Activity Pegboard Toy

Purpose

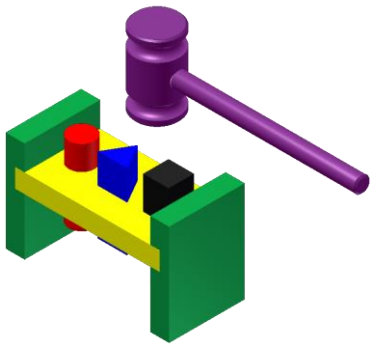
When you receive a toy, what is the first thing you wonder about it? Do you wonder how it works? Have you ever wondered who designed it or who may have made decisions about its color or the materials that were used to make it? Being a toy designer may seem like it would be easy, but would it?

Designing a toy can be a challenging but fun process. You must consider many factors, such as safety, materials, and appropriate use. In addition you have a chance to try out ideas and experiment with what you think might be fun. However, you must design something that is useful and will be enjoyed by kids the toy is appropriate for.

Learning how to design is a process that requires time and opportunities to explore and learn. In previous lessons and activities, you have been taught different aspects about design, sketching, and 3D modeling. In this activity you will see how a pegboard with matching mallet is designed. You will learn how to test the pieces to ensure that they fit appropriately and that they are easy for a young child to enjoy.

Equipment

- Sketch paper
- Pencil
- PLTW Gateway notebook
- Computer with 3D modeling program
- Sample pegboard with mallet (optional)



Procedure

As a new employee of Tattered Toy Company, you have been asked to learn more about their best-selling toy, the Pegboard (See Figure 1). Your supervisor, Mr. Duggle, states that you need to know how the pegboard was designed. He wants you to learn as much about the design process as possible while working on this project.

“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,” explains Mr. Duggle. “I will be checking your work and watching how you work with others.”

As Mr. Duggle leaves you to work, he calls back to you, “Good luck! Be sure to save all of your work so that we can review it later.”

Directions

Read each step, perform each operation, and check them off after completion.

Creating Parts:

Round Peg

- **Open a new** Part File.
- Create a round part 1 in. diameter and 3 in. long.
- Save as **ROUND PEG_Intials** (.ipt).

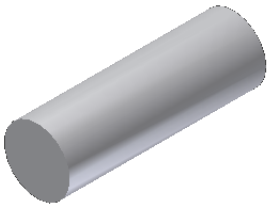


Figure 1. Round Peg

Square Peg

- Open a new **Part File**.
- Create a square part 1” x 1” x 3” long.
- Save as **SQUARE PEG_Intials** (.ipt).

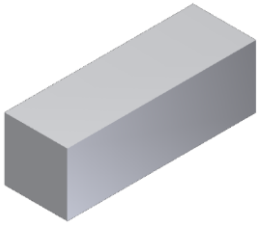


Figure 2. Square Peg

Triangle

- Open a new **Part File**.
- Create an equilateral triangle peg 1” high and 3” long
- Save part as **TRIANGLE PEG_intials** (ipt file).

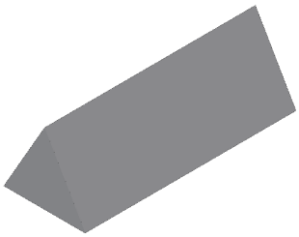


Figure 3. Triangle Peg

Pegboard

- Open a new **Part File**.
- Identify the front, top, and right side of the pegboard below. Think about the view you are drawing before dimensioning your rectangle.
- Create a pegboard part ¾”(height) x 5¾” (width) x 3” (depth) with holes that will accept the round and square pegs you designed. Both holes should be properly centered both vertically and horizontally within the rectangular base.
- Save as **PEGBOARD_Intials** (.ipt).

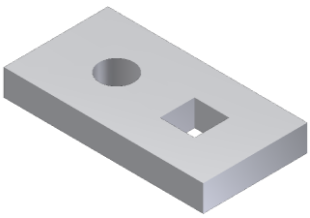
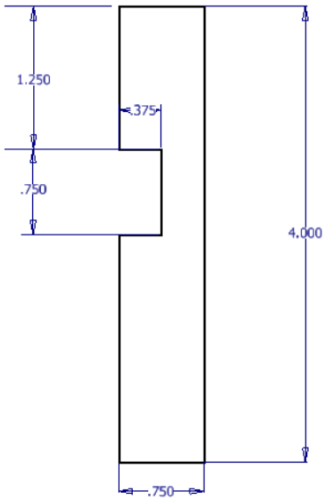


Figure 4. Pegboard

Pegboard End

- Open a new **Part File**.



