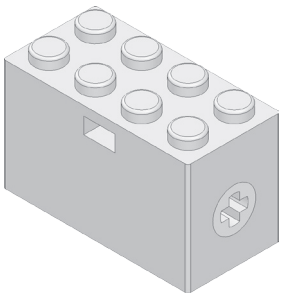
Chapter 13

Circuit Cubes All Terrain

Motor



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**.

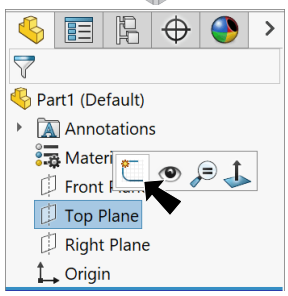


Fig. 1

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**.

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

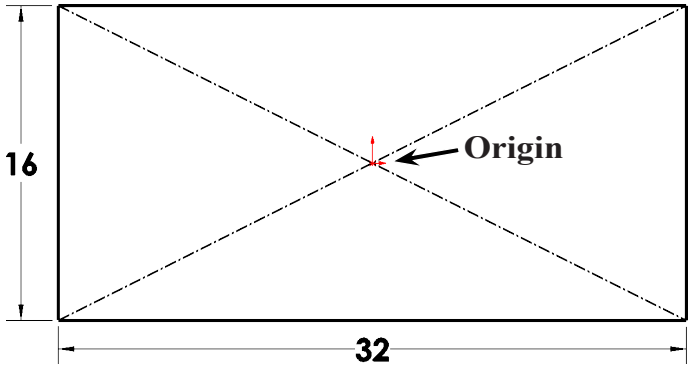


Fig. 2

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 .

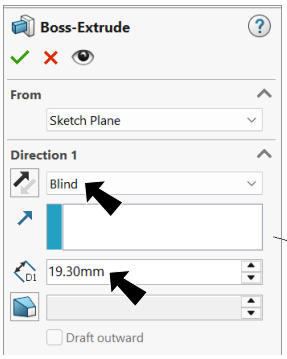


Fig. 3

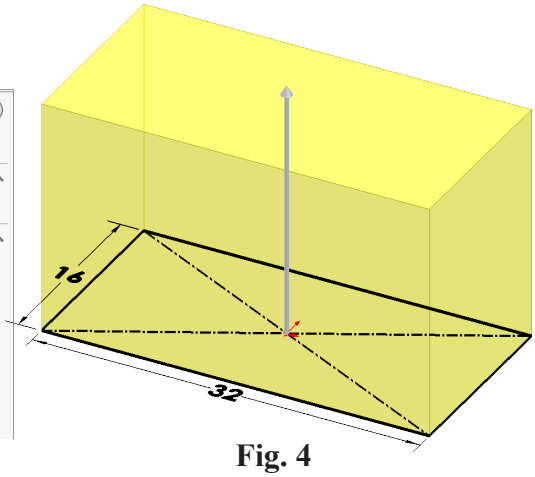


Fig. 4

B. Save as "MOTOR".

Step 1. Click File Menu > Save As.

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

http://www.cudacountry.net email:cudacountry@hotmail.com

C. Extruded Cut1 Sketch2 Cable Jack Outlet1.

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).

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

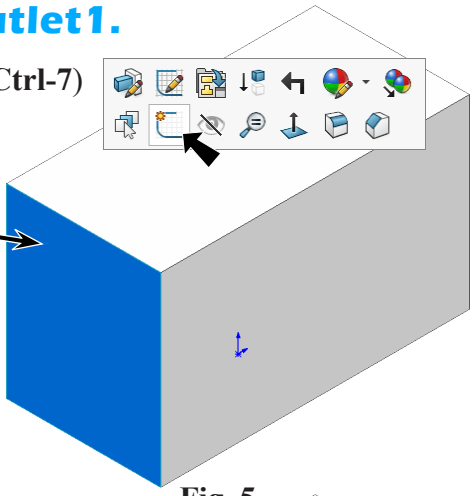


Fig. 5

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.

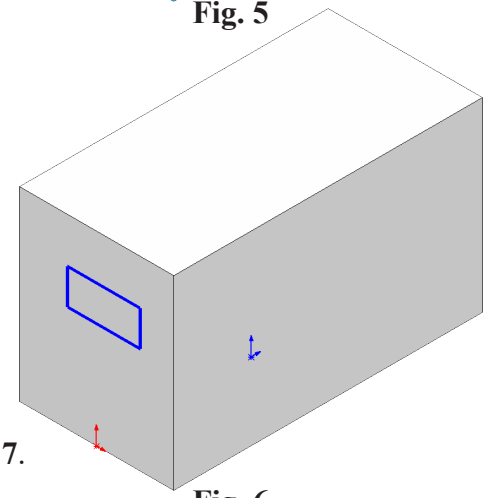


Fig. 6

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**.

Step 8. Click **Smart Dimension** (**S**) on the Sketch toolbar.

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

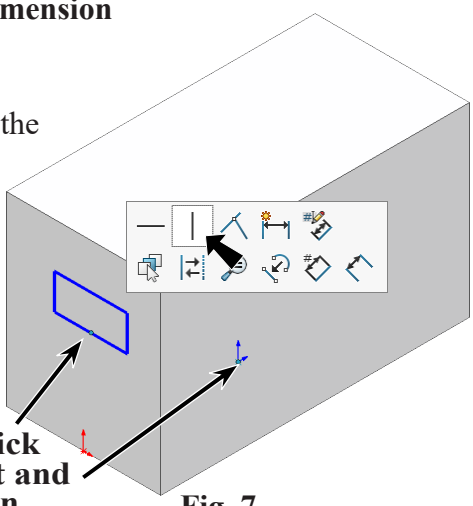


Fig. 7

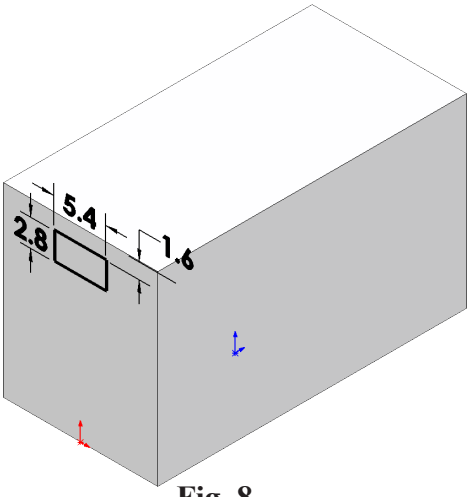


Fig. 8

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

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

Step 12. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 9**
Depth D1 **6**
click OK .

