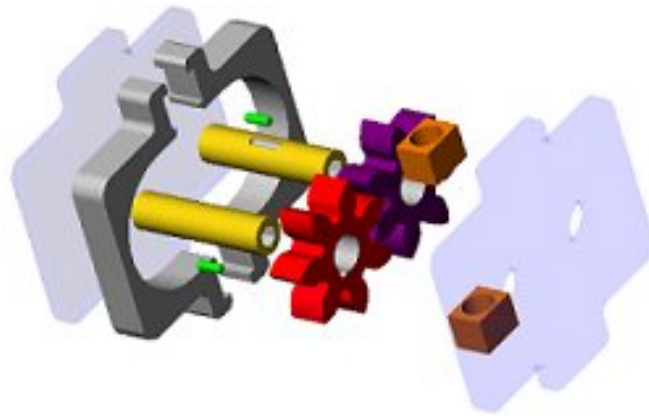


# Solid Modeling & Basic Design Intent



# Why Solid Modeling & Design Intent?

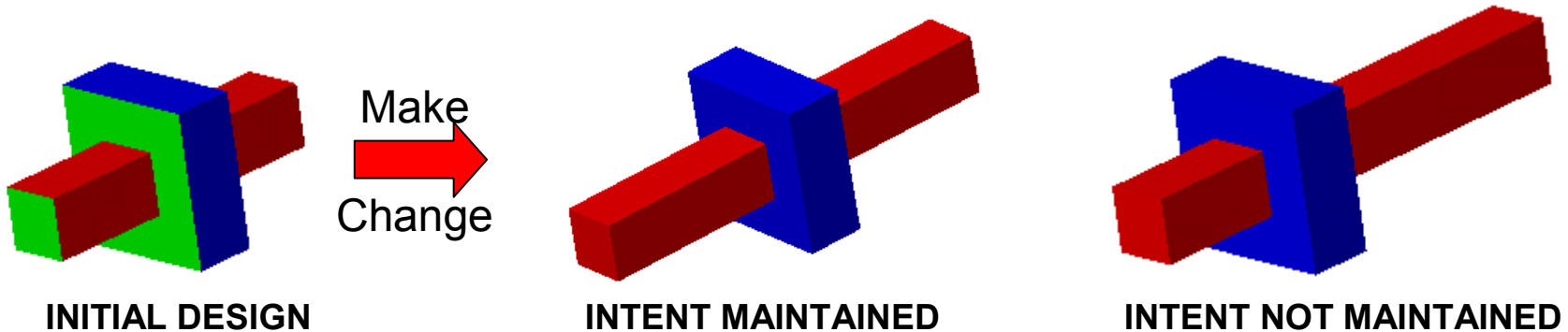
## Why Solid Modeling?

- Design is a process of constant change and iteration
- 98% of all machines are now designed/made using Solid Modeling (SM)
- SM allows designers to make large/sweeping changes with little re-work of prints

## Why Design Intent?

- To minimize re-work, the computer must know what you intend
- Design Intent = How you wish the design/model to be (even if changed)
- You **MUST THINK AHEAD** & build design intent into your model
- You **MUST NAME ALL OF THE 3D FEATURES IN YOUR MODEL TREE**

**EX. Design Intent = Parts Remain Symmetric      &      Design Change = Length**



**Solid Modeling is 90% design intent and 10% knowing the program**

**A large part of your SM grades will be based on use of proper design intent**

# Symmetric Design Intent (DI) For **Parts & Assemblies**

## Purpose:

- Demonstrate need for DI & give practice in Part-Assembly design intent

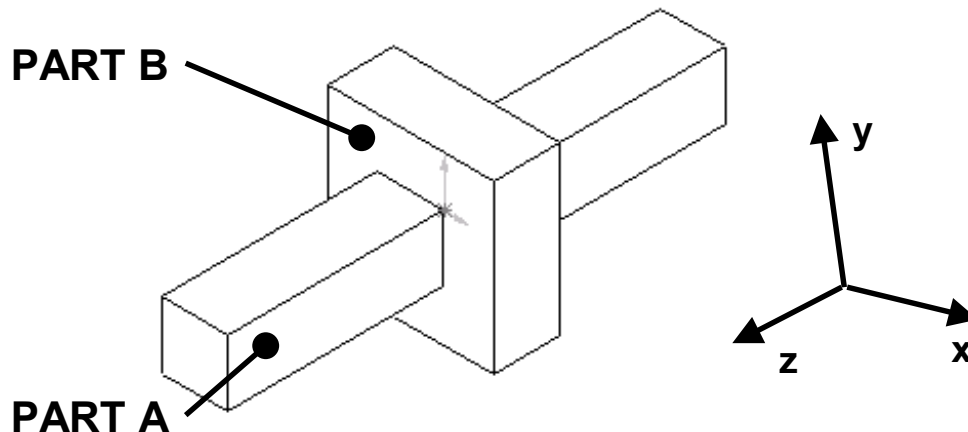
## Today's Exercise:

- You will be given the part and assembly files for a CAD model with poor design intent
- You will see the effects of poor DI
- You will correct the design intent

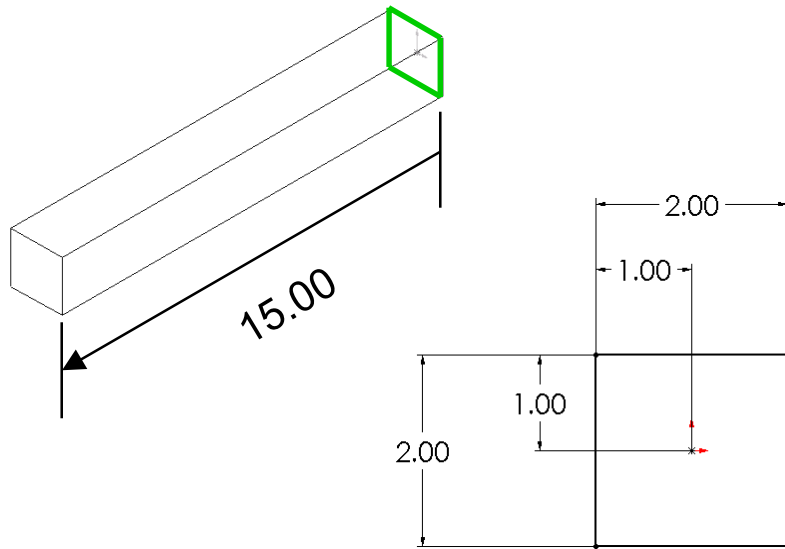
## Why you need this:

- Similar to the design intent required for GEAR PUMPS
- Will save you hours on future projects at MIT

