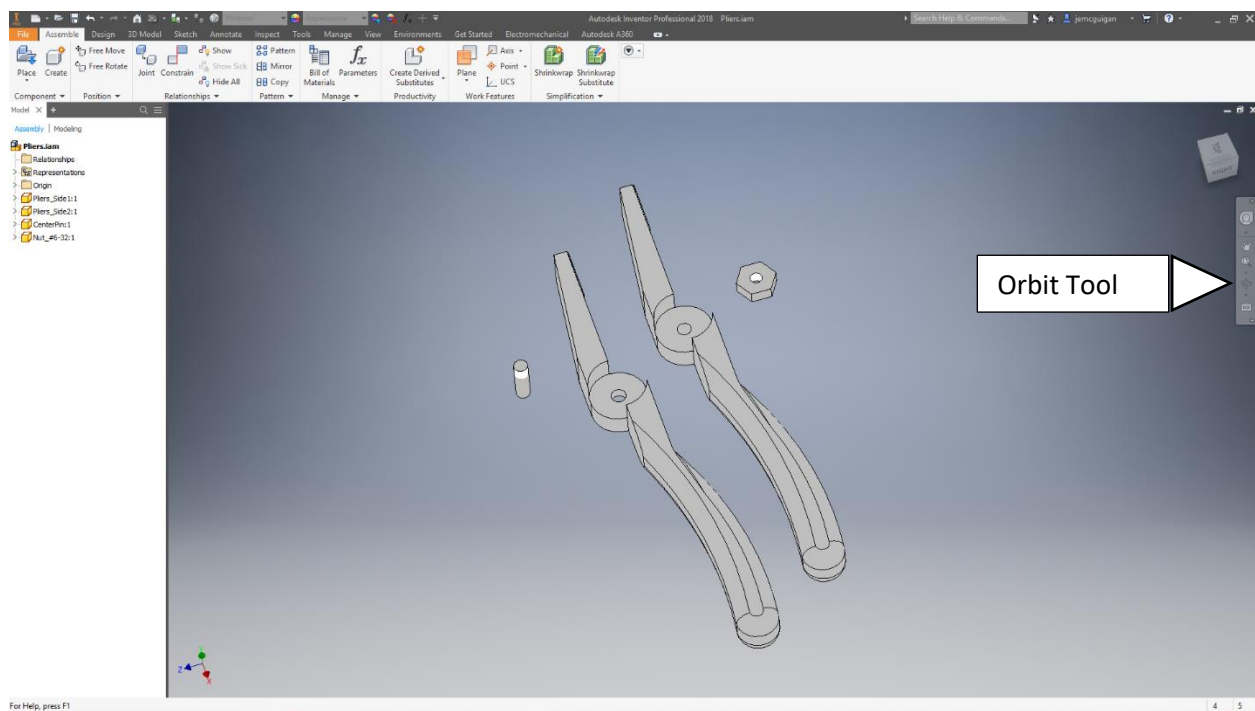
On the top ribbon, click the “View” tab. From there, you can access a dropdown menu under “Visual Style.” We recommend picking the “Technical Drawing” style because it requires less processing power, but you should pick the style that works the best for you.

With that out of the way, let's start some actual CAD.

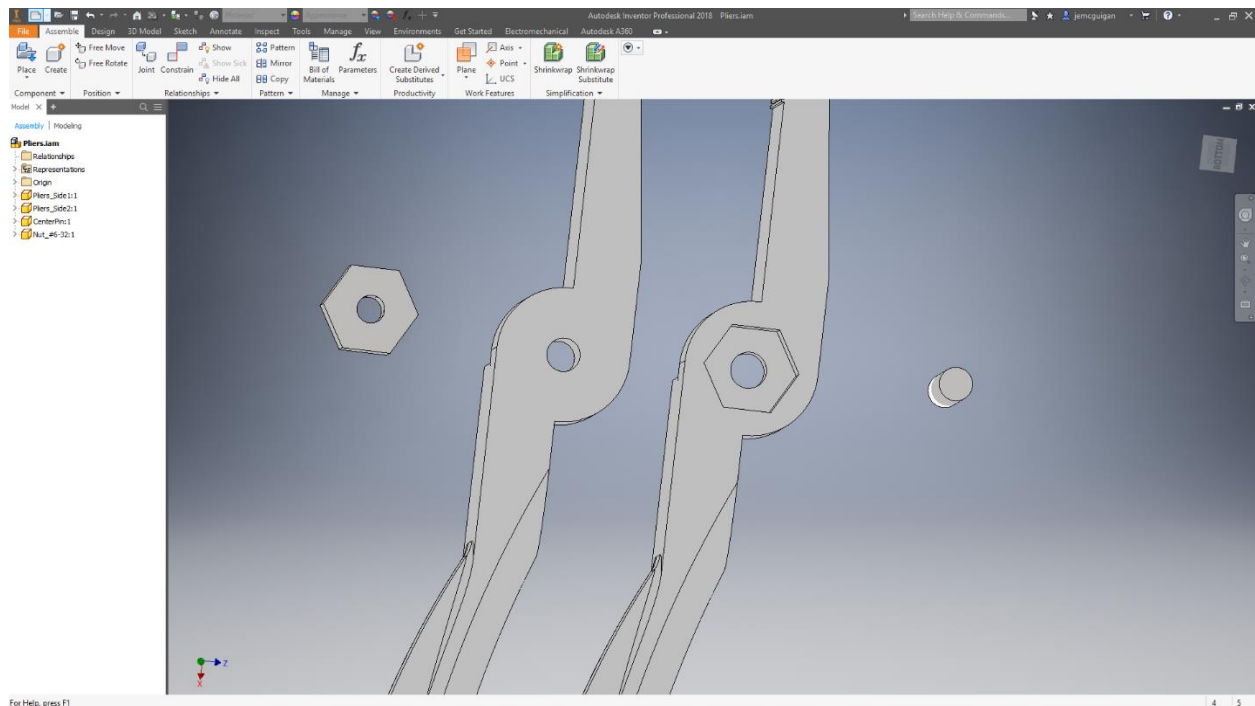
You may notice that our “Pliers” assembly file doesn't look a whole lot like a pair of pliers- not yet, at least- that part is your job.

