CAD Tutorial : 3D Printable Tank

Design out the box

Time 50-60 mins approx

Level of difficulty ★★★★☆

By the end of this tutorial you will be able to…

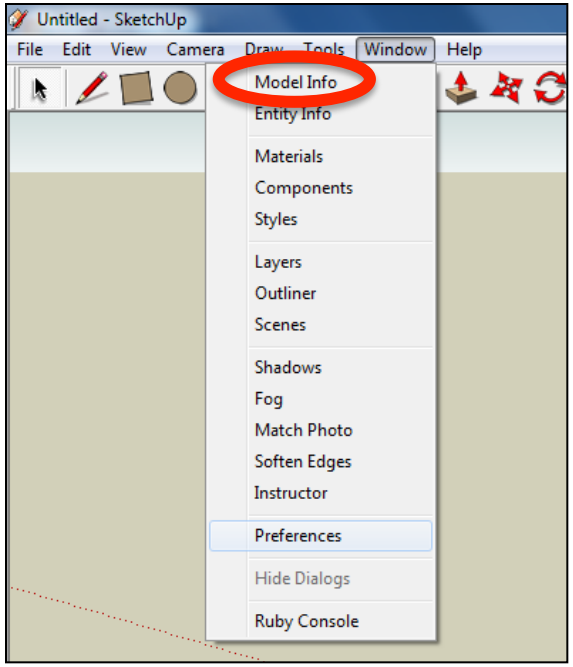
- Use construction lines
- Make components
- Move and Copy components
- Colour/render your design
- Have a 3D printable object complete with moving wheels and rotating turret.

Skills to be used in this project…

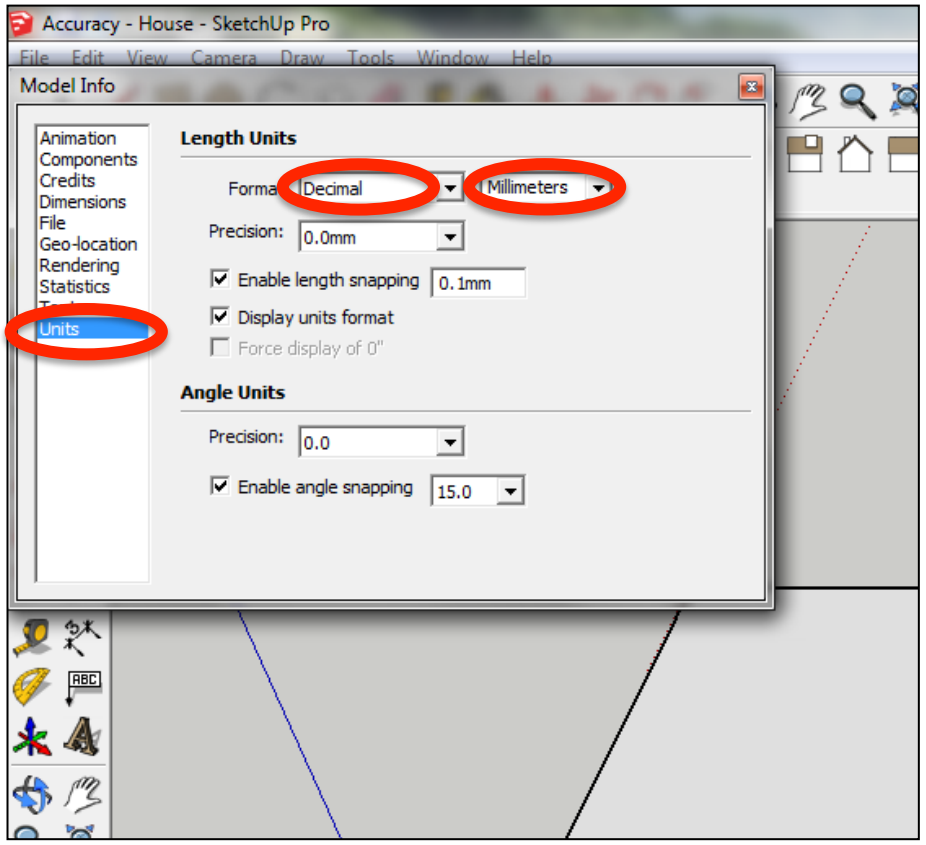
Basic Skills	New and Higher Skills
Zoom tool	Tape Measure tool (for guidelines)
Orbit tool	Use the Views toolbar
Pan tool	Create and Move components
Line tool	Paint Bucket tool
Rectangle tool	
Circle tool	
Eraser tool	
Push/Pull tool	

Basic skills are those required to do very basic drawings and are detailed as part of this presentation.

