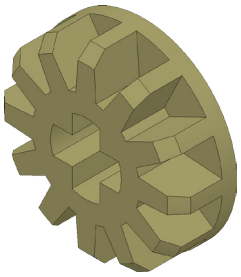
Chapter 7

Circuit Cubes All Terrain
Bevel Gear



A. Extrude1.

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

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

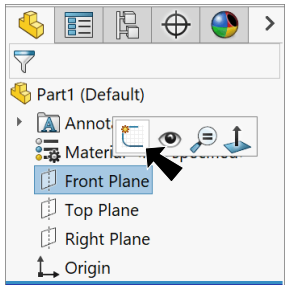


Fig. 1

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

Step 4. Sketch **circle at the Origin** , **Fig. 2**.

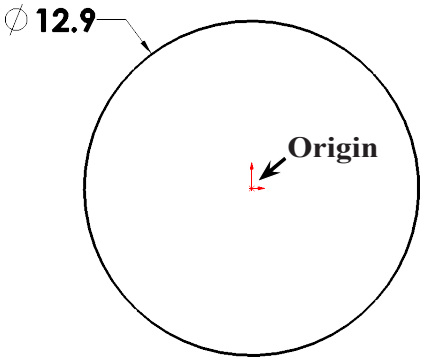


Fig. 2

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

Step 6. Dimension **diameter 12.9**, **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 Property Manager set:
under Direction 1, **Fig. 3**
End Condition **Blind**
Depth **1.1**
click OK .

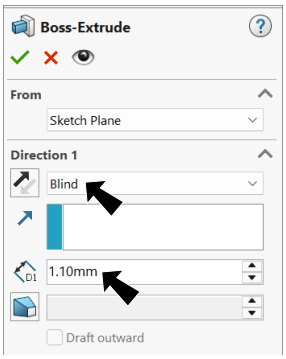


Fig. 3

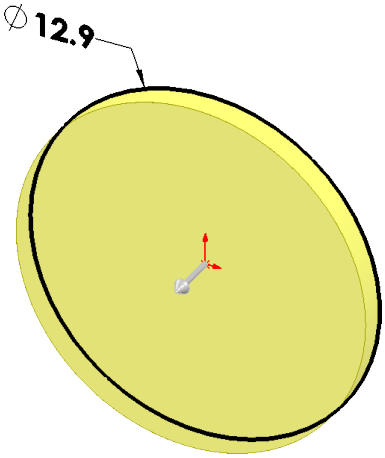


Fig. 4

B. Save as "BEVEL GEAR".

Step 1. Click File Menu > Save As.

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

C. Extrude2 Tooth.

Step 1. Click the **front face** and click **Sketch** on the context toolbar, **Fig. 5**.

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

Step 3. With the face still selected, click **Convert Entities** on the Sketch toolbar, **Fig. 6**.

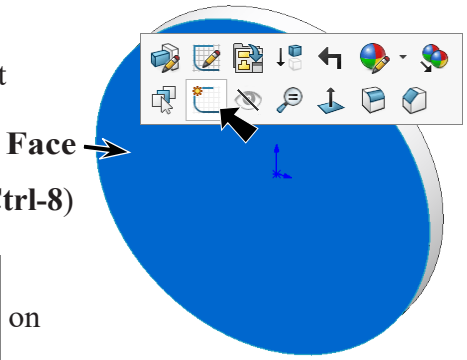


Fig. 5

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

Step 5. Sketch **circle at the Origin**, **Fig. 7**.

Step 6. Click **Centerline** in the **Line flyout** on the Sketch toolbar.

Step 7. Sketch a **vertical centerline from the Origin up to circular edge**, **Fig. 8**.

Step 8. Click **Line** (**L**) on the Sketch toolbar.