In our disassembled assembly file, we have four parts: two halves of the pliers along with a threaded pin and nut to connect them.

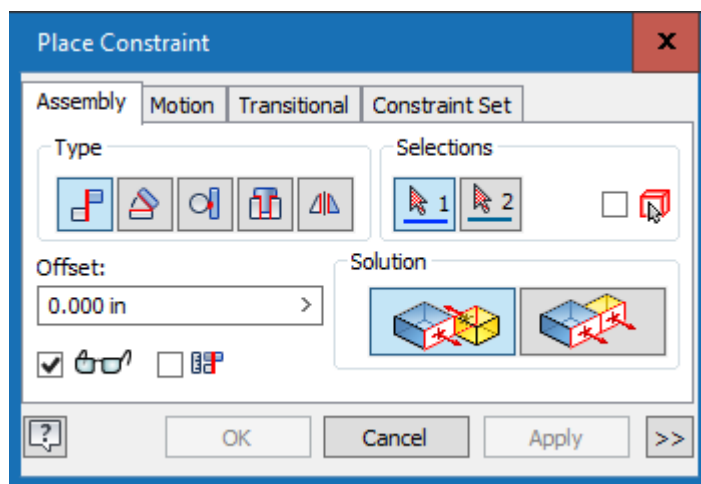
You can get a closer look at these parts with the “Orbit” tool on the right panel. Click and drag to rotate your camera around and look at the parts. Clicking on a space will set that as the new point your camera rotates around.



Rotate your view so you see the side of the pliers with the hex-shaped indent.