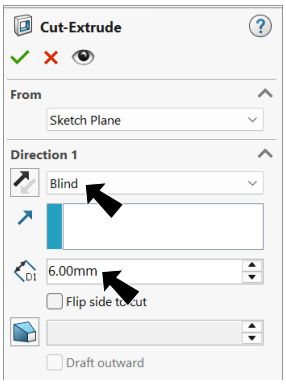


Fig. 9

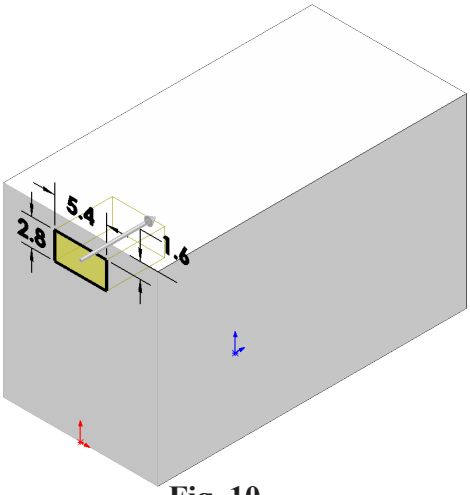


Fig. 10

D. Copy Paste Cut-Extrude1 Cable Jack Outlet2.

Step 1. Copy **Cut-Exturde1** . To copy, click **Cut-Exturde1** in the Feature Manager and use **Ctrl-C**, **Fig. 11**.

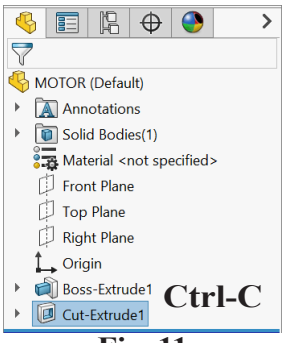


Fig. 11

Step 2. Paste **Cut-Exturde1** on side face. To paste, click **side face and Ctrl-V**, **Fig. 12**.

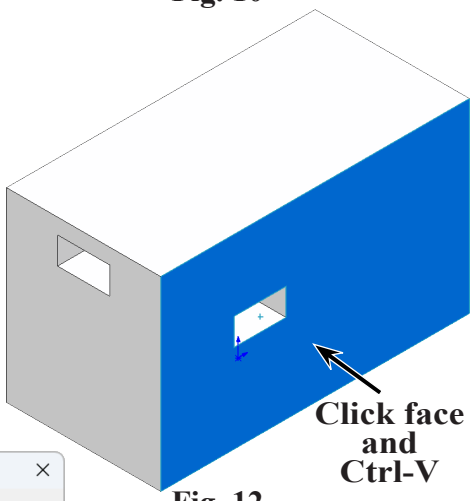


Fig. 12

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

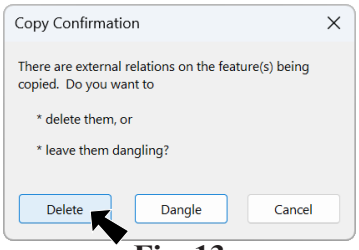


Fig. 13

Step 4. Click **Cut-Exturde2** in the Feature Manager and click **Edit Sketch** on the context toolbar, **Fig. 14**.

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

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

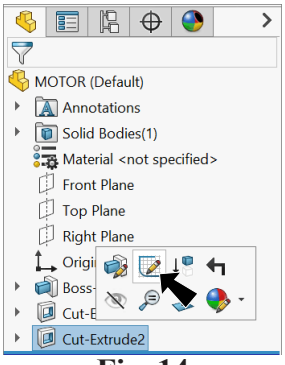


Fig. 14

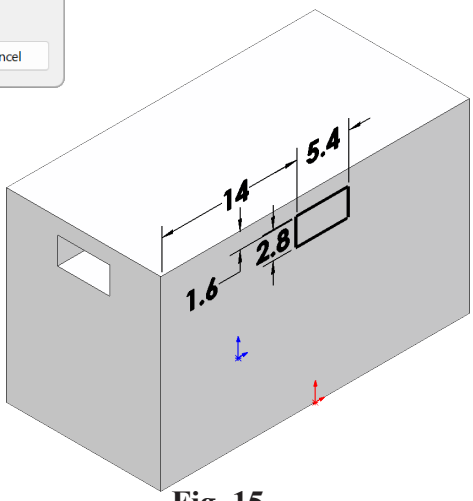


Fig. 15

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

Step 8. Save **(Ctrl-S)**.

E. Paste Cut-Extrude1 Cable Jack Outlet3.

Step 1. If necessary, copy **Cut-Exturde1** again. To copy, click **Cut-Exturde1** in the Feature Manager and use **Ctrl-C**, **Fig. 16**.

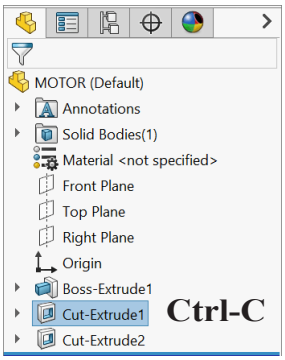
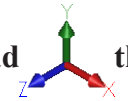


Fig. 16

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

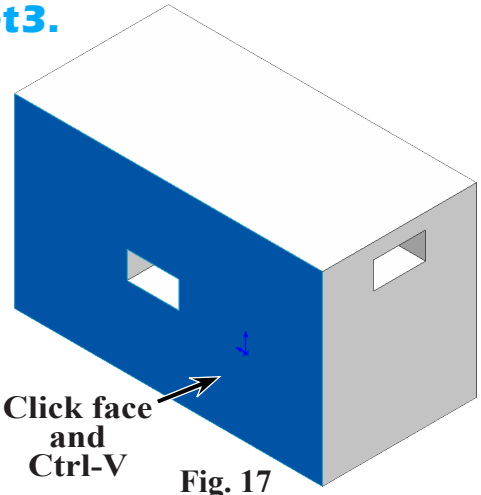


Fig. 17

Step 3. Again paste **Cut-Exturde1** on side face. Click **side face and Ctrl-V**, **Fig. 17**.

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

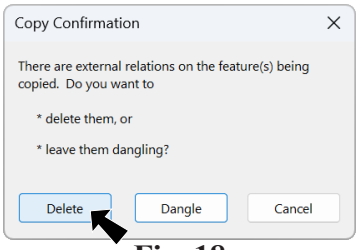


Fig. 18

Step 5. Click **Cut-Exturde3** in the Feature Manager and click **Edit Sketch** on the context toolbar, **Fig. 19**.