- Extrude the Depth to 3”
- Save part as **Pegboard End_Intials** (ipt file).

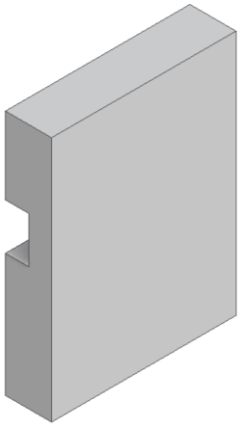


Figure 5. Pegboard End

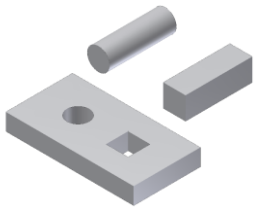
✓ **Have Part Checked off by Mrs. Silva.**

Creating Assembly of Parts

Pegboard Toy

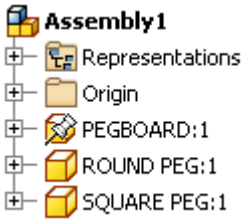
- Open a new **Assembly File**.
- From the **Component** panel, select **Place.**

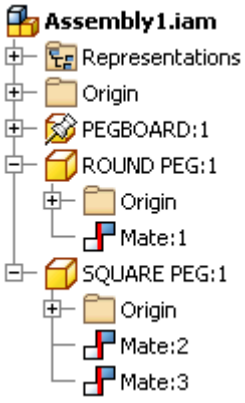
- Place the pegboard part.
- Repeat the process and place round and square peg parts into the assembly.



Pegboard Toy

- Look in the **Model Browser** and right click on the Pegboard and select the icon **Grounded**
  - This symbol means the part is grounded or tacked in place. Only one part in an assembly is usually grounded.
- From the **Relationship** panel, select **Constrain**. **Mate** the parts. The parts should still be able to move up and down.
- If you expand the Round Peg part, you should see one Mate constraint. If you expand the Square Peg part, you should see two Mate constraints. Why do you think that is?





- Save as **PEGBOARD TOY** (.iam). See Figure 6.

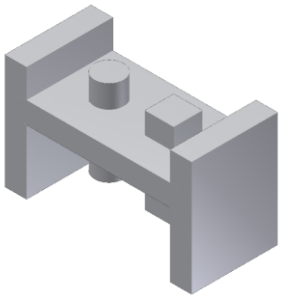


Figure 6. Pegboard Toy

✓ **Have Assembly Checked off by Mrs. Silva.**

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 that the toy needs something else to make it more fun for children. After some discussion the design department team decided that the Pegboard Toy needs an additional triangular-shaped peg to improve the design.

Your challenge is to design the triangular-shaped peg and edit the Pegboard Toy so that it will remain the same size, have the two original parts, and include the new triangular-shaped peg.

This process has been provided to guide you as you learn how to modify a design. Follow each step, performing the operation and keeping track as you complete each step. Continue to take notes and be sure to note challenges and questions that you may have as you improve the Pegboard Toy. This information will come in handy for you when you work on your own designs later in the next lesson.

- Open a new **Part File**.
- Create an equilateral triangle peg 1 in. high and 3 in. long
- Save part as **TRIANGLE PEG** (ipt file).

✓ **Have Part Checked off by Mrs. Silva.**

Figure 9. Triangular peg.

- Open the **PEGBOARD.ipt** and edit the sketch and feature to accept the **TRIANGLE PEG**.
- *You may want to consider the idea of placing the three openings equally distant from each other with the openings of each shape centered on the pegboard*.
- **Save**.
- Open the **PEGBOARD TOY** (.iam).
- **Update** the assembly.

- Place and mate the **TRIANGLE PEG** in the Assembly.
- **Save**.
- See Figure 10 for what your Pegboard Toy with the triangular peg should look like when complete.