New and higher skills may be new to the novice and are the focus for learning in this presentation.



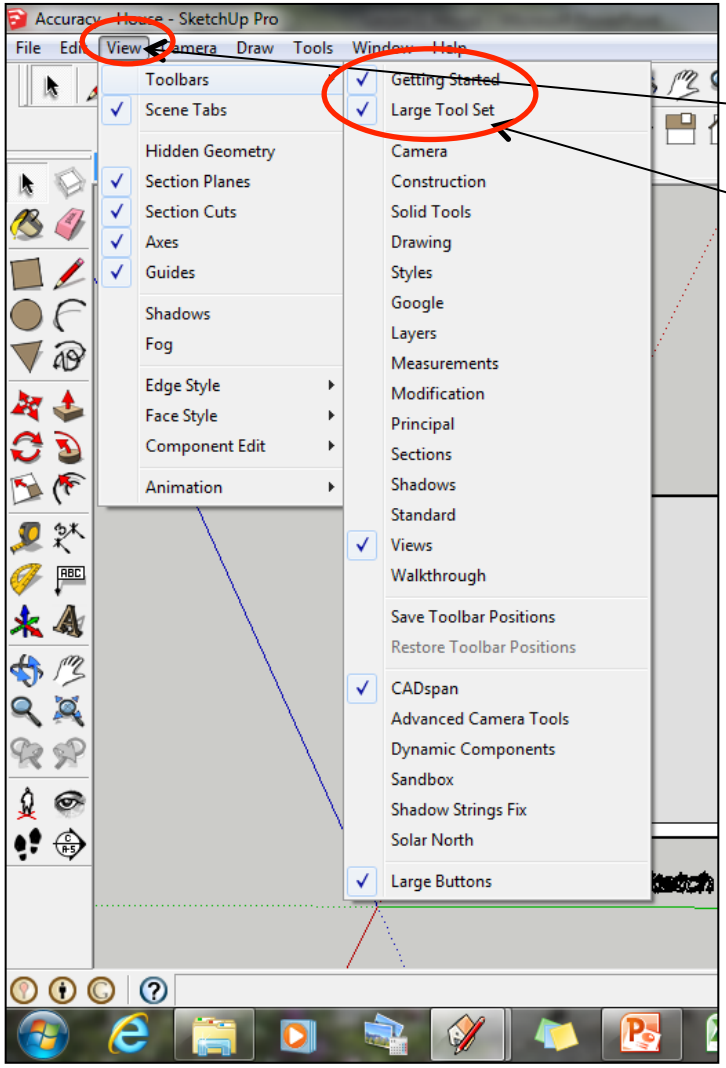
1. Open the sketch up drawing. Once you have opened SketchUp, go to **Window** and select **Model Info**



2. Select **Units** and choose **Decimal Millimetres**. We are using this template because we are doing a product design.

