



Activity 4.5 – Pegboard Toy

Procedure

As a new employee of Tattered Toy Company, you have been asked to learn more about their best selling toy, Pegboard (See Figure 1). Your supervisor, Mr. Duggle said that you needed to know how this pegboard was designed and that he wanted you to learn as much about the design process as possible.

“You will need to keep track of your work, so be sure you keep notes and check off your work as you complete each step,” continued Mr. Duggle, “I will be watching you!”

You reach for your engineer’s notebook, sketch paper, and pencil to prepare to keep notes and learn how to make a 3D model of the Pegboard. As Mr. Duggle leaves you to work, he calls back to you, “Good luck! Be sure to save all of your work.”

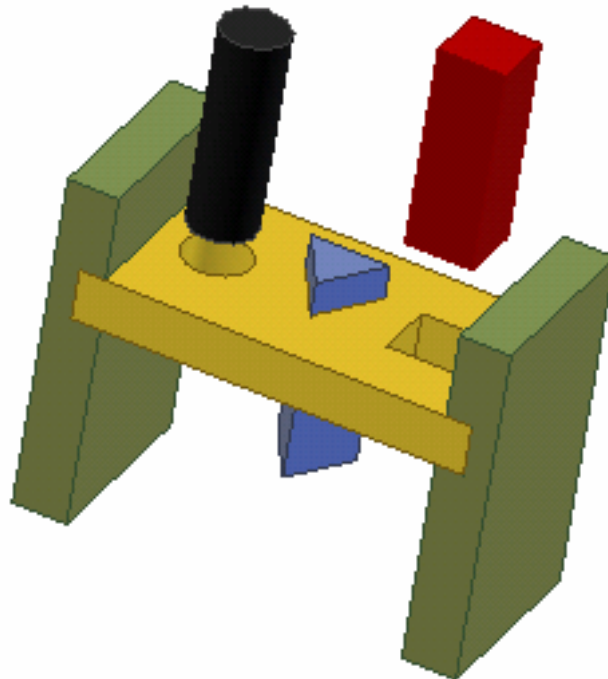


Figure 1: Pegboard

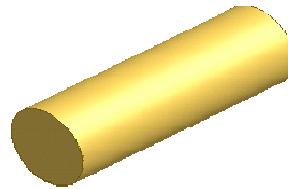
Directions: Read each step, perform the operation, and check the box after completion.

Creating Parts:

STEP #1:



- Open a new **Part File** from the English tab.
- Create a round part using the “Center point circle” tool. Using General Dimension, change it to 1” diameter, finish your sketch and extrude to 3” long.



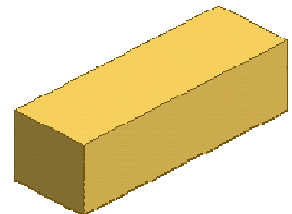
Part 1: Round Peg

- Change the color to black.
- Save as **Round Peg**.
- Close this window, but not Inventor.

STEP #2:



- Open a new **Part File** from the English tab..
- Create a square part 1” x 1” x 3” long. (Use **two point rectangle** and dimension to 1” x 1”, then finish your sketch and extrude 3”.)



Part 2: Square Peg

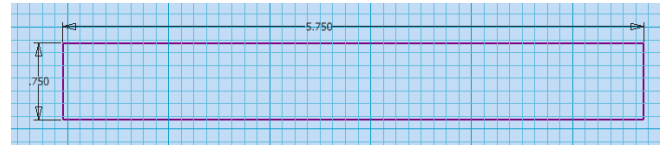
- Change the color to any shade of red.
- Save as **Square Peg**.
- Close this window, but not Inventor.

STEP #3:

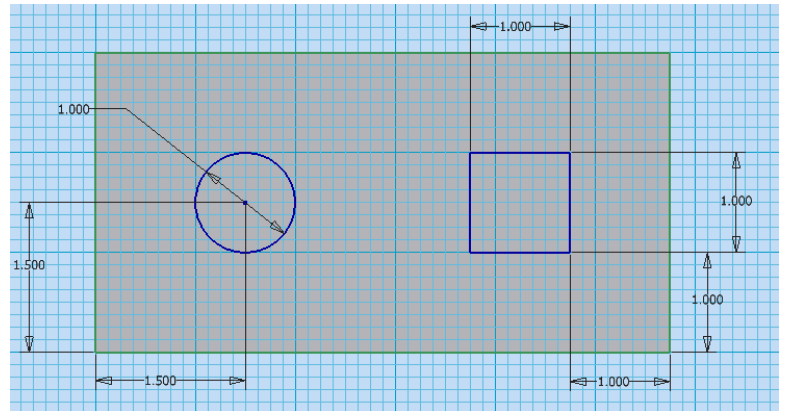


- Open a new **Part File** from the English tab.