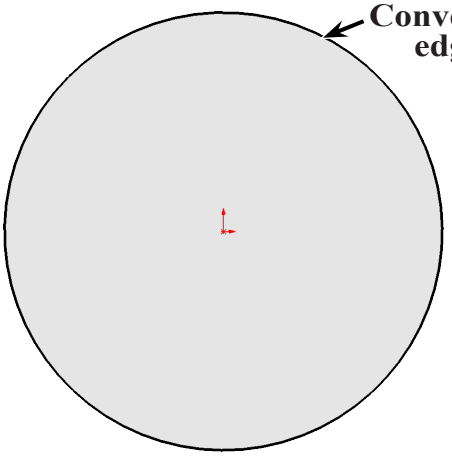


Fig. 6

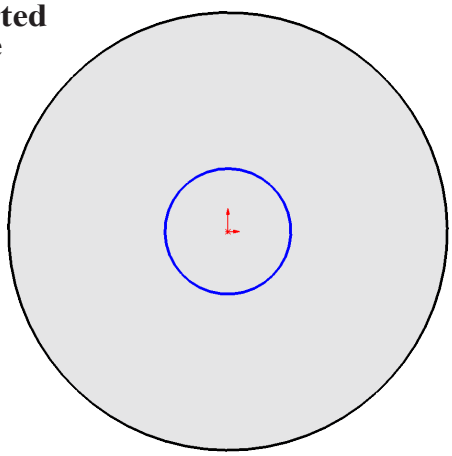


Fig. 7

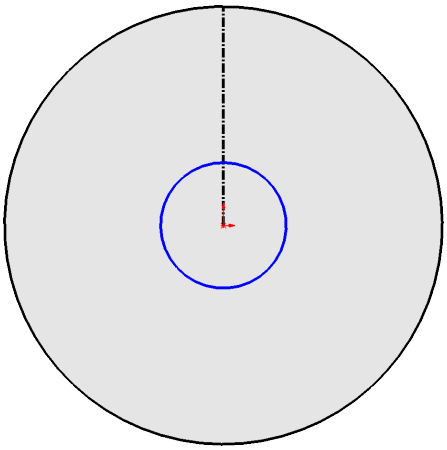


Fig. 8

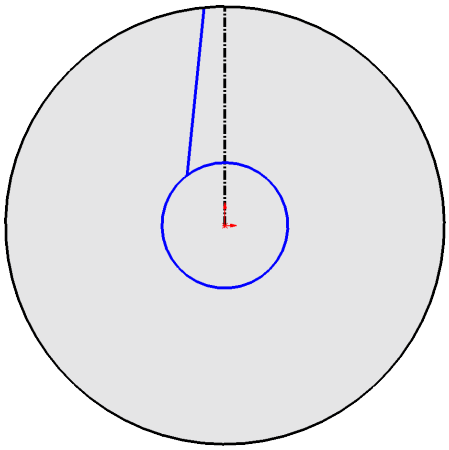


Fig. 9

Step 9. Sketch **line at angle from converted circular edge down to circle**, **Fig. 9**.

Step 10. **Unselect Line tool**. To unselect, right click graphics area and click Select from menu.

Step 11. **Ctrl drag a selection to left to select spoke geometry, Fig. 10.**

Step 12. Click **Mirror Entities** 

on the Sketch toolbar.

Step 13. Click **Smart Dimension** 

(S) on the Sketch toolbar.

