

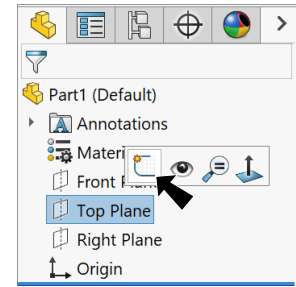


**A. Extrude1 Sketch1 Body.**

Step 1. Click **New**  on the Standard toolbar, click **Part Metric**  and OK.

Step 2. Click **Top Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 1**.



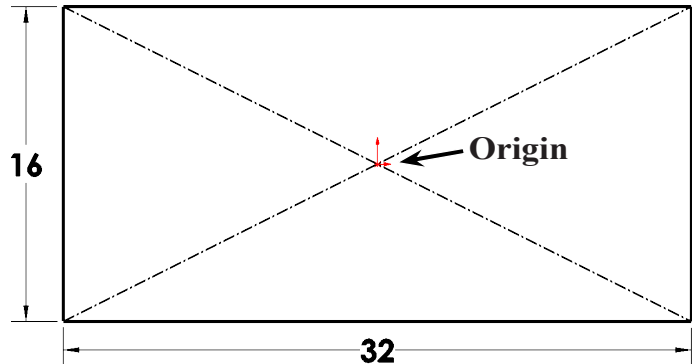
**Fig. 1**

Step 3. Click **Center Rectangle**  in the **Rectangle flyout**  on the Sketch toolbar.

Step 4. Sketch **center rectangle at the Origin** , **Fig. 2**.

Step 5. Click **Smart Dimension**  (S) on the Sketch toolbar.



Step 6. Add dimensions, **Fig. 2**.

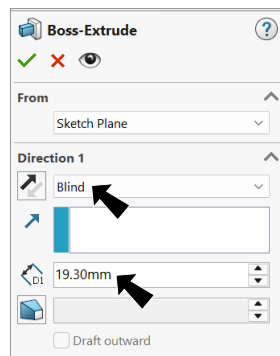


**Fig. 2**

Step 7. Click **Features**  on the Command Manager toolbar.

Step 8. Click **Extruded Boss/Base**  on the Features toolbar.

Step 9. In the Boss-Extrude Property Manager set:  
 under Direction 1, **Fig. 3**  
 End Condition **Blind**  
 Depth  **19.3**  
 click OK .

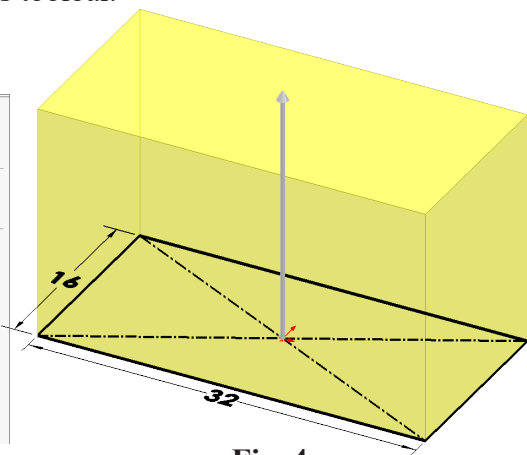


**Fig. 3**

**B. Save as "MOTOR".**

Step 1. Click File Menu > Save As.

Step 2. Key-in **MOTOR** for the filename and press ENTER.

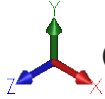


**Fig. 4**

## C. Extruded Cut 1 Sketch2 Cable Jack Outlet 1.

Step 1. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 2. Rotate view to **left side face**, **Fig. 5**. To rotate view, **Ctrl-Shift** click the **Y axis** of the **Reference Triad**



(bottom left corner of graphics area).

Face →

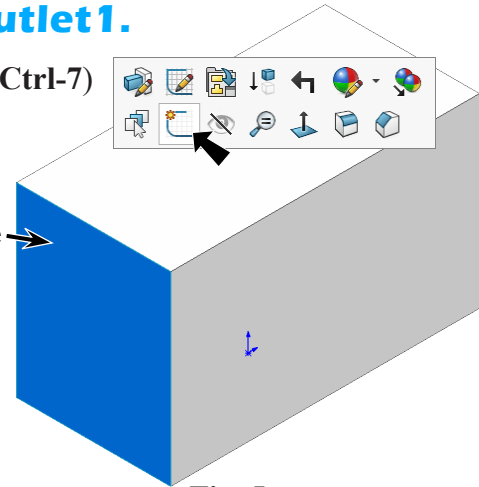
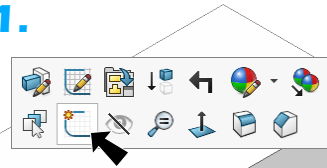









Fig. 5

Step 3. Click the **left side face** and click **Sketch**  on the context toolbar, **Fig. 5**.

Step 4. Click **Corner Rectangle**  in the **Rectangle flyout**  on the Sketch toolbar.

Step 5. Sketch a **corner rectangle**, **Fig. 6**.

Step 6. **Unselect Rectangle tool**. To unselect, right click graphics area and click **Select**  from menu.

Step 7. **Ctrl** click **midpoint**  of a **horizontal line** and **Origin**  (blue) to select both. Release **Ctrl** key and click **Make Vertical**  on the context toolbar, **Fig. 7**.

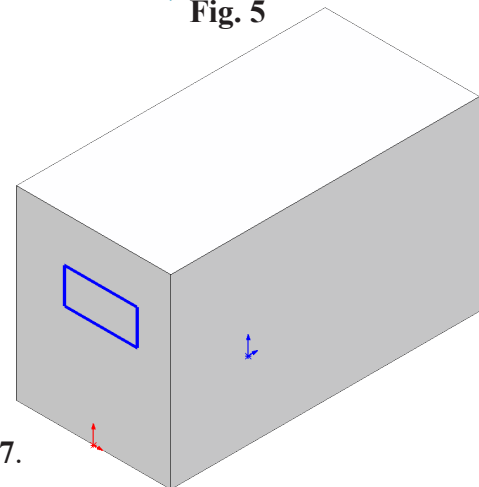


Fig. 6

Step 8. Click **Smart Dimension**



(**S**) on the Sketch toolbar.

Step 9. Add dimensions, **Fig. 8**.

Ctrl click midpoint and Origin

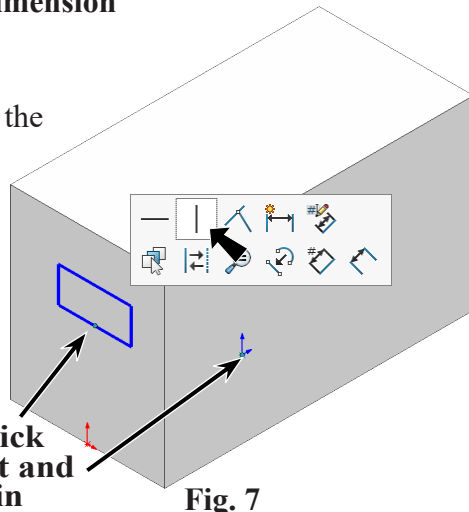
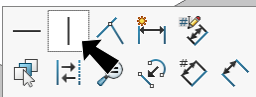


Fig. 7

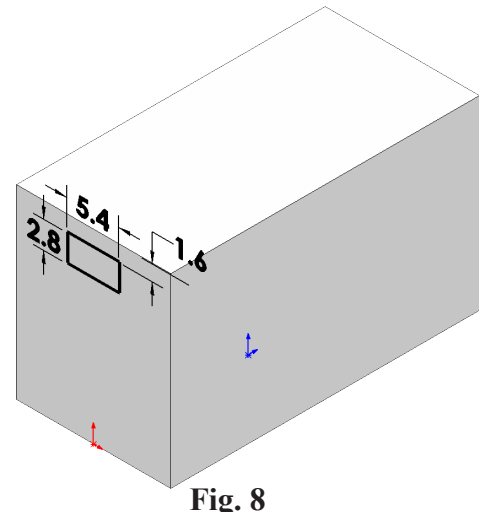
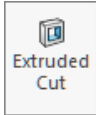


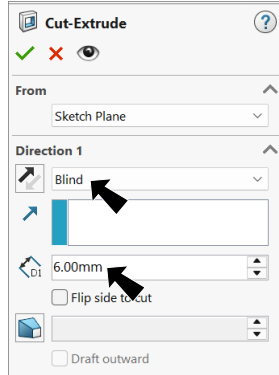
Fig. 8

Step 10. Click **Features**  on the Command Manager toolbar.