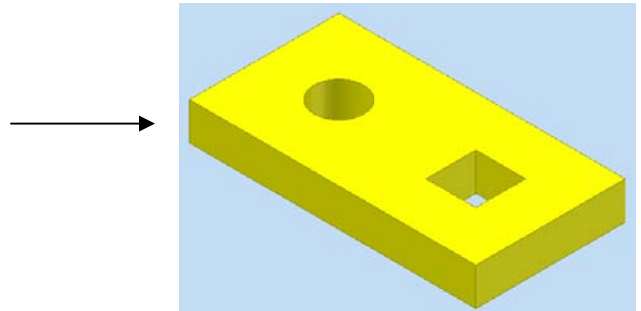
- ❑ Create a pegboard part $\frac{3}{4}$ " x $5\frac{3}{4}$ " x 3". (Use **two point rectangle** and dimension to $\frac{3}{4}$ " x $5\frac{3}{4}$ ", then finish your sketch and extrude 3".)



- ❑ Add a new **sketch** to the top of your object and add holes that will accept the round and square pegs you designed. First draw the shapes using center point circle and two point rectangle, then add the dimensions to match your pegs. **Extrude** both the circle and the square at the same time, choose **CUT** and change the distance to **ALL**.



- ❑ Change the color to any shade of yellow.
- ❑ Your Isometric View should look like this.
- ❑ Save as **Pegboard**.
- ❑ Close this window, but not Inventor.



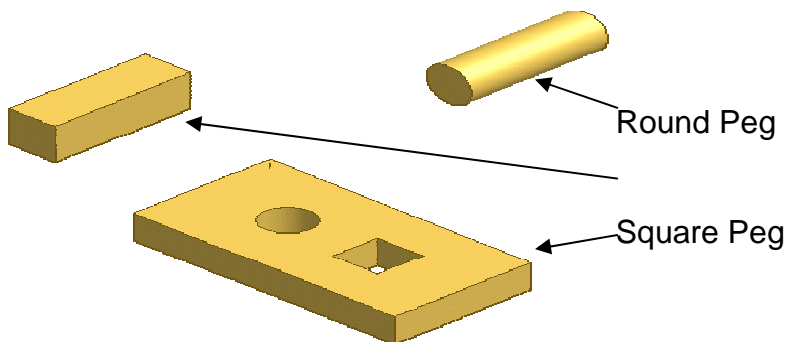
Creating Assembly of Parts:

STEP #4:



Standard.iam

- Open a new **Assembly File**.
- In **Panel Bar**, select **Place Component** and place the following parts:
 - Pegboard (This will automatically place one for you, so right click and select Done.)
 - Round Peg (Click once to tell it you want one piece, then right click and select Done.)
 - Square Peg (Click once to tell it you want one piece, then right click and select Done.)

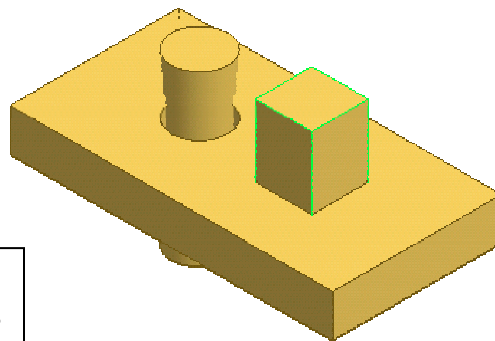


Icon shows it is grounded

- Look in **Browser** to see if the pegboard is *grounded*. If not, right click on its icon and select **Grounded**.
- In **Panel Bar**, select **Constraint** then choose to **Mate** parts.

Round Peg:
1 constraint through the center line

Square Peg: 2 constraints
(2 sides of peg with 2 surfaces of inside of square hole)



You MUST rotate object to find correct surface to constrain!