***Note**: It is often necessary to start a new file to use the new template. Go to **File** then **New**.*

3. Now select the **View** then **toolbars** and ensure **Getting Started** and **Large Tool Set** are ticked

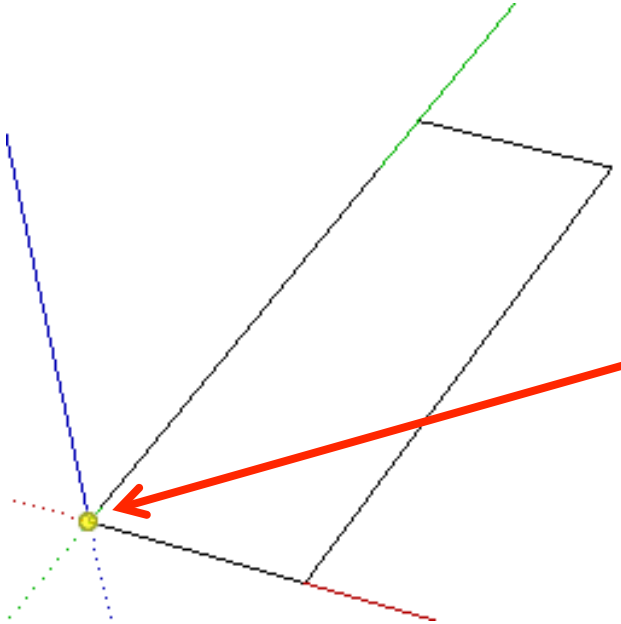


3a Select **View**

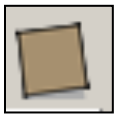
3b Tick Getting Started

3c Tick Large Tool Set

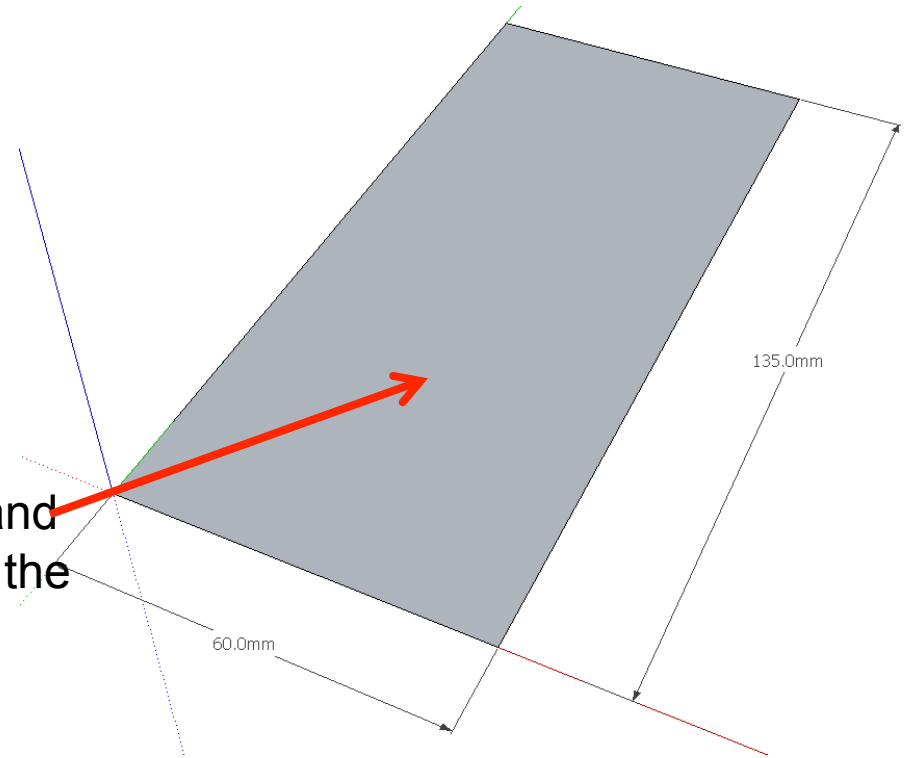
Note**: this will place a tool bar across the top **(getting started)** and the side **(Large Tool Set)

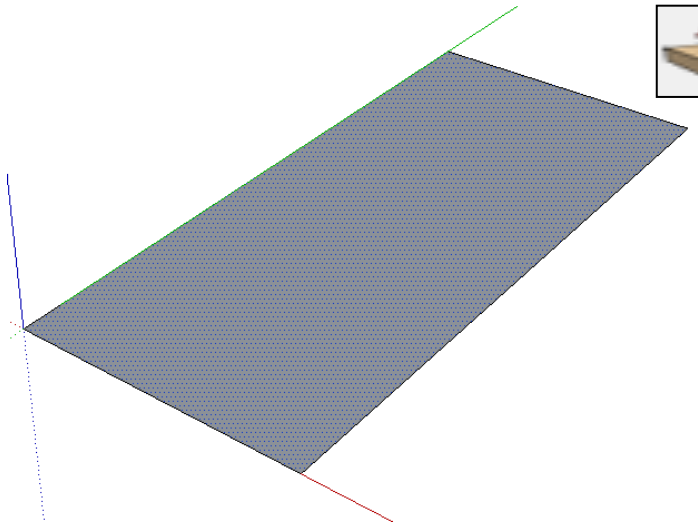


4. Select the ***Rectangle tool*** and draw a rectangle on the base by clicking and ***dragging the cursor diagonally.***