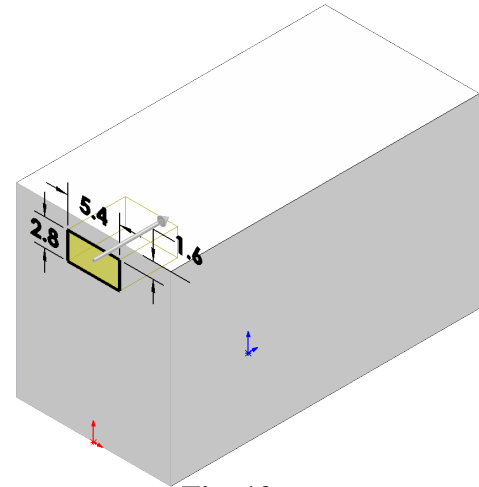
Step 11. Click **Extruded Cut**  on the Features toolbar.

Step 12. In the Cut-Extrude Property Manager set:

under Direction 1, **Fig. 9**  
**Depth**  **6**  
click **OK** .






**Fig. 9**





**Fig. 10**


### D. Copy Paste Cut-Extrude1 Cable Jack Outlet2.

Step 1. Copy **Cut-Extrude1** . To copy, click **Cut-Extrude1**  in the Feature Manager and use **Ctrl-C**, **Fig. 11**.

Step 2. Paste **Cut-Extrude1**  on side face. To paste, click **side face** and **Ctrl-V**, **Fig. 12**.

Step 3. In the Copy Conformation dialog box click **Delete**, **Fig. 13**.

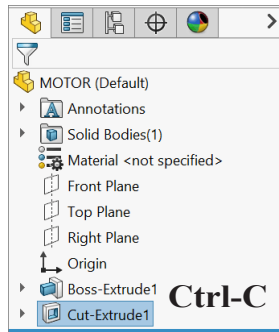
Step 4. Click **Cut-Extrude2**  in the Feature Manager and click **Edit Sketch**  on the context toolbar, **Fig. 14**.

Step 5. Click **Smart Dimension**  (S) on the Sketch toolbar.

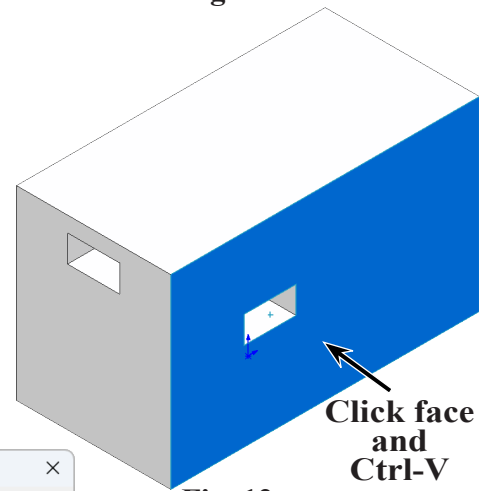
Step 6. Add dimensions, **Fig. 15**.

Step 7. Click **Exit Sketch**  on the Sketch toolbar.

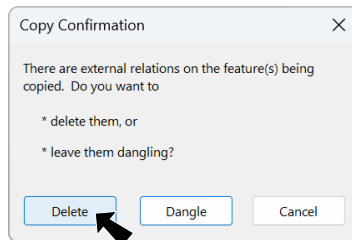
Step 8. Save  (Ctrl-S).



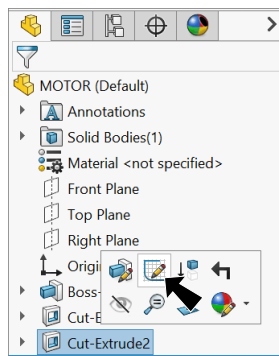
**Fig. 11**



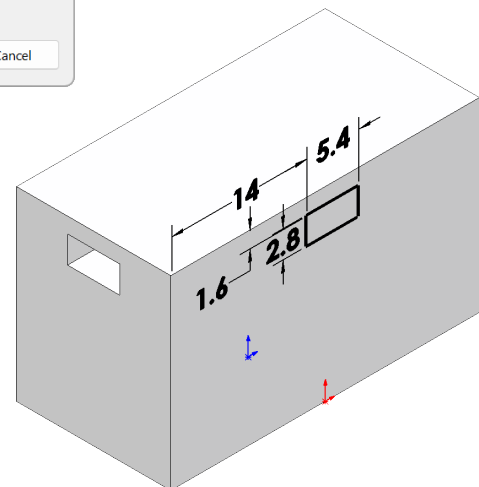
**Fig. 12**



**Fig. 13**



**Fig. 14**



**Fig. 15**

## E. Paste Cut-Extrude1 Cable Jack Outlet3.

Step 1. If necessary, copy **Cut-Extrude1** again. To copy, click **Cut-Extrude1** in the Feature Manager and use **Ctrl-C**, Fig. 16.

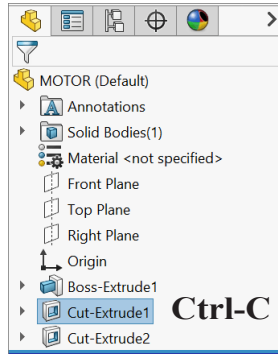


Fig. 16

Step 2. Rotate view to **left side face**, Fig. 17. To rotate view, **Shift** click the **Y** axis of the Reference Triad **three times**.

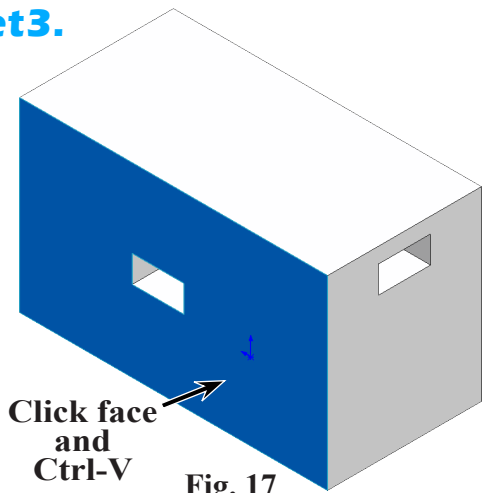
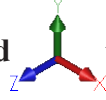


Fig. 17

Step 3. Again paste **Cut-Extrude1** on side face. Click **side face** and **Ctrl-V**, Fig. 17.

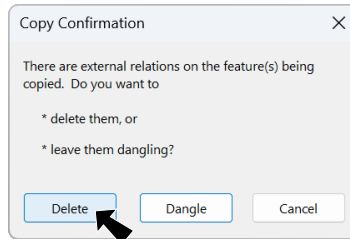


Fig. 18

Step 4. In the Copy Confirmation dialog box click **Delete**, Fig. 18.

Step 5. Click **Cut-Extrude3** in the Feature Manager and click **Edit Sketch** on the context toolbar, Fig. 19.

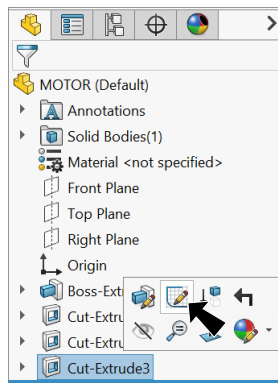


Fig. 19

Step 6. Click **Smart Dimension** (S) on the Sketch toolbar.