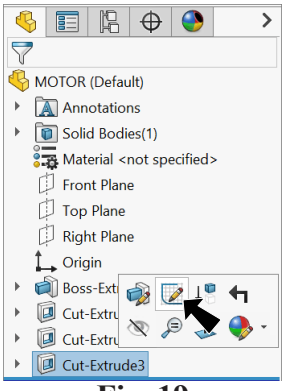


Fig. 19

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

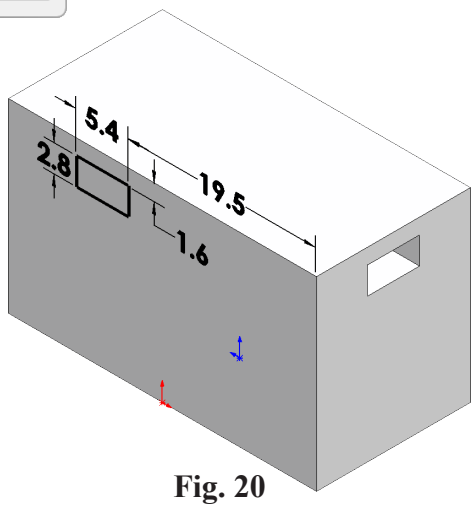


Fig. 20

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)**

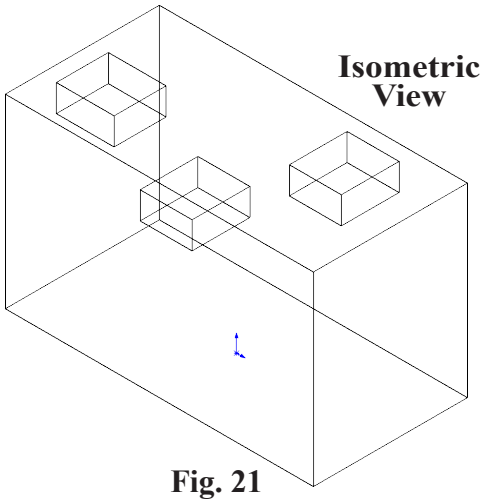


Fig. 21

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

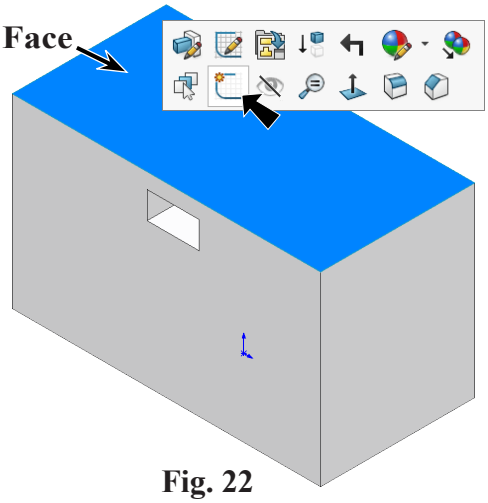


Fig. 22

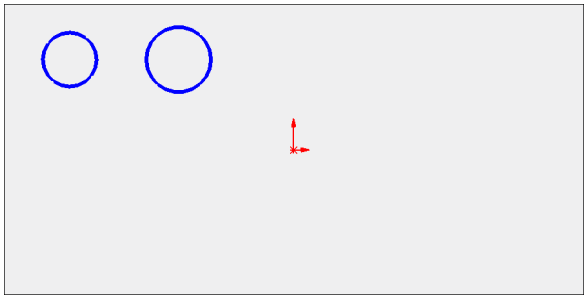


Fig. 23

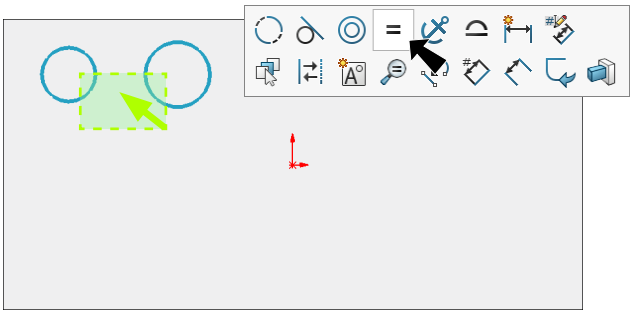


Fig. 24

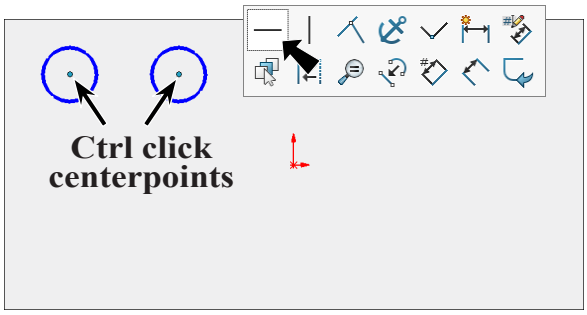


Fig. 25

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

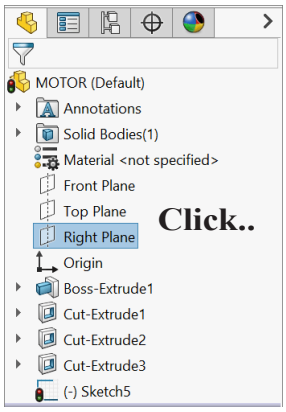


Fig. 26

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

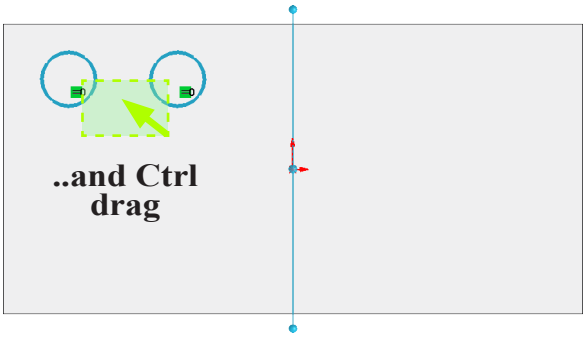


Fig. 27

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

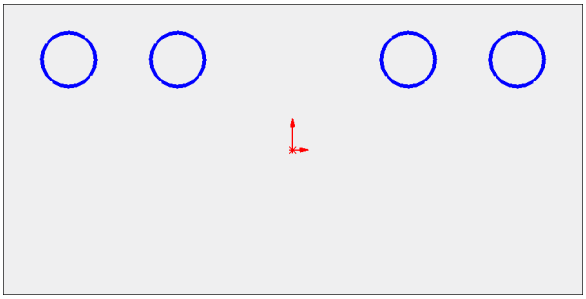


Fig. 28

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

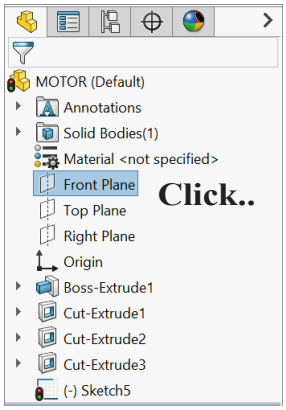


Fig. 29

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

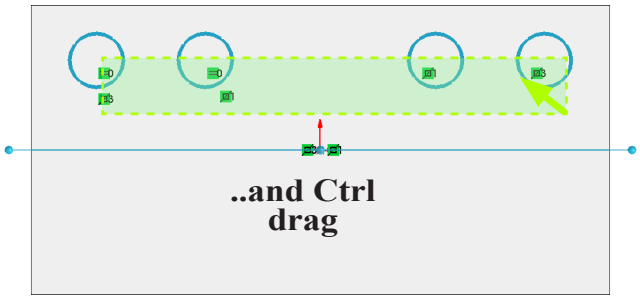


