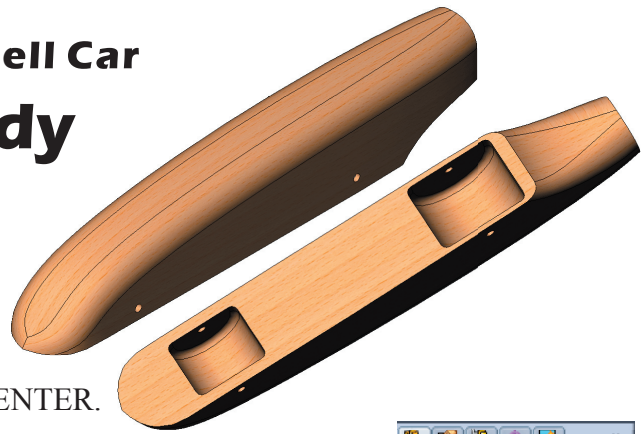


CO2 Shell Car Body



A. Save as "BODY".

- Step 1. If necessary, open your **BLANK** file.
- Step 2. Click File Menu > Save As.
- Step 3. Key-in **BODY** for the filename and press ENTER.

B. FRONT Wheel Cutout.

- Step 1. Click **Right** (plane) in the Feature Manager and click **Sketch** from the Content toolbar, **Fig. 1**.

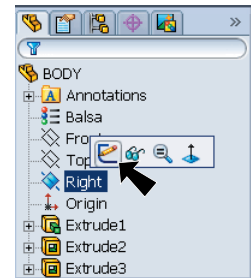


Fig. 1

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

- Step 3. Use the **Zoom to Area**  in the View toolbar to drag a zoom window around the **front of the body at the axle hole**, **Fig. 2**.

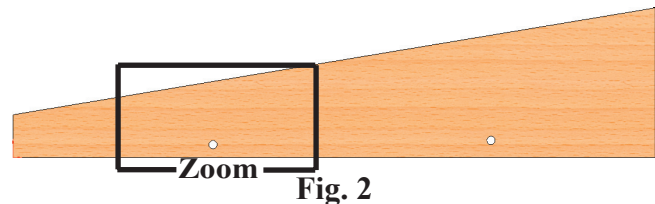


Fig. 2

- Step 4. Click **Centerpoint Arc**  (S) in the Arc flyout



on the Sketch toolbar.

- Step 5. Click in the center of the axle hole to start the arc and move the cursor to the right. Click to place the first end point, then move cursor counterclockwise 180 degrees. Click to place the second end point, **Fig. 3**.

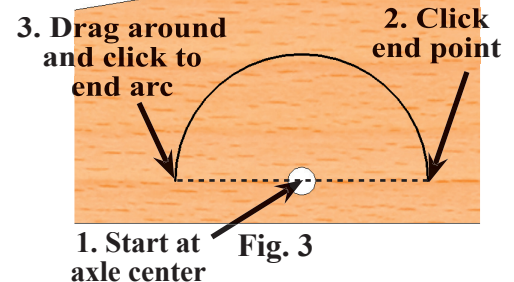


Fig. 3

- Step 6. Click **Fully Defined Sketch**  (D) on the Sketch toolbar and OK  in the Property Manager.

- Step 7. **Dimension arc 18**, **Fig. 4**. The front wheel diameter is 34.7 mm. We're setting the cutout radius to slightly larger than 1/2 the wheel diameter.

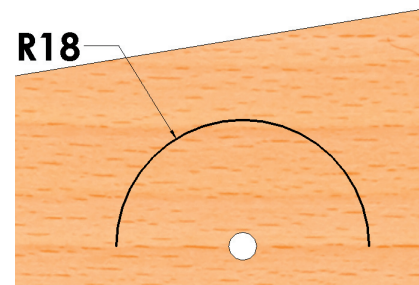


Fig. 4

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

Step 9. Draw the **3 lines** in **Fig. 5**. Start the line at the end of the arc. Use the inferencing line, the dotted line that appears when you draw the lines. Be sure to add the line across the bottom between the vertical lines, as sketch has to be closed.

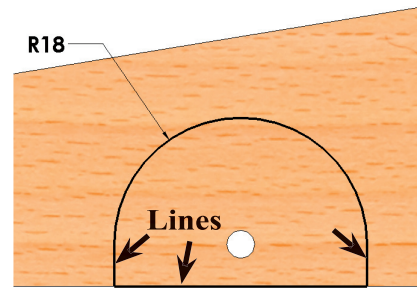
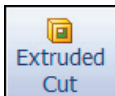


Fig. 5

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

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

Step 12. Click **Bottom**  on the Standard Views toolbar. (**Ctrl-6**)

Step 13. Click **Zoom to Selection**  (**Q**) on the View toolbar.

Step 14. In the Property Manager, under **Direction 1** set:
End Condition to **Mid Plane**

Depth  to 29

click OK , **Fig. 6** and **Fig. 7**.

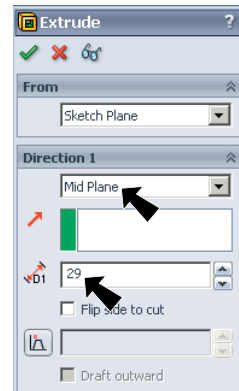


Fig. 6

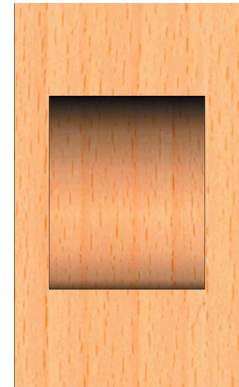


Fig. 7

C. REAR Wheel Cutout.

Step 1. Click **Right** (plane) in the Feature Manager and click **Sketch**  from the Content toolbar, **Fig. 8**.