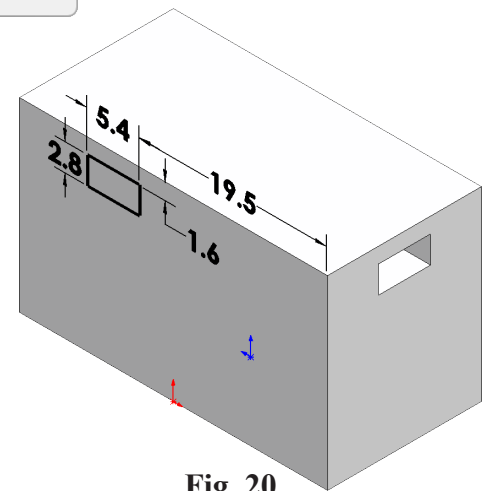


Fig. 20

Step 7. Add dimensions, Fig. 20.

Step 8. Click **Exit Sketch** on the Sketch toolbar.



Step 9. Click **Isometric** on the Standard Views toolbar. (Ctrl-7)



Step 10. Confirm Cut-Extrudes. Click **Wireframe** on the View toolbar, then switch back to **Shaded With Edges**, Fig. 21.

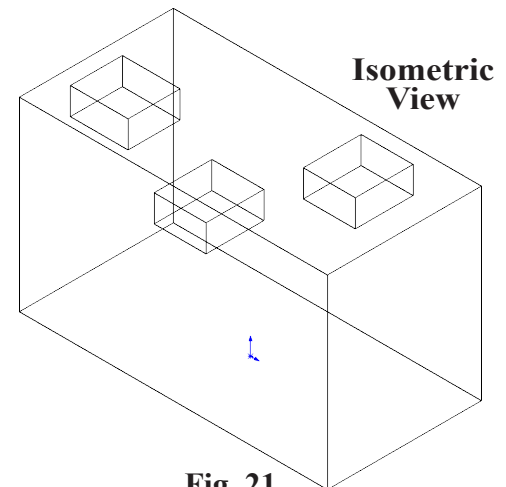



Fig. 21

Step 11. Save (Ctrl-S).




## F. Lego 2 by 4 Studs.


Step 1. Click the **top face** and click **Sketch**  on the context toolbar, **Fig. 22**.


Step 2. Click **Normal To**  on the Standard Views toolbar. (**Ctrl-8**)

Step 3. Click **Circle**  (S) on the Sketch toolbar.

Step 4. Sketch **two circles in top left quadrant**, **Fig. 23**.

Step 5. **Unselect Circle tool**. To unselect, right click graphics area and click **Select**  from menu.

Step 6. **Drag selection to left to select both circles** and click **Make Equal**  on the context toolbar, **Fig. 24**.

Step 7. **Ctrl click both circle centerpoints** to select both. Release Ctrl key and click **Make Horizontal**  on the context toolbar, **Fig. 25**.

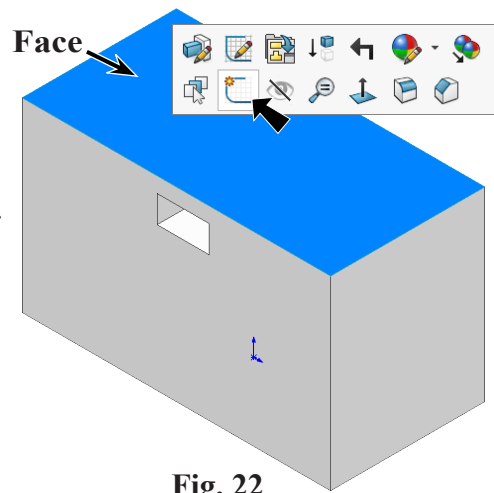


Fig. 22

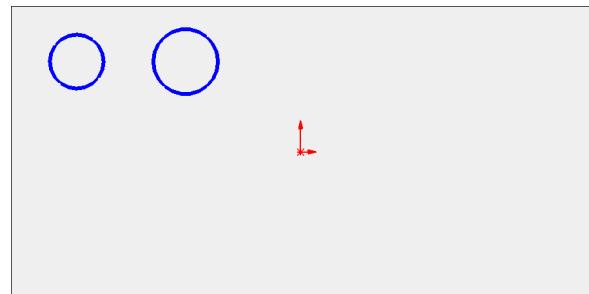


Fig. 23

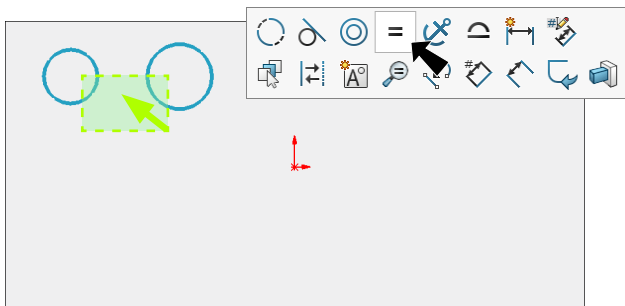


Fig. 24

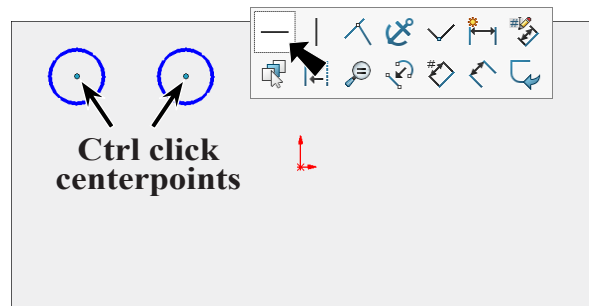
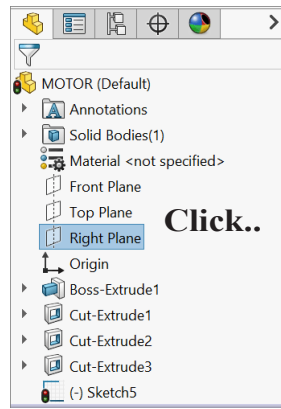


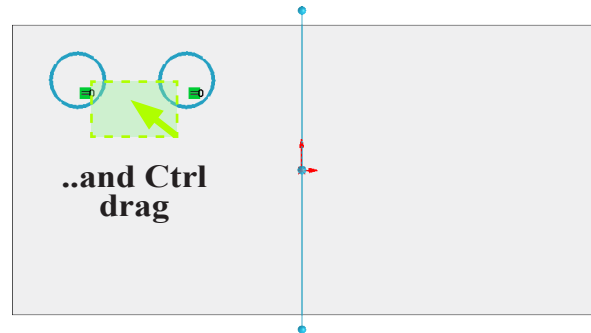
Fig. 25

Step 8. Click **Right Plane**  in the Feature Manager to select plane, **Fig. 26**.



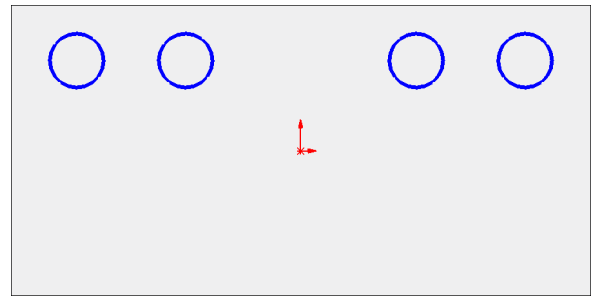
**Fig. 26**

Step 9. And **Ctrl drag** a selection to **select both circles and the Plane**, **Fig. 27**.




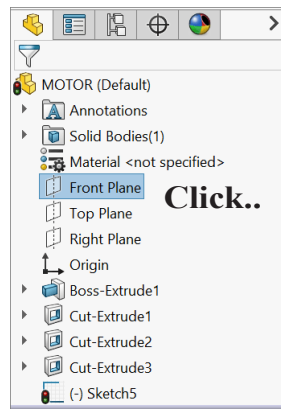
**Fig. 27**

Step 10. Click **Mirror Entities**  on the Sketch toolbar, **Fig. 28**.



