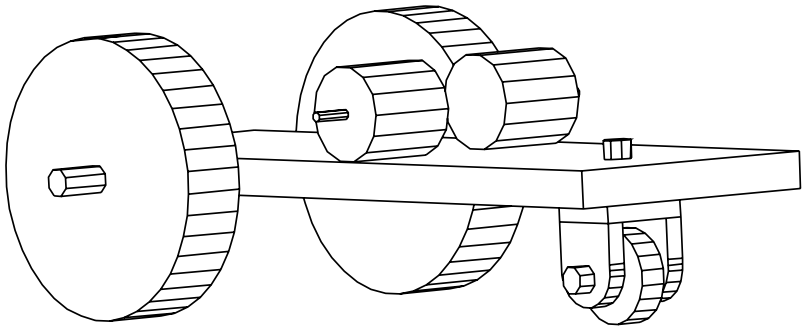
# Chapter 24 SUMO CAR 3D

## A. OPEN B FILE.

Step 1. When you start a new drawing away start with the B file. If you started this drawing as the B file go directly to Steps B. If your did not start as the B file complete these Steps: Click **Open** from the File Menu. Click **F1 No** to save current part. Key in **b** for the filename and press ENTER.

## B. CREATE A RECTANGLE.

Step 1. ESC to Main Menu.



Step 2. F1 CREATE.

Step 3. F1 LINE.

Step 4. F7 RECTANGLE.

Step 5. F2 WIDTH/HEIGHT.

Step 6. Key in **9** for width and press ENTER.

Step 7. Key in **3** for height and press ENTER.

Step 8. F9 KEY IN.

Step 9. Key in:
Zero (0) for coordinate X and press ENTER.
0 for Y and press ENTER.
0 for Z and press ENTER.

Step 10. ESC to Main Menu.

Step 11. Use **ALT-A** to center the rectangle on the screen. Hold down ALT and press A.

## C. CHANGE DISPLAY TO 4 VIEWPORTS.

Step 1. ESC to Main Menu.

Step 2. Click Viewport from the Menu Bar.

Step 3. Click Layout from the Viewport menu.

Step 4. Click the bottom right viewport to set 4 viewports.

Step 5. Click the top right viewport to make it active.

Step 6. Use **ALT-A** to center the drawings in the 4 viewports. **Then, press ENTER**.

## D. ADD THE 3rd DIMENSION TO CHASSIS.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F7 ALL DISPLAY.

Step 6. Click any viewport.

Step 7. F1 ALL.

Step 8. Key in 1 for the Number of Copies and press ENTER.

Step 9. Key in:
0 for dX and press ENTER.
0 for dY and press ENTER.
**-.4** for dZ and press ENTER.

Step 10. At this time it is a good idea to save the drawing. Click **Save As** from the File Menu. Key **sumo3d** filename and press ENTER. Press ESC for Part Description.

## E. DRAW THE REAR AXLE.

Step 1. Turn on Tracking. Use **CTRL-T**. Hold down CTRL and press T.

Step 2. F3 WORLD.

Step 3. Draw the axle in a different color. Change the color to **yellow**. Click the color swatch in the side Tool Bar. Click the yellow, number 4.

Step 4. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 5. F1 VALUE.

Step 6. Key in **1.4** for the new depth and press ENTER.

Step 7. ESC to Main Menu.

Step 8. F1 CREATE.

Step 9. F5 POLYLINE.

Step 10. F3 N-GON.

Step 11. Key in **8** for the Number of Sides and press ENTER.

Step 12. Key in 0 for Rotation Angle.

Step 13. Key in **.14** for Radius.

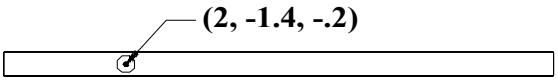


FIG. 1

Step 14. F2 FLAT.

Step 15. In the Side View, move cursor to coordinates **(2, -1.4, -.2)** and click for the center of the axle, **Fig. 1**.