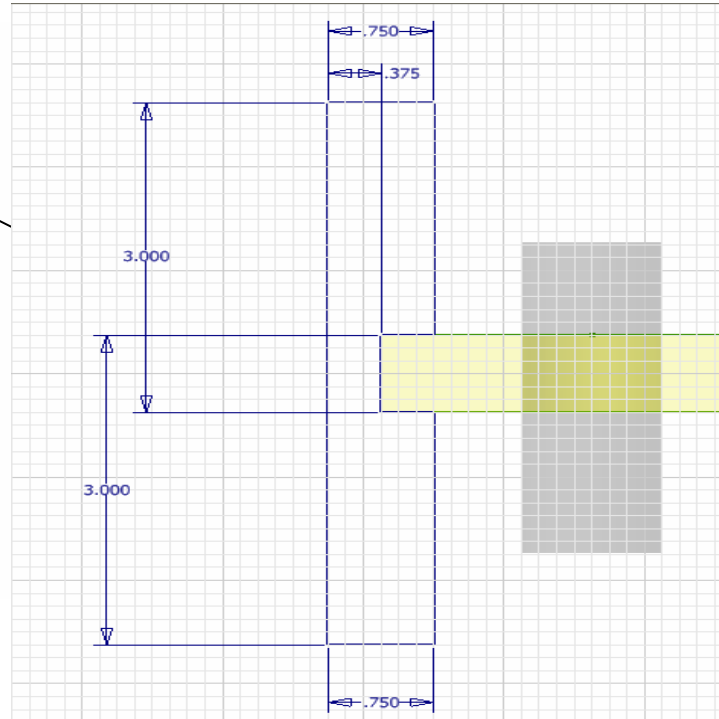
- Save as **Pegboard Toy**.

STEP #5:

Next, you will add end legs to the Pegboard Toy. These legs will raise the pegboard up off a table so that the square and round pegs may be inserted until they are flush with the top surface of the pegboard.

You will be using wood that is $\frac{3}{4}$ " thick. The end legs will be assembled to the pegboard using a Dado Joint, a special joint that adds strength to joining two pieces of wood.

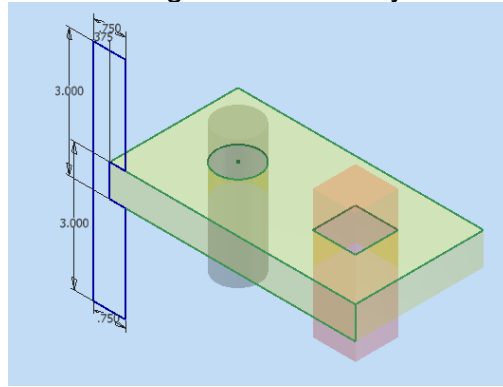
This is what a Dado Joint looks like.



Again, read each step, carefully performing each operation while keeping track of your work by checking each box after completion.

- Open your **Pegboard Toy Assembly File**.
- In **Panel Bar**, select **Create Component**.
- In the Dialog Box, name the component **End**. Check the box beside *Constrain Sketch Plane to Selected Face*. Click OK.
- Before you click on anything else, while your cursor looks like stair steps, click on the **front** of the pegboard. (Your assembly should look transparent.)
- Place a **Sketch Plane** on the **front** of the pegboard.
- Choose **Project Geometry** from the Panel Bar and click on the front edge of pegboard (the outline will change from red to green).
- Use the **Line** tool to **Sketch** a **profile** of the shape to look like the sketch above and add the necessary dimensions.

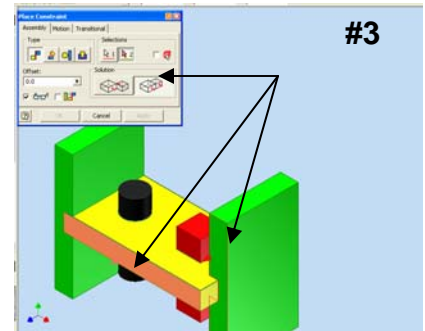
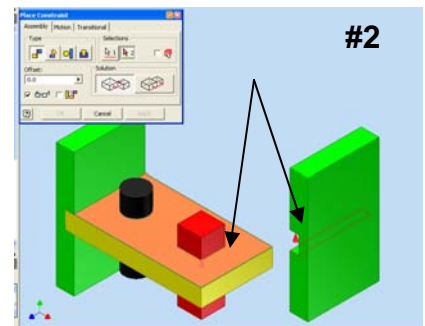
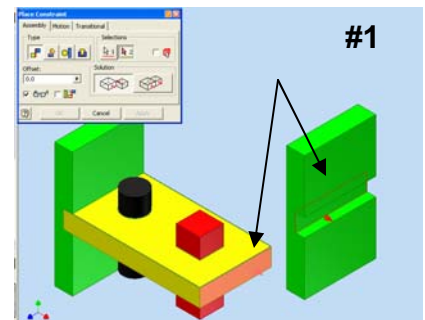
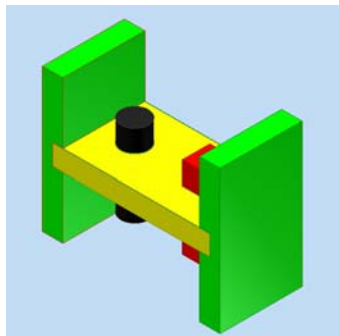
Your screen should look something like this while you are sketching