Fig. 30

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

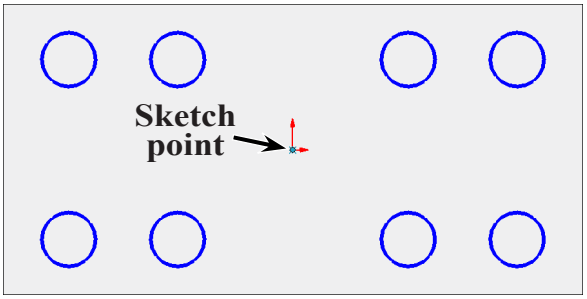


Fig. 31

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

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

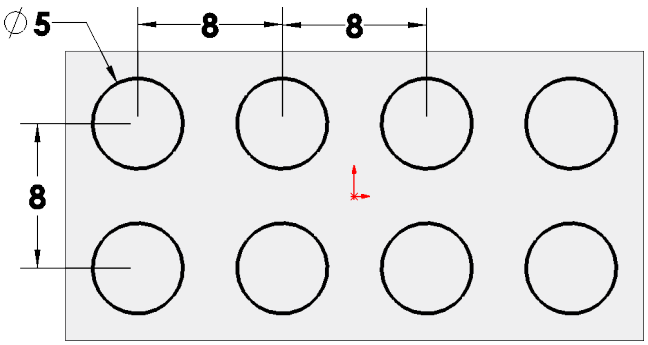


Fig. 32

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.

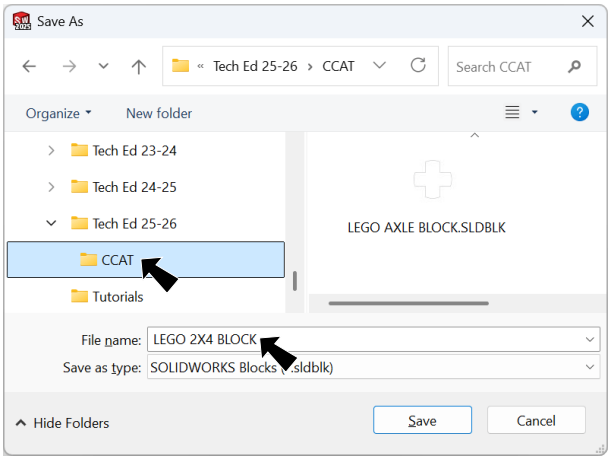


Fig. 33

H. Extrude2 Sketch5 Studs.

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

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

Step 3. Click **Extruded Boss/Base** 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 D1 **1.8**
click OK .

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

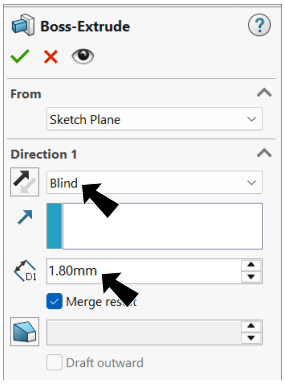


Fig. 34

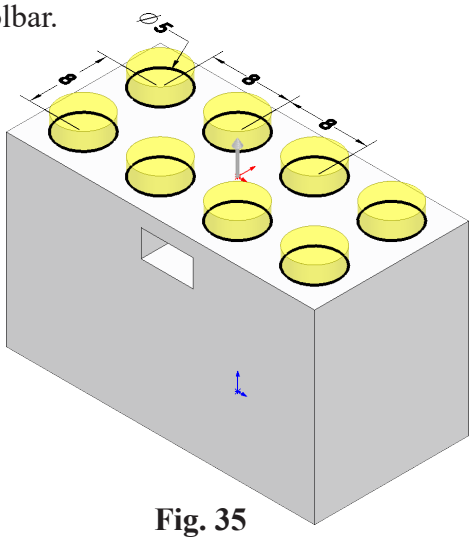


Fig. 35

I. Extruded Cut4 Sketch6 Anti-Studs.

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

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

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

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
click OK .