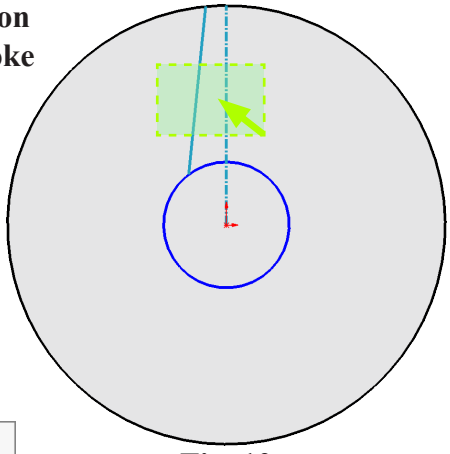


Fig. 10

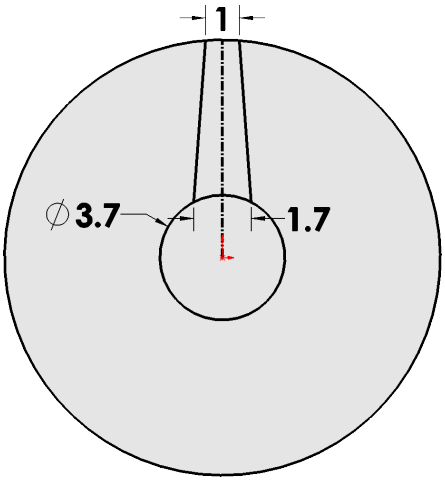


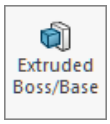
Fig. 11

Step 14. Add dimensions, **Fig. 11**.

Step 15. Click **Isometric**  on the Standard Views toolbar. **(Ctrl-7)**

Step 16. Click **Features** 

on the Command Manager toolbar.

Step 17. Click **Extruded Boss/Base** 

on the Features toolbar.

Step 18. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 12**
End Condition **Blind**
Depth D1 **3**
under Selected Contours
click the **two contours**, **Fig. 13**
click OK ✔ .

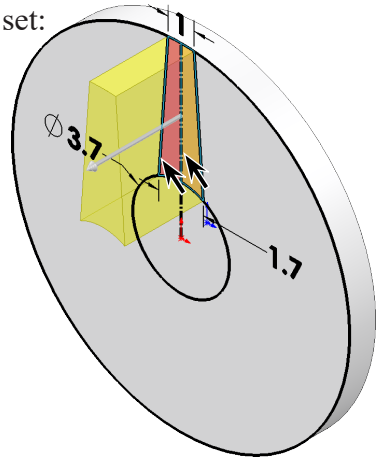


Fig. 13

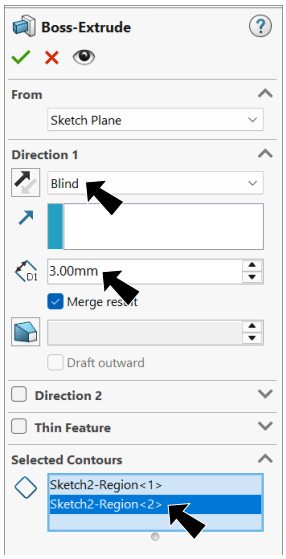


Fig. 12

D. Chamfer.

Step 1. Click **Chamfer** 

on the Features toolbar.

Step 2. In the Chamfer Property Manager set:
under Chamfer Type, **Fig. 14**
select **Angle Distance** 
click **top outside edge**, **Fig. 15**
under Chamfer Parameters
Distance  **.8**
Angle  **45°**
click OK  .

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

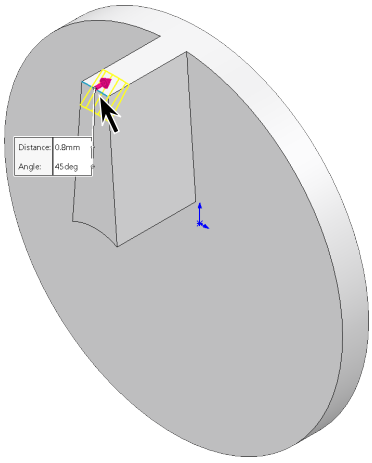


Fig. 15

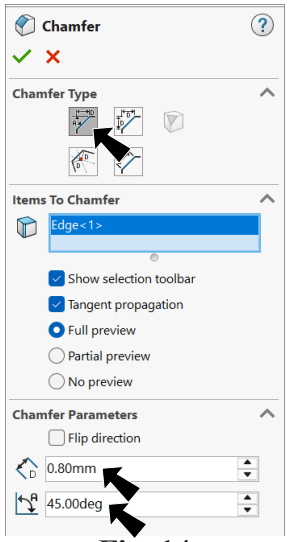
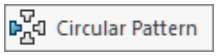


Fig. 14

E. Circular Pattern.

Step 1. Click **Circular Pattern** 

in the **Linear Pattern flyout** 

on the Features toolbar.