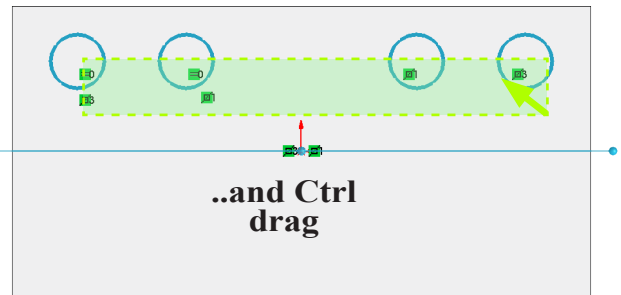
**Fig. 28**

Step 11. Click **Front Plane**  in the Feature Manager to select plane, **Fig. 29**.




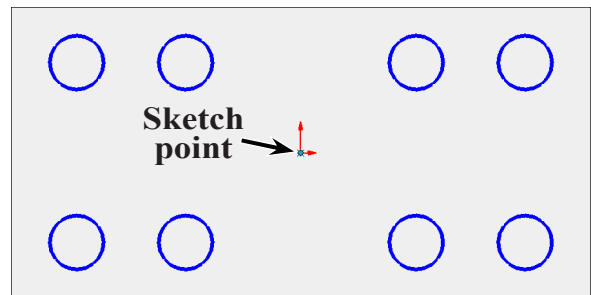
**Fig. 29**

Step 12. And **Ctrl drag** a selection to **select all circles**, **Fig. 30**.




**Fig. 30**

Step 13. Click **Mirror Entities**  on the Sketch toolbar, **Fig. 31**.



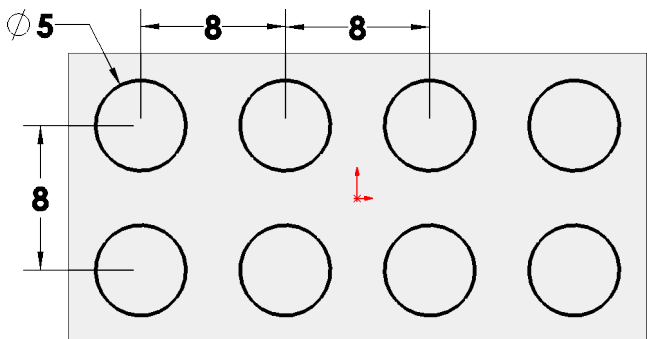
**Fig. 31**

Step 14. Click **Point**  on the Sketch toolbar.

Step 15. Sketch point at Origin , **Fig. 31**. Be care not to add any extra points.

Step 16. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 17. Add dimensions, **Fig. 32**.



**Fig. 32**

## G. Create "LEGO 2 X 4 BLOCK".

Step 1. Click Tools Menu > Blocks > Save.

Step 2. In the Save As dialog box, **Fig. 33** key-in **LEGO 2X4 BLOCK** for the filename navigate to: **Documents\Tech Ed 24-25\CCAT** click Save button.

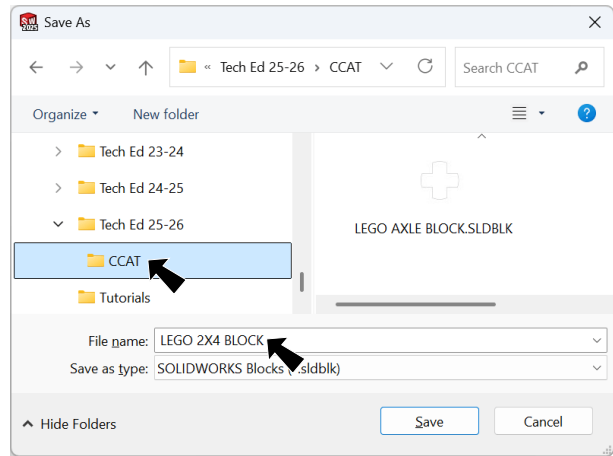





Fig. 33

## H. Extrude2 Sketch5 Studs.

Step 1. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 2. Click **Features**  on the Command Manager toolbar.

Step 3. Click **Extruded Boss/Base**  on the Features toolbar.

Step 4. In the Boss-Extrude Property Manager set: under Direction 1, **Fig. 34** End Condition **Blind** **Depth**  **1.8** click OK .

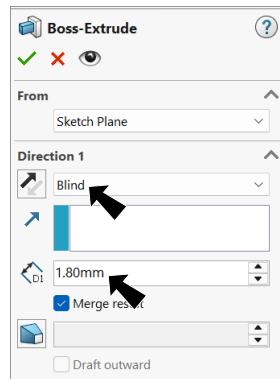


Fig. 34

Step 5. Save  (**Ctrl-S**).

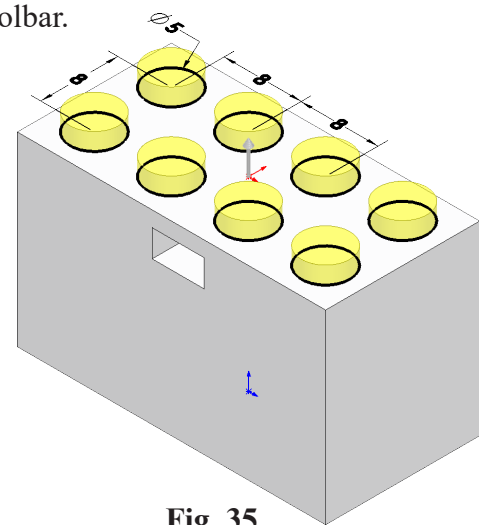

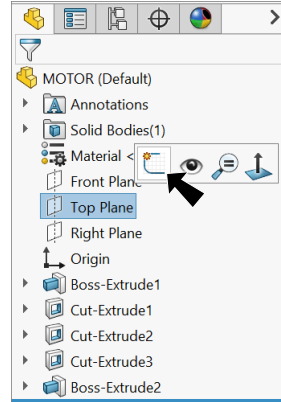



Fig. 35

## I. Extruded Cut4 Sketch6 Anti-Studs.

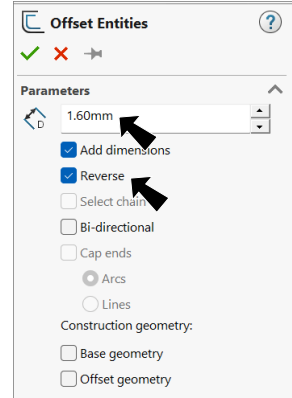
Step 1. Click **Top Plane**  in the Feature Manager and click **Sketch**  on the context toolbar, **Fig. 36**.



**Fig. 36**


Step 2. Click **Bottom**  on the Standard Views toolbar. (**Ctrl-6**)

Step 3. Click **Offset Entities**  on the Sketch toolbar.

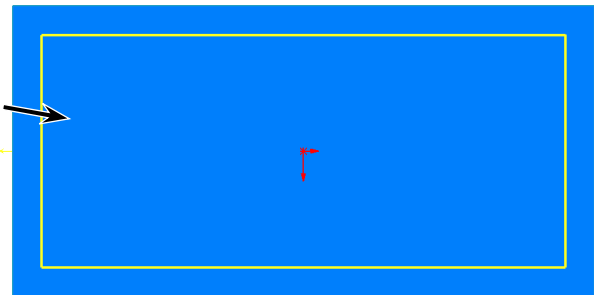


**Fig. 37**

Step 4. In the Offset Entities Property Manager set: under Parameters, **Fig. 37**

**Distance**  **1.6**  
 check **Reverse**  
 uncheck **Bi-directional**  
 click the **face**, **Fig. 38**  
**yellow offset on inside**

Face 

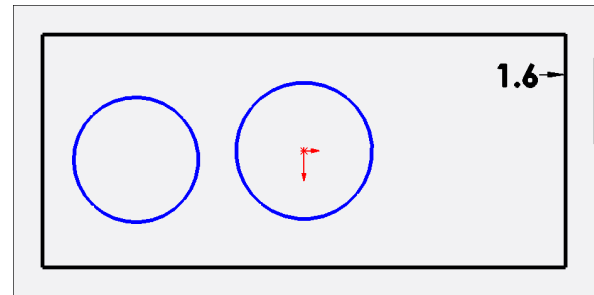


**Fig. 38**


click OK .