✓ **Have Part Checked off by Mrs. Silva.**

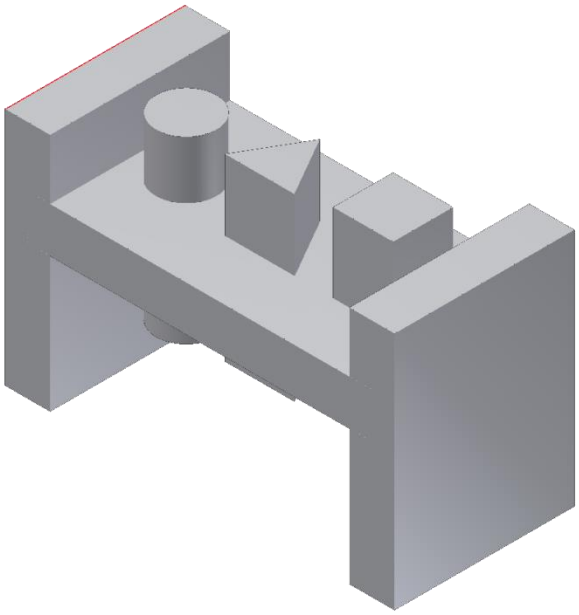


Figure 10. Pegboard Toy with triangular peg addition.

After you completed the 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.

The Design Department team decided to have you create a mallet for the Pegboard Toy. When creating the mallet, you will need to demonstrate how well you can sketch and create 3D models.

Because you are a new employee, the Design Department team decided to give you a few ideas to help you with your design of the mallet. Include the following requirement in your design.

- The mallet head must be 1 ¾ in. diameter x 3 in. long.

Creation of the Mallet

- Draw a sketch of your **Mallet Head** in your Engineering Notebook – have it initialed/checked by you teacher before moving on to the next step.

The following steps will guide you in converting your sketch of the mallet into an Inventor Part File.

Converting a Sketch to a Part File

- 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.

Your sketch might look like Figure 11 before geometric and dimension constraints are applied. NOTE**:** Dimensions are omitted.

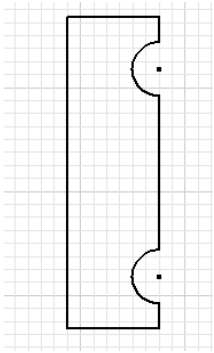


Figure 11. Sketch before constraints applied.

- Finish the sketch and switch to **Home** view.
- From **Create** panel select **Revolve.** Use Revolve pop up or on-screen selection tags to create the revolution. See Figure 12.

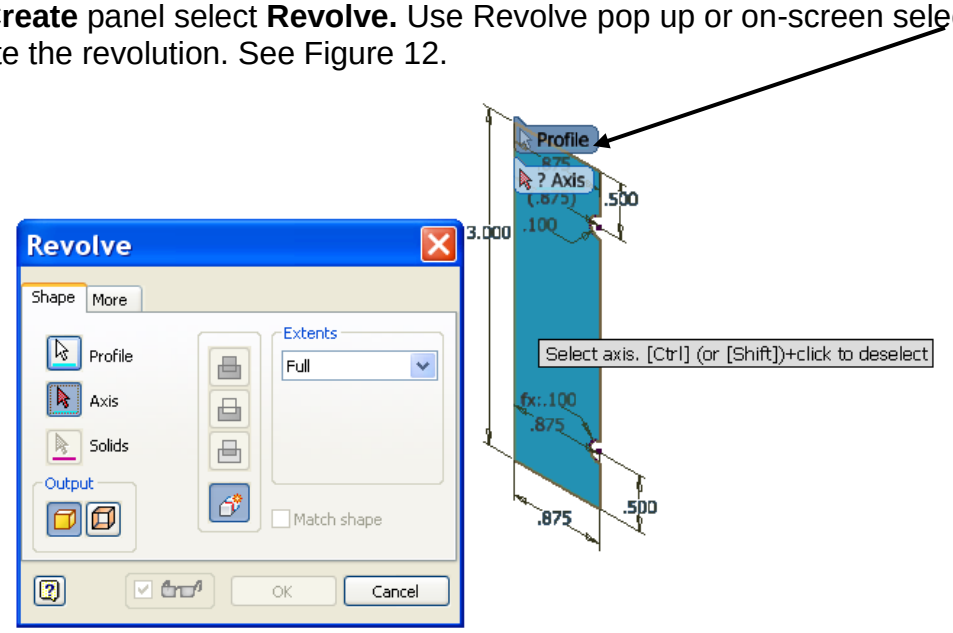


Figure 12. Completed mallet head part.