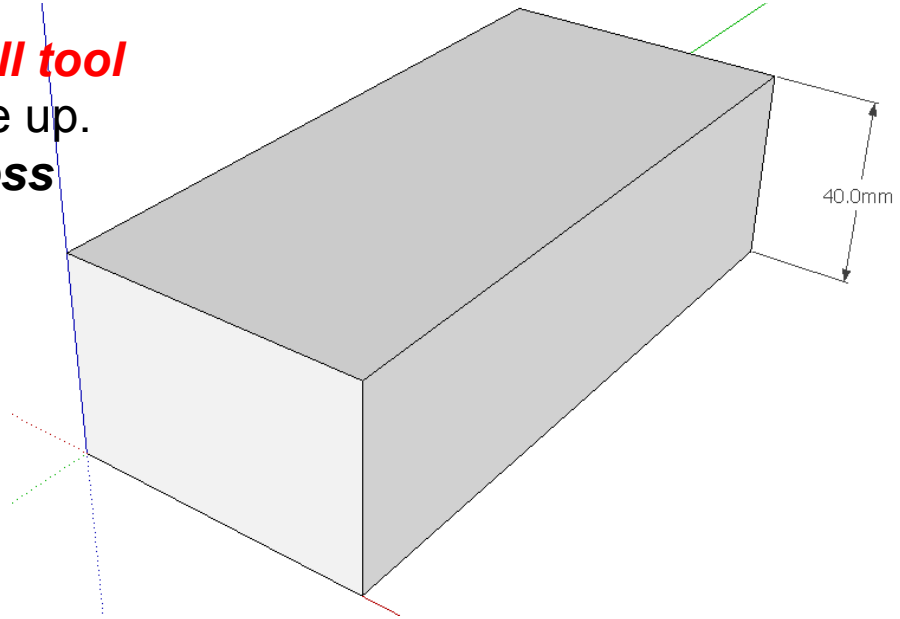
5. Once you have drawn the rectangle, enter ***'60, 135'*** and then press ***Enter*****.** Click on the **zoom extents** symbol.

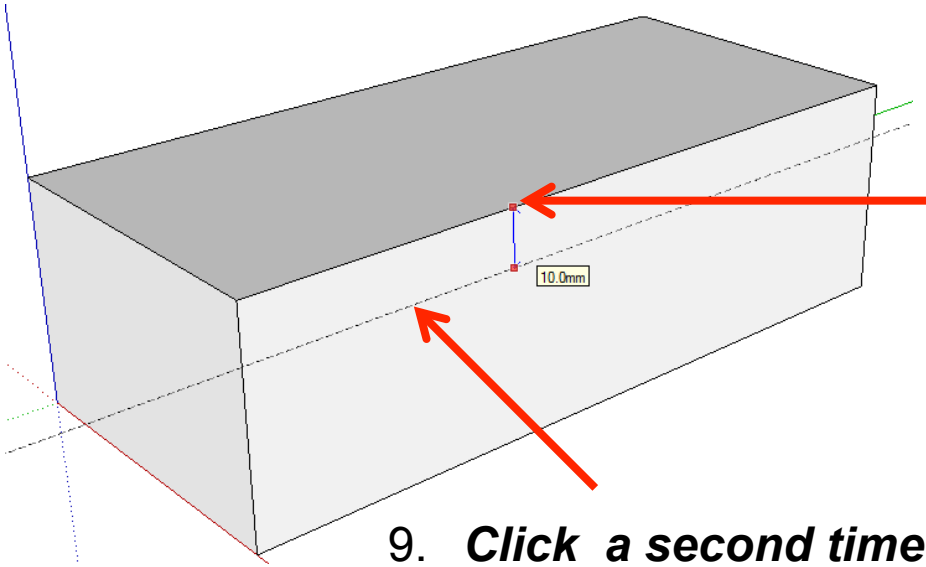




6. Select the ***push pull tool.*** ***Hover over the rectangle you have just drawn.*** It will indicate you are over it by going ***dotted.***