- ❑ **Finish Sketch** (be careful to **NOT** click Finish Edit!)
- ❑ Change to Isometric View and **Extrude 3"**.
- ❑ Change the color to any shade of green.
- ❑ Click the **Save** button on the toolbar.
- ❑ **Right click**, choose **Finish Edit**. (You should now have one end already attached to your pegboard.)

You only have to sketch one end piece since both end pieces are identical. To attach the opposite end to the pegboard, follow these next few steps and the corresponding pictures:

- ❑ In **Panel Bar**, select **Place Component**.
- ❑ Place the *end* in the drawing area.
- ❑ In **Panel Bar**, select **Constraint** then choose to **Mate** parts to place the following 3 constraints:
 1. Click the end of the yellow pegboard and the inside of the notch.
 2. Click the top of the yellow pegboard and the flat part of the inside of the notch (be sure to select the entire rectangle).
 3. Change the **Solution** box to the **Flush** constraint and click the front of the pegboard and the front of the end.
- ❑ Click the **Save** button on the toolbar.
- ❑ **Your updated assembly should look like this.**



ALERT!

You have now completed the first part of the 3D model of the Pegboard Toy. Like all toys, once an initial design is made, it must go before the design department. The Tatter Toy design department has just finished with their review of your Pegboard Toy. They decided the toy needed something else to make it fun to play. After some discussion, they decided that it needs an additional triangular shaped peg to improve the design.

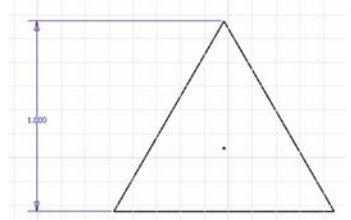
You are to design this peg and edit the Pegboard toy so that it will remain the same size, but will have the necessary parts.


Follow each step, performing the operation and checking off each box as you complete the step. Continue to take notes and be sure you note challenges and questions you may have as you improve the Pegboard Toy

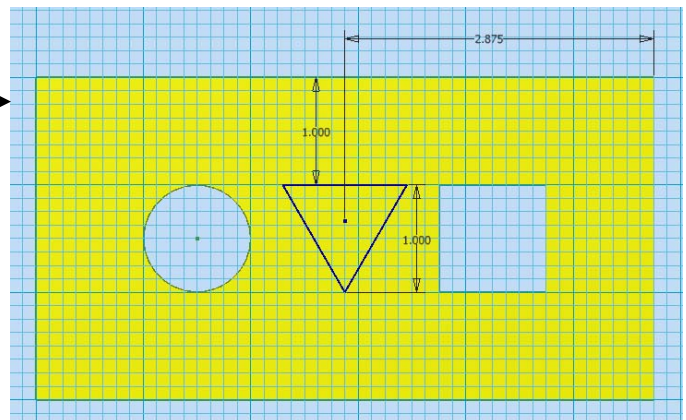
STEP #6:



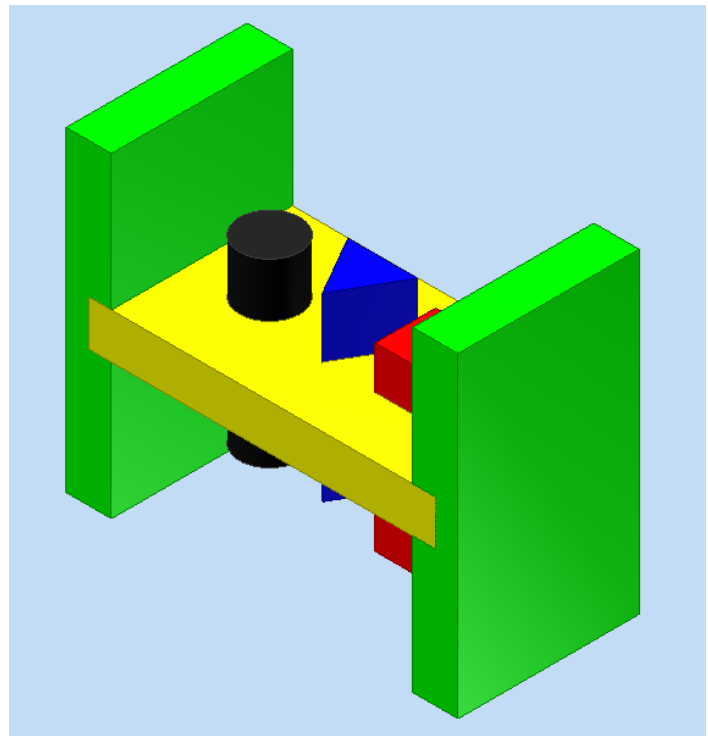
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- Open a new **Part File**.
- Create an *equilateral* triangle peg 1" high using the **Polygon** tool (choose 3 sides). Use the **Horizontal** constraint to make the bottom edge straight. (It may be hidden under Perpendicular.)
- Finish your sketch and **Extrude** 3".
- Change the color to any shade of blue.
- Save part as **Triangle Peg** and then close this window, but not Inventor.
- Open your **Pegboard.ipt** file, add a Sketch to the top and draw a triangle as shown here.  Use the **Horizontal** constraint to make your triangle level. Finish your sketch and **Extrude** the triangle, choose **CUT** and change the distance to **ALL**.
- Save** and close this window.
- Open the **Pegboard Toy**.
- Place and mate the **Triangle Peg** in the *Assembly* using **Constraint**.
- Save**.



Your updated Pegboard Toy should now look like this one.



ALERT!

After you completed your update of the Pegboard Toy, the Tattered Toy Design Department reviewed your work and came up with yet another idea to help make the Pegboard Toy more fun. They decided to have you create a mallet for the Pegboard Toy. You will get to show them how well you can sketch and create 3D models. Since you are a new employee, the Design Department decided to give you some ideas to help you with your design of the mallet with the following requirement: The mallet head must be $1 \frac{3}{4}$ " **in diameter x 3" long**.

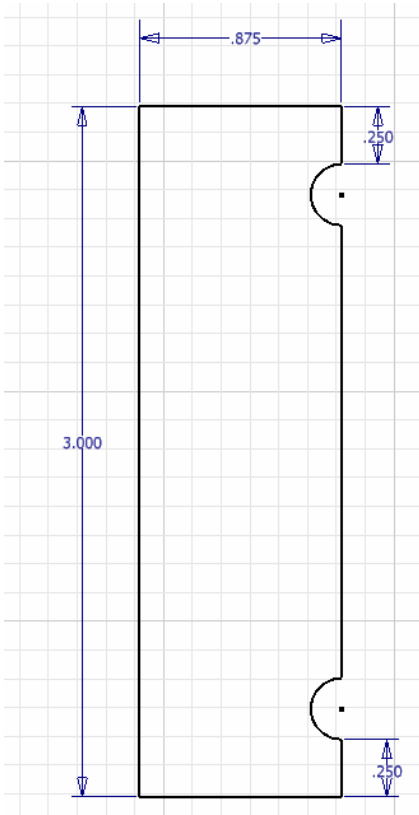
Creating the Mallet Head

STEP #1:



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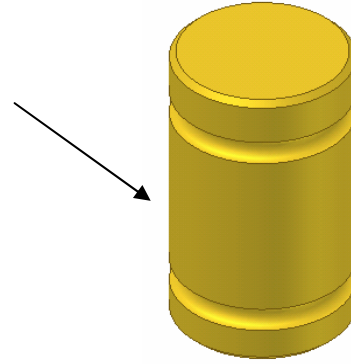
- Open a new **Part File**.
- Sketch a profile of *one-half* of the mallet head. This profile will be revolved in order to create a full image of the mallet head. Start with a **two-point rectangle** with the dimensions you see below.



- If you want to add grooves to your mallet:
 - Use the **three-point arc** tool to draw them, making sure the center point of the arc lines up with the right side line of your rectangle.
 - Use the **Equal** constraint and click on all of your arcs to make them equal in size. (Remember that the constraints are sometimes hidden under Perpendicular in the Panel Menu.)
 - Use **General Dimension** to make sure your dimensions are set so that they are the same at the top of your rectangle and at the bottom. (You may choose this dimension measurement.)
 - Use **Trim** and click on the inside of each arc.