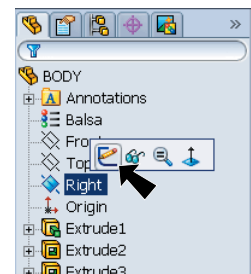


Fig. 8

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

Step 3. Use the **Zoom to Area**  in the View toolbar to drag a zoom window around the **rear of the body at the axle hole**, **Fig. 9**.

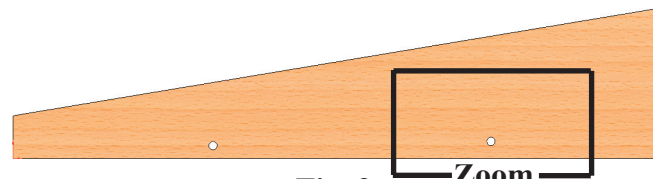
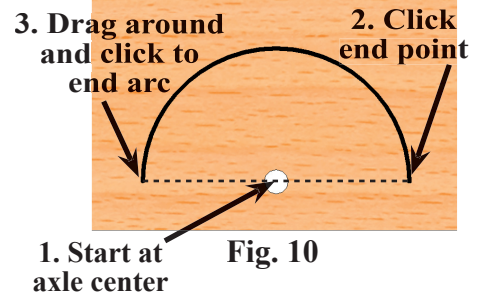


Fig. 9

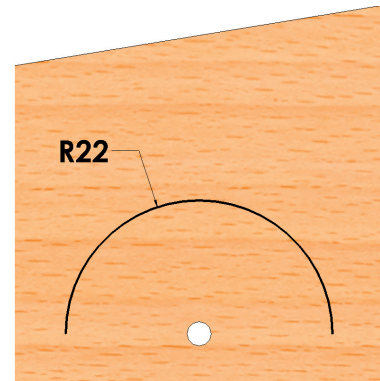
Step 4. Click **Centerpoint Arc**  (S) in the **Arc flyout**  on the Sketch toolbar.

Step 5. Click in the center of the axle hole to start the arc and move the cursor to the right. Click to place the first end point, then move cursor counterclockwise 180 degrees. Click to place the second end point, **Fig. 10**.



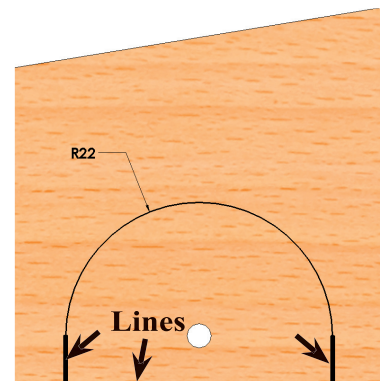
Step 6. Click **Fully Defined Sketch**  (D) on the Sketch toolbar and OK  in the Property Manager.

Step 7. **Dimension arc 22, Fig. 11.** The front wheel diameter is 34.7 mm. We're setting the cutout radius to slightly larger than 1/2 the wheel diameter.



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

Step 9. Draw the **3 lines** in **Fig. 12**. Start the line at the end of the arc. Use the inferencing line, the dotted line that appears when you draw the lines. Be sure to add the line across the bottom between the vertical lines close the sketch.



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

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

Step 12. Click **Bottom**  on the Standard Views toolbar. (Ctrl-6)

Step 13. Click **Zoom to Selection**  on the View toolbar.

Step 14. In the Property Manager, under **Direction 1** set:
End Condition to **Mid Plane**

Depth  to 35

click OK , **Fig. 13** and **Fig. 14**.

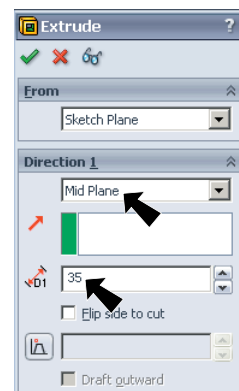


Fig. 13



Fig. 14

D. Fillet Inside Edges Wheel Cutout.

Step 1. Click **Bottom**  on the Standard Views toolbar. (Ctrl-6)

Step 2. Use the **Zoom to Area**  in the View toolbar to drag a zoom window around the **front wheel cutout**, **Fig. 15**.

Step 3. Use the left arrow on the keyboard to rotate view as shown in **Fig. 17**.

Step 4. Click **Fillet**  on the Features toolbar.

Step 5. Set the **Radius**  to **3** in the Fillet Property Manager, **Fig. 16**.

Step 6. Click the inside arc edge, **Fig. 17**.

Step 7. Use right arrow on keyboard to rotate view and click the other inside arc edge, **Fig. 18** and click OK  in the Property Manager.

Step 8. Repeat and fillet the inside edges of the rear wheel cutout. Scroll down to rear of body. To scroll hold down **Ctrl** and press **up arrow** key.

Step 9. Save. Use **Ctrl-S**.

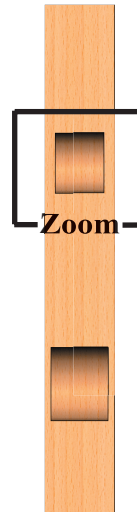


Fig. 15

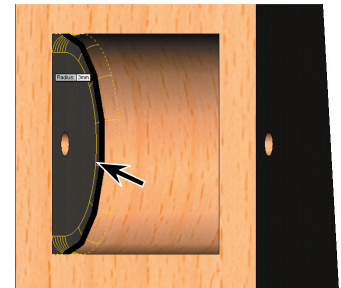


Fig. 17

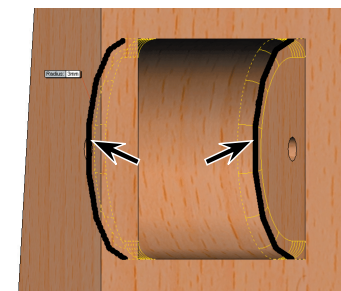


Fig. 18

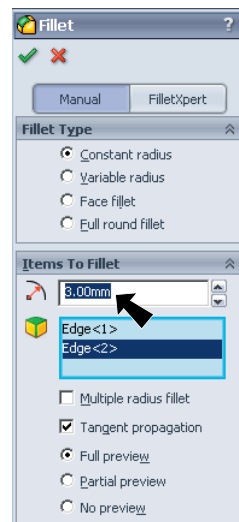


Fig. 16

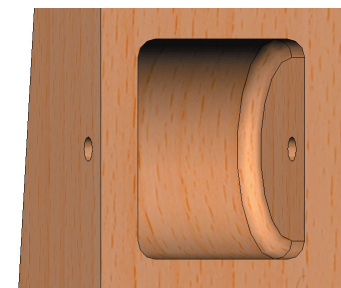


Fig. 19

E. Right Splines.

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

Step 2. Click the **right face** and click **Sketch**  on the Content menu, **Fig. 20**.