7. Using the ***push pull tool*** to raise each shape up. Type in ***40 and press enter.***



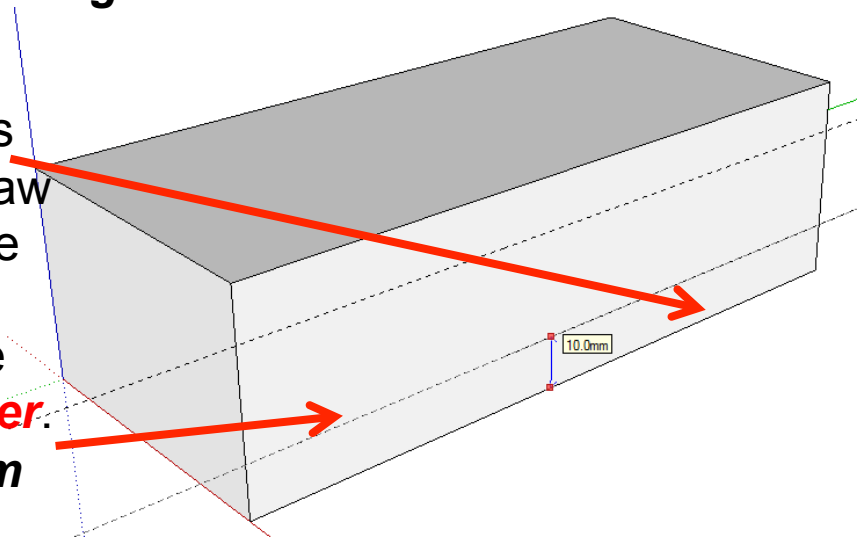


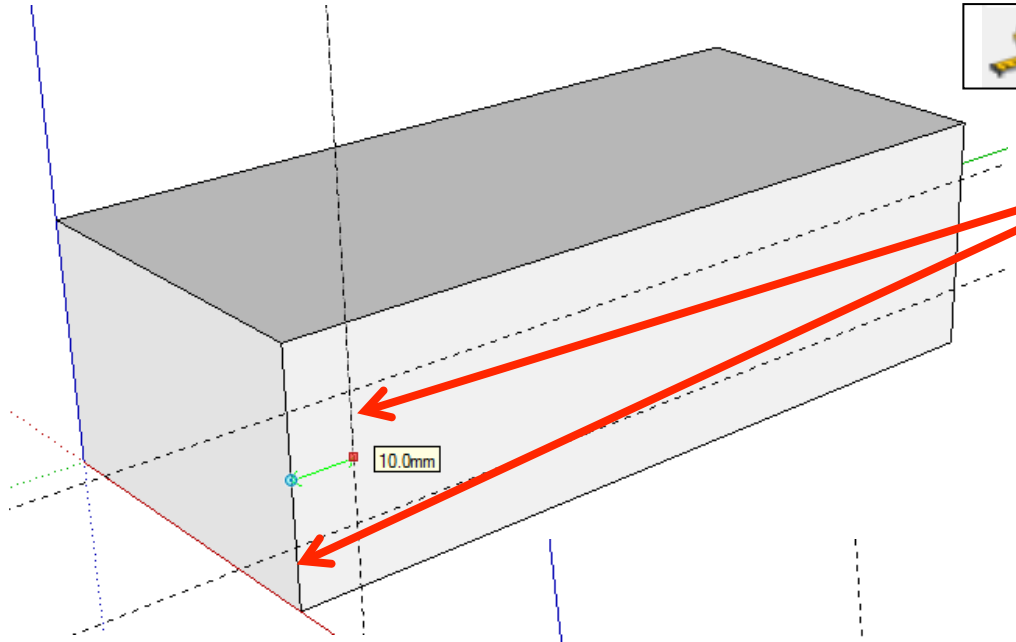
8. Select the ***Tape measure tool*** and snap to the ***top edge*** as shown. ***Click once*** and it will draw a dotted guide line from the edge