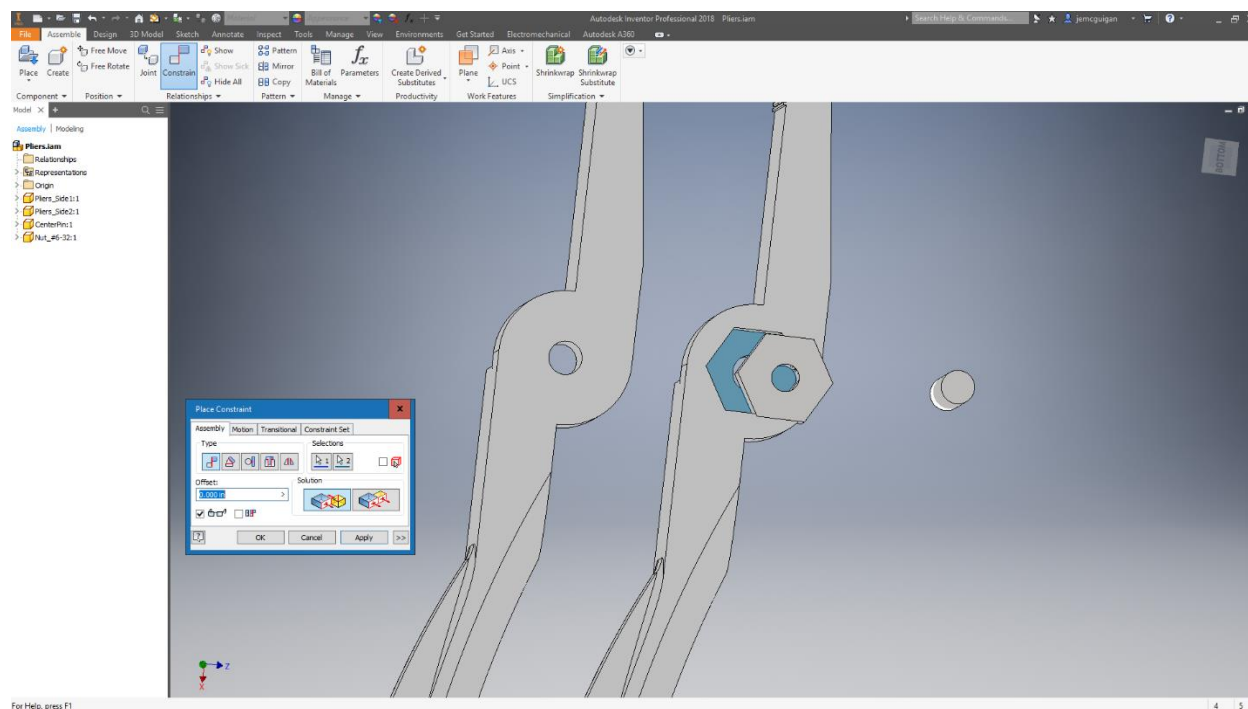


Under the “Assemble” tab, you’ll find a button labeled “constraint.” Clicking this will open a small window with a number of options. The “mate” type should be selected by default. If not, click on it to select it. Under “Solution,” select mate instead of “flush.”

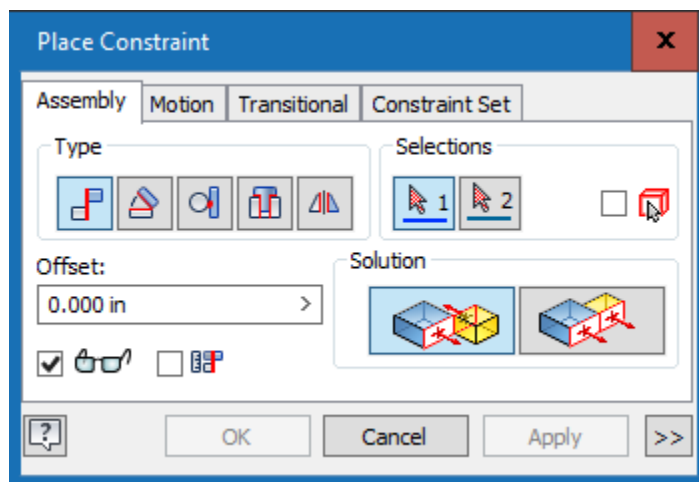


Next, click on the flat surface of the hex nut (left in picture above), then on the hex-shaped indent on the plier half (right in picture above.)

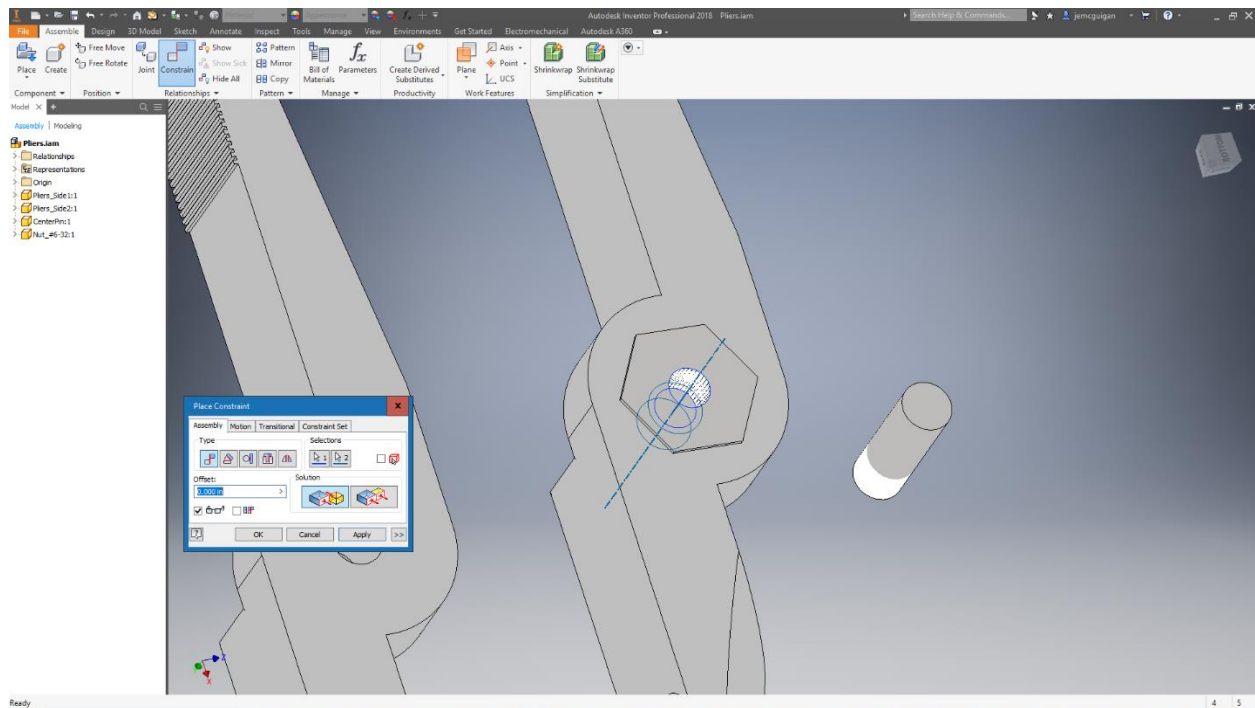
Your assembly should now look like the image below.