Step 3. Click **Normal To**  on the Standard Views toolbar. (Ctrl-8)

Step 4. Click **Wireframe**  on the View toolbar.

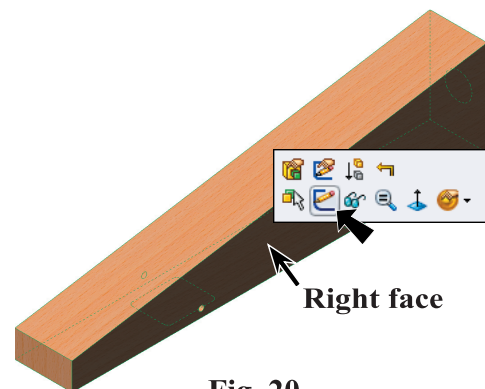


Fig. 20

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

Step 6. Start on the bottom edge of the sketch, **Point 1, Fig. 21**. Click approximately where the 4 points are positioned in **Fig. 21**. Start and end the spline on a line of the sketch. Keep the other spline points, Points 2 and 3 away from other geometry. Press Escape to end the spline.

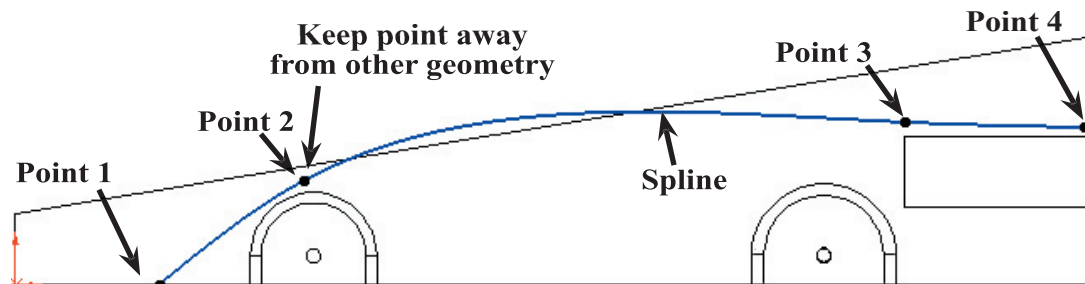


Fig. 21

Step 7. Use the **Zoom to Area**  in the View toolbar to drag a zoom window around the **rear end of the body, Fig. 22**. Click Zoom to Area  again or Escape to unselect Zoom to Area.

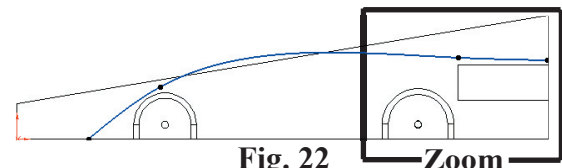


Fig. 22

Step 8. **Shift click** the **3rd spline point and cartridge cutout top front corner** to select both (Hold down Shift key and click both spline point and corner point), **Fig. 23**.

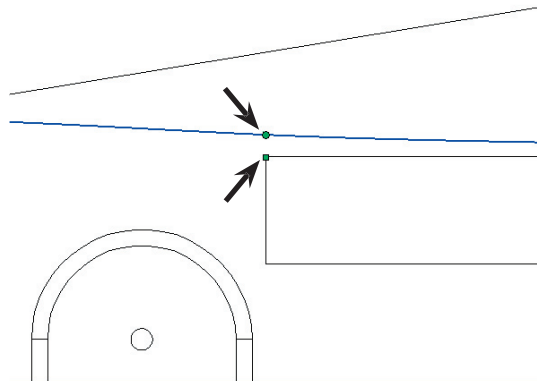


Fig. 23

Step 9. In the Property Manager under Add Relations, click **Vertical** , **Fig. 24**.

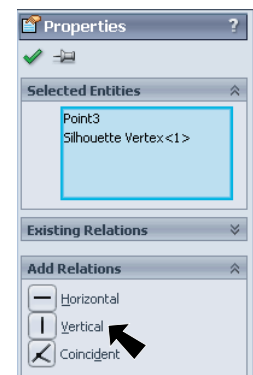


Fig. 24

Step 10. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 11. Add **dimension between 3rd spline point and cartridge cutout top front corner** as shown in **Fig. 25**. To Smart dimension click the spline point and the cartridge corner, then move the cursor up off the sketch and click. Key-in **4** for the dimension and press ENTER.

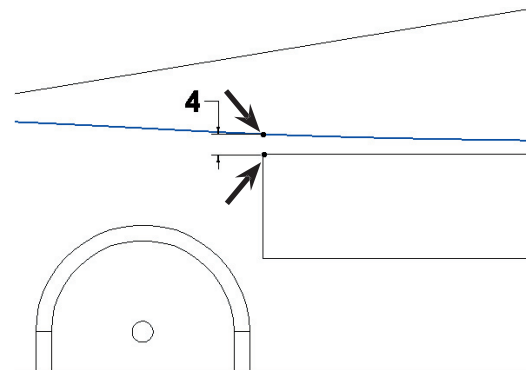


Fig. 25

Step 12. Add **dimension between end of spline and cartridge cutout top back corner** as shown in **Fig. 26**. To Smart dimension click the end of spline point and the cartridge back corner, then move the cursor up off the sketch and click. Key-in **4** for the dimension and press ENTER.

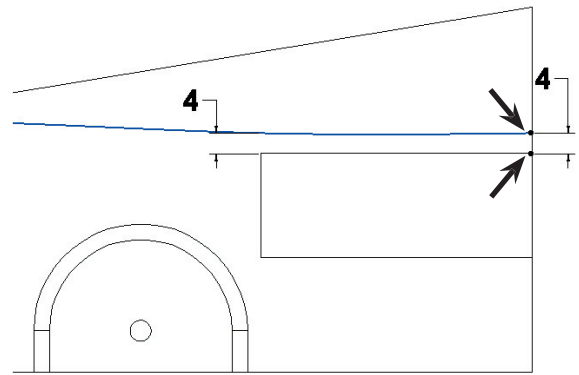


Fig. 26

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

Step 14. Draw a spline from the **bottom edge of the sketch to the back of the sketch under cartridge cutout**, **Fig. 27**. Press Escape to end the spline.

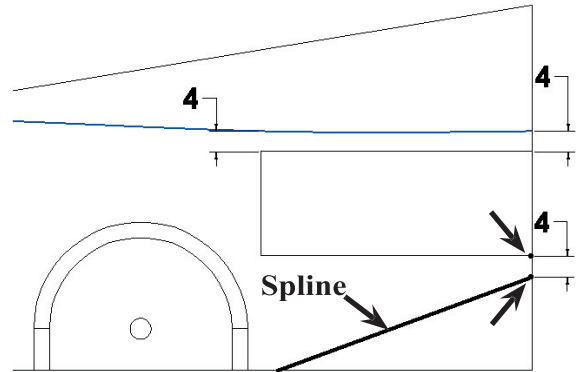


Fig. 27

Step 15. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 16. Add **dimension between end of spline and cartridge cutout bottom back corner** as shown in **Fig. 27**. Smart dimension the end of spline point and the cartridge back corner. Key-in **4** for the dimension and press ENTER.

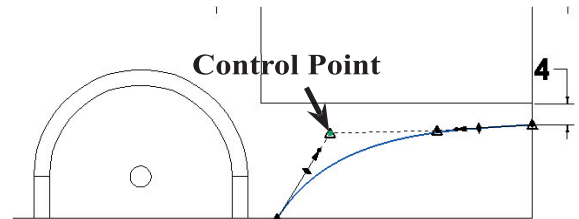


Fig. 28

Step 17. Press the **Escape** key to unselect Smart Dimension.

Step 18. Click the spline to display the Spline Points (green) and Control Polygon.

Step 19. Click a gray Control Point to activate it and the Control Point turns yellow. Move the yellow Control Point to adjust spline. Keep the spline inside the blank, **Fig. 28**.

Step 20. Click **Line**  (L) on the Sketch toolbar.

Step 21. Draw a line to **connect the ends of the splines**, **Fig. 29**. Press the **Escape** key to unselect Line.

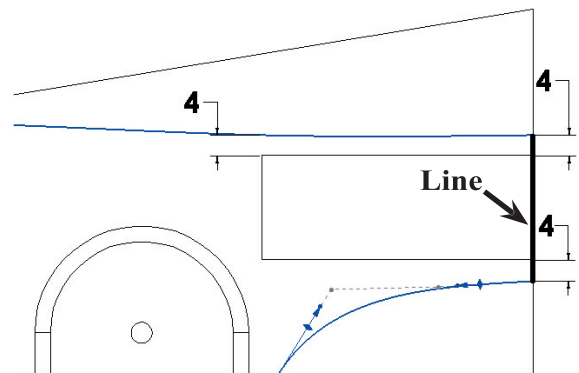


Fig. 29

Step 22. Click Zoom to Fit  (F) on the View toolbar.

Step 23. Click the first spline to display the Control Polygon.

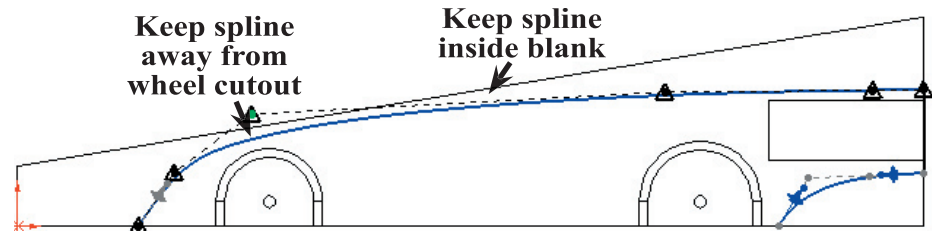


Fig. 30

Step 24. Click a gray Control Point to activate it and the Control Point turns yellow. Move the yellow Control Point to adjust spline. Adjust spline so it is inside the blank, **Fig. 30**.

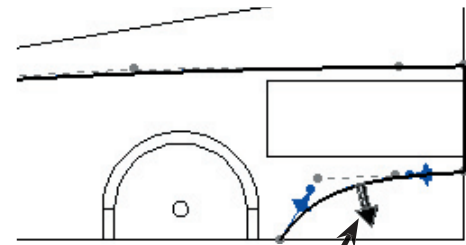
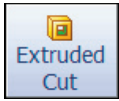


Fig. 32 Direction arrow

Step 25. Click **Features**  on the Command Manager toolbar.

Step 26. Click **Extruded Cut**  on the Features toolbar.

Step 27. In the Cut-Extrude Property Manager: under **Direction 1**
End Condition to Through All
The Direction arrow should point towards area to be cut away, **Fig. 32**. If arrow is pointing in wrong

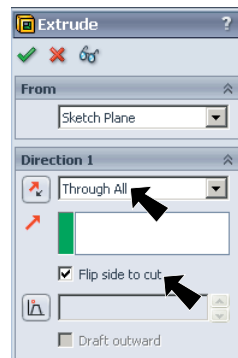


Fig. 31

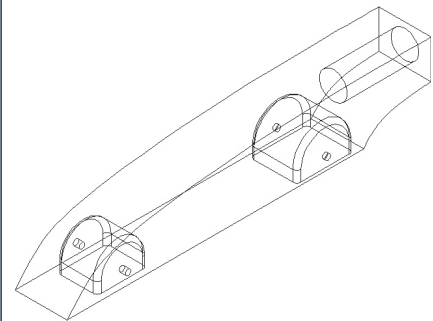


Fig. 33

direction, click **Flip side to cut**, **Fig. 31**. Click OK .

F. Bottom Spline.

Step 1. Click **Bottom**  on the Standard Views toolbar. (Ctrl-6)

Step 2. Click the **bottom face** and click **Sketch**  on the Content menu, **Fig. 34**.

Step 3. Click **Centerline**  in the **Line flyout**  (S) on the Sketch toolbar.

Step 4. Starting from midpoint of the bottom of the sketch, draw a centerline up through the sketch, **Fig. 34**.

Step 5. Press the **Escape** key to unselect Centerline.

Step 6. Click the centerline to select it, **Fig. 35**.

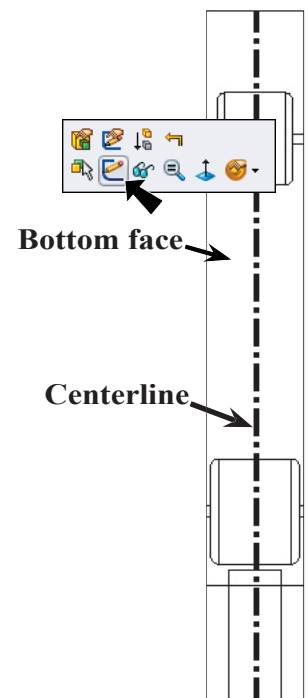
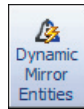
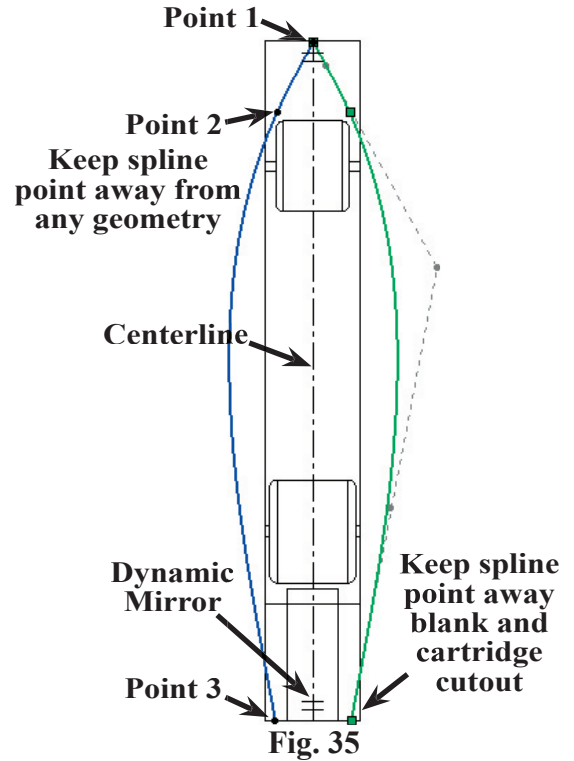


Fig. 34



Step 7. Click **Dynamic Mirror** on the Sketch toolbar or Tools Menu > Sketch Tools > Dynamic Mirror, **Fig. 35**. Symmetry symbols appear at both ends of the centerline. Geometry drawn on one side of mirror centerline will mirror onto the other side.



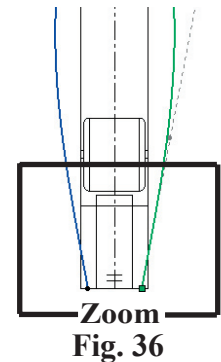
Step 8. Click **Spline**  (S) on the Sketch toolbar.

Step 9. Draw a spline starting from the end of the centerline, **Point 1, Fig. 35**. Click approximately where the 3 points are positioned in **Fig. 35**. **Keep Point 2 away from any geometry**, the blank and wheel cutout. **Keep Point 3 away from the blank corner and cartridge cutout**. Press Escape to end the spline.

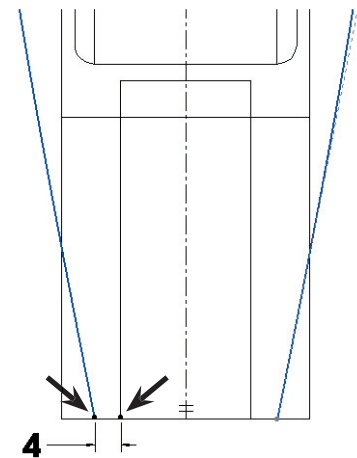
Step 10. Use the **Zoom to Area**  in the View toolbar to drag a zoom window around the **rear end of the body, Fig. 36**.

Step 11. Click **Smart Dimension**  (S) on the Sketch toolbar.

Step 12. Add **dimension between bottom spline point and cartridge cutout bottom corner** as shown in **Fig. 37**. To Smart dimension click the spline point and the cartridge corner, then move the cursor up off the sketch and click. Key-in **4 for the dimension** and press ENTER.



Step 13. **Press Escape** to unselect Smart Dimension.



Step 14. Scroll up to front of body. To scroll hold down **Ctrl** and press down arrow key.

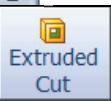
Step 15. Click the spline to display the Spline Points (green) and Control Polygon.

Step 16. Click the second gray Control Point to activate it and the Control Point turns yellow. Pull the second Control Point (yellow) out to round the front of the spline and this will start to align the spline with the wheel cutout, **Fig. 38** and **Fig. 39**.

Step 17. Then, pull back in the next Control Point (yellow) to align spline between blank and the wheel cutout, **Fig. 38** and **Fig. 39**.

Step 18. Scroll down to rear of body. Use **Ctrl** and down arrow key.

Step 19. Pull the Control Point (yellow) that is outside the rear wheel cutout back behind the wheel cutout and align spline between the blank edge and the wheel cutout, **Fig. 40** and **Fig. 41**. The spline must be between the blank and the wheel cutouts.

Step 20. Click **Features**  on the Command Manager toolbar and **Extruded Cut**  on the Features toolbar.

Step 21. Click **Shaded With Edges**  on the View toolbar.

Step 22. In the Cut-Extrude Property Manager: under **Direction 1**

End Condition to Through All
The Direction arrow should point towards area to be cut away, Fig. 42. If arrow is pointing in wrong direction, click **Flip side to cut**, **Fig. 43**, click OK .

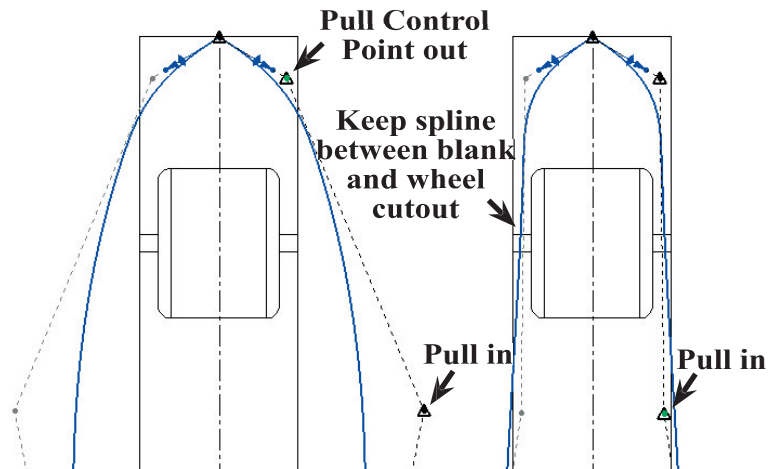


Fig. 38

Fig. 39

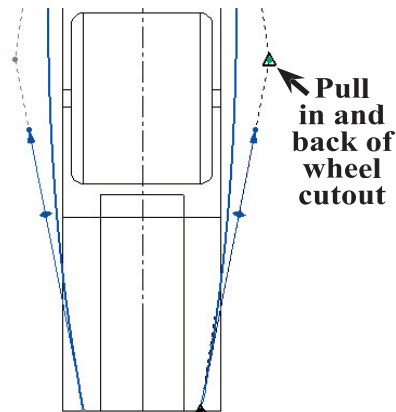


Fig. 40

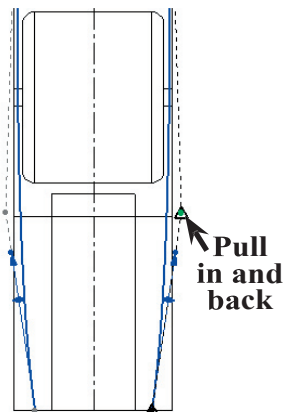


Fig. 41

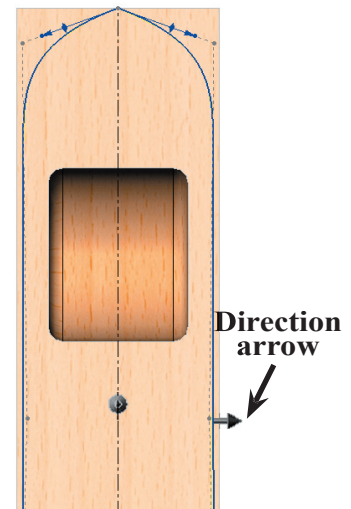


Fig. 42

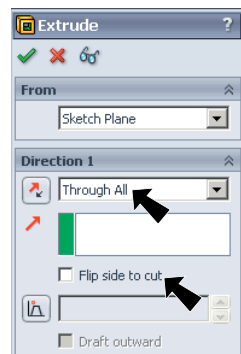


Fig. 43

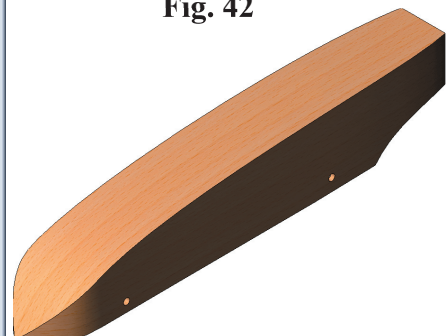


Fig. 44

G. Fillet Top Edges.

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

Step 2. Click **Fillet**  on the Features toolbar.

Step 3. Click the **top edge on both sides** of the body, **Fig. 45**.

Step 4. Set the **Radius**  to **12** in the Fillet Property Manager and click **OK** , **Fig. 46** and **Fig. 47**.

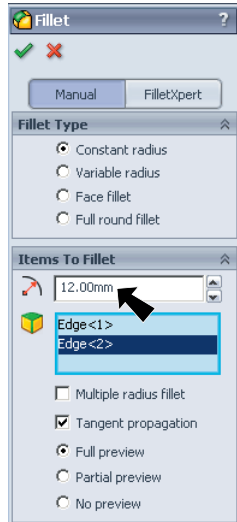


Fig. 46

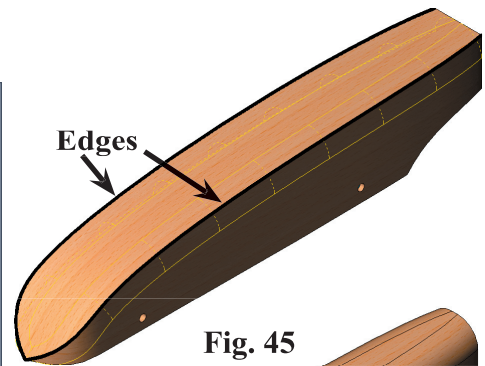


Fig. 45

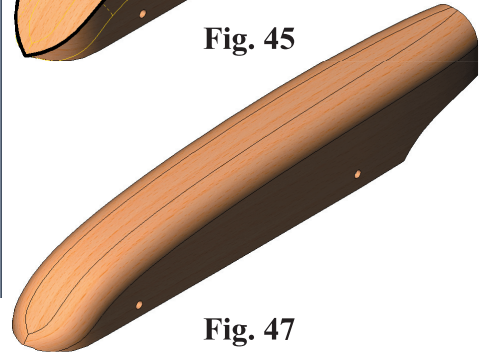


Fig. 47

H. Variable Fillet Edges Under Cartridge.

Step 1. Use the left arrow on the keyboard to rotate view as shown in **Fig. 48**.

Step 2. Click **Fillet**  on the Features toolbar.

Step 3. Click the **both edges under cartridge cutout**, **Fig. 48**.

Step 4. In the Fillet Property Manager:
under **Fillet type**
Select **Variable radius**
Set the **Unsigned Variable radius** to **12** in the rear and **6** in the front. To set radius, click **Unsigned** and key in radius

Click **OK** , **Fig. 49** and **Fig. 50**.

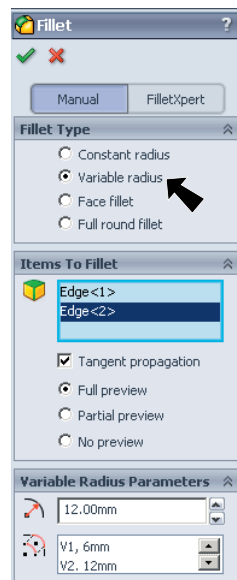


Fig. 49

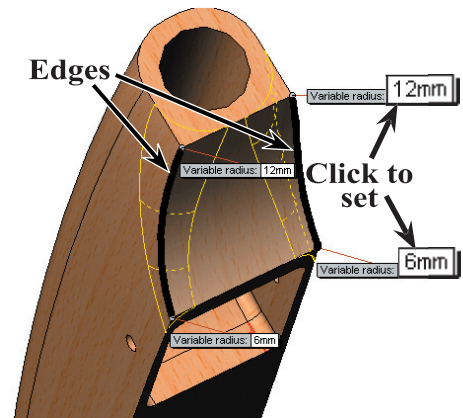


Fig. 48

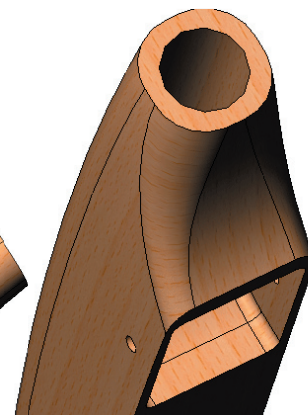


Fig. 50

Step 5. Save. Use **Ctrl-S**.

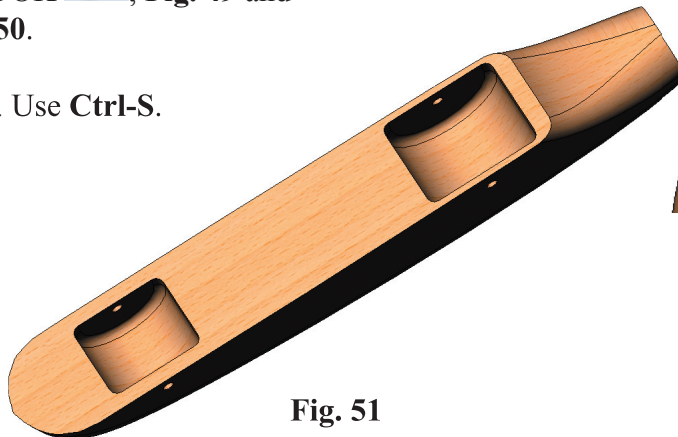


Fig. 51

I. "Duck Tail" Extrude Under Cartridge Hole.

Step 1. Click **Bottom**  on the Standard Views toolbar. (Ctrl-6)

Step 2. Click the **bottom face** and click **Sketch**  on the Content menu, **Fig. 52**.

Step 3. Use the **Zoom to Area**  in the View toolbar to drag a zoom window around the **rear end of the body**, **Fig. 52**.

Step 4. Click **Centerline**  in the **Line flyout**  (S) on the Sketch toolbar.

Step 5. Starting from midpoint of the bottom of the sketch, draw a centerline up to the wheel shell, **Fig. 53**.

Step 6. Press the **Escape** key to unselect Centerline tool.

Step 7. Click the centerline to select it, **Fig. 53**.

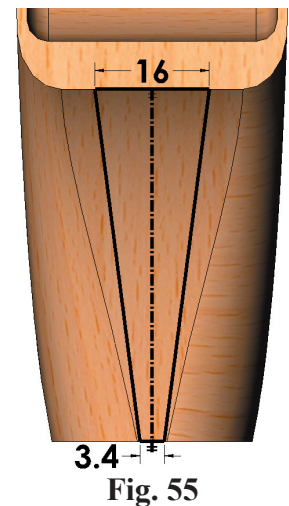
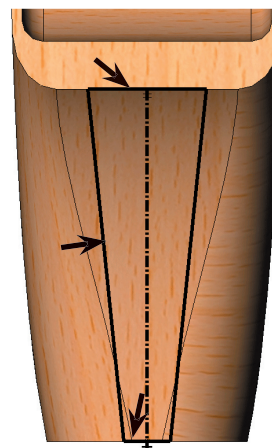
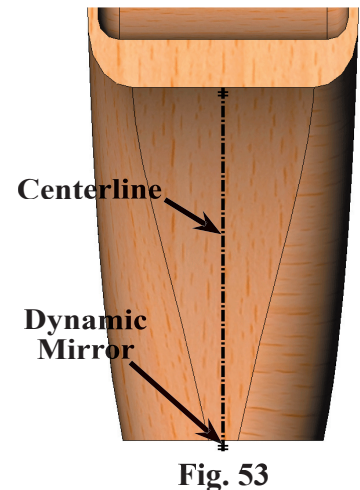
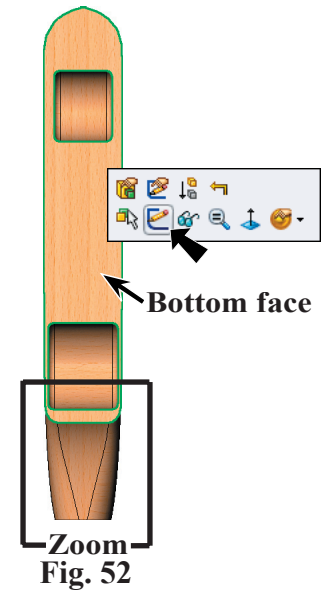
Step 8. Click **Dynamic Mirror**  on the Sketch toolbar or Tools Menu > Sketch Tools > Dynamic Mirror, **Fig. 53**. Symmetry symbols appear at both ends of the centerline. Geometry drawn on one side of mirror centerline will mirror onto the other side.

Step 9. Click **Line**  (L) on the Sketch toolbar.

Step 10. Draw the **3 lines** in **Fig. 54**. Draw the lines on one side of the centerline and the Dynamic Mirror will mirror lines to other side. Start at the centerline.

Step 11. Click **Smart Dimension**  (S) on the Sketch toolbar.

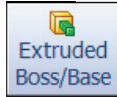
Step 12. Dimension as shown **Fig. 55**. To Smart dimension click the line to dimension, then move the cursor up off the line and click. Key-in the dimension and press ENTER.



Step 13. Use the **Rotate View**  in the View toolbar or hold down middle mouse button and drag mouse to rotate view as shown in **Fig. 56**.

Step 14. Click **Features**  on the Command Manager toolbar.

Step 15. Click **Extruded Boss/Base**



on the Features toolbar.

Step 16. In the Property Manager set:
under **Direction 1**

End Condition  to **Up To Surface**, **Fig. 57**

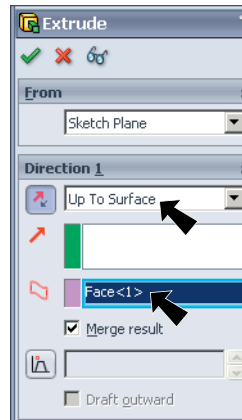


Fig. 57

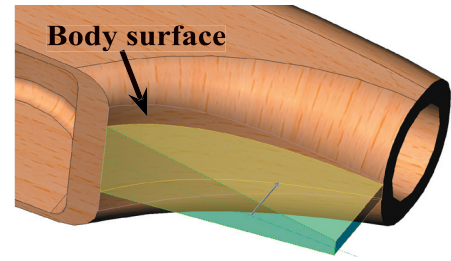


Fig. 56

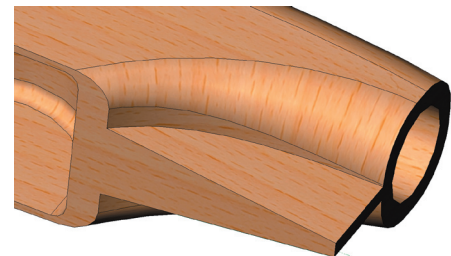


Fig. 58

set **Face/Surface**: click the body surface under the cartridge hole (not the fillet), **Fig. 56**

click OK , **Fig. 58**.

J. Variable Fillet Edges Along "Duck Tail".

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

Step 2. Click the both edges under cartridge cutout, **Fig. 59**.

Step 3. In the Fillet Property Manager:
under **Fillet type**
Select **Variable radius**
Set the **Unsigned Variable radius to 12 in the rear and 6 in the front**. To set radius, click **Unsigned** and key in radius, **Fig. 59**.

Click OK , **Fig. 61**.

Step 4. Save. Use **Ctrl-S**.

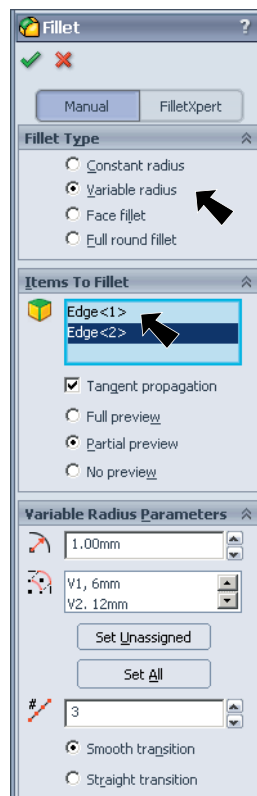


Fig. 60

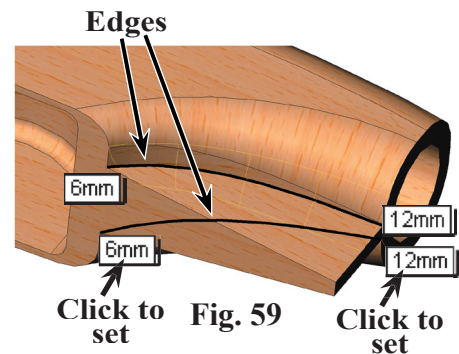


Fig. 59

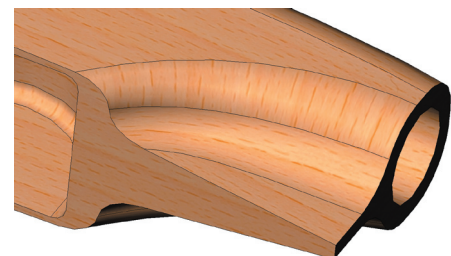


Fig. 61