9. ***Click a second time*** to set the guide line and ***type 10 and enter***. You will have a guide line ***10mm*** in from the ***top edge***

10. Select the ***Tape measure tool*** and snap to the ***bottom edge*** as shown. ***Click once*** and it will draw a dotted guide line from the edge

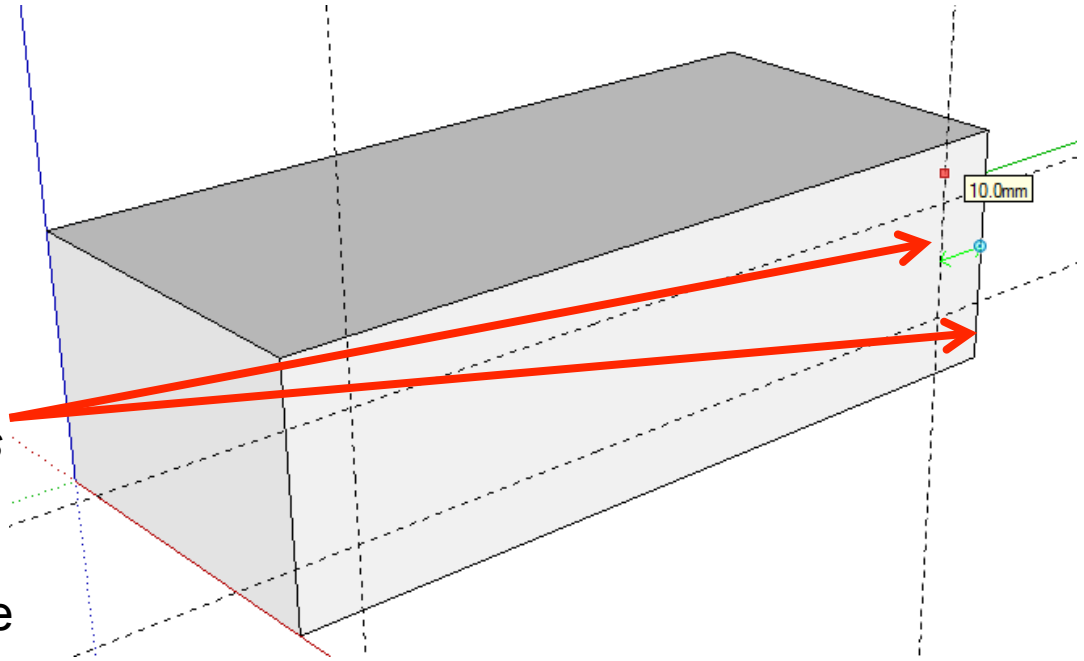
11. ***Click a second time*** to set the guide line and ***type 10 and enter***. You will have a guide line ***10mm*** in from the ***bottom edge***