Step 2. In the Circular Pattern Property Manager set:
under Features and Faces, **Fig. 16**
click **Boss-Extrude2 and Chamfer** in graphics area, **Fig. 17**
under Direction 1
click in Pattern Axis  box
click a **cylindrical face**
select **Equal spacing**
Number of Instances  **12**
click OK  .

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

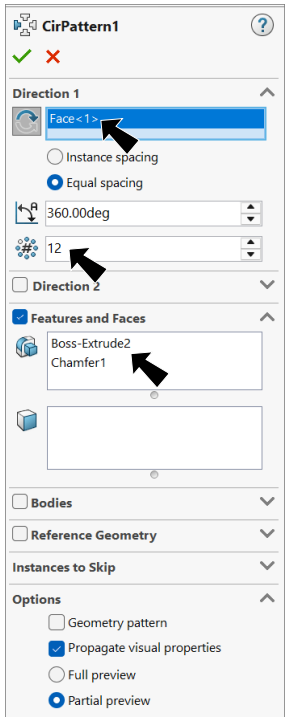


Fig. 16

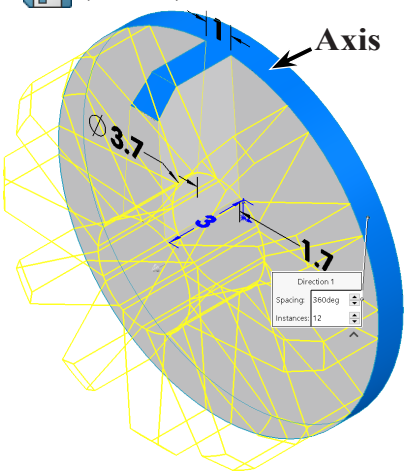


Fig. 17

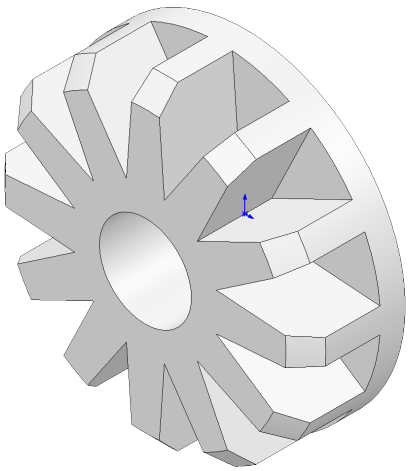


Fig. 18

F. Extrude3 Hub.

Step 1. Click the **front face of Extrude1** and click **Sketch** on the context toolbar, **Fig. 19**.

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

Step 3. Sketch **circle at the Origin** , **Fig. 20**.

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

Step 5. Dimension **diameter 7.4**, **Fig. 20**.

Step 6. Click **Features** on the Command Manager toolbar.

Step 7. Click **Extruded Boss/Base** on the Features toolbar.

Step 8. In the Boss-Extrude Property Manager set:
under Direction 1, **Fig. 21**
End Condition **Through All**
click OK .

Step 9. Save (**Ctrl-S**).