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

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

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

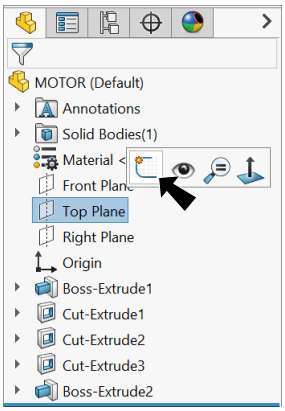


Fig. 36

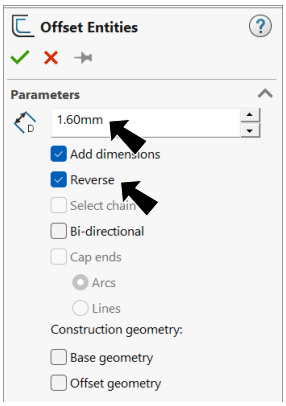


Fig. 37

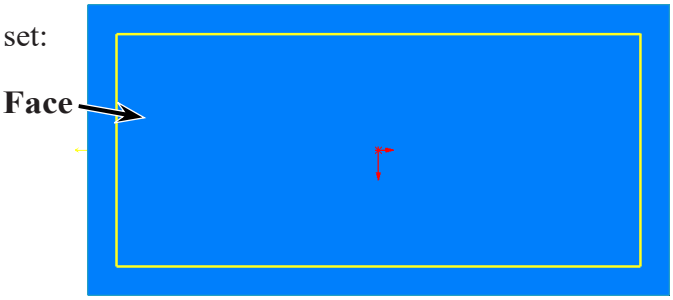


Fig. 38

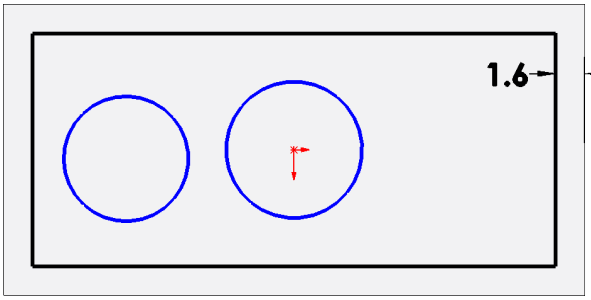


Fig. 39

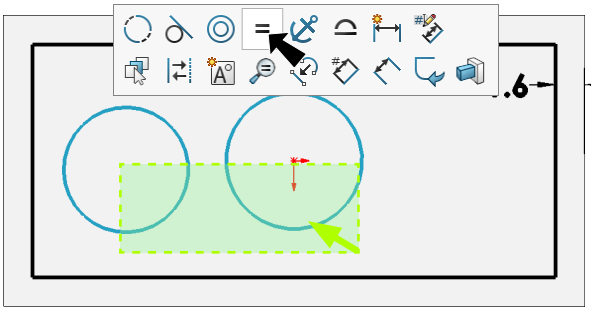


Fig. 40

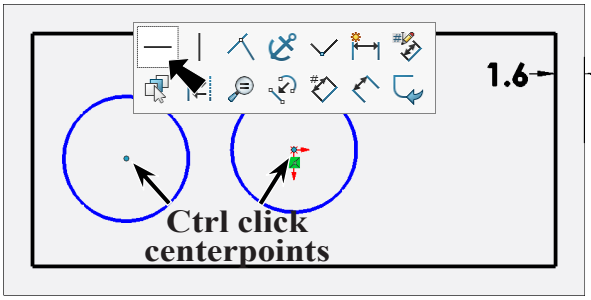


Fig. 41

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

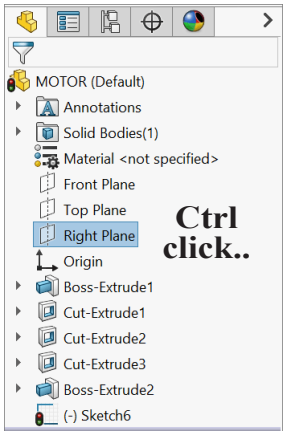


Fig. 42

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

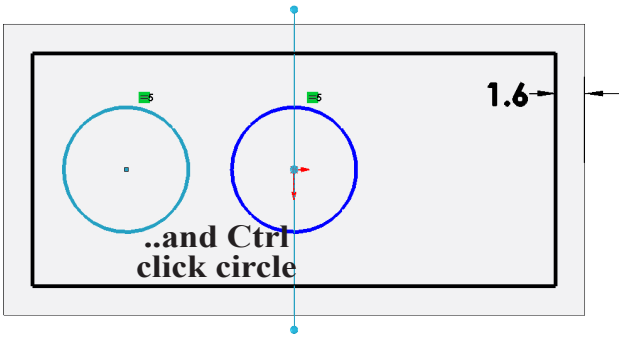
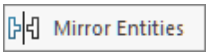


Fig. 43

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**.

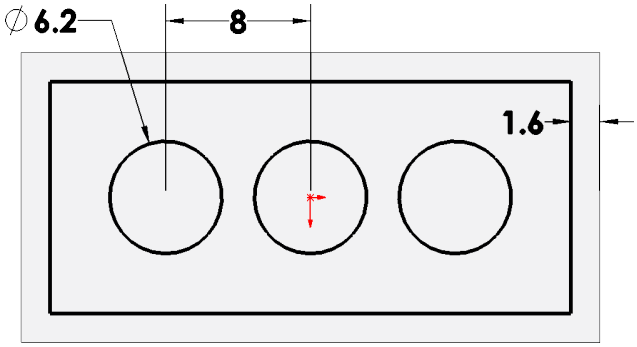
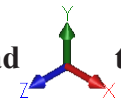
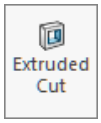


Fig. 44

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**.

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:
under Direction 1, **Fig. 45**
Depth  **2**
click OK  .

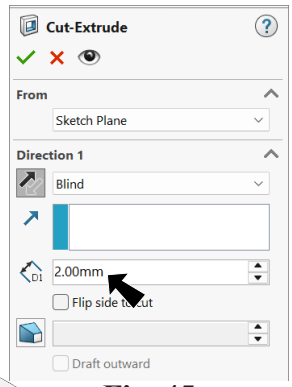


Fig. 45

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

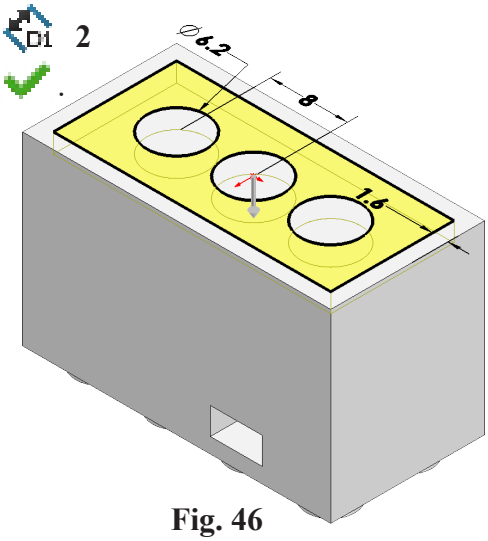


Fig. 46

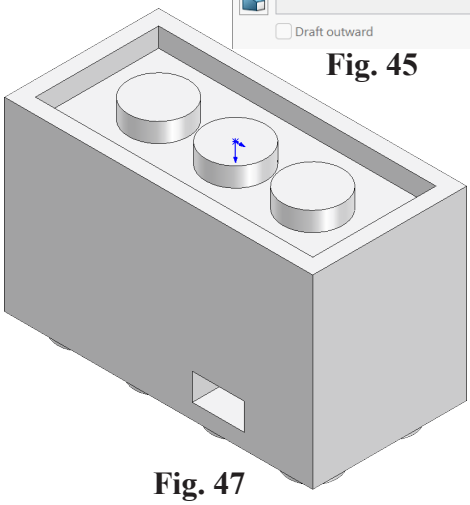


Fig. 47

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 **0º**
click OK .