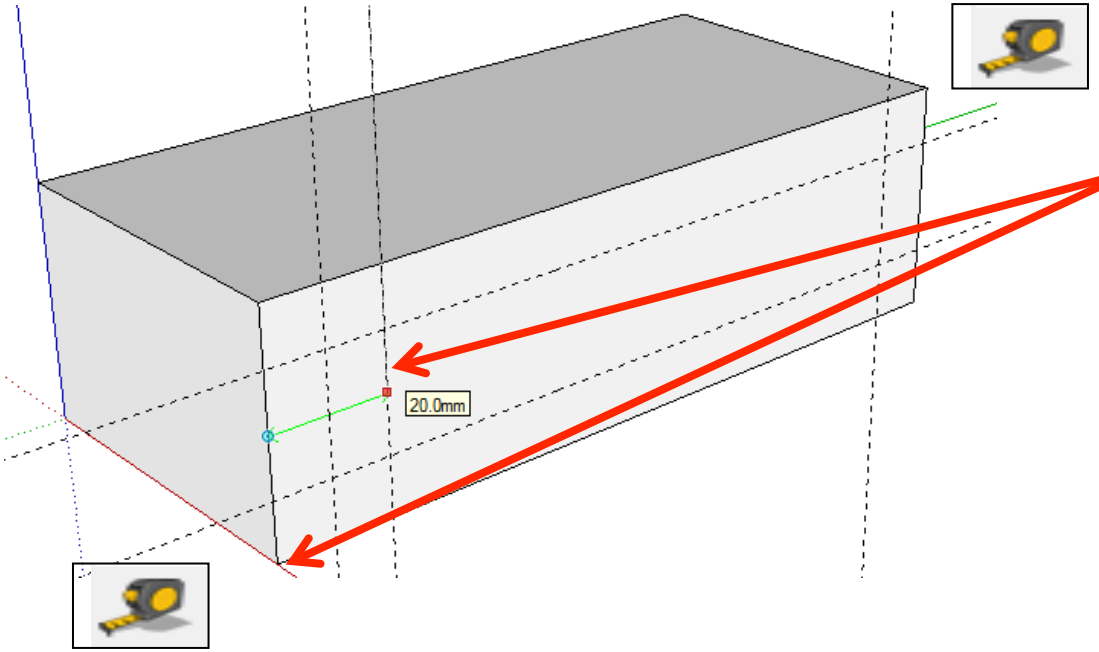




12. Select the ***Tape measure tool*** and repeat ***steps 8 and 9*** above to add a guide line ***10mm*** in from the ***front edge shown***

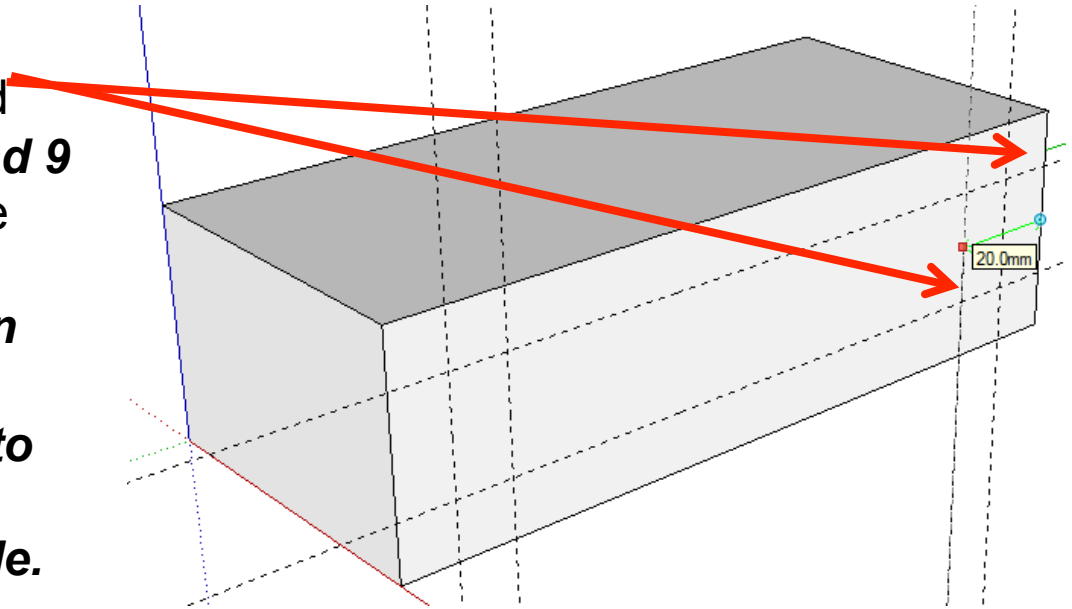
13. Select the ***Tape measure tool*** and repeat ***steps 8 and 9*** above to add a guide line ***10mm*** in from the ***back edge shown***