Step 5. Click **Circle**  (S) on the Sketch toolbar.

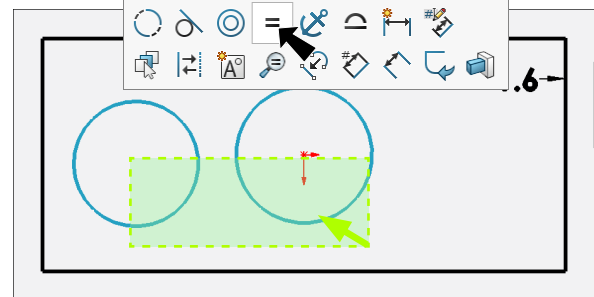
Step 6. Sketch **two circles with one at Origin** , **Fig. 39**.




**Fig. 39**

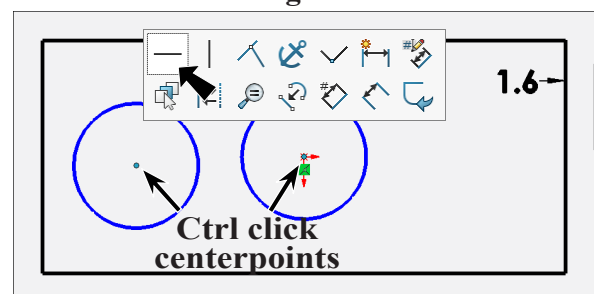
Step 7. **Unselect Circle tool**. To unselect, right click graphics area and click **Select**  from menu.

Step 8. **Drag selection to left to select both circles** and click **Make Equal**  on the context toolbar, **Fig. 40**.



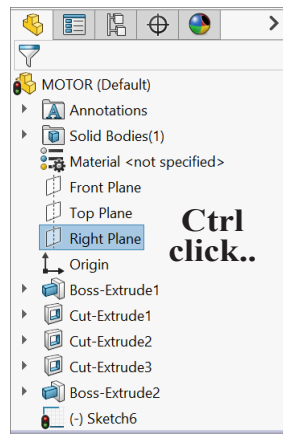
**Fig. 40**

Step 9. **Ctrl click both circle centerpoints** to select both. Release Ctrl key and click **Make Horizontal**  on the context toolbar, **Fig. 41**.



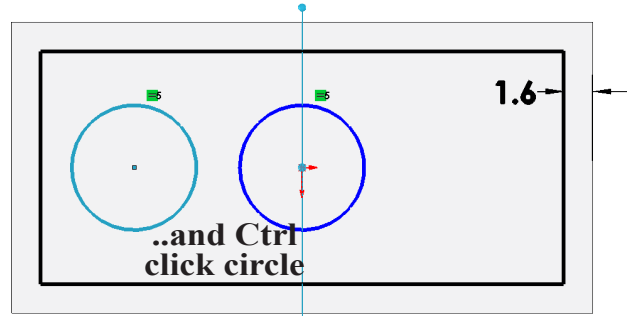
**Fig. 41**

Step 10. Click **Right Plane** in the Feature Manager to select plane, **Fig. 42**.



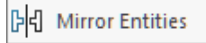
**Fig. 42**

Step 11. **Ctrl click left circle**, **Fig. 43**.

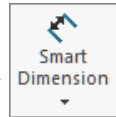


**Fig. 43**

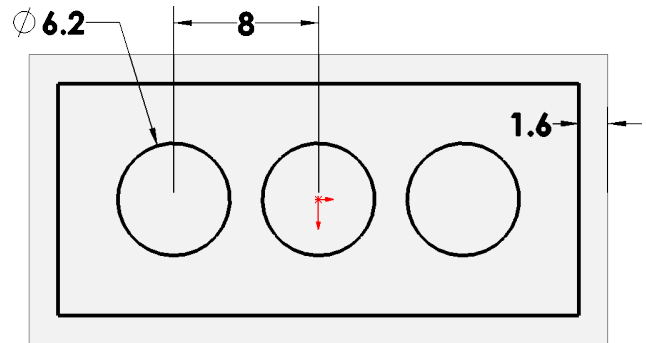
Step 12. Click **Mirror Entities** on the Sketch toolbar.



Step 13. Click **Smart Dimension (S)** on the Sketch toolbar.



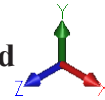
Step 14. Add dimensions, **Fig. 44**.



**Fig. 44**

Step 15. Rotate view to bottom, **Fig. 46**. To rotate view, click **Isometric** on the Standard Views toolbar (Ctrl-7), then **Shift click the X axis of the Reference Triad two times**.

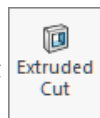
Views toolbar (Ctrl-7), then **Shift click the X axis of the Reference Triad two times**.



Step 16. Click **Features** on the Command Manager toolbar.

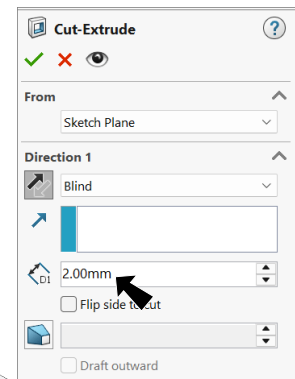


Step 17. Click **Extruded Cut** on the Features toolbar.



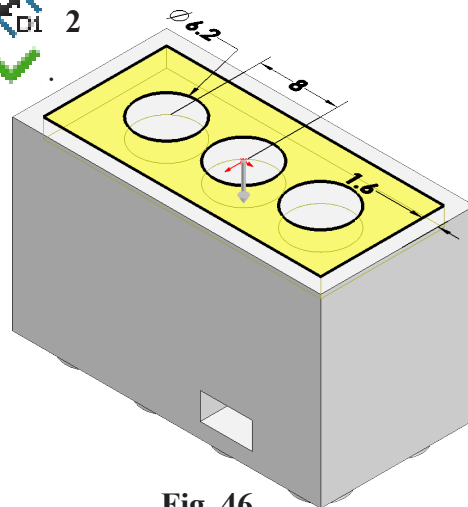
Step 18. In the Cut-Extrude Property Manager set: **Depth 2** under Direction 1, **Fig. 45**

**Depth 2**  
click OK

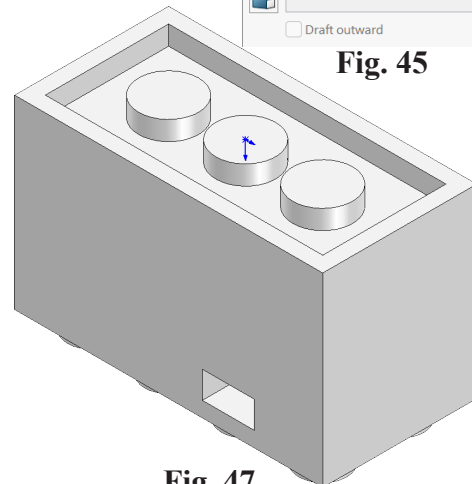


**Fig. 45**

Step 19. Save **(Ctrl-S)**.



**Fig. 46**



**Fig. 47**


## J. Insert LEGO AXLE Block and Cut.



Step 1. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

Step 2. Click the **right side face** and click **Sketch**  on the context toolbar, **Fig. 48**.

Step 3. Click Tools Menu > Blocks > Insert.

Step 4. In Insert Block Property Manager, click **Browse**, **Fig. 49** in the Open dialog box, navigate to **Documents\Tech Ed 24-25\CCAT** and open **LEGO AXLE BLOCK** file, **Fig. 50**


click **above Origin** , **Fig. 51** under Parameters


**Block Scale**  **1**  
**Block Rotation**  **0°**

click **OK** .