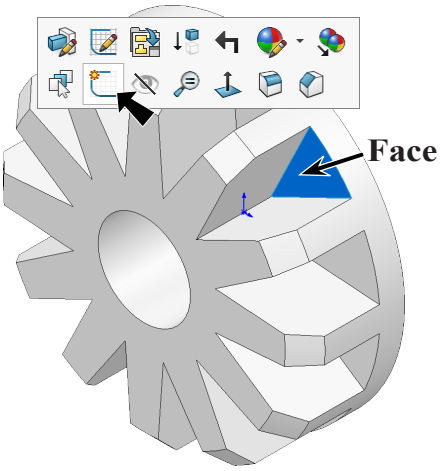


Fig. 19

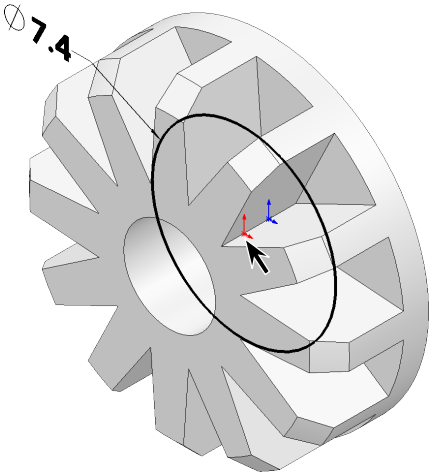


Fig. 20

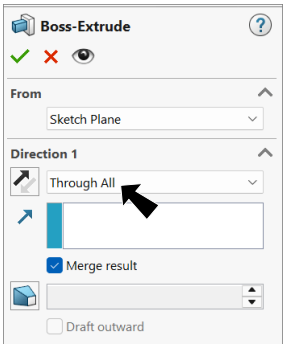


Fig. 21

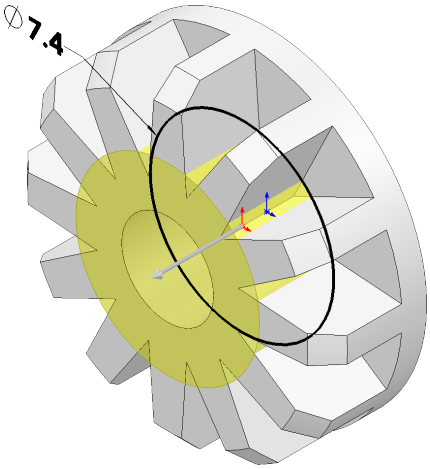


Fig. 22

G. Insert LEGO AXLE Block and Cut.

Step 1. Click the **front face of Extrude2** and click **Sketch** on the context toolbar, **Fig. 23**.

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

Step 3. Click Tools Menu > Blocks > Insert.

Step 4. In Insert Block Property Manager,
click **Browse**, **Fig. 24**
in the Open dialog box, navigate to: **Documents\Tech Ed 25-26\CCAT** and open **LEGO AXLE BLOCK** file, **Fig. 25**
under Parameters
Block Scale **1**
Block Rotation **0º**
click **Origin**, **Fig. 26**
click OK.

Step 5. Edit Block, **Fig. 27**. To edit block, **right click the block** and click **Edit Block**.