Don't worry if the holes on the hex nut and the pliers don't line up. We'll fix that next. Open the constraint window again, keeping the same settings.



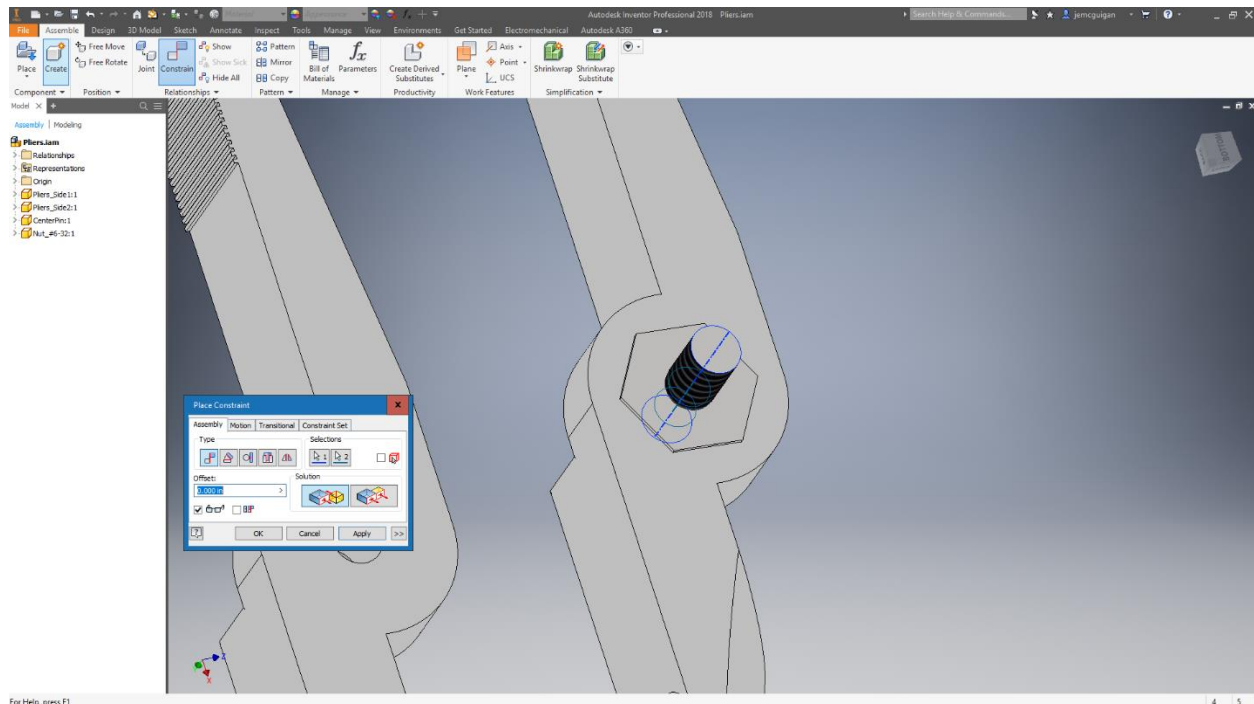
Click on the cylindrical inner edge of the hex nut. There should be an axis line that indicates the center of the hole. Then, do the same for the plier half. Again, an axis line should be shown, this time with both centers on the same axis line. This means the holes are now coaxial.



If one of the holes is not easily visible to click on, you can move your camera with the orbit tool. Alternatively, you can exit the constraint window and freely move one of the parts by clicking and dragging it out of the way.

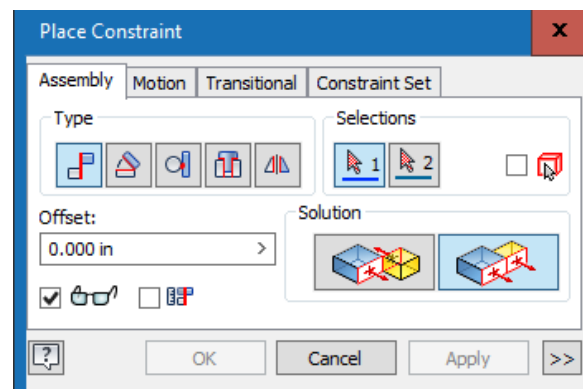
Next, open the constraint window again, using the same settings as before.