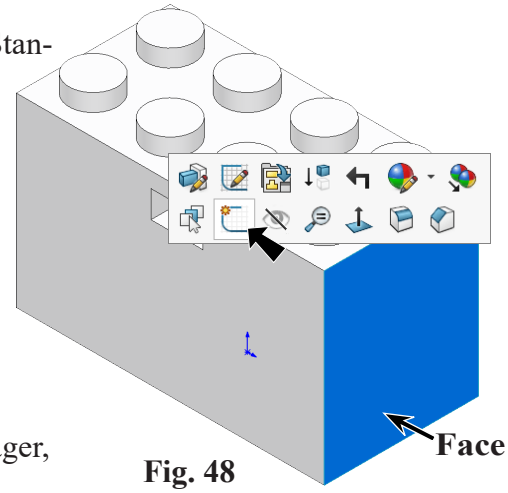


Fig. 48

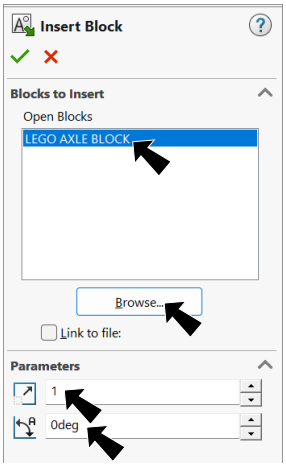


Fig. 49

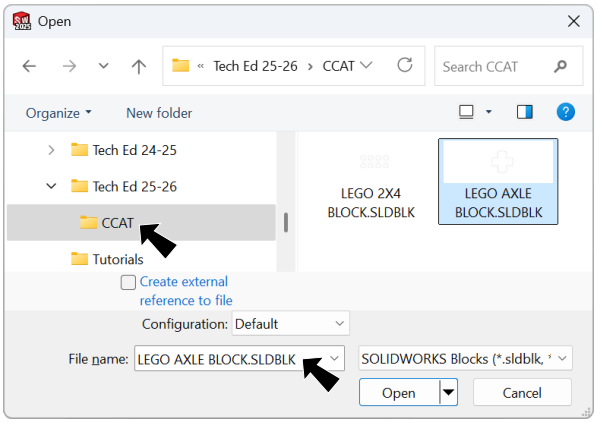


Fig. 50

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**.

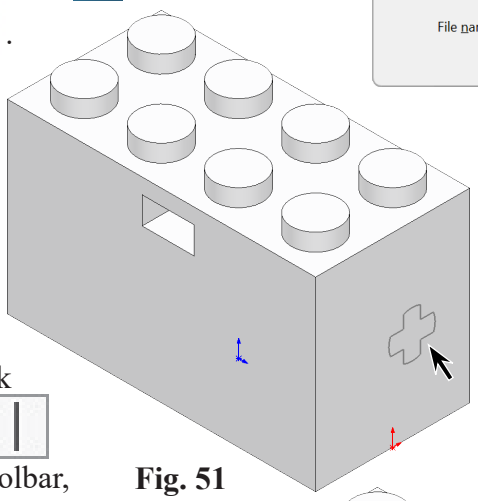


Fig. 51

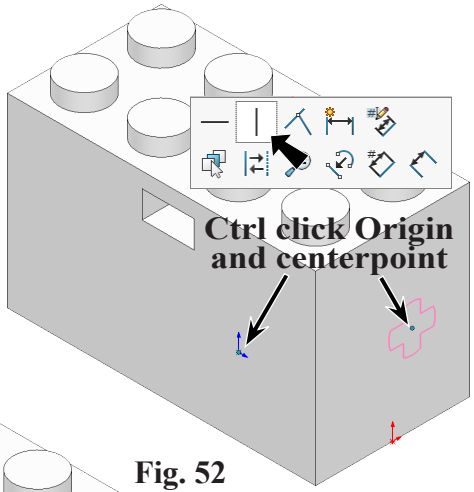


Fig. 52

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

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

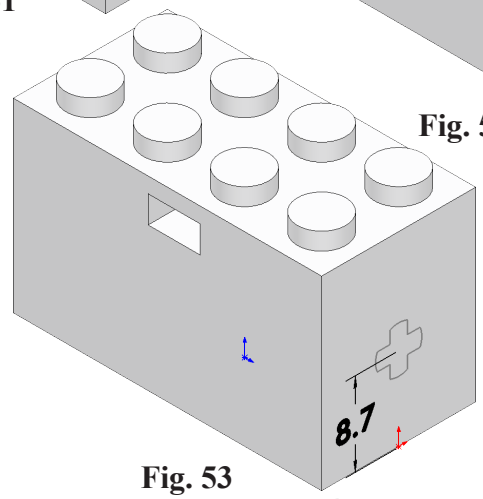


Fig. 53

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

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

Step 10. In the Cut-Extrude Property Manager set:
under Direction 1, **Fig. 54**
Depth D1 **12**
click OK .

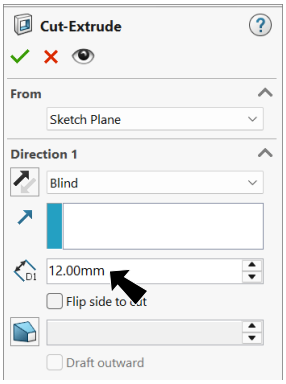


Fig. 54

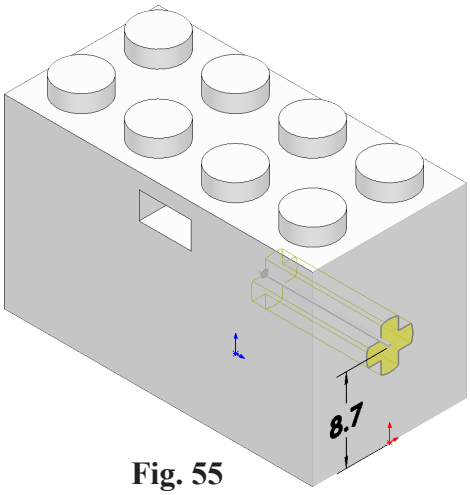


Fig. 55

K. Split Line.

Step 1. Click the **right side face** and click **Sketch** on the context 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 centerpoint, hover cursor over circular edge of cut.

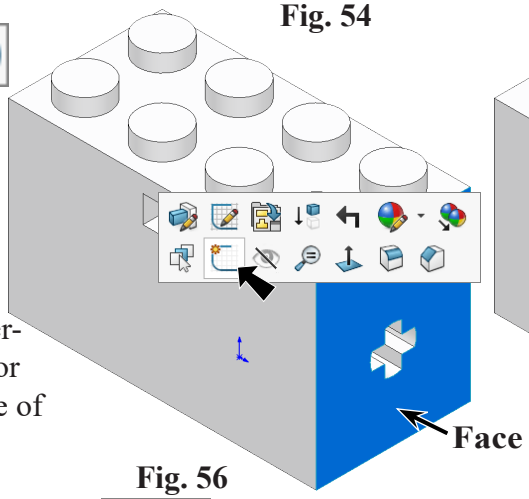


Fig. 56

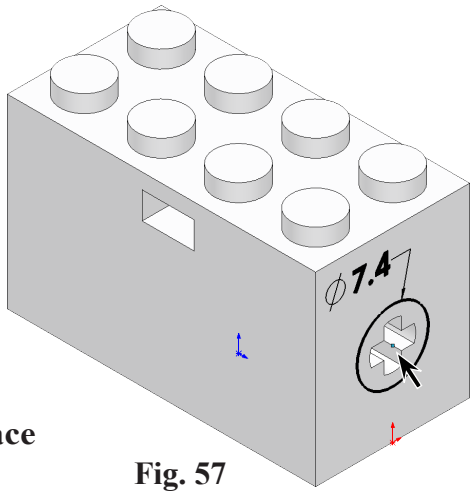


Fig. 57

Step 4. Click **Smart Dimension** 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 .