**Design intent for this CAD model: A & B are symmetric about X,Y,Z axes**



# How the Parts Were Built

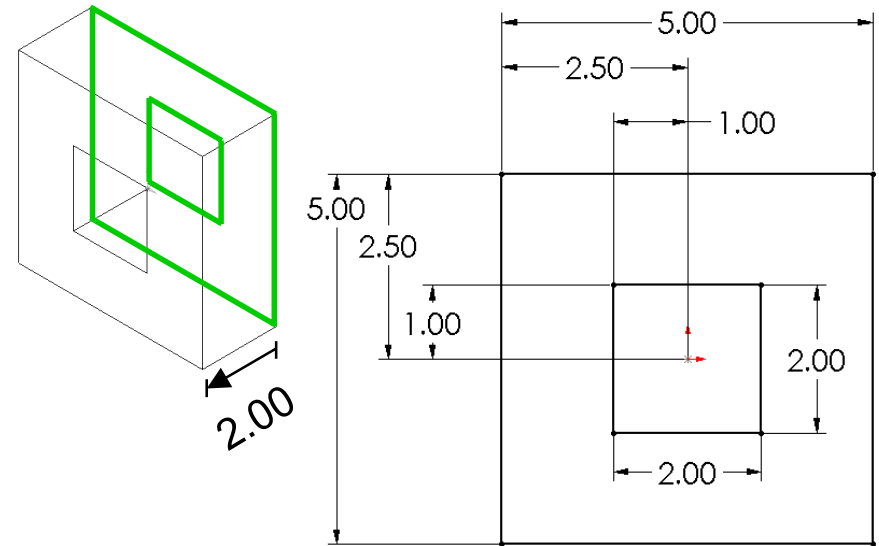


## PART A:

**Blind Extrusion**

**Depth = 15 inches**

**Note how the sketch is centered**



## PART B:

**Blind Extrusion**

**Depth = 2 inches**

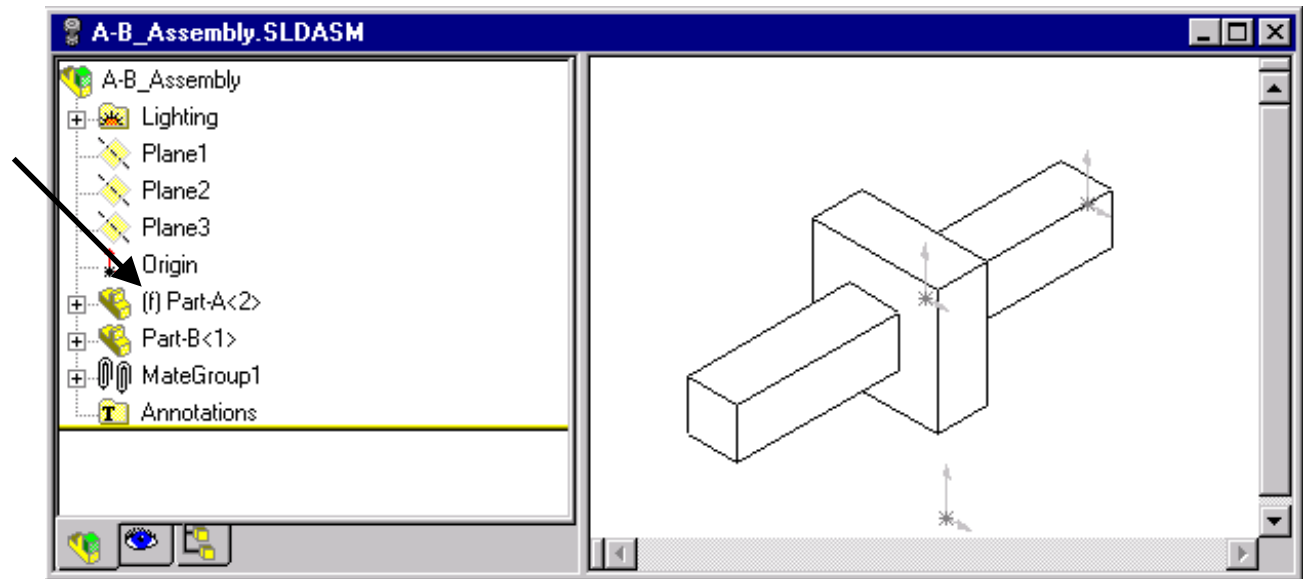
**Note how the sketch is centered**

# How the Parts Were Located In Assembly

## Putting parts into assembly file:

- Unfortunately, SolidWorks may “fix” the first part placed into an assembly. When SolidWorks does this, the first part (in this case Part A) is ARBITRARILY fixed in the 3D space of the assembly file.
- This is POOR SOLID MODELING PRACTICE!!!!
- DO NOT TRY TO FIX THIS NOW, we will fix it momentarily

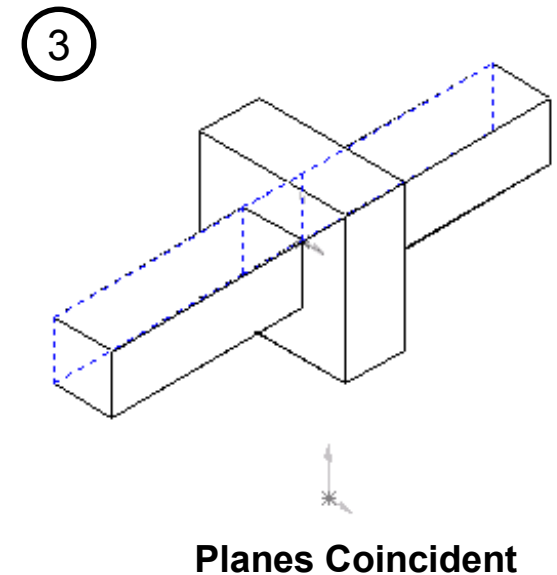
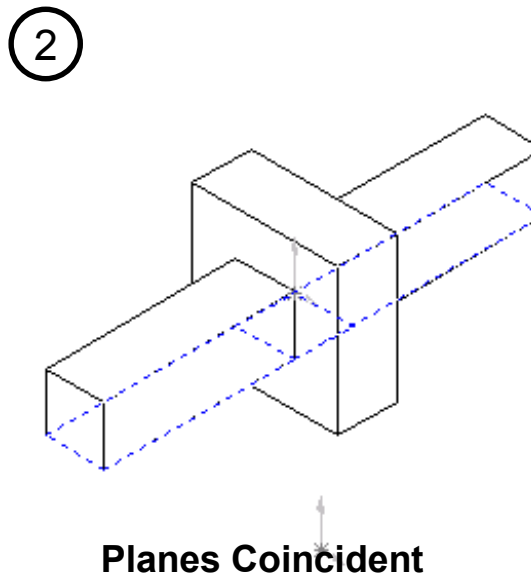
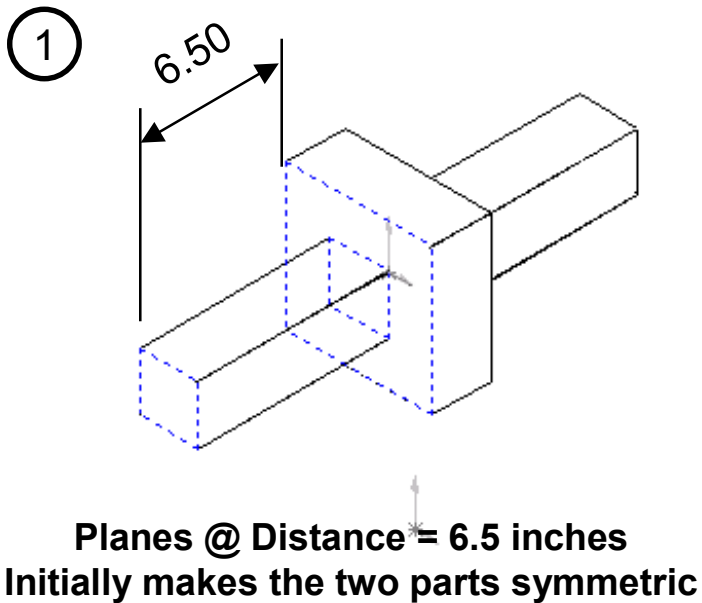
The (f) before Part-A shows that it is arbitrarily fixed



# How the Parts Were Mated

## The parts were mated as shown below:

- You can see details on how the parts were mated by:
  - Clicking on the “+” sign to the left of the MateGroup1 icon in the feature tree
  - Then Left Click ONCE on the mates to see which planes were mated (I.e. below)
  - As you click through the mates, they will highlight the mated planes/features
  - The planes below should be highlighted as you click through
- In the next steps, we will see why these mates reflect POOR DESIGN INTENT