This time, click on the outer rounded surface of the threaded pin, then on the inner rounded face of the hex nut. This will insert the pin into the hole.

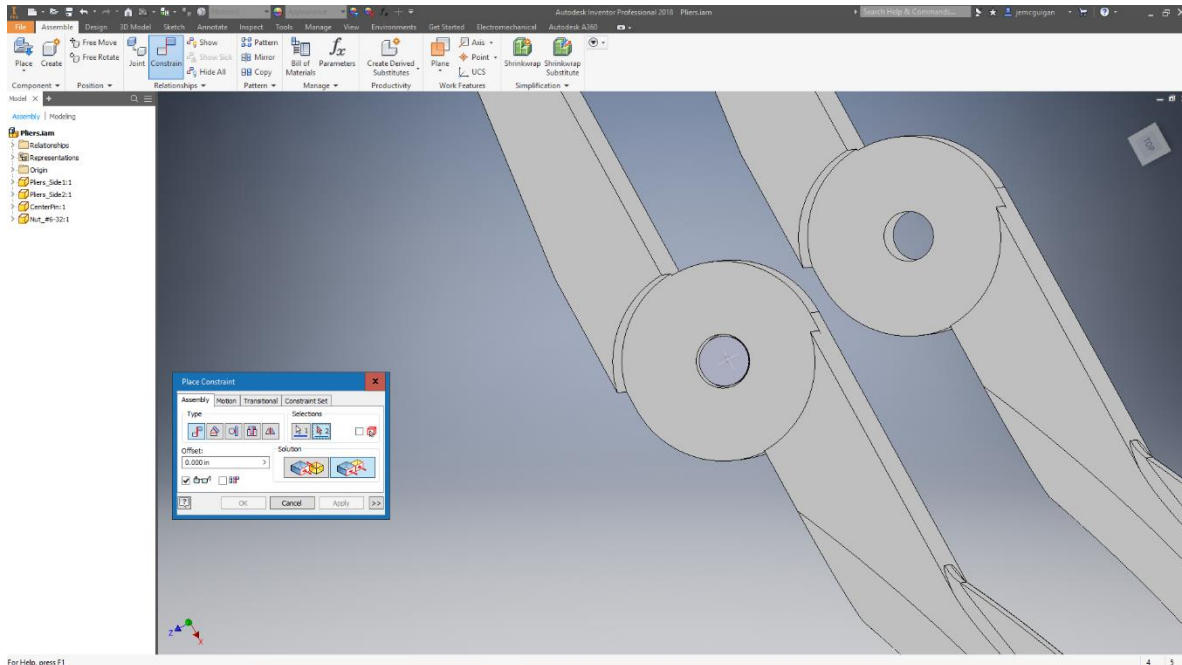


Unfortunately, the pin still isn't quite in the right spot. The top sticks out and the threads are in the wrong place, which doesn't make sense in the context of the real world.

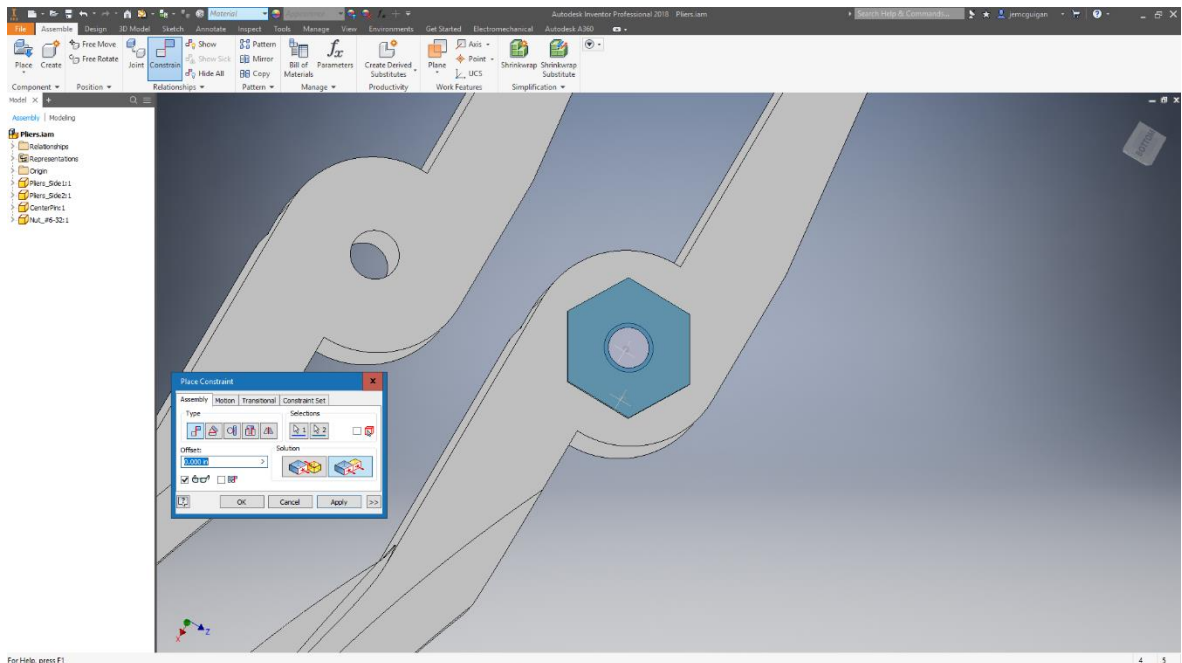
To fix this, open the constraint window again, and select the following settings:



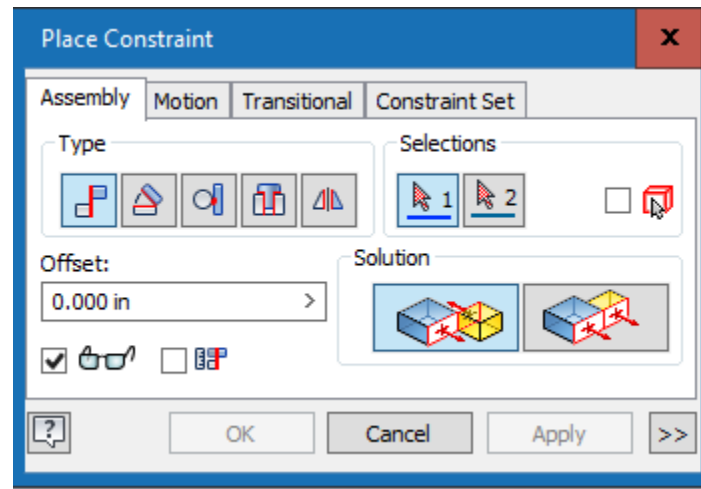
After selecting “flush” in the constraints window, rotate your view to the other side of the pliers with the orbit tool. You should see something like the view below:



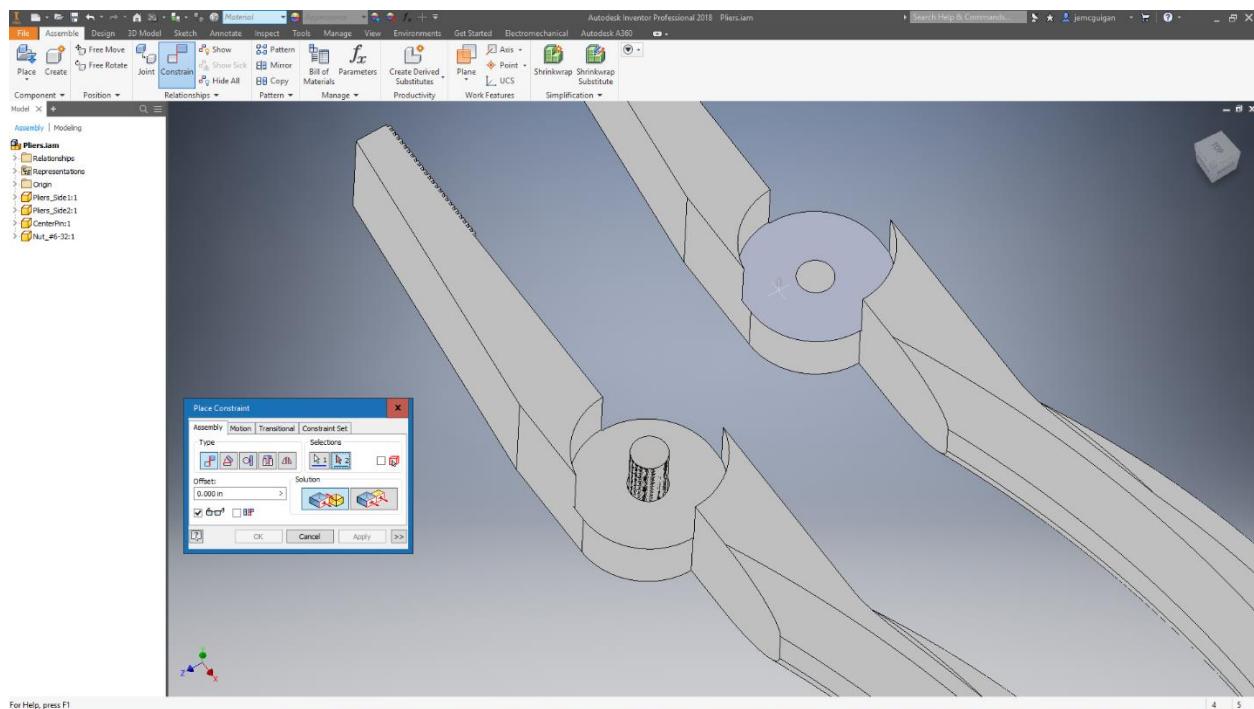
From this view, we can see the top of the threaded rod. Click on the top face and rotate your view to the other side again. From there, click the top face of the hex nut. This will correct the orientation of the threaded rod and put its' top flush with the top of the hex nut.