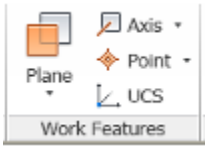
- Place 1/16 in. **Chamfer** on each end to give the mallet its characteristic look.
- Save part as **MALLET HEAD** (ipt).

Figure 13. Completed mallet head part.

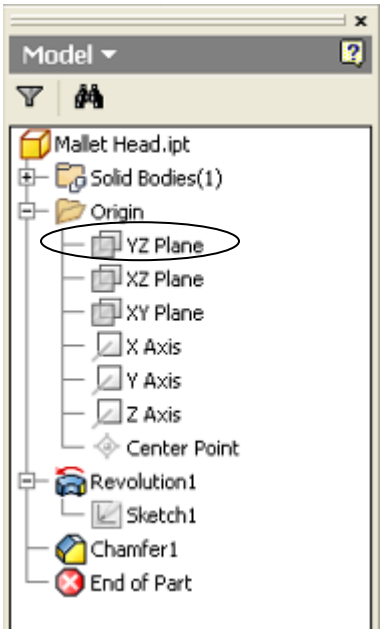
✓ **Have Part Checked off by Mrs. Silva..**

Work Plane on the YZ Plane

In order to place a **Work Plane** on the *YZ* plane and tangent to the circumference of the mallet head, follow the directions listed below:



1. From the **Work Features** panel, select **Plane.**
2. In **Model Browser**, find and expand the **Origin Folder** and then left click on the **YZ Plane.**
3. Click on the circumference of the mallet so the work plane will be made tangent.



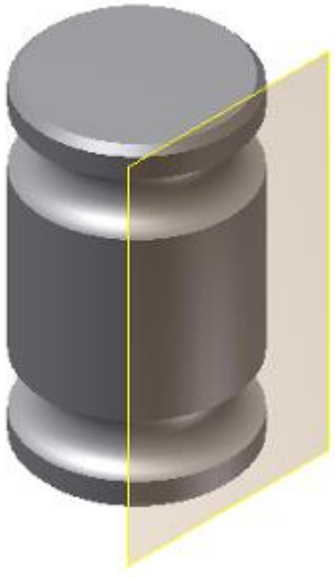


Figure 14. Mallet with work plane tangent.

4. Place a **Sketch Plane** on the work plane you just created. Click on the edge of the work plane to place the sketch.
5. Left click on the **Right side** of the view cube.
6. **Project Geometry** the height and width edges of the mallet head details onto the Sketch Plane.
7. From the **Draw** panel select **Point**. Place and locate the Point in the middle of the mallet. Dimension the point from the projected edges so it is centered on the mallet. See Figure 15.
8. Use **Hole** from the **Modify** panel to create a drilled and tapped **Hole Feature**. See Figure 16.

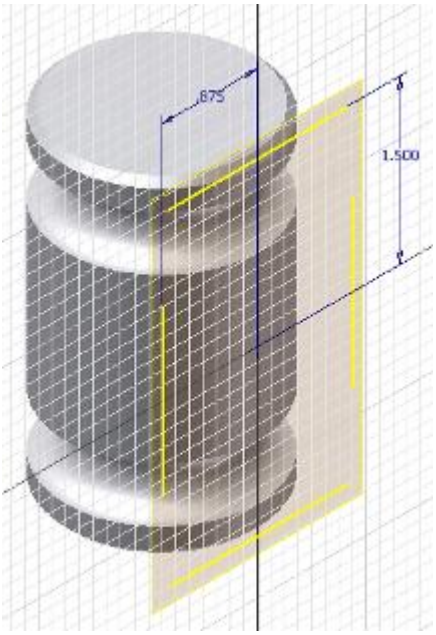


Figure 15. Placing and locating a hole center in the middle of the mallet.