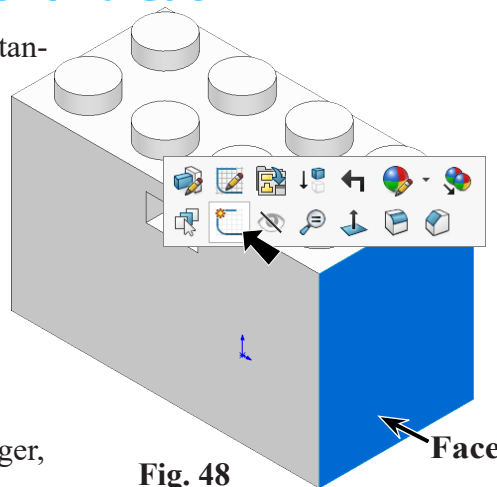
Step 5. **Ctrl click centerpoint of block** and

**Origin** (blue) to select both. Release Ctrl key and click

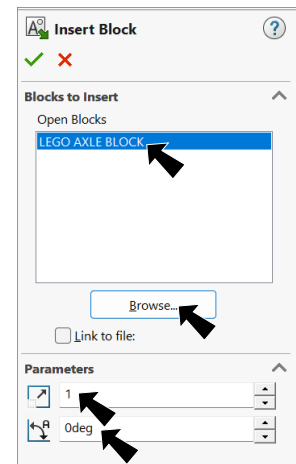
**Make Vertical**  on the context toolbar, **Fig. 52**.

Step 6. Click **Smart Dimension**  (S) on the Sketch toolbar.

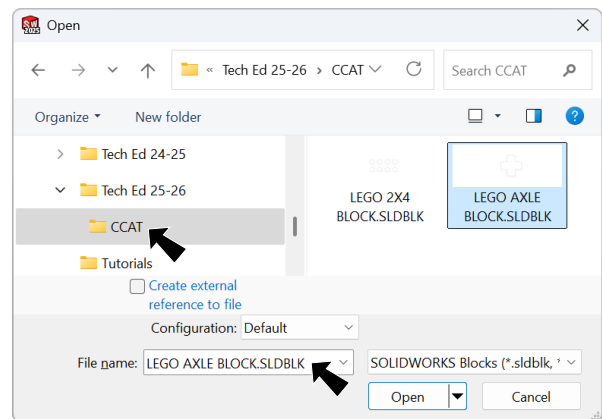
Step 7. Add dimension, **Fig. 53**.



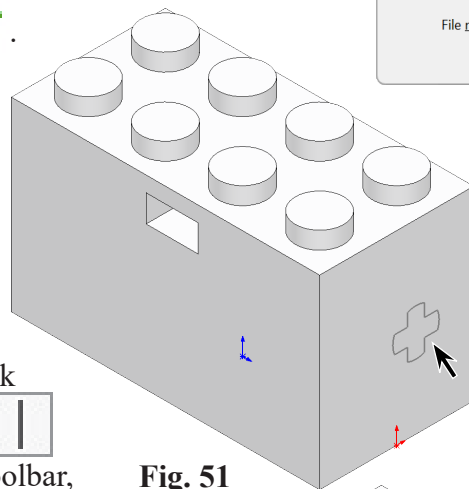
**Fig. 48**



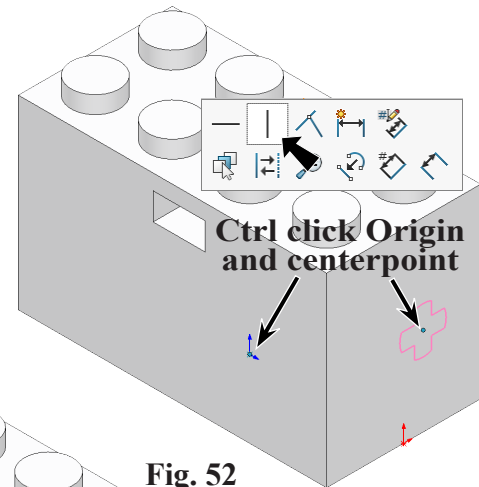
**Fig. 49**



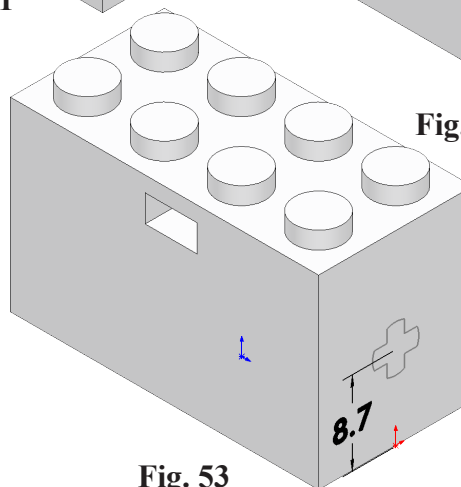
**Fig. 50**



**Fig. 51**



**Fig. 52**



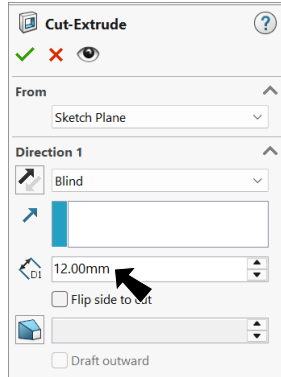
**Fig. 53**

Step 8. Click **Features**  on the Command Manager toolbar.

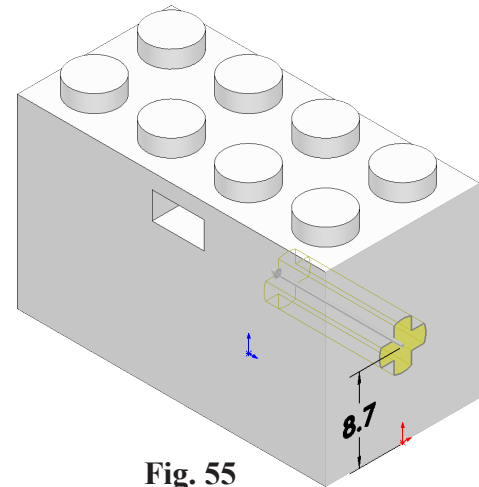
Step 9. Click **Extruded Cut**  on the Features toolbar.

Step 10. In the Cut-Extrude Property Manager set:  
under Direction 1, **Fig. 54**

**Depth**  **12**  
click OK .





**Fig. 54**



**Fig. 55**

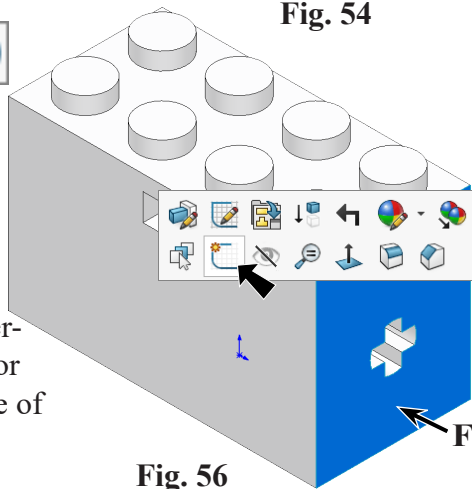
### **K. Split Line.**

Step 1. Click the **right side face** and  
click **Sketch**  on the con-  
text toolbar, **Fig. 56**.

Step 2. Click **Circle**   
(S) on the  
Sketch toolbar.

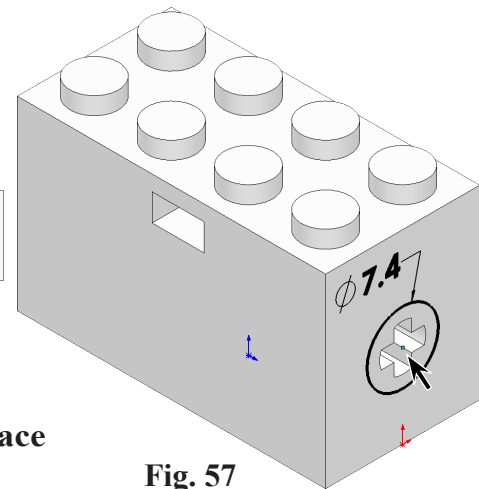
Step 3. Sketch **circle at  
centerpoint of  
block**, **Fig. 57**.