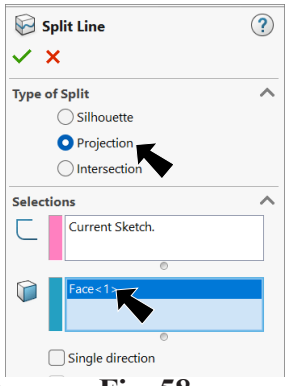


Fig. 58

Step 8. Save (Ctrl-S).

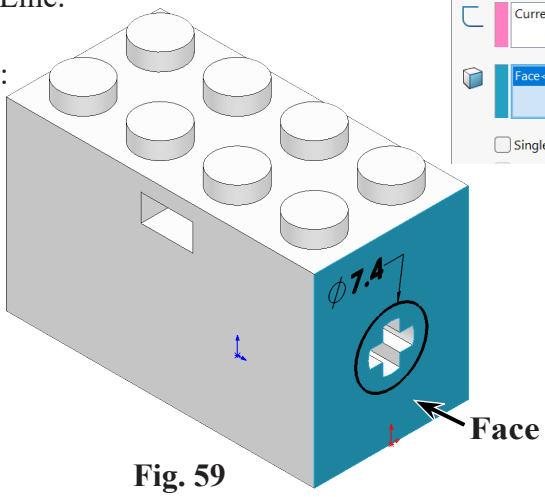


Fig. 59

L. Fillets 1-3.

Step 1. Click **Fillet** 

on the Features toolbar.

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

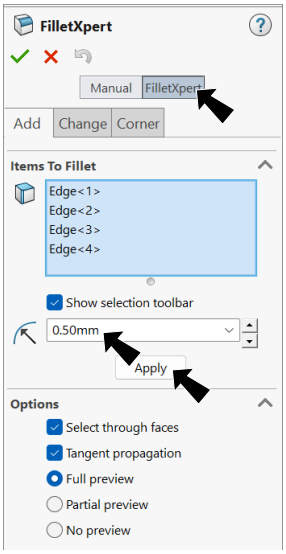


Fig. 60

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

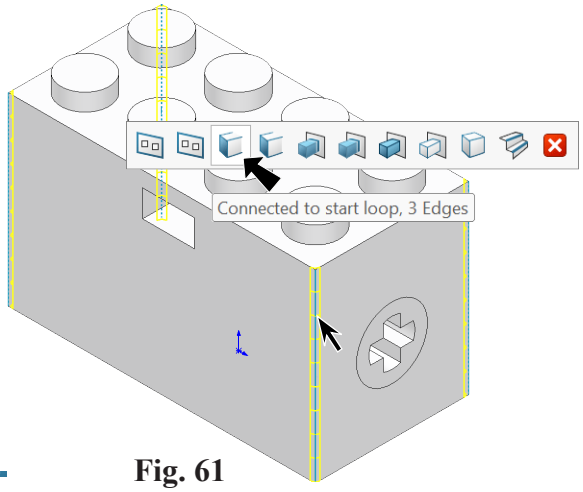


Fig. 61

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

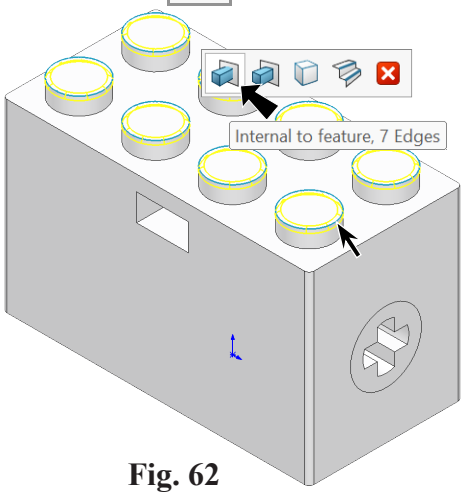


Fig. 62

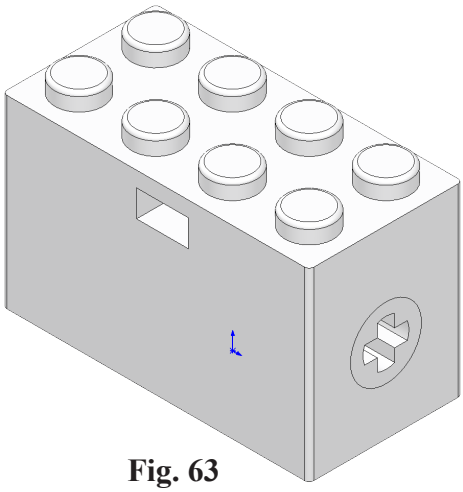
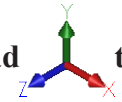


Fig. 63

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

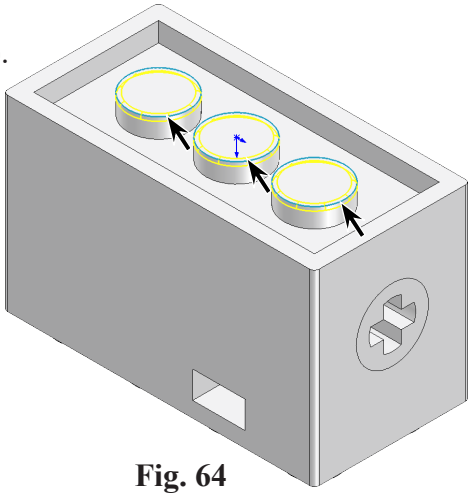


Fig. 64

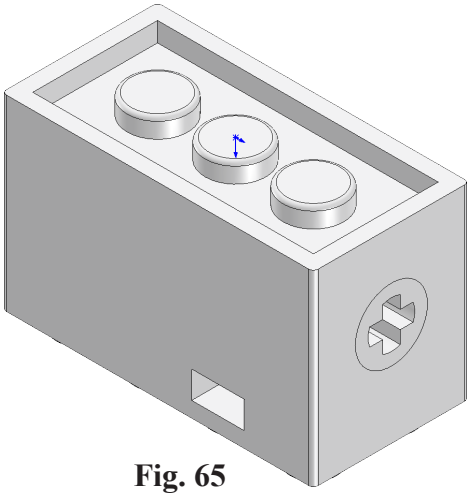


Fig. 65

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**).