- Finish your sketch and change view to *Isometric*.
- In the **Features Environment**, select **Revolve** and follow the directions in the dialog box to create the revolution. Once you click **Revolve**, you must click on your sketch to select it, then click the **Axis** button and select the solid line on the left of your sketch as the axis.
- Choose **Chamfer** from the Panel menu. Click on the circle at each end of your mallet head and change the Distance box to **1/16"**.

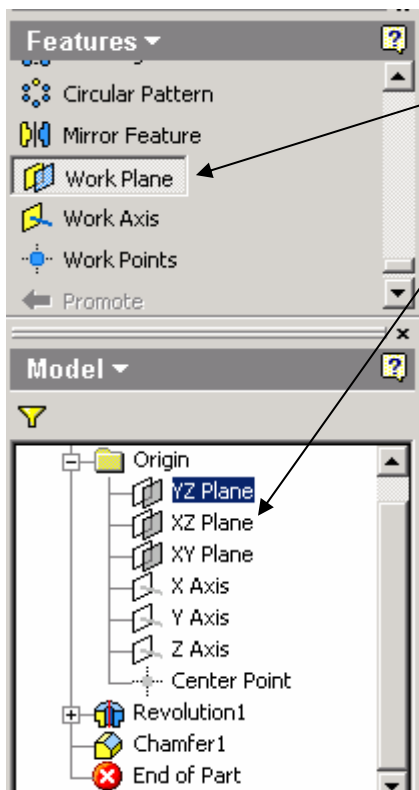
The mallet head may look something like this



- Save drawing as **Mallet Head**.

STEP #2: Drilling the hole for the handle.

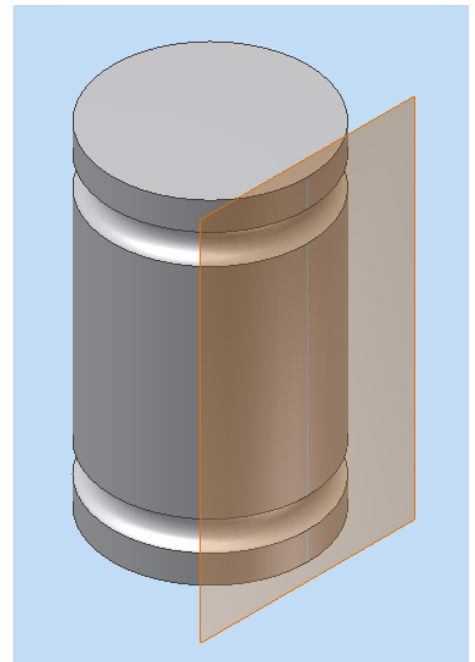
- Place a **Work Plane** on the *YZ plane* and *tangent* to the *circumference* of the Mallet head by following the next few steps:
(Part has been displayed as a wire frame to better show this step)



1. Select **Work Plane** from the Panel menu.

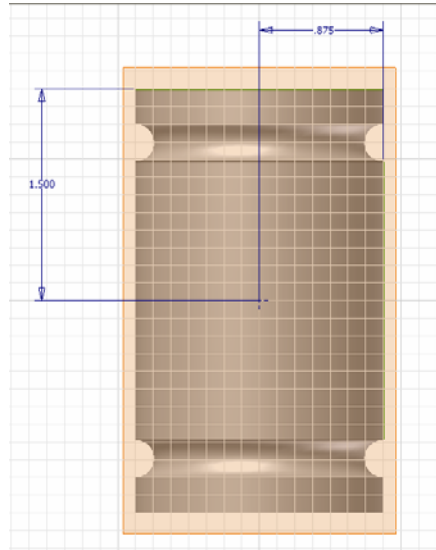
2. In the Browser menu (under Model), click the plus sign in front of the Origin folder and Select **YZ Plane**.