## F. X-FORM THE AXLE ACROSS THE CHASSIS.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

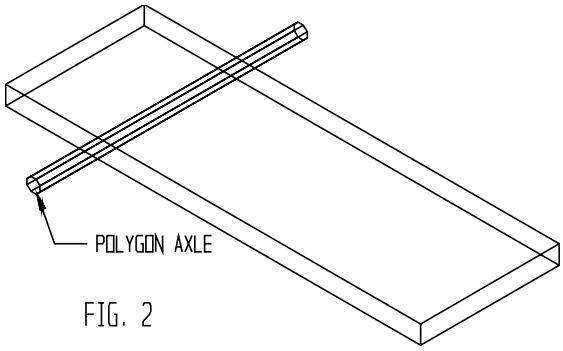


FIG. 2

Step 6. Click the yellow polygon of the axle and press ENTER.

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER
**5.8** for dY and press ENTER
0 for dZ and press ENTER, **Fig. 2**.

Step 9. Save the drawing. Use **CTRL-S**.

## G. DRAW BACK WHEEL.

Step 1. Draw the wheel in a different color. Change the color to **red**. Click the color swatch in the side Tool Bar. Click the red, number 2.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **.85** for the new depth and press ENTER.

Step 5. ESC to Main Menu.

Step 6. F1 CREATE.

Step 7. F5 POLYLINE.

Step 8. F3 N-GON.

Step 9. Key in **40** for the Number of Sides and press ENTER.

Step 10. Key in 0 for Rotation Angle.

Step 11. Key in **1.5** for Radius.

Step 12. F2 FLAT.

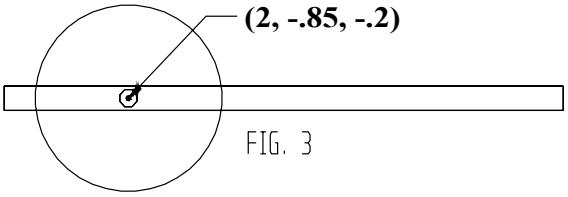


FIG. 3

Step 13. In the Side View, move cursor to the center of the axle, coordinates **(2, -.85, -.2)** and click for the center of the wheel, **Fig. 3**.

## H. ADD THE 3rd DIMENSION TO WHEEL.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

Step 6. Click the red polygon of the wheel and press ENTER.

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER
**.7** for dY and press ENTER
0 for dZ and press ENTER, **Fig. 4**.

Step 9. Save the drawing. Use **CTRL-S**.

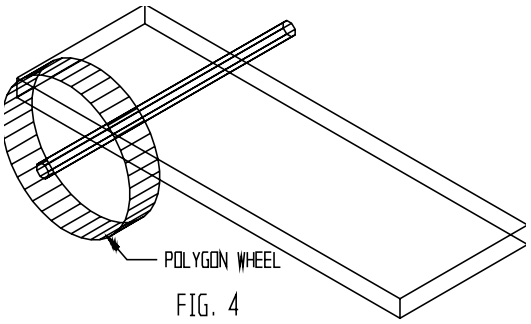


FIG. 4

## I. MIRROR WHEEL.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F5 MIRROR.

Step 4. F2 COPY.

Step 5. F3 WINDOW.

Step 6. In the Top View, window around the wheel. To window, move the cursor to just outside the top left corner of the wheel and click to start the 1ST WINDOW CORNER, **Fig. 5**. Stretch the window to surround the wheel. Click to set 2ND WINDOW CORNER.

Step 7. F1 1 POINT HORIZONTAL.

Step 8. F4 CENTER.

Step 9. To indicate position on plane, in the Top View, click the right side of the chassis rectangle, **Fig. 5**.

Step 10. ESC to Main Menu.

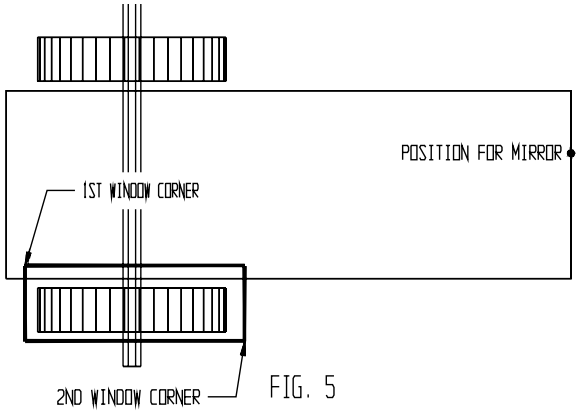


FIG. 5

## J. DRAW THE MOTOR.

Step 1. Draw the motor in a different color. Change the color to **pink**. Click the color swatch in the side Tool Bar. Click the pink, number 13.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **-.1** for the new depth and press ENTER.

Step 5. **Set the Snap to .1**. Use **CTRL-G**. Hold down CTRL and press G. Change the **Snap Properties Increment** to **X = .1 and Y = .1** Click OK.

Step 6. ESC to Main Menu.

Step 7. F1 CREATE.

Step 8. F5 POLYLINE.

Step 9. F3 N-GON.

Step 10. Key in **14** for the Number of Sides and press ENTER.

Step 11. Key in 0 for Rotation Angle.

Step 12. Key in **.5** for Radius.

Step 13. F2 FLAT.

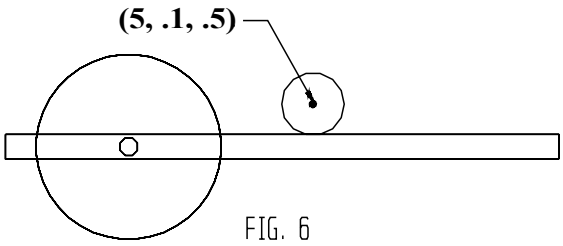


FIG. 6

Step 14. In the Side View, move cursor to the center of the motor, coordinates **(5, .1, .5)** and click for the center of the motor, **Fig. 6**.

## K. DRAW THE MOTOR SHAFT.

Step 1. Draw the motor shaft in a different color. Change the color to **peach**. Click the color swatch in the side Tool Bar. Click the peach, number 12.

Step 2. ESC to Main Menu.

Step 3. F1 CREATE.

Step 4. F5 POLYLINE.

Step 5. F3 N-GON.

Step 6. Key in **8** for the Number of Sides and press ENTER.

Step 7. Key in 0 for Rotation Angle.

Step 8. Key in **.05** for Radius.

Step 9. F2 FLAT.

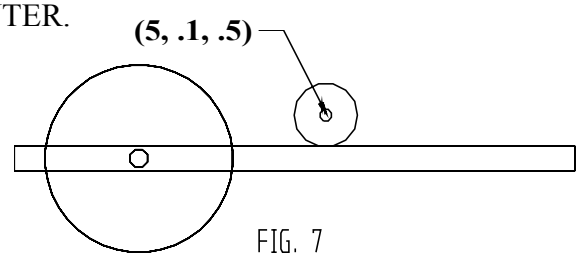


FIG. 7

Step 10. In the Side View, move cursor to coordinates **(5, .1, .5)** and click for the center of the motor shaft, **Fig. 7.**

Step 11. Save the drawing. Use **CTRL-S**.

## L. ADD THE 3rd DIMENSION TO MOTOR SHAFT.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

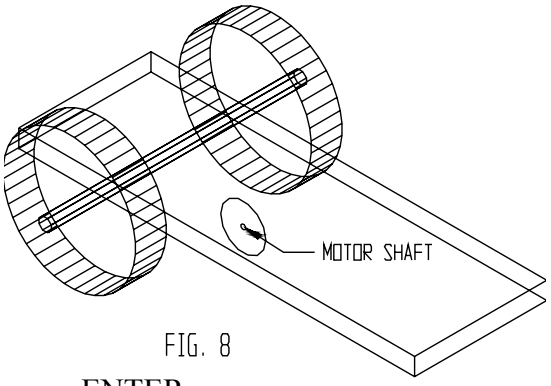


FIG. 8

Step 6. Click the polygon of the motor shaft, **Fig. 8,** and press ENTER.

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER.
**-.4** for dY and press ENTER.
0 for dZ and press ENTER.

## M. ADD THE 3rd DIMENSION TO MOTOR.

Step 1. Draw the motor in a different color. Change the color to **pink**. Click the color swatch in the side Tool Bar. Click the pink, number 13.

Step 2. ESC to Main Menu.

Step 3. F4 X-FORM.

Step 4. F1 DELTA.

Step 5. F3 JOIN.

Step 6. F1 SINGLE.

Step 7. Click the motor polygon, **Fig. 9,** and press ENTER.

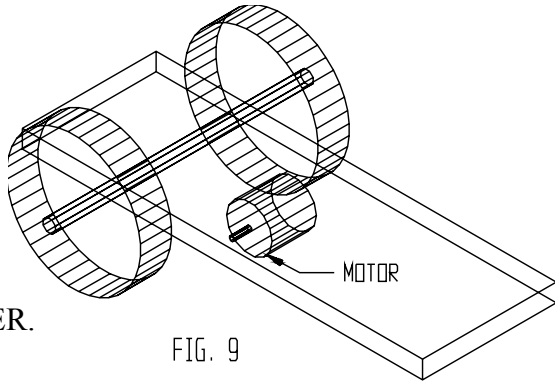


FIG. 9

Step 8. Key in 1 for the Number of Copies and press ENTER.

Step 9. Key in:
0 for dX and press ENTER.
**1** for dY and press ENTER.
0 for dZ and press ENTER.

Step 10. Save the drawing. Use **CTRL-S**.

## N. MIRROR THE MOTOR and SHAFT.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F5 MIRROR.

Step 4. F2 COPY.

Step 5. F3 WINDOW.

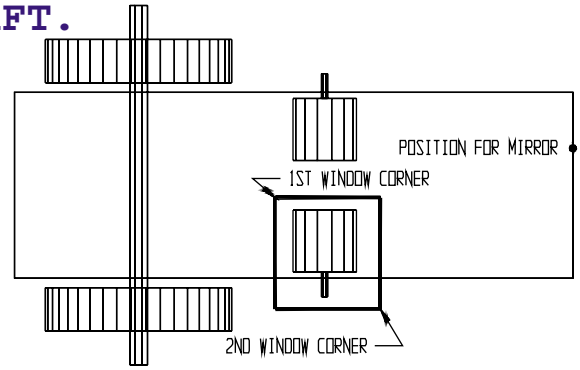


FIG. 10

Step 6. In the Top View, window around the motor and shaft. To window, move the cursor to just outside the top left corner of the motor and click to start the 1ST WINDOW CORNER, **Fig. 10**. Stretch the window to surround the motor and shaft. Click to set 2ND WINDOW CORNER.

Step 7. F1 1 POINT HORIZONTAL.

Step 8. F4 CENTER.

Step 9. To indicate position on plane, in the Top View, click the right side of the chassis rectangle, **Fig. 10**.

## O. FRONT WHEEL CASTER RECTANGLE.

Step 1. Draw the caster. Change the color to **dark blue**. Click the color swatch in the side Tool Bar. Click the dark blue, number 8.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **-.45** for the new depth and press ENTER.

Step 5. ESC to Main Menu.

Step 6. F1 CREATE.

Step 7. F1 LINE.

Step 8. F7 RECTANGLE.

Step 9. F1 CORNERS.

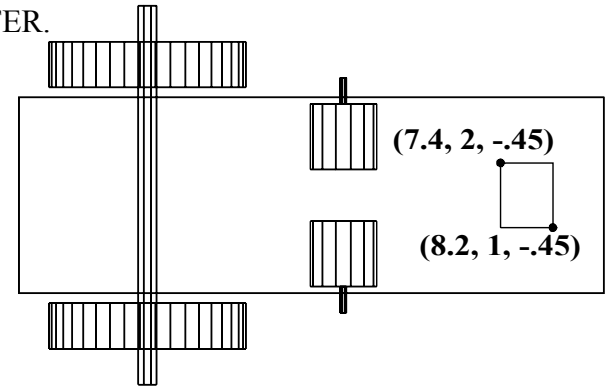


FIG. 11

Step 10. In the Top View, start the rectangle with a click at coordinates **(7.4, 2, -.45)**, **Fig. 11**. Move the cursor to stretch the rectangle to coordinates **(8.2, 1, -.45)** and click.

## P. X-FORM CASTER DEPTH.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

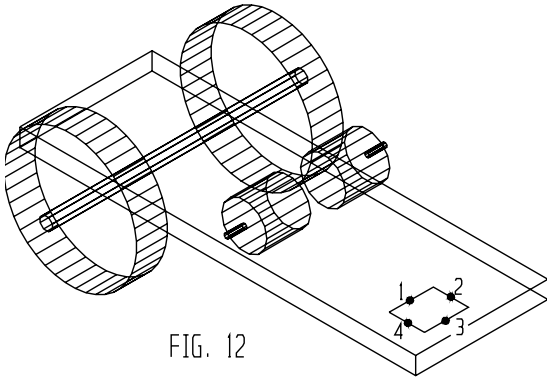


FIG. 12

Step 6. Click the lines that make up the caster rectangle, Lines 1 through 4, **Fig. 12**, and press ENTER.

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER
0 for dY and press ENTER
**-.2** for dZ and press ENTER.

Step 9. Save the drawing. Use **CTRL-S**.

## Q. X-FORM THE DEPTH OF THE CASTER SIDE.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3 F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

Step 6. Click Line 4, **Fig. 13** and press ENTER.

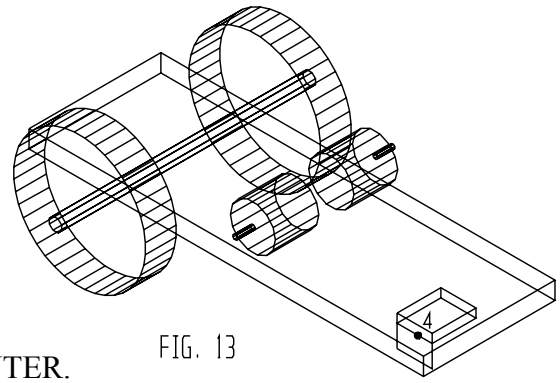


FIG. 13

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER
0 for dY and press ENTER
**-.5** for dZ and press ENTER.

## R. ROUND CORNERS OF CASTE SIDE.

Step 1. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 2. F1 VALUE.

Step 3. Key in **-1** for the new depth and press ENTER.

Step 4. ESC to Main Menu.

Step 5. F1 CREATE.

Step 6. F5 POLYLINE.

Step 7. F3 N-GON.

Step 8. Key in **20** for the Number of Sides.

Step 9. Key in 0 for Rotation Angle.

Step 10. Key in **.4** for Radius and press ENTER.

Step 11. F2 FLAT.

Step 12. F4 CENTER.

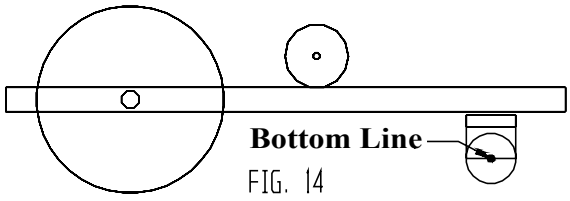


FIG. 14

Step 13. In the Side View, click the bottom line of the caster's side, **Fig. 14**.

## S. EDIT USING TRIM DOUBLE.

Step 1. In the Isometric View, use **ALT-W** to zoom in on the area to trim. Hold down ALT and press W. Move the cursor to just outside the top left corner of the caster, **Fig. 15**. Click to start the window. Stretch the window by moving the mouse to surround the caster with the window. Click to set the window.

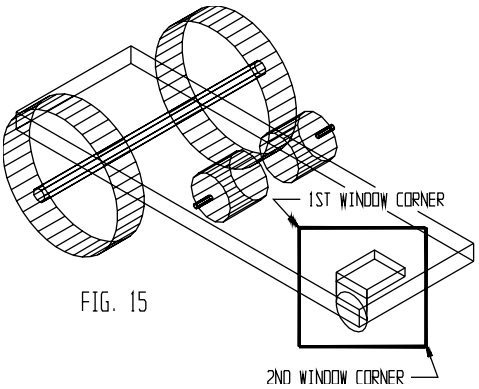


FIG. 15

Step 2. ESC to Main Menu.

Step 3. F2 EDIT.

Step 4. F1 TRIM/EXTEND.

Step 5. F3 DOUBLE.

Step 6. Click the n-gon Line 1, Fig. 16, as the line to keep, then click the intersections with the n-gon, Lines 2 and 3.

Step 7. Delete Line 4, **Fig. 16**, by using **CTRL-Q**. Hold down CTRL and press Q. Move the cursor over the line and select the line with a click and press ENTER.

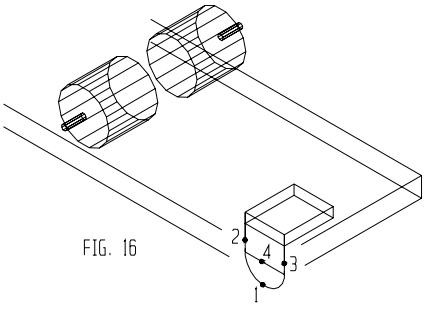


FIG. 16

## T. ADD THE 3rd DIMENSION TO CASTER SIDE.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

Step 6. Click the n-gon, Line 1, Line 2 and Line 3, **Fig. 17**, and press ENTER.

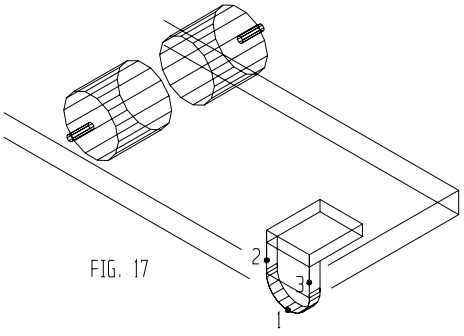


FIG. 17

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER.
**.2** for dY and press ENTER.
O for dZ and press ENTER.

## U. MIRROR THE CASTER SIDE.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F5 MIRROR.

Step 4. F2 COPY.

Step 5. F3 WINDOW.

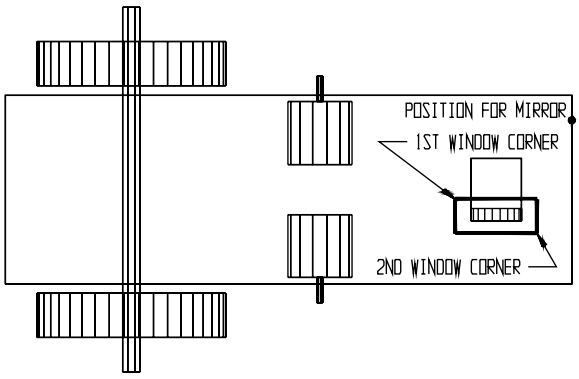



FIG. 18

Step 6. In the Top View, window around the caster's side. To window, move the cursor to just outside the top left corner of the caster's side and click to start the 1ST WINDOW CORNER, **Fig. 18**. Stretch the window to surround the caster's side. Click to set 2ND WINDOW CORNER.

Step 7. F1 1 POINT HORIZONTAL.

Step 8. F4 CENTER.

Step 9. To indicate position on plane, in the Top View, click on the right side of the chassis rectangle, **Fig. 18**.

Step 10. ESC to Main Menu.

## V. DRAW THE CASTER AXLE.

Step 1. Draw the axle in a different color. Change the color to **yellow**. Click the color swatch in the side Tool Bar. Click the yellow, number 4.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **-.8** for the new depth and press ENTER.

Step 5. ESC to Main Menu.

Step 6. F1 CREATE.

Step 7. F5 POLYLINE.

Step 8. F3 N-GON.

Step 9. Key in **8** for the Number of Sides and press ENTER.

Step 10. Key in 0 for Rotation Angle.

Step 11. Key in **.14** for Radius.

Step 12. F2 FLAT.

Step 13. In the Side View, move cursor to coordinates **(7.8, .8, -1.2)** and click for the center of the axle, **Fig. 19**.

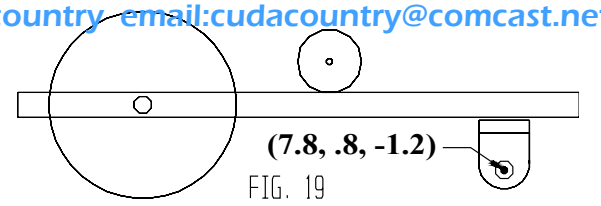


FIG. 19

## W. X-FORM AXLE ACROSS CASTER.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

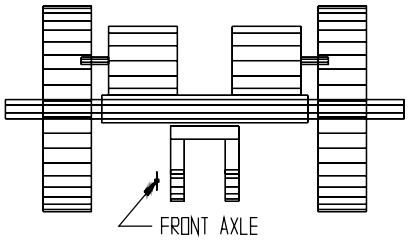


FIG. 20

Step 6. In the Front View, click the yellow polygon of the axle, **Fig. 20** and press ENTER.

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER
**1.4** for dY and press ENTER
0 for dZ and press ENTER.

Step 9. Save the drawing. Use **CTRL-S**.

## X. DRAW THE STEM.

Step 1. Draw the caster stem in a different color. Change the color to **green**. Click the color swatch in the side Tool Bar. Click the green, number 1.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **.2** for the new depth and press ENTER.

Step 5. ESC to Main Menu.

Step 6. F1 CREATE.

Step 7. F5 POLYLINE.

Step 8. F3 N-GON.

Step 9. Key in **8** for the Number of Sides and press ENTER.

Step 10. Key in 0 for Rotation Angle.

Step 11. Key in **.14** for Radius.

Step 12. F2 FLAT.

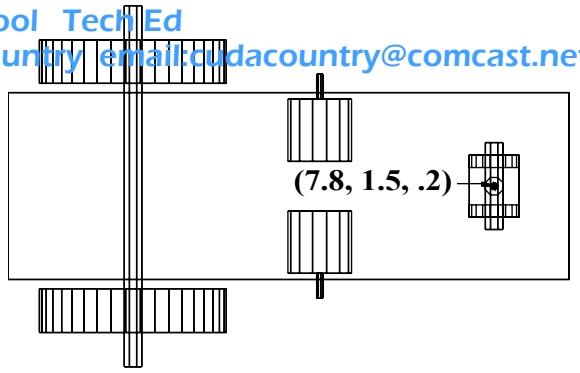



FIG. 21

Step 13. In the Top View, move cursor to center of the caster, coordinates **(7.8, 1.5, .2)**, **Fig. 21** and click for the center of the stem.

## Y. X-FORM STEM THROUGH FORK.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

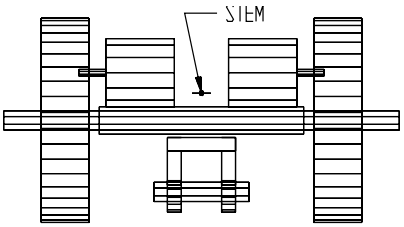



FIG. 22

Step 6. In the Front View, click the green polygon of the stem, **Fig. 22** and press ENTER.

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER
0 for dY and press ENTER
**-.85** for dZ and press ENTER.

## Z. DRAW CASTER WHEEL.

Step 1. Draw the caster wheel in a different color. Change the color to **red**. Click the color swatch in the side Tool Bar. Click the red, number 2.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **-1.35** for the new depth and press ENTER.

Step 5. ESC to Main Menu.

Step 6. F1 CREATE.

Step 7. F5 POLYLINE.

Step 8. F3 N-GON.

Step 9. Key in **20** for the Number of Sides and press ENTER.

Step 10. Key in 0 for Rotation Angle.

Step 11. Key in **.5** for Radius and press ENTER.

Step 12. F2 FLAT.

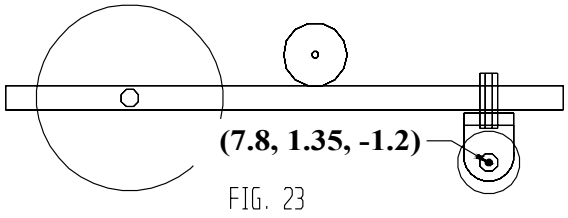


FIG. 23

Step 13. In the Side View, move cursor to coordinates **(7.8, 1.35, -1.2)** and click for the center of the front wheel, **Fig. 23**.

## AA. ADD THE 3rd DIMENSION TO WHEEL.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

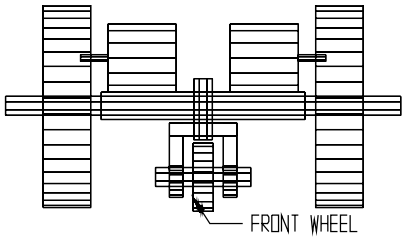


FIG. 24

Step 6. In the Front View, click the red polygon of the front wheel and press ENTER, **Fig. 24**.

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:
0 for dX and press ENTER
**.3** for dY and press ENTER
0 for dZ and press ENTER.

Step 9. Save the drawing. Use **CTRL-S**.

## BB. CREATE LAYOUT VIEW.

Step 1. Sumo Car construction is now complete. The final step is to create a layout drawing of the Sumo Car in three different views, plus the Isometric View.

Step 2. ESC to Main Menu.

Step 3. Click the **down arrow** on the top Tool Bar until the **Layout Button** is displayed.

Step 4. Click the **Layout Button**.

Step 5. Key in: **scar2** for the Name.

Step 6. Set the **Paper Size** to **B**.

Step 7. Set the **Drawing Scale** to **KEY-IN** (Key-In is at bottom of list).

Step 8. Set **Actual Scale** to .8

Step 9. Click OK.

Step 10. F5 INSTANCE.

Step 11. F1 CREATE.

Step 12. Select **Top View** and click OK.

Step 13. Key in **0** for Rotation Angle and Press ENTER.

Step 14. F9 KEYIN.

Step 15. Key in: For **TOP VIEW**,
**5** for X and press ENTER.
**7.5** for Y and press ENTER.
**0** for Z and press ENTER.

Step 16. F1 CREATE.

Step 17. Select **Front View** and click OK.

Step 18. Key in **0** for Rotation Angle and Press ENTER.

Step 19. F9 KEYIN.

Step 20. Key in: For **FRONT VIEW**,
**5** for X and press ENTER.
**2.3** for Y and press ENTER.
**0** for Z and press ENTER.

Step 21. F1 CREATE.

Step 22. Select **Left View** and click OK.

Step 23. Key in **0** for Rotation Angle and Press ENTER.

Step 24. F9 KEYIN.

Step 25. Key in: For **LEFT VIEW**,
**13.2** for X and press ENTER.
**2.3** for Y and press ENTER.
**0** for Z and press ENTER.

Step 26. F1 CREATE.

Step 27. Select **Isometric View** and click OK.

Step 28. Key in **0** for Rotation Angle and Press ENTER.

Step 29. F9 KEYIN.

Step 30. Key in: For **ISOMETRIC VIEW**,
**13.2** for X and press ENTER.
**7.7** for Y and press ENTER.
**0** for Z and press ENTER.

Step 31. Save the drawing. Use **CTRL-S**.

## CC. ROTATE ISOMETRIC INSTANCE.

Step 1. F10 BACKUP.

Step 2. F6 MODELIZE.

Step 3. F1 INSTANCE.

Step 4. Click the Isometric View instance as instance to modelize.

Step 5. F2 YES.

Step 6. ESC to Main Menu to return to model mode.

Step 7. F4 X-FORM.

Step 8. F3 ROTATE.

Step 9. F1 MOVE.

Step 10. F7 ALL DIS-
PLAYED.

Step 11. F1 ALL.

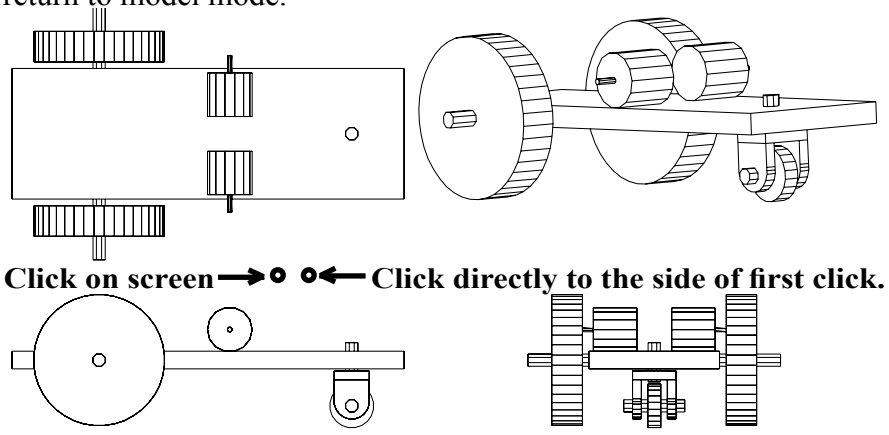



FIG. 30

Step 12. To indicate first point on axis, click in the middle of the screen, **Fig. 25**.

Step 13. To indicate 2nd point on axis click directly to side of your first click, **Fig. 25**.

Step 14. Key in **-30** degrees for rotation angle and press ENTER.

Step 15. Save the drawing. Use **CTRL-S**.