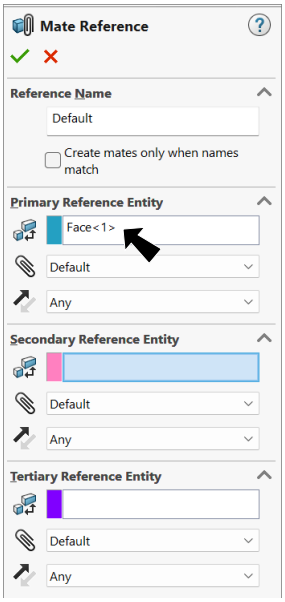


Fig. 66

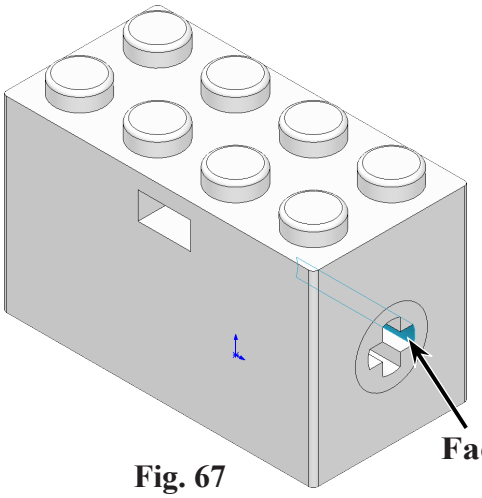


Fig. 67

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**.

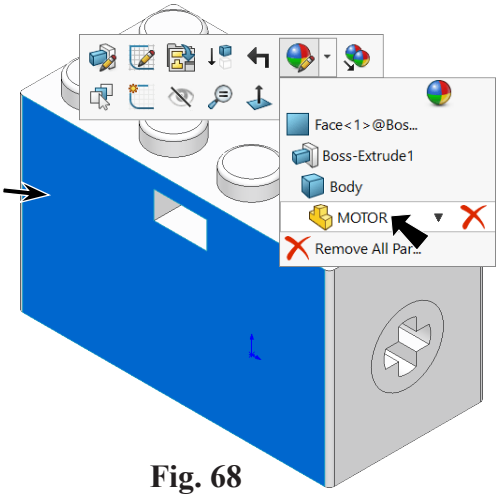


Fig. 68

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.

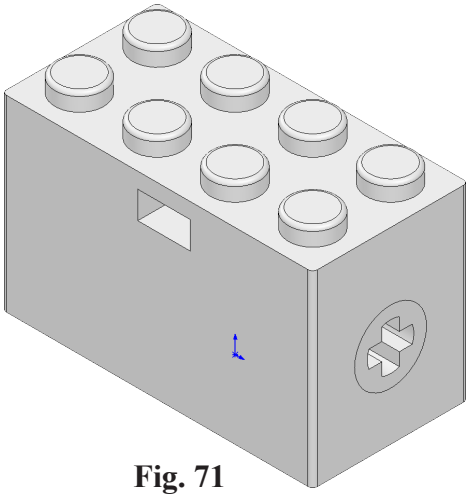


Fig. 71

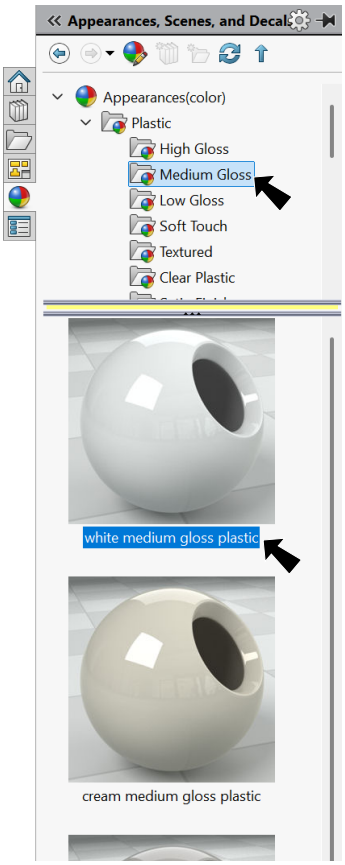


Fig. 69

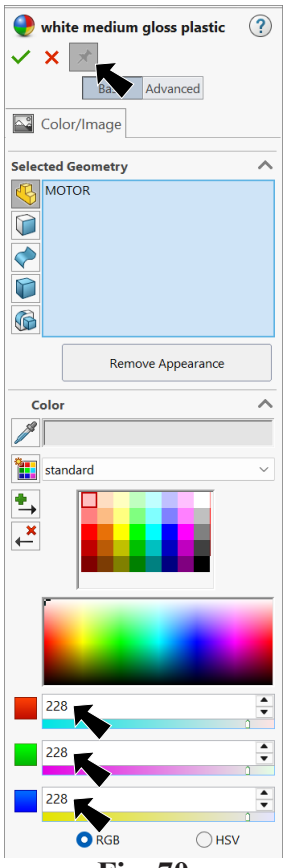


Fig. 70

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**).

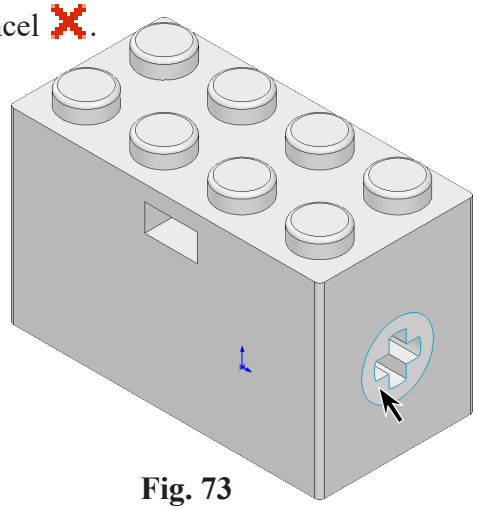


Fig. 73

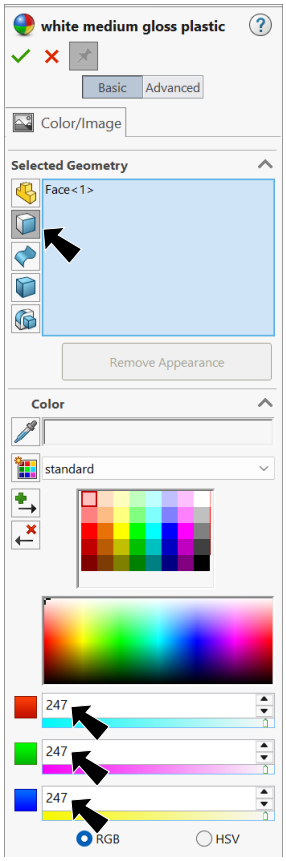


Fig. 72