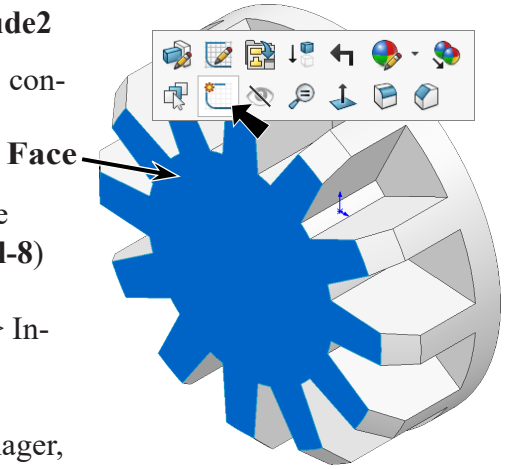


Fig. 23

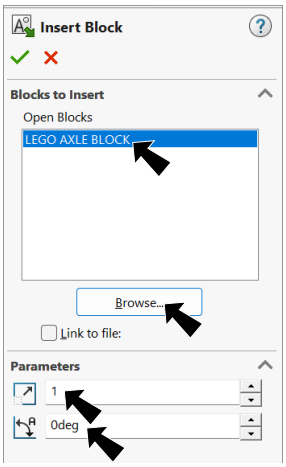


Fig. 24

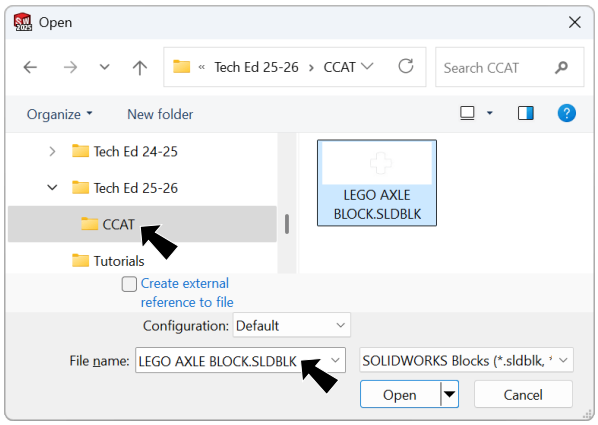


Fig. 25

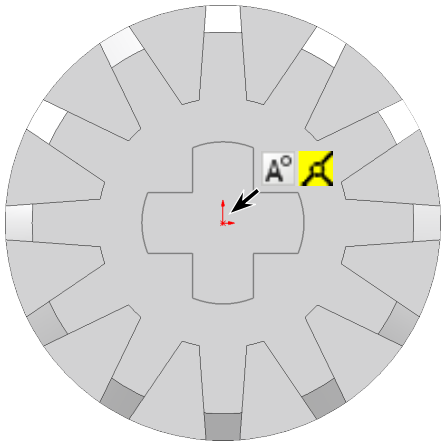


Fig. 26

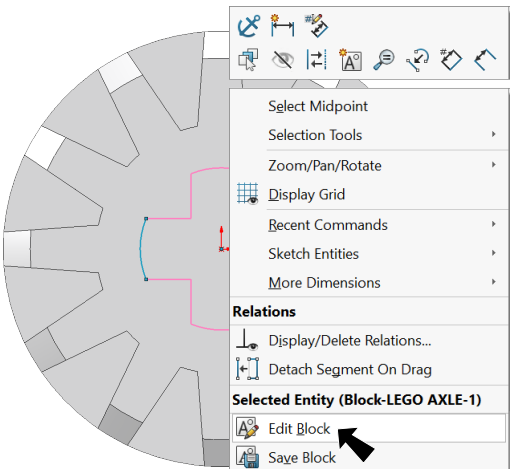


Fig. 27

Step 6. Click **Offset Entities** 

on the Sketch toolbar.

Step 7. In the Offset Entities Property Manager set:
under Parameters, **Fig. 28**

Distance **.05 (clearance for Lego Axle hole)**
uncheck **Reverse**
check **Select chain**
uncheck **Bi-directional**
under Construction geometry
check **Base geometry**
click an **entity**, **Fig. 29**
yellow offset circle on outside -
base geometry (construction) on inside
click OK .