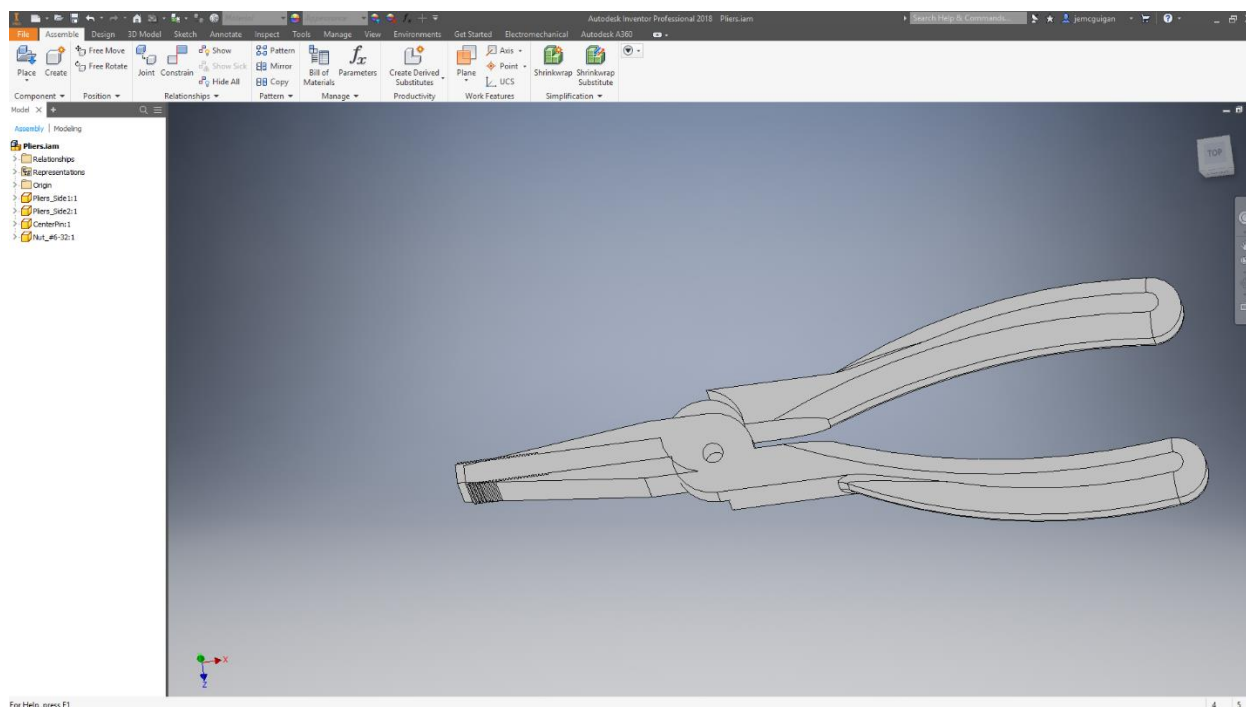
Now, rotate your view so you can see the smooth end of the threaded rod protruding from the plier half.



Next, open the constraint window again and, using the settings above, click the indented face on one plier half, then click the indented face on the other half.