3. Click on the circumference (outside line) of the mallet head so that the work plane is made tangent to it.



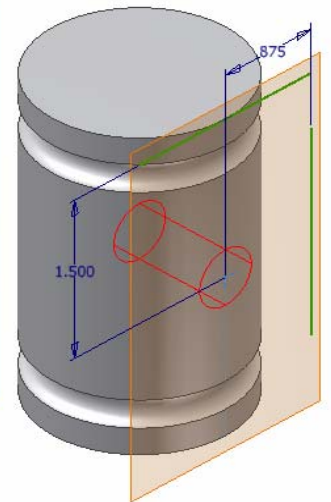
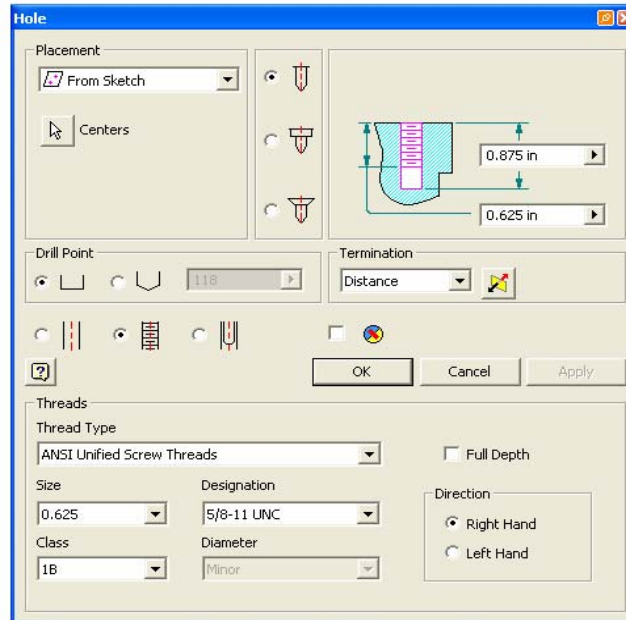
- Once the work plane is visible, click **Sketch** and then click on the red outline of the *work plane* you just created. Click the **Look At** button and click again on the red outline of the *work plane*.

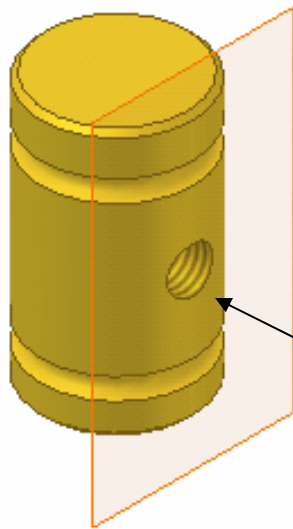
- From the Panel menu, choose **Project Geometry** to project the Mallet Head details onto the **Sketch Plane**. You will need to click on the very top horizontal line of the mallet head and one side line.
- Choose **Point, Center Point** from the Panel menu **and** place and locate a Hole Center in the middle of the Mallet.
- Use **General Dimension** to add the necessary dimensions.



- Finish your sketch and change to Isometric view.
- Choose **Hole** from the Panel menu and change the specifications to match below.

The **specifications** for this hole are:
0.875 drill depth
0.625 tap depth
5/8 Nominal size
ANSI Unified
Screw Threads
5/8-11 UNC





The tapped hole should look like this.

- ❑ In the **Browser** (under Model), right click on *Work Plane1* and un-check its visibility so that you no longer see the work plane.
- ❑ Since you have *already* saved this file as **Mallet Head**, all you have to do is click the **Save** icon on the toolbar.

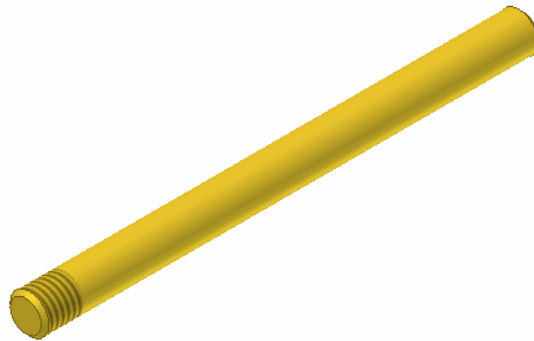
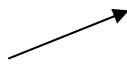
Creating the Mallet Handle:



Standard (in).ipt

- ❑ Open a new **Part File** from the English tab.
- ❑ Create a sketch using the **Center-point Circle** tool with 5/8" diameter. Finish your sketch, change to Isometric View and **Extrude** to 8" long.
- ❑ Save drawing as **Mallet Handle**.
- ❑ Choose **Chamfer** from the Panel menu. Click on each end of the handle and change the distance to 0.0625".
- ❑ Choose **Thread** from the Panel menu.
 - Click on your mallet handle to select it.
 - Un-check **Full Length**.
 - Make sure the **Offset** is set at zero.
 - Change the **Length** to .625".
- ❑ Save as **Mallet Handle**.