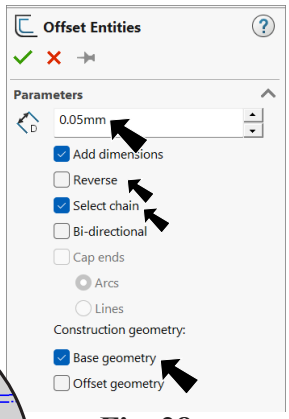


Fig. 28

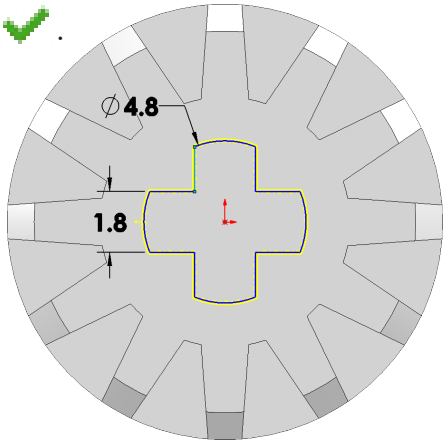


Fig. 29

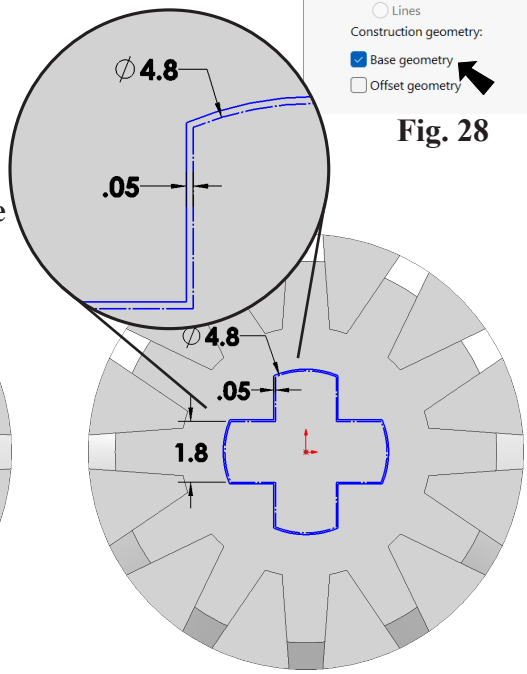


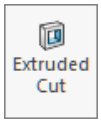
Fig. 30

Step 8. Exit **Block.** To Exit, click **Block Confirmation** in top right corner of graphics area.

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

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. 31**
End Condition **Through All**
click OK .

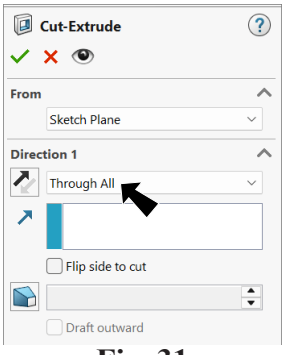


Fig. 31

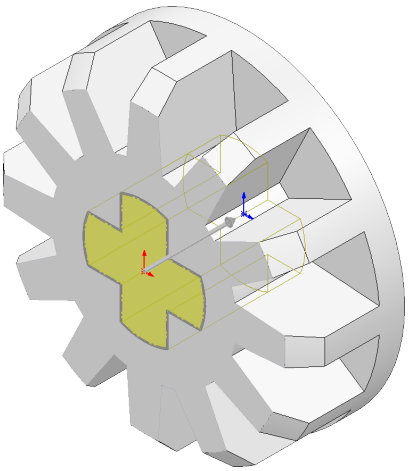
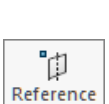


Fig. 32

H. Mate Reference.

Step 1. Click **Reference Geometry** on the Features toolbar and **Mate Reference** from the menu.



Step 2. In the Mate Reference Manager set:
under **Primary** Reference Entity
click **cylindrical face**, **Fig. 34**
click OK ✔ .

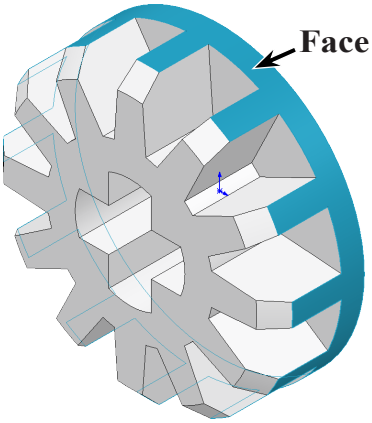


Fig. 34

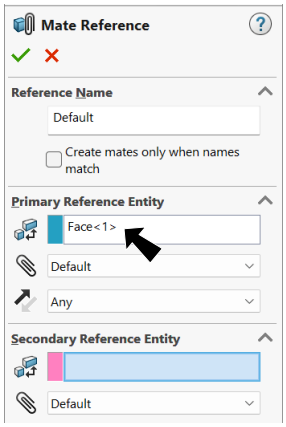


Fig. 33

I. Material: Brown (Husk).

Step 1. Click part, click **Appearance Callout** on the context toolbar and click **BEVEL GEAR**, **Fig. 35**.