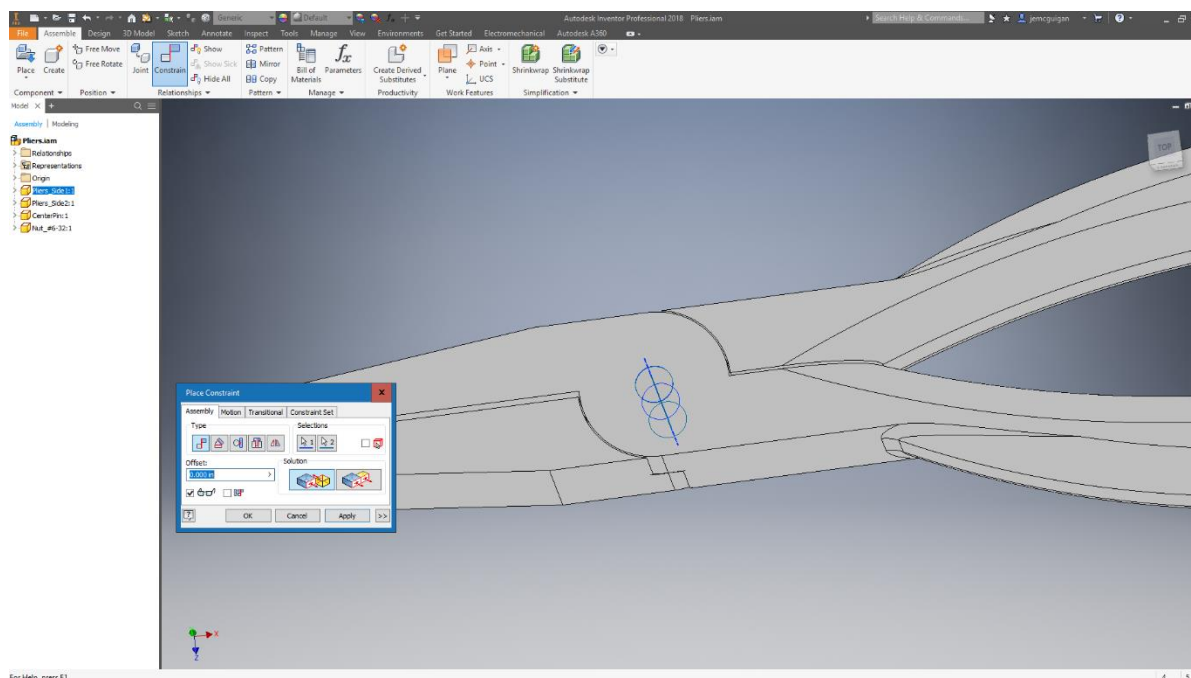


This will flip one half on to the other, with the jaws and grips at the same height.

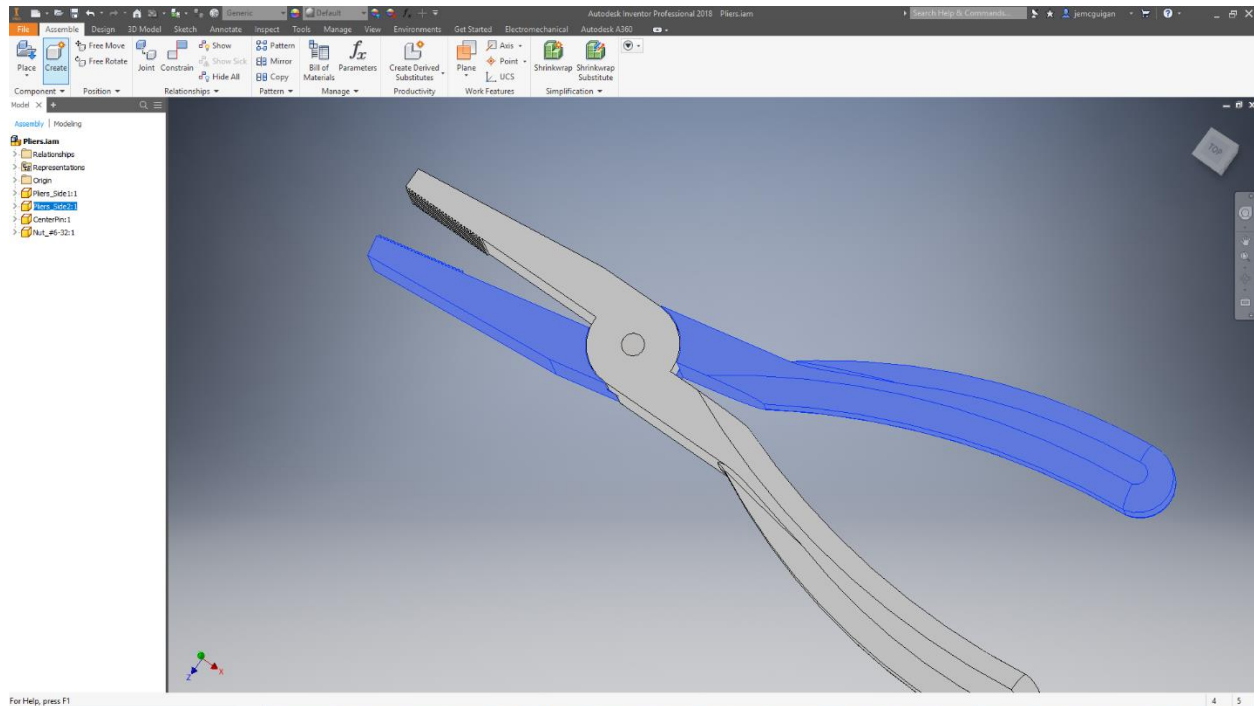


We're getting close, but our plier halves still need to swing on the hinge we made with the threaded rod.

Using the same settings in the constraint window, select the inside edge of the hole on one half of the pliers and the outside curved face of the rod.



With your two halves connected to each other on a hinge, you now have a pair of functioning virtual pliers! You can even open and close them by dragging one half's grip or jaws.



Now that you've assembled your pliers in Inventor, it's time to assemble them in the *real world*! You can follow the same steps as you did in the virtual assembly, although there are a few minor changes- you won't need to worry about jamming the unthreaded end of the rod into the hex nut, for one. You'll also need to be careful when connecting the two halves in the last step, as it may require a bit of force to push the rod through the hole on the second half.