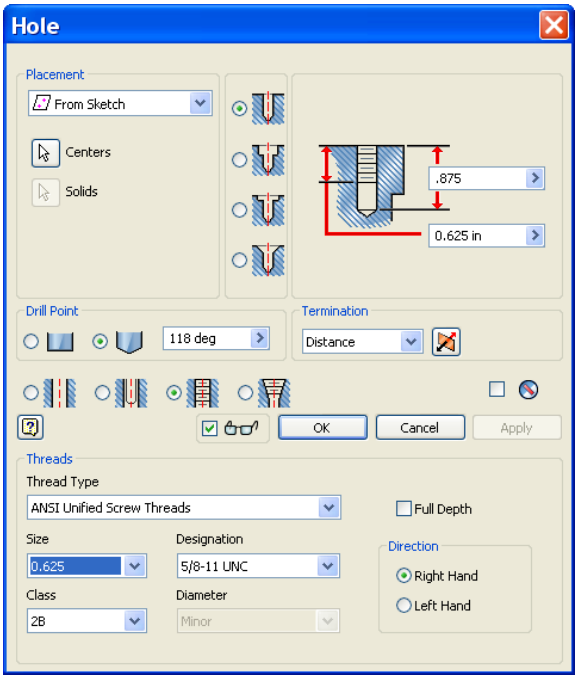


Figure 16. Specifying hole feature.

The specifications for this hole are:

- 0.875 in. drill depth
- 0.625 in. tap depth
- 5/8 in. Size

ANSI Unified Screw Threads:

- 5/8-11 Designation

- In the **Model Browser**, right click on **Work Plane** and uncheck visibility.
- **Save**.

✓ **Add notes in your Engineering Notebook when step is completed.**

Creating the Mallet Handle

- Open a new **Part File**.
- Create a part 5/8 in. diameter and 8 in. long.
- Save drawing as **MALLET HANDLE** (ipt).
- Place 0.0625 **Chamfer** on each end.
- Select **Thread** from **Modify** panel. Use thread specifications from mallet head to place threads on one of the handle. See Figure 17.
- **Save**.

✓ **Have Part Checked off by Mrs. Silva.**

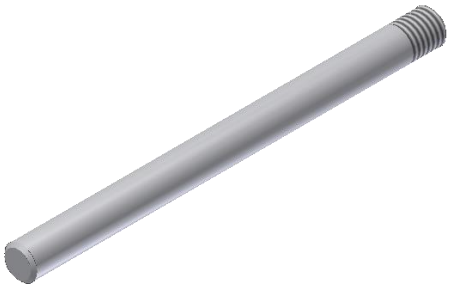


Figure 17. Mallet handle.

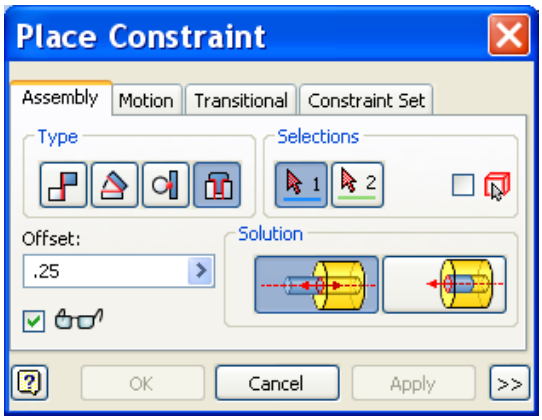
Assembly of Mallet Head and Handle

- Open a new **Assembly File**.
- From **Component** panel, select **Place**.
- Place the **MALLET HEAD** and the **MALLET HANDLE** in the graphics window.

Figure 18. Mallet head and mallet handle.

- Place an **Insert Constraint** between the head and handle.
- Be sure to offset the handle 0.250 in. to allow for the bottom part of the hole in the mallet head that was not threaded.
- Save drawing as **Mallet** (iam). See Figure 19.

✓ **Have Part Checked off by Mrs. Silva.**



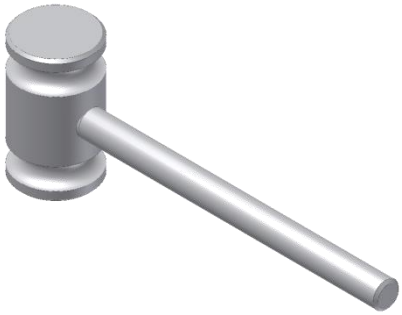


Figure 19. Completed mallet.

Conclusion – answer in your Engineering Notebook

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 create a 3D model?
    c. Why is the use of dimensions and knowing the requirements for a sketch, such as criteria and constraints, important?
    d. How is the use of a computer, in making a 3D model, helpful for you to describe the features of the object?