Step 2. In the Appearances Task pane, expand **Plastic**, click **Medium Gloss** and in the lower pane select **beige medium gloss plastic**, **Fig. 36**.

Step 3. In the Appearances Property Manager set:
under Color, **Fig. 37**
set **RGB values**
R 162
G 156
B 103
click OK ✔ .

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

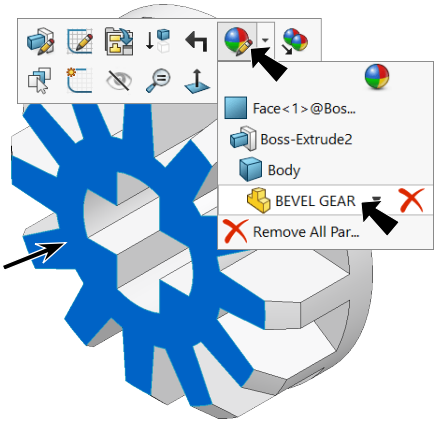


Fig. 35

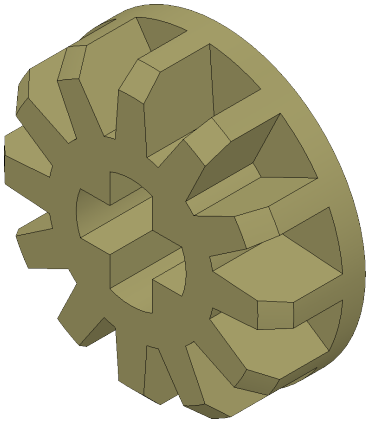


Fig. 38

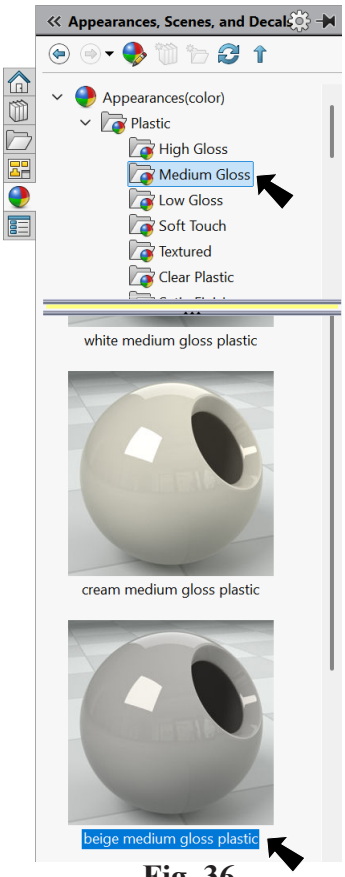


Fig. 36

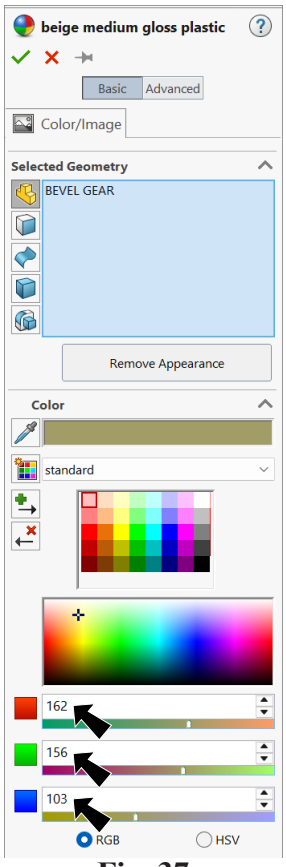


Fig. 37