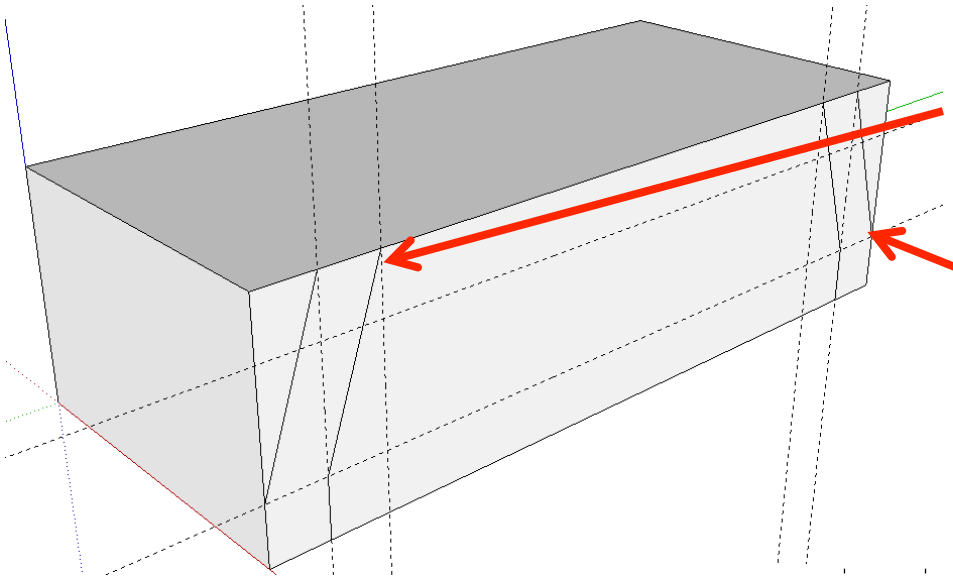


14. Select the ***Tape measure tool*** and repeat ***steps 8 and 9*** to add a guide line ***20mm*** in from the ***front edge shown***

15. Select the ***Tape measure tool*** and repeat ***steps 8 and 9*** to add a guide line ***20mm*** in from the ***back edge shown***

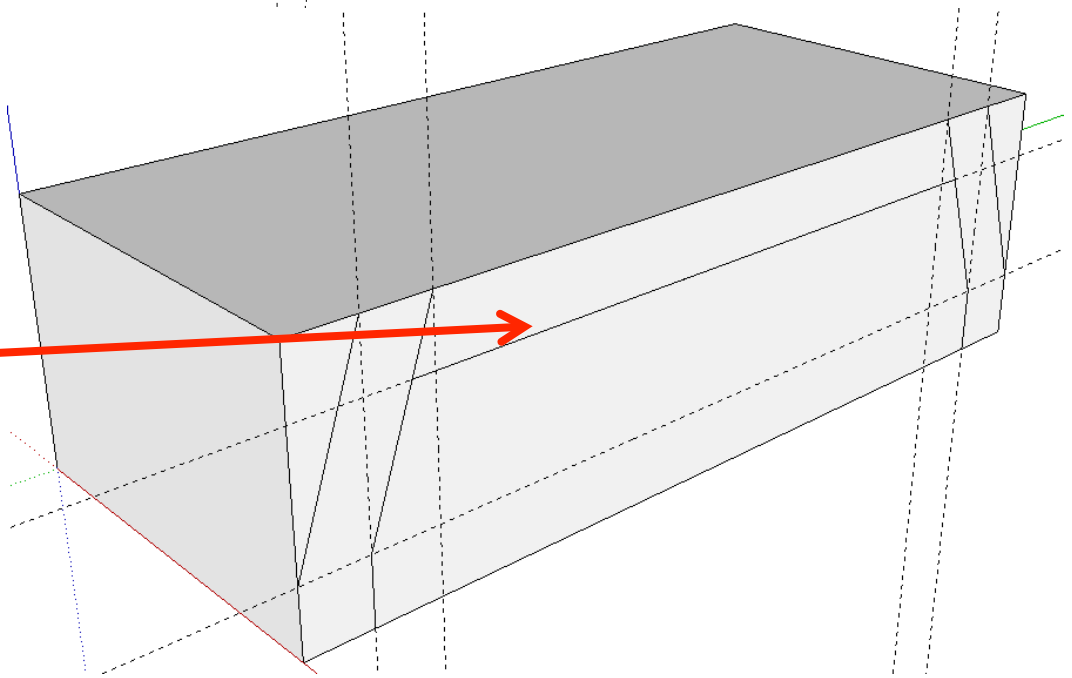