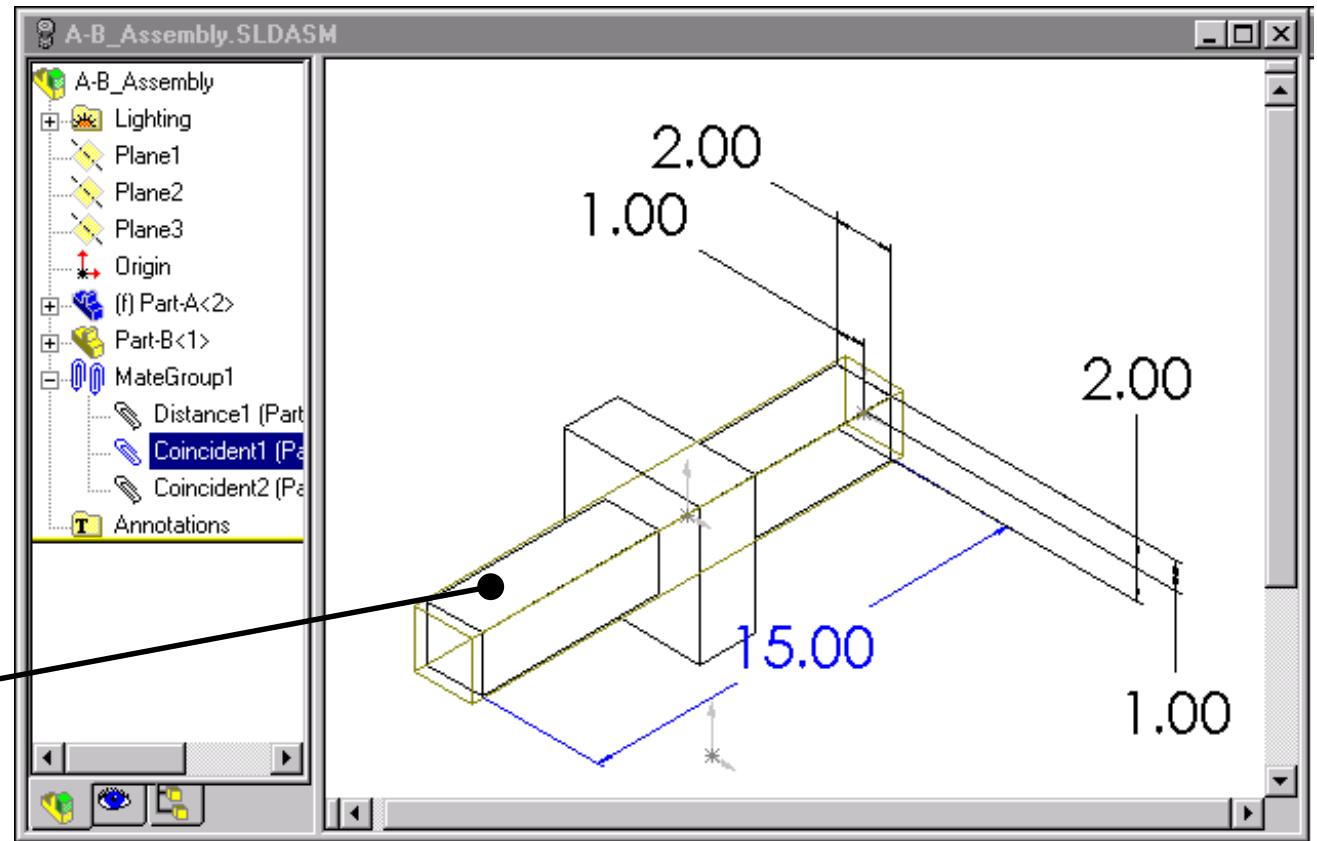


# Results of Poor Design Intent

## Changing Model Dimensions

- Make sure you are working on **A-B\_Assembly.sldasm**, Not a part file
- Set the view type to: No Hidden Lines
- Double Click on Part A (long skinny part) in the window to see its dimensions
- Change the 15.00 inch dimension to 4 inches
- Rebuild the model

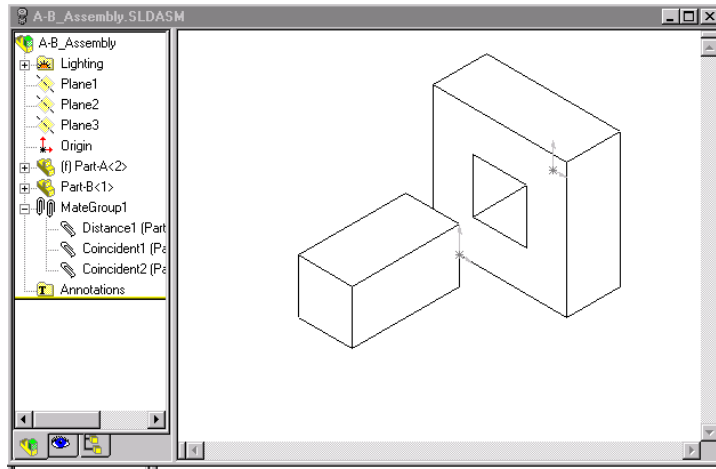
Double Click Here



# Results of Poor Design Intent

## Changing Model Dimensions

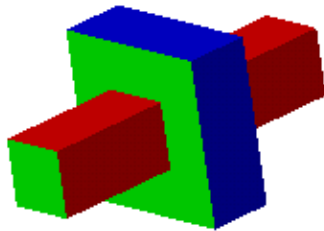
- Part A is no longer centered in Part B!!!! The design intent is not maintained.



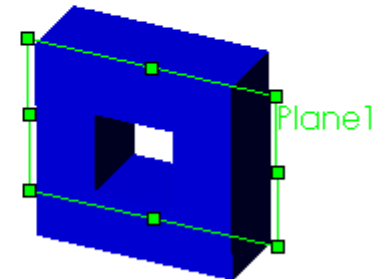
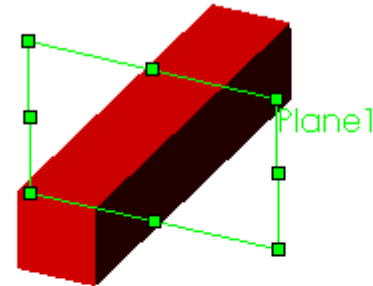
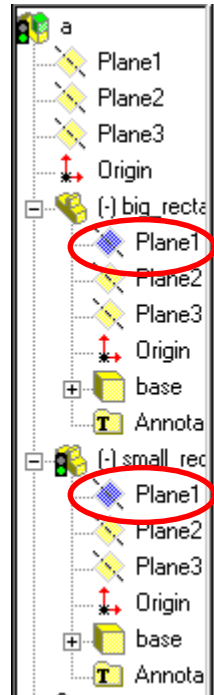
- Spend ~ 3 Minutes changing other dimensions and extrusion depths in parts A and B (by double clicking on the parts as on the previous slide).
- You will be able to see how the design intent is not preserved.
- Next we will fix the model in real time on the screen so that the proper design intent is preserved.
- If you finish early, think about how you would fix the model. There is a hint on the next slide. Call me if you figure it out.



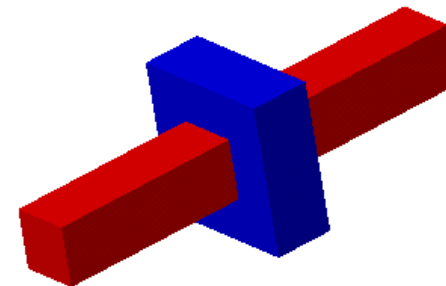
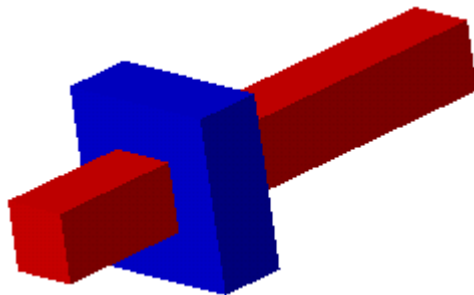
# Symmetric Design Intent in Assemblies



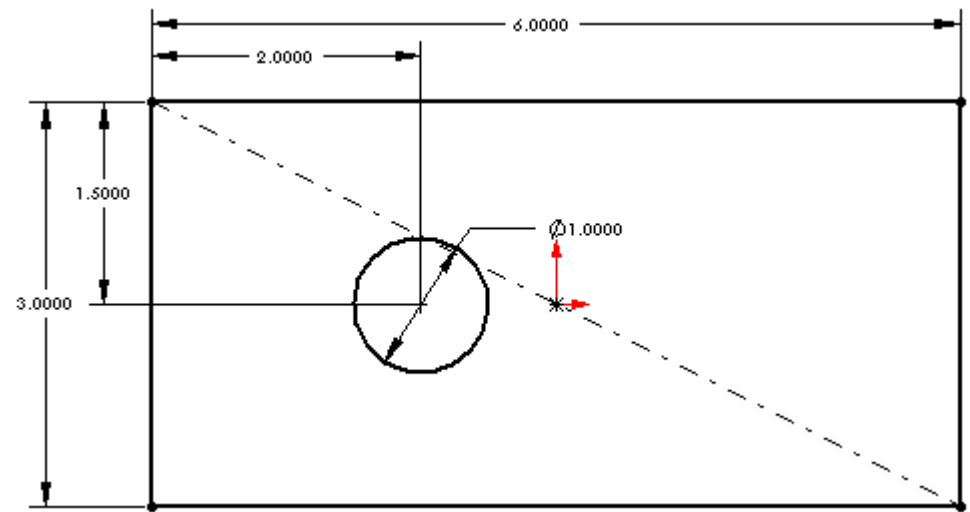
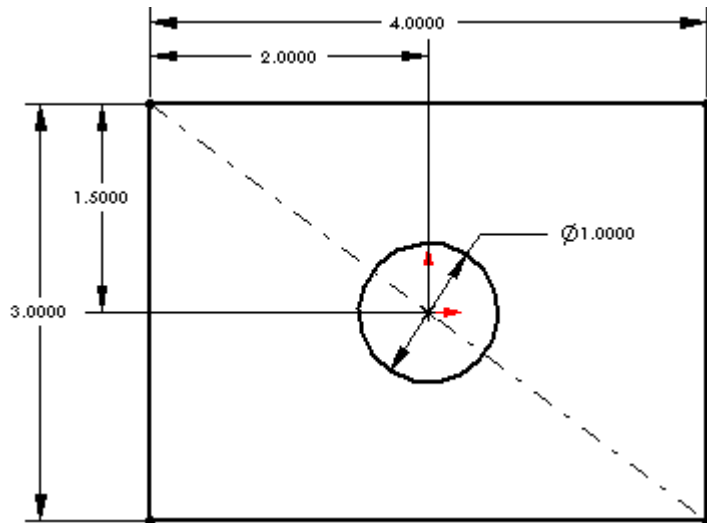
**MATING FACES AT A DISTANCE:  
INCORRECT**



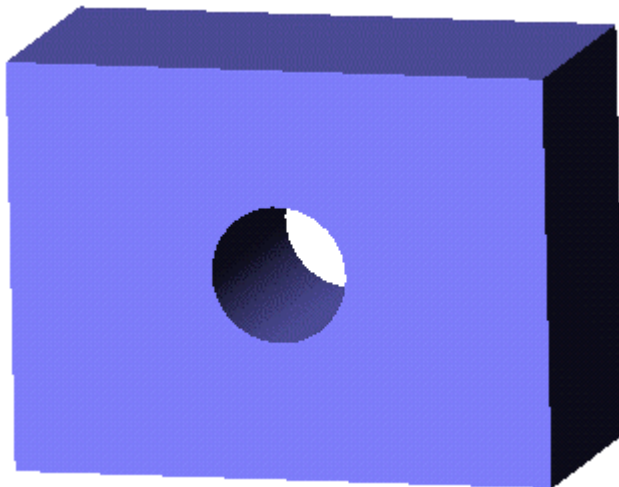
**MATING DEFAULT PLANES  
CORRECT**



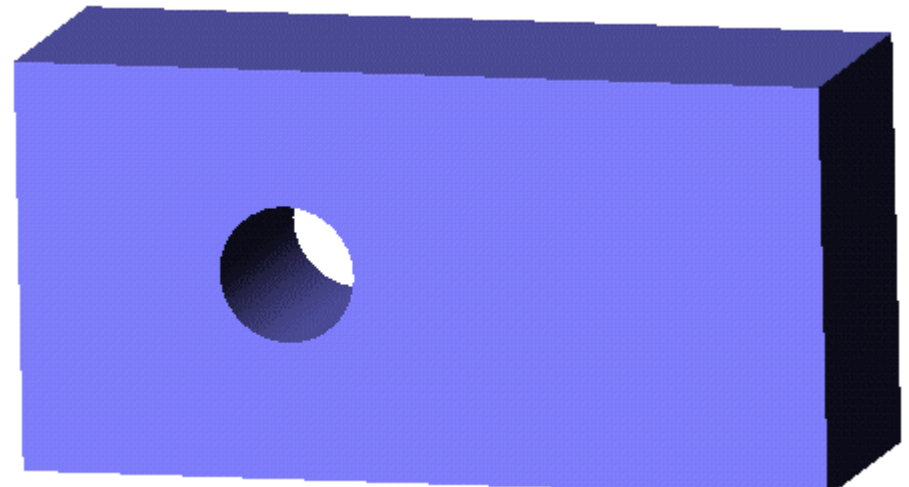
# Centered Design Intent in Parts - Why?



Original Intent Was to Have Hole Centered



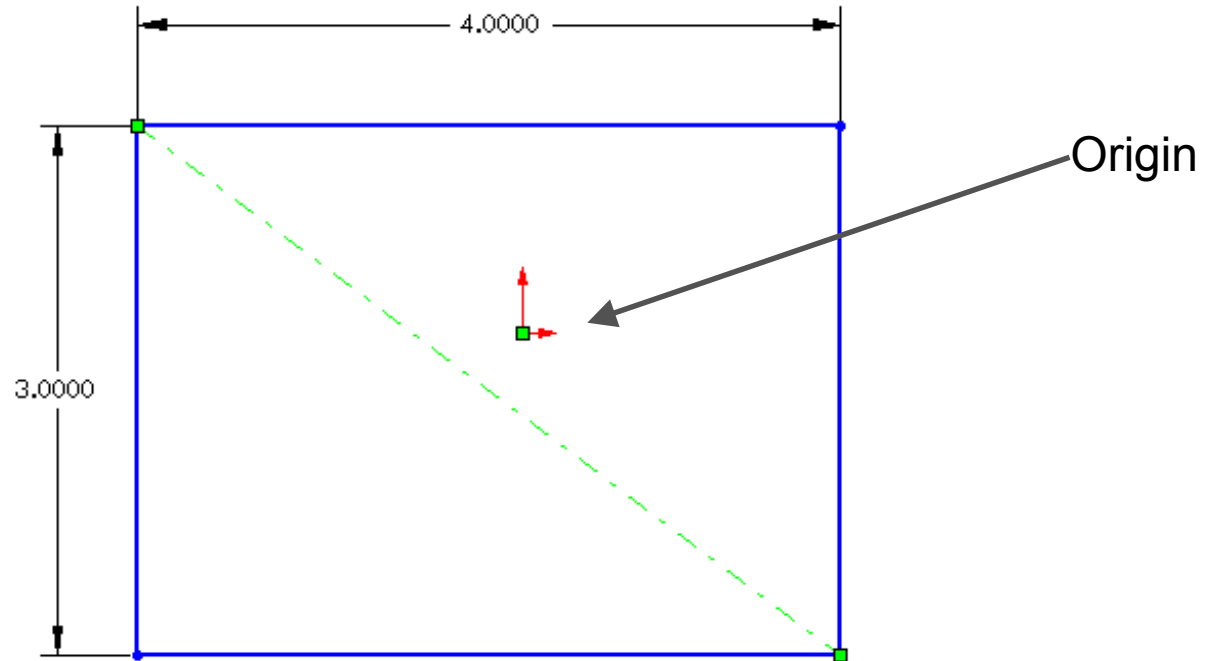
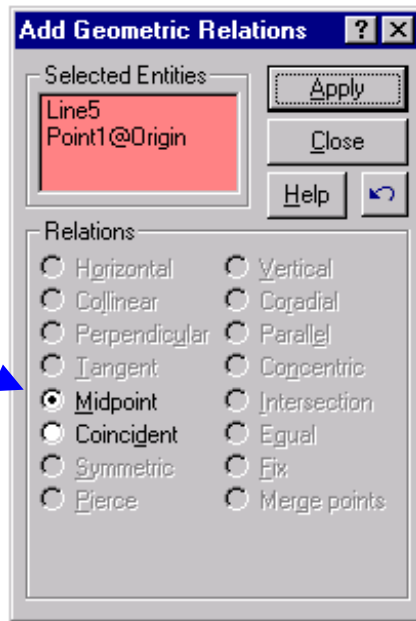
Intent Not Maintained During Design Change

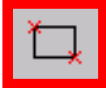


You would have to re-edit the sketch to fix!

# Centered Design Intent in Parts/Sketches


## CLASS EXERCISE: ALL BUTTONS ARE IN THE SKETCHING TOOL BAR



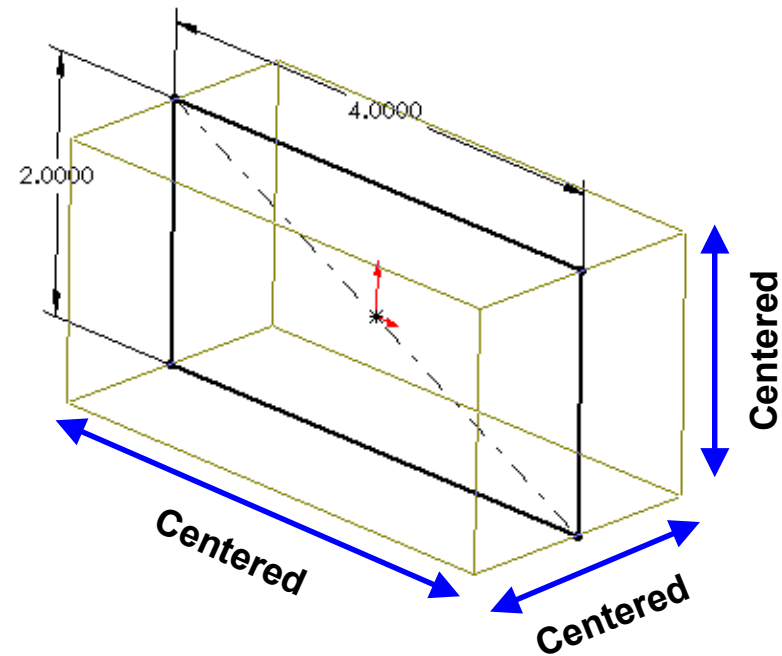
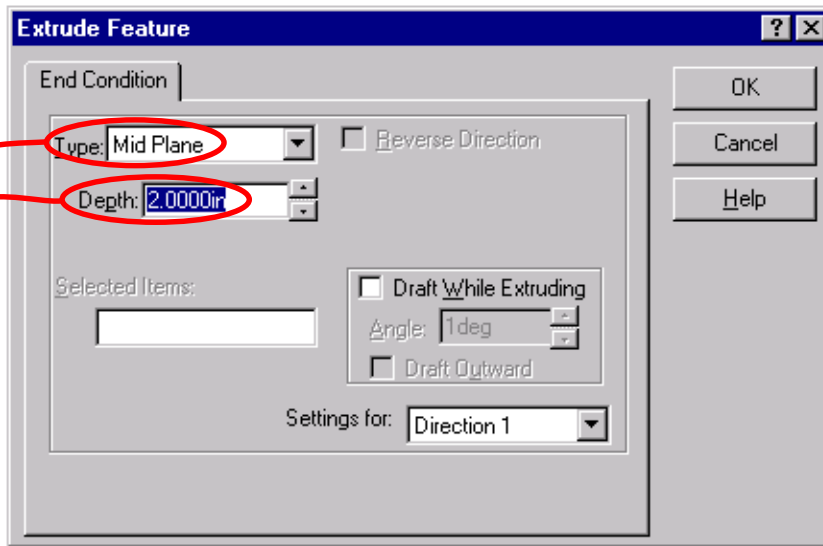
STEP 1: Sketch a box  roughly centered about the origin

STEP 2: Dimension the width and length of the box as shown above

STEP 3: Draw a Center Line  from one corner to an opposing corner

STEP 4: Use ADD RELATION  to constrain the Origin and Mid-point of the CL

# Centered Design Intent in Parts/Sketches



**Mid-Plane Extrusions center an extruded piece about its sketch plane**

STEP 5: Extrude as a **MID-PLANE Extrusion** @ **Depth = 2 inches** (Note This step centers about the 3rd plane)

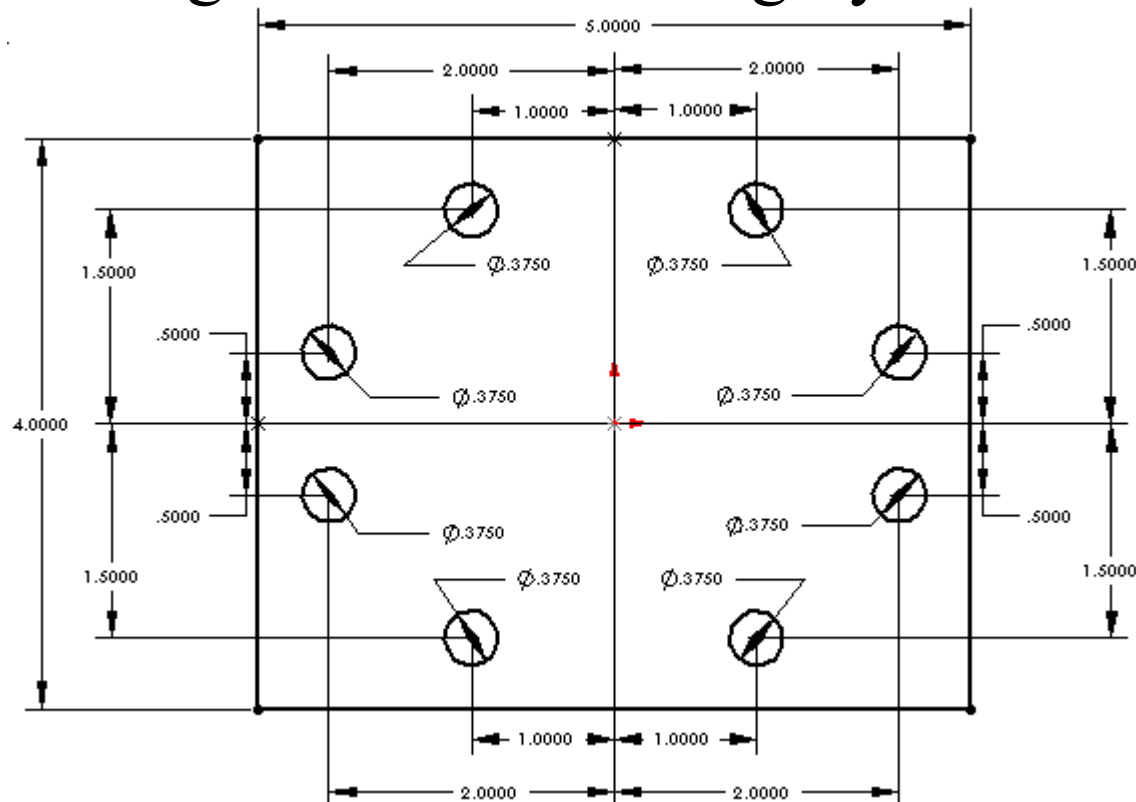
STEP 6: Click OK, then click on Planes 1,2,3 in the feature tree window to see if part is centered

RESULTS: You should now have a part centered about the origin in **ALL 3 DIRECTIONS**

# Symmetric Design Intent: Mirroring Symmetric Parts

26 Dimensions

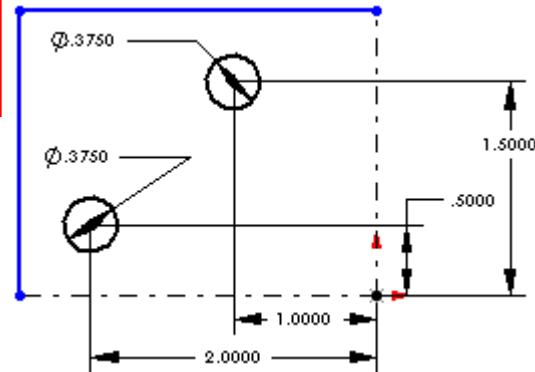
This is poor practice



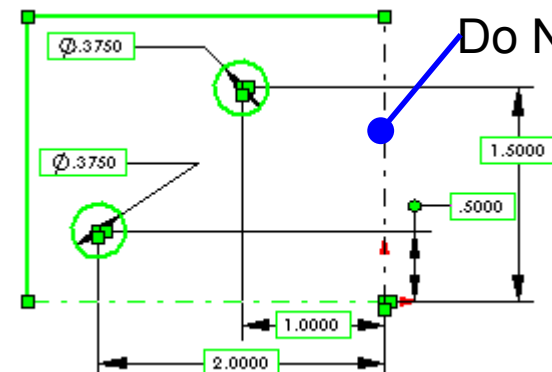
C Line



Mirror



**STEP 1:  
DRAW THE FOLLOWING**

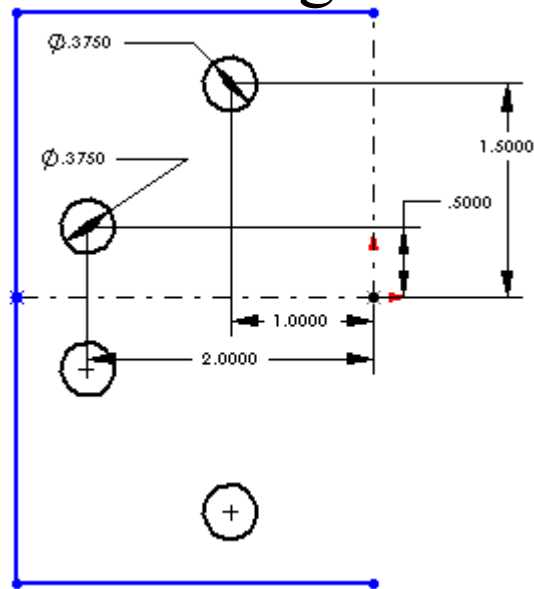


**STEP 2:  
SELECT & MIRROR**



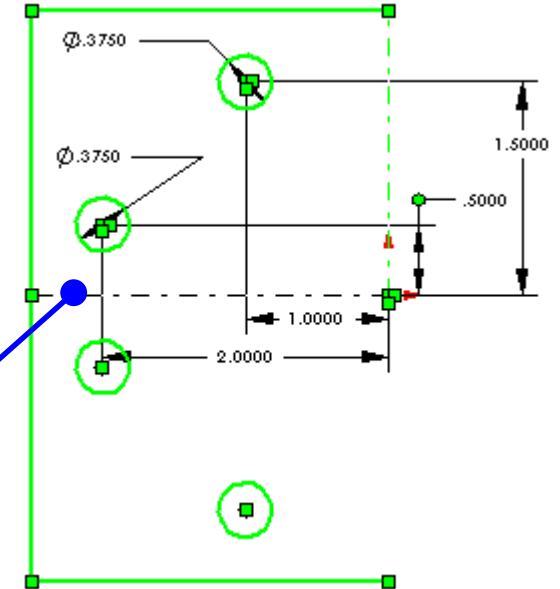
# Symmetric Design Intent: Mirroring Symmetric Parts

**RESULT OF  
STEP 2**

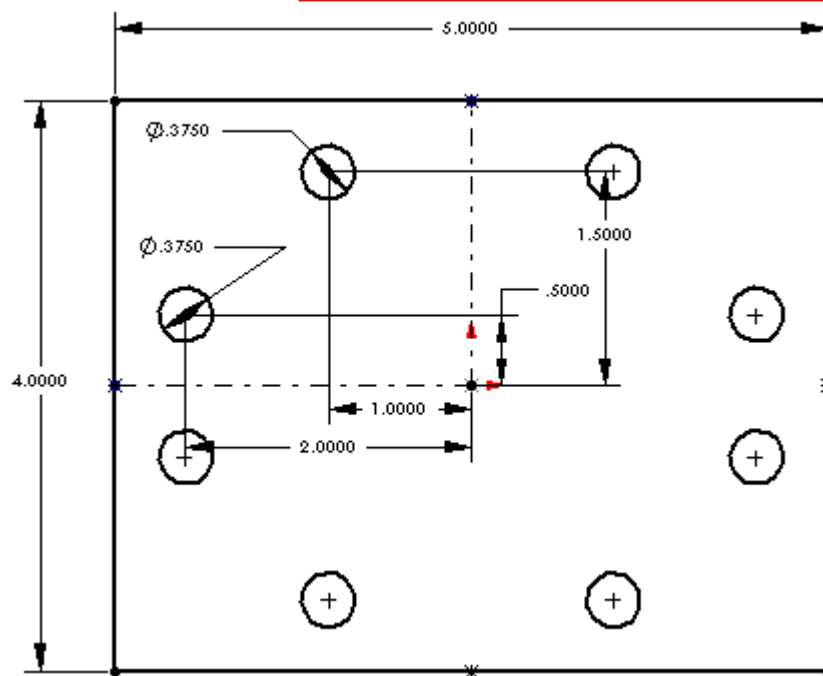


**STEP 3:  
SELECT & MIRROR**

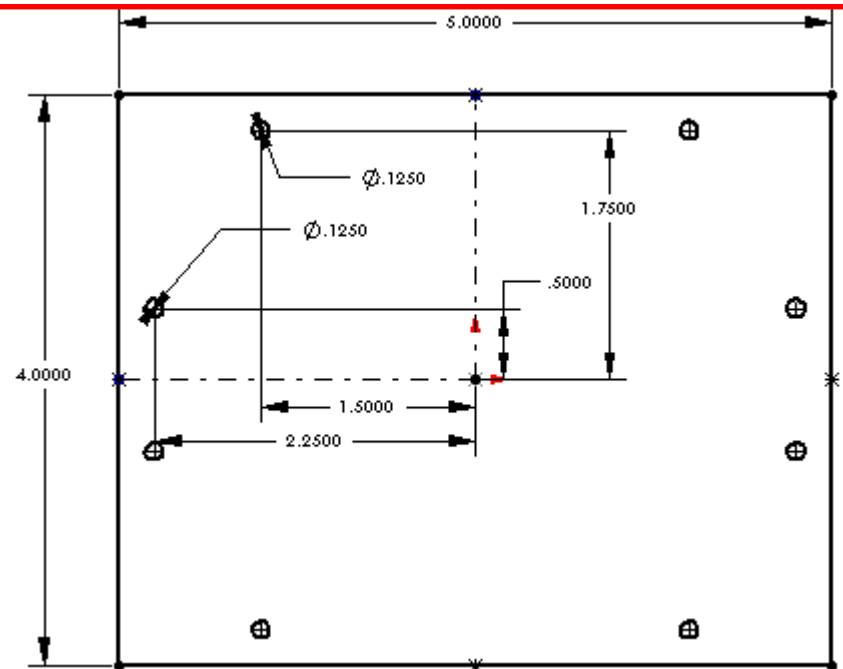
Do Not Select



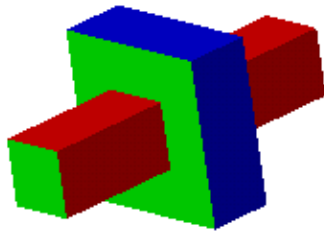
**STEP 4:  
DIMN SIDES**



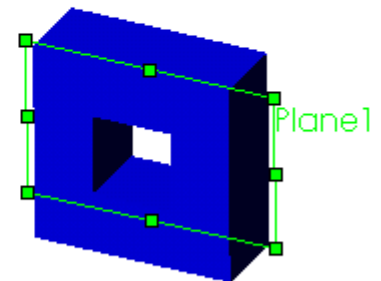
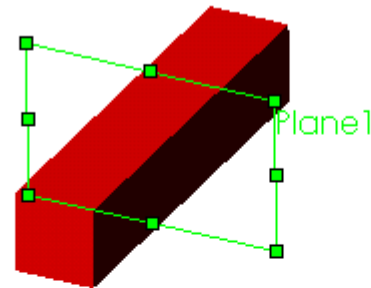
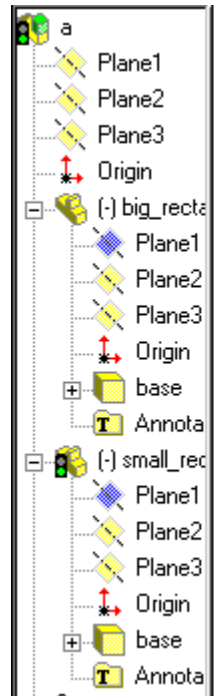
Make  
Changes



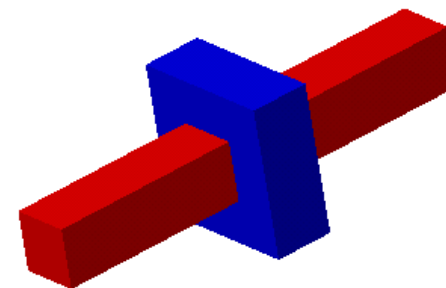
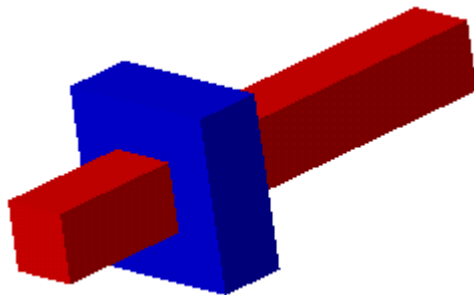
# Symmetric Design Intent in Assemblies



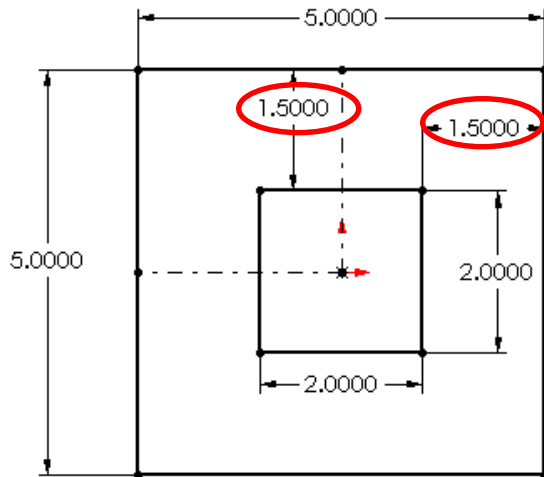
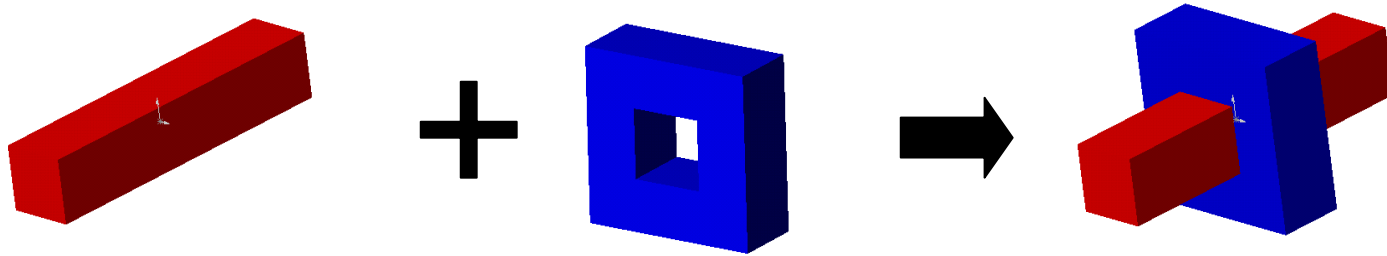
**MATING FACES AT A DISTANCE:  
INCORRECT**



**MATING DEFAULT PLANES  
CORRECT**

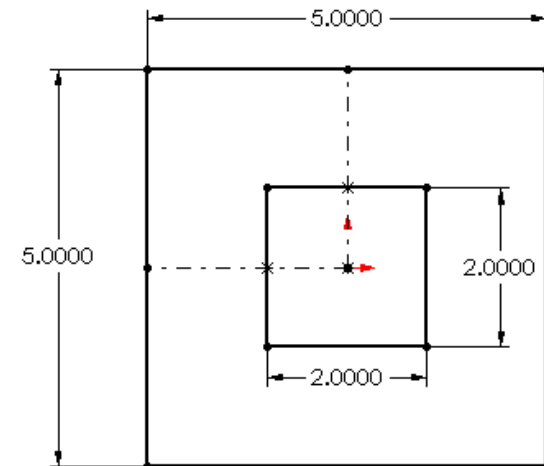
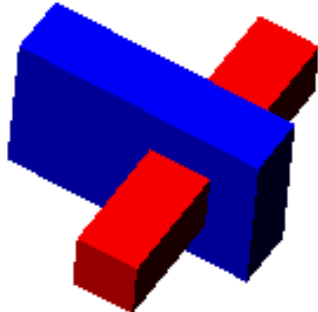


# Symmetric Design Intent **Parts & Assemblies**



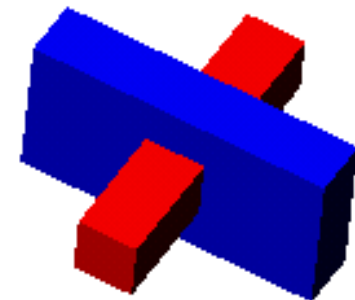
**USING DIMENSIONS**

**INCORRECT**



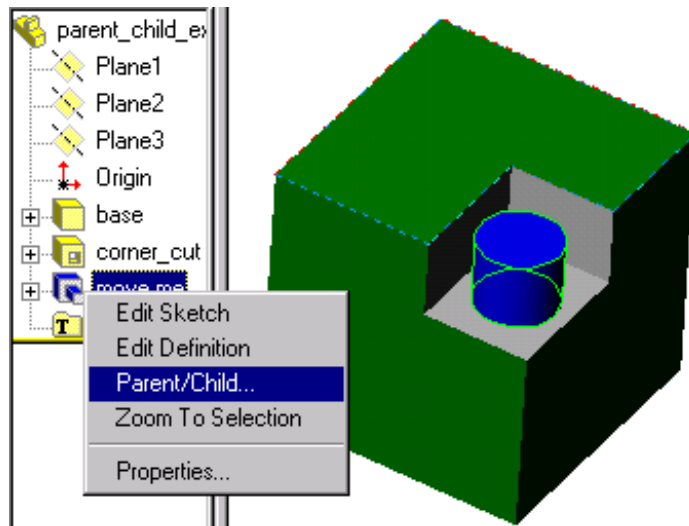
**USE RELATIONS TO FORCE INTENT**

**CORRECT**





# Parent - Child Relationships & Changing Design Intent



base



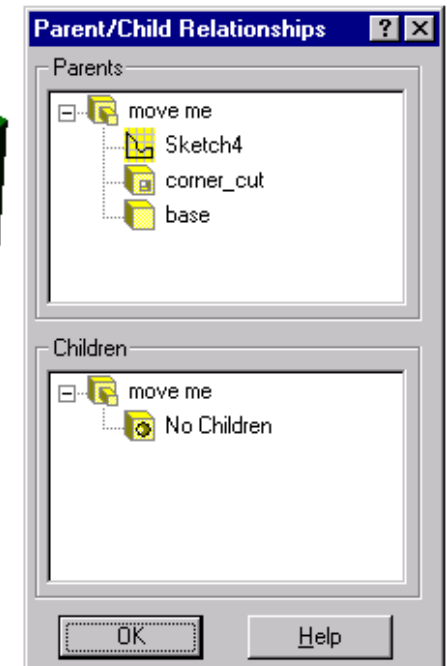
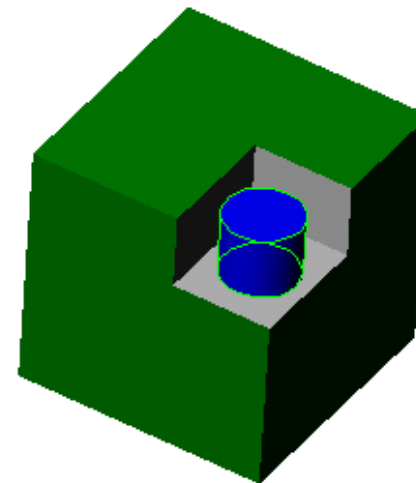
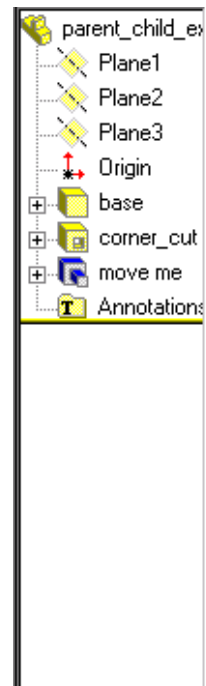
corner cut



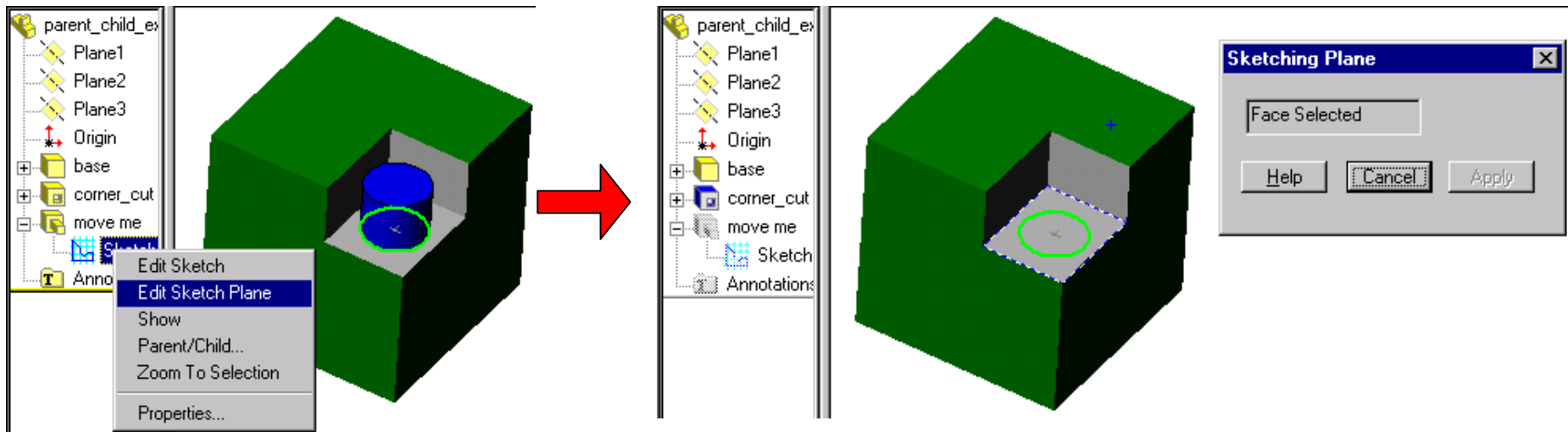
move me

1. “move me” sketch is on the surface of the corner\_cut, so it is a child of the corner cut

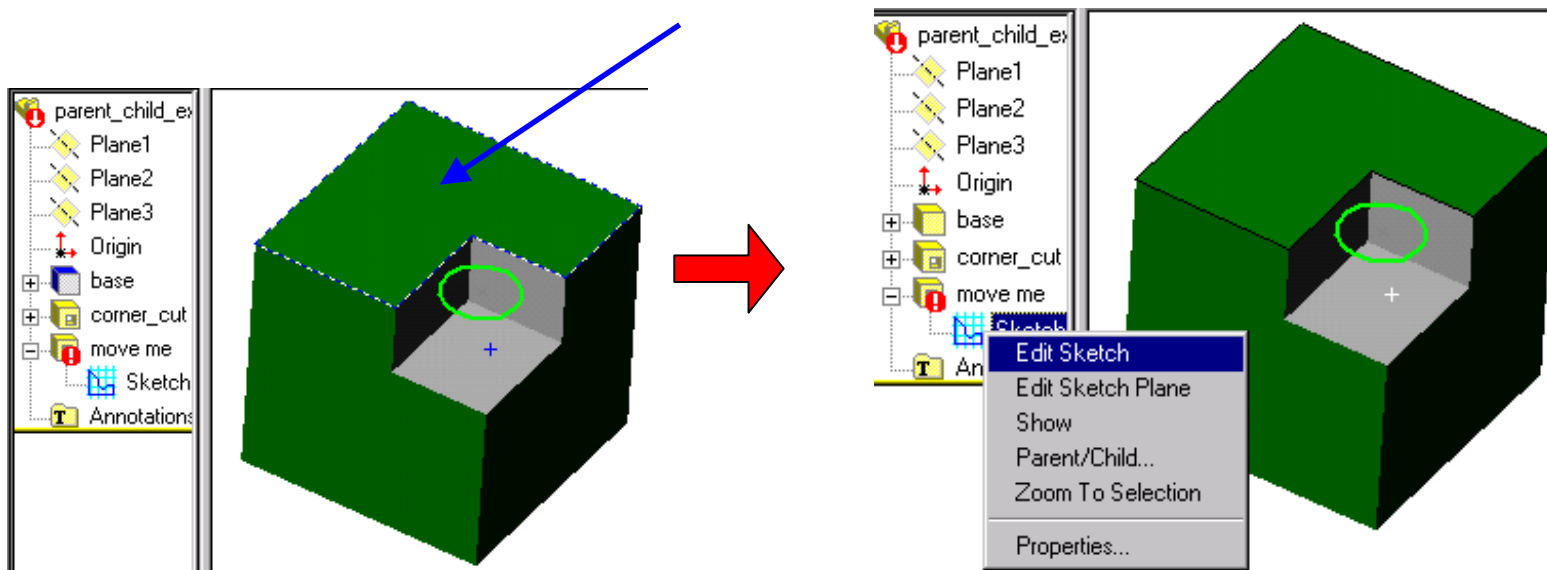
2. Corner cut sketch is on a face of the base, so it is a child of the base



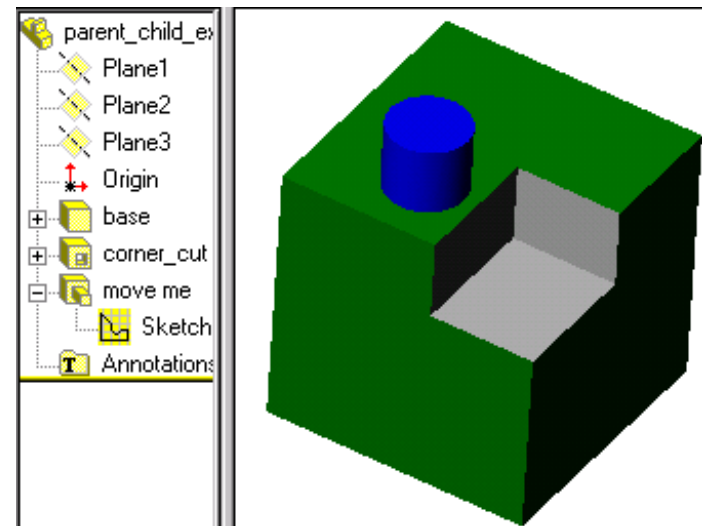
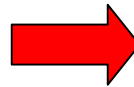
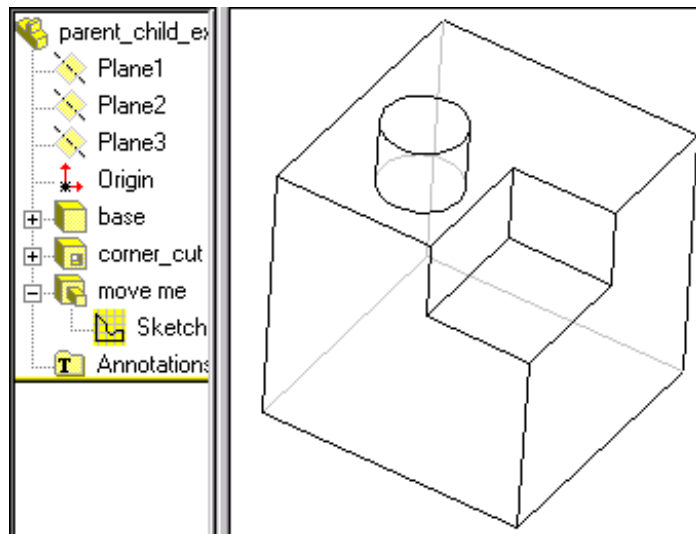
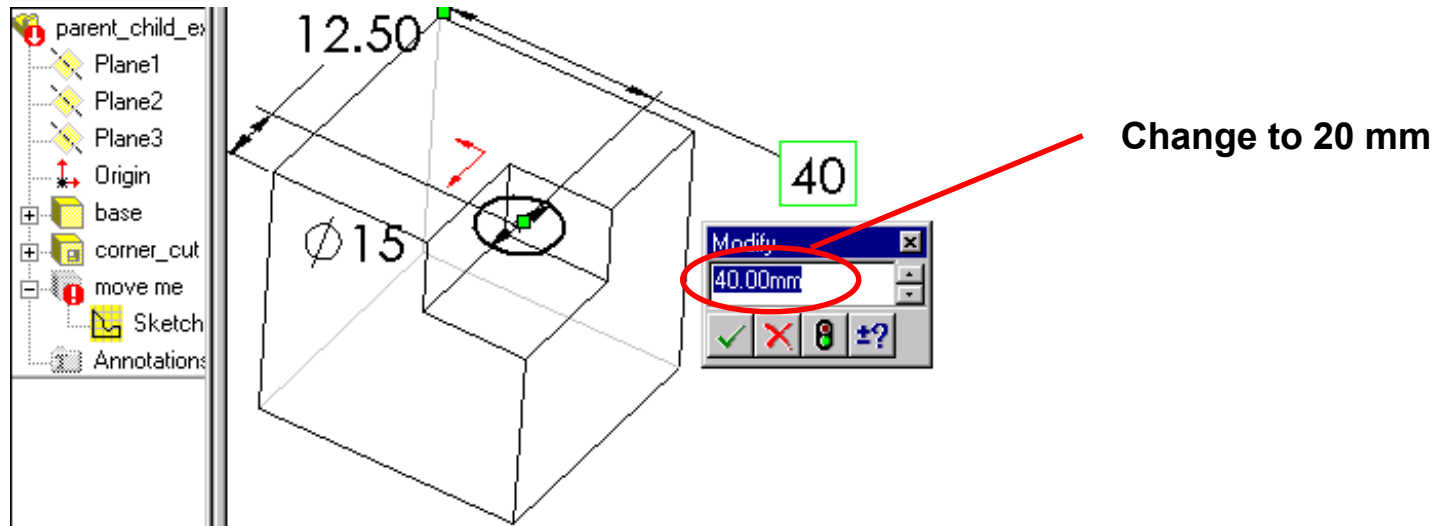
# Parent - Child Relationships & Changing Design Intent



Select



# Parent - Child Relationships & Changing Design Intent



# Symmetric Design Intent in Assemblies: Exercise

1. **YOU SHOULD HAVE DOWNLOADED THE SHAFT AND GEAR FROM THE WEB SITE**
2. **MAKE THE KEY BY YOURSELF ( 0.0125" Diameter x 0.5" Long).**
3. **ASSEMBLE THE GEAR-KEY-SHAFT, THEN ASK ME TO CHECK OFF**