The mallet handle should look like this

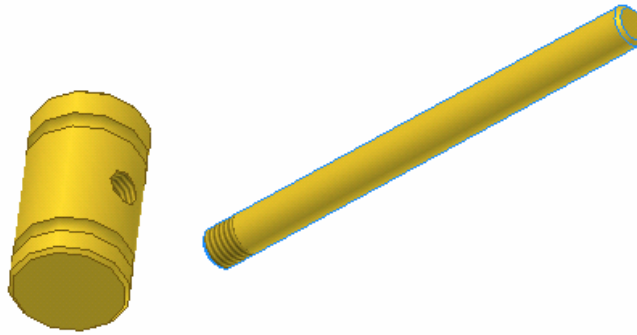


Assembly of Mallet Head and Handle:

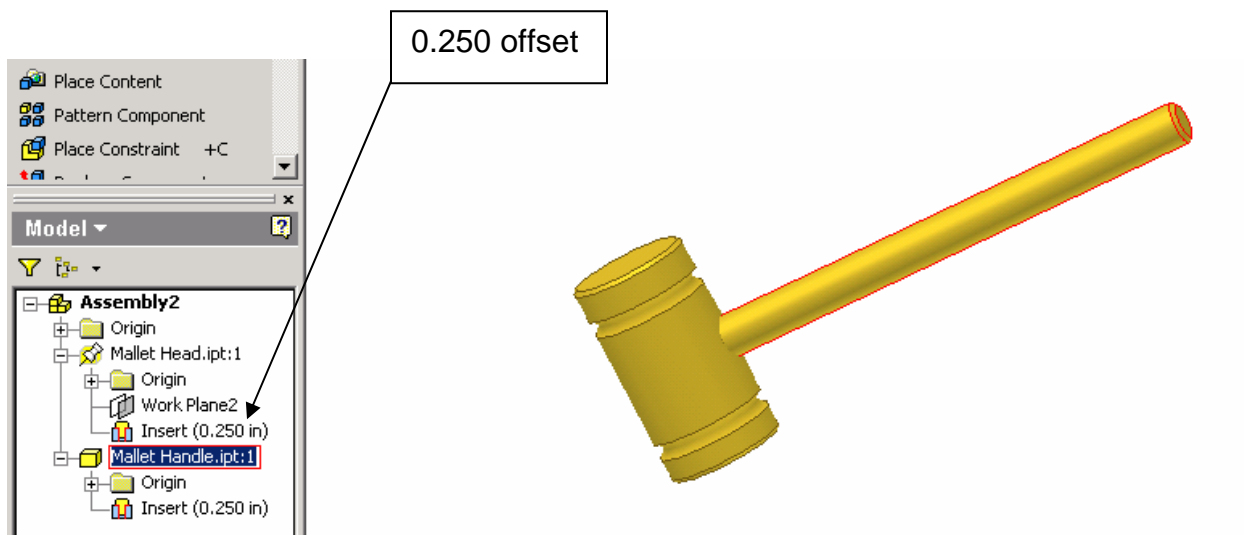


Standard.iam

- ❑ Open a new **Assembly File** from the English tab.
- ❑ In the **Panel Bar**, select **Place Component**.
- ❑ Place the **Mallet Head** and the **Mallet Handle** in the graphics window. Make sure the Mallet head is grounded (look for the thumbtack in the Browser list).



- ❑ Choose **Constraint** from the Panel menu.
 - Select the **Insert** button.
 - Choose the center line of the hole and the center line of the threaded end of the handle.
 - Be sure to *offset* the Handle 0.250" to allow for the bottom part of the hole in the Mallet Head that was not threaded.



The Mallet Assembly

- ❑ You may make the mallet any color you wish, as long as it matches the pegboard toy!
- ❑ Save drawing as **Mallet**.

Conclusion

1. Explain your understanding of 3D modeling after working on the Pegboard Toy with Mallet. To help you with your explanation, answer the following questions:
 - a. What is 3D modeling?
 - b. How is sketching used to help do a 3D model?
 - c. Why are the use of dimensions and knowing the requirements for a sketch, such as criteria and constraints, important?
 - d. How does the use of a computer in making a 3D model helpful for you in explaining what an object looks like or should look?

2. You have been asked by the president of Tattered Toy Company to make a presentation about 3D modeling using a computer. List below the main ideas you will put in your presentation, such as a definition for 3D modeling.