To wake up center-  
point, hover cursor  
over circular edge of  
cut.



**Fig. 56**

**Face**



**Fig. 57**



Step 4. Click **Smart Dimension**  (S) on the Sketch toolbar.

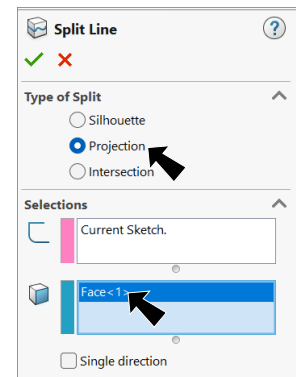
Step 5. Dimension **diameter 7.4**, **Fig. 57**.

Step 6. Click Insert Menu > Curve > Split Line.

Step 7. In the Split Line Property Manager:  
under Type of Split, **Fig. 58**  
select **Projection**

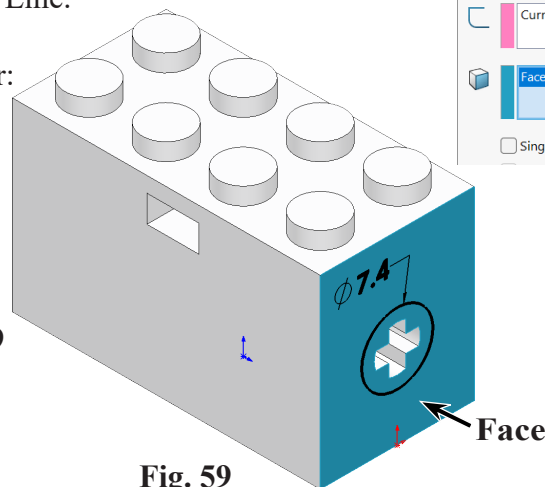
under Selections   
**Sketch** should be selected

in the Faces to Split field   
click **right side face**, **Fig. 59**  
click OK .



**Fig. 58**

Step 8. Save  (Ctrl-S).



**Fig. 59**

**Face**

## L. Fillets 1-3.

Step 1. Click **Fillet**  on the Features toolbar.

Step 2. In the Fillet Property Manager set:  
select **FilletXpert**, **Fig. 60**

① **Radius**  **.5**

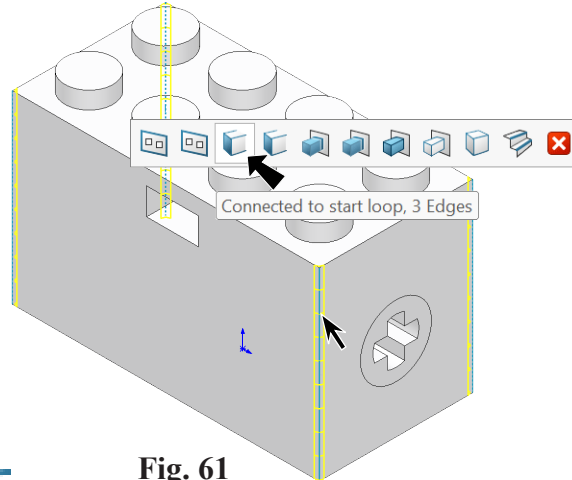
click **vertical edge of Motor (1)**, **Fig. 61**

click **Connected to start loop**  **3 edges** on the Fillet pop-up

click **Apply**

**Radius .5**

①



**Fig. 61**

② **Radius**  **.4**

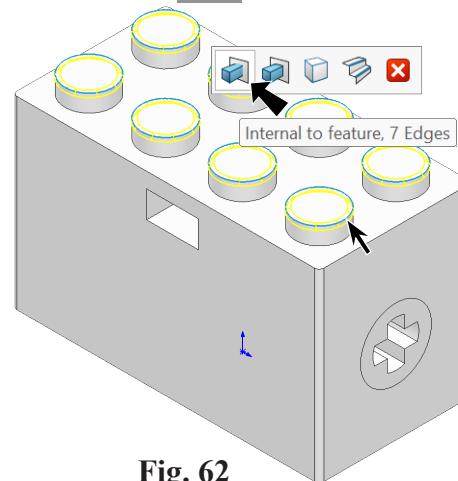
click **top edge of a stud**, **Fig. 62**

click **Internal to feature**  **7 edges** on the Fillet pop-up

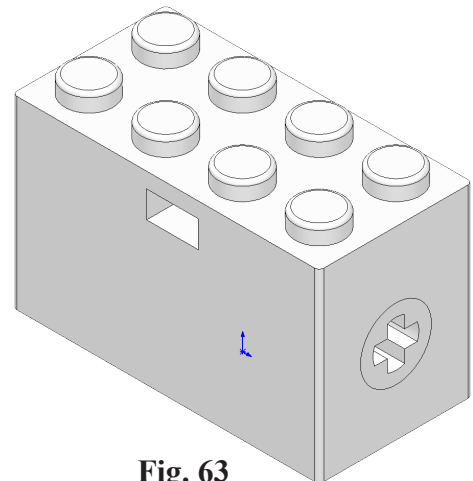
click **Apply**

**Radius .4**

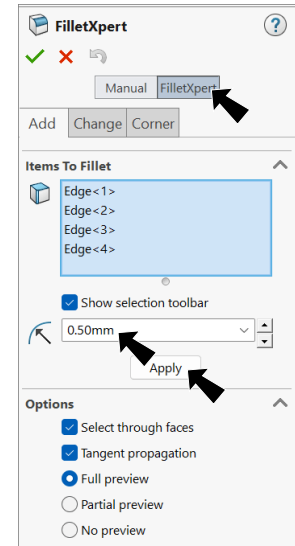
②



**Fig. 62**






**Fig. 63**



**Fig. 60**

Rotate view to bottom, **Fig. 64**. To rotate view, **Shift click the X axis of the Reference**

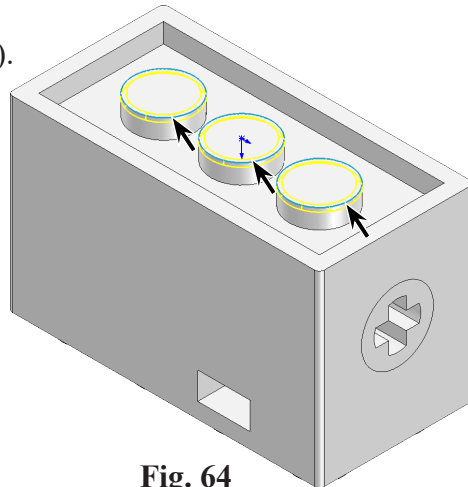
**Triad**  **two times.**

③ **Radius**  **.4**  
click **top edge of the three studs (3)**, **Fig. 64**  
click **OK** .

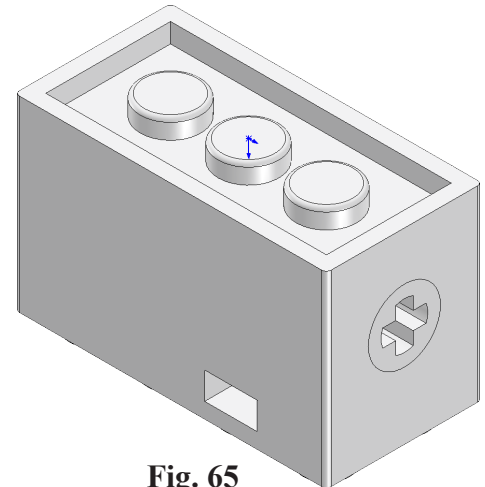
Step 3. Save  (**Ctrl-S**).

**Radius .4**

③




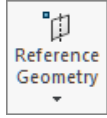
**Fig. 64**




**Fig. 65**

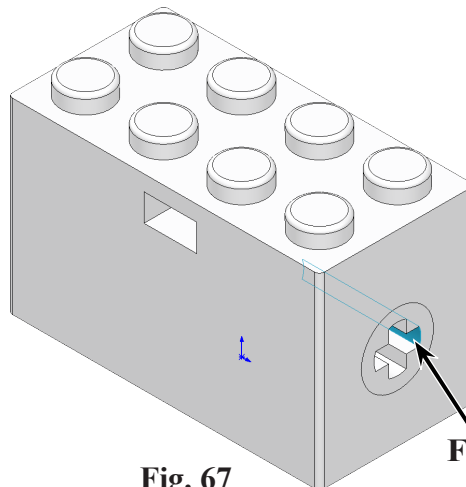
## **M. Mate References.**

Step 1. Click **Isometric**  on the Standard Views toolbar. (**Ctrl-7**)

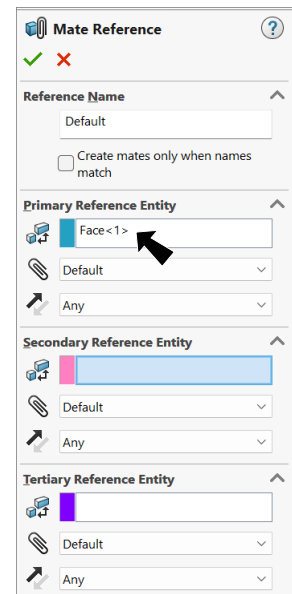
Step 2. Click **Reference Geometry**  on the Features toolbar and **Mate Reference** from the menu.

Step 3. In the Mate Reference Manager set:  
under **Primary Reference Entity**  
click a **cylindrical face of Lego Axle cut**, **Fig. 67**  
click **OK** .

Step 4. Save  (**Ctrl-S**).



**Fig. 67**



**Fig. 66**

## N. Motor and Split Line Appearance.

Step 1. Click the Motor to select part, click **Appearances**

**Callout**  on the context toolbar and click **Motor** , Fig. 68.

Step 2. In the Appearances Task pane, expand **Plastic**, click **Medium Gloss** and in the lower pane select **white medium gloss plastic**, Fig. 69.

Step 3. In the Appearances Property Manager, under Color, Fig. 70


set **RGB** values

**R 228**

**G 228**

**B 228**

Click **Keep Visible**  and **OK** .

The Push Pin  on allows selection of other appearance.

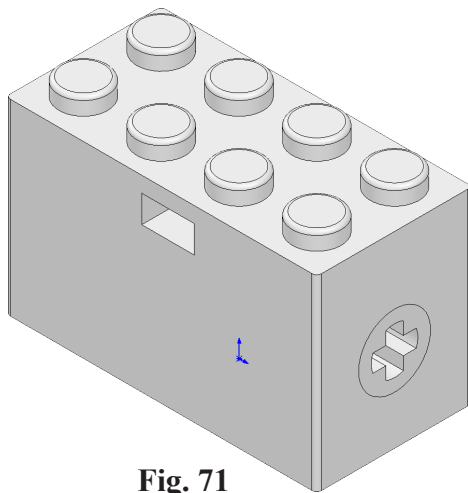


Fig. 71

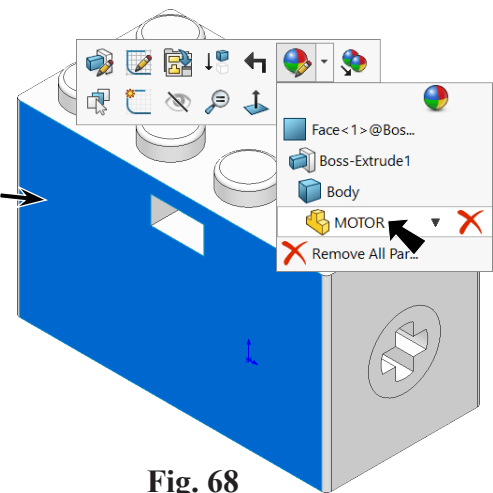


Fig. 68

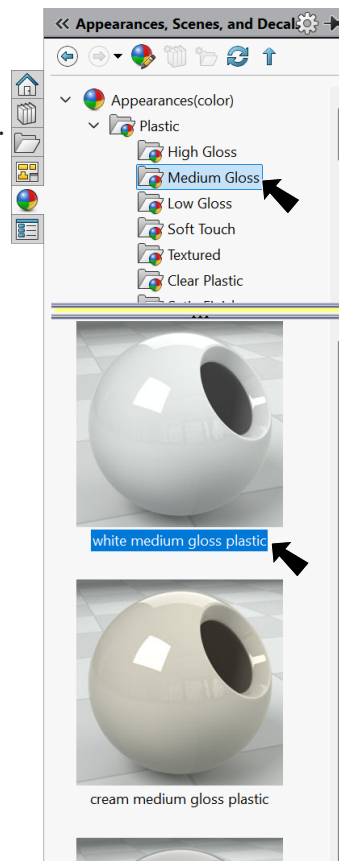


Fig. 69

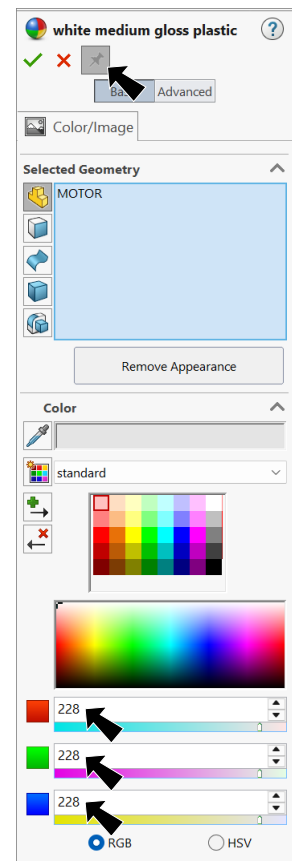


Fig. 70

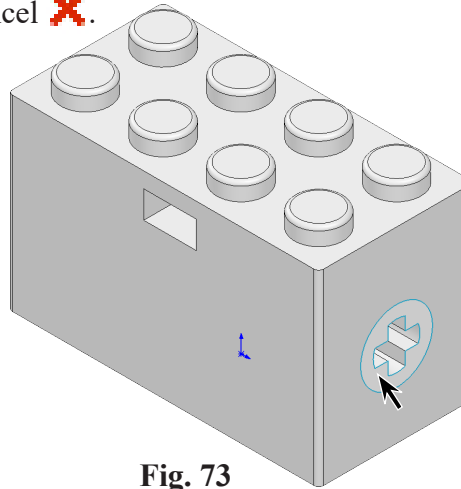
Step 4. In the Appearances Property Manager, under Selected Geometry

click **Select Faces** , **Fig. 72**  
click the **split line face**, **Fig. 73**

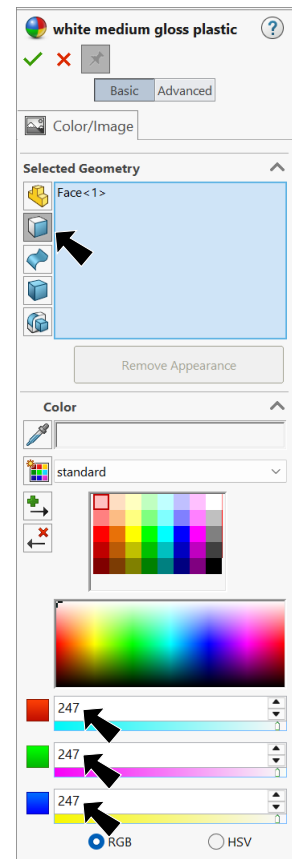
under Color  
set **RGB values**  
**R 247**  
**G 247**  
**B 247**

click OK  and click Cancel .

Step 5. Save  (Ctrl-S).



**Fig. 73**



**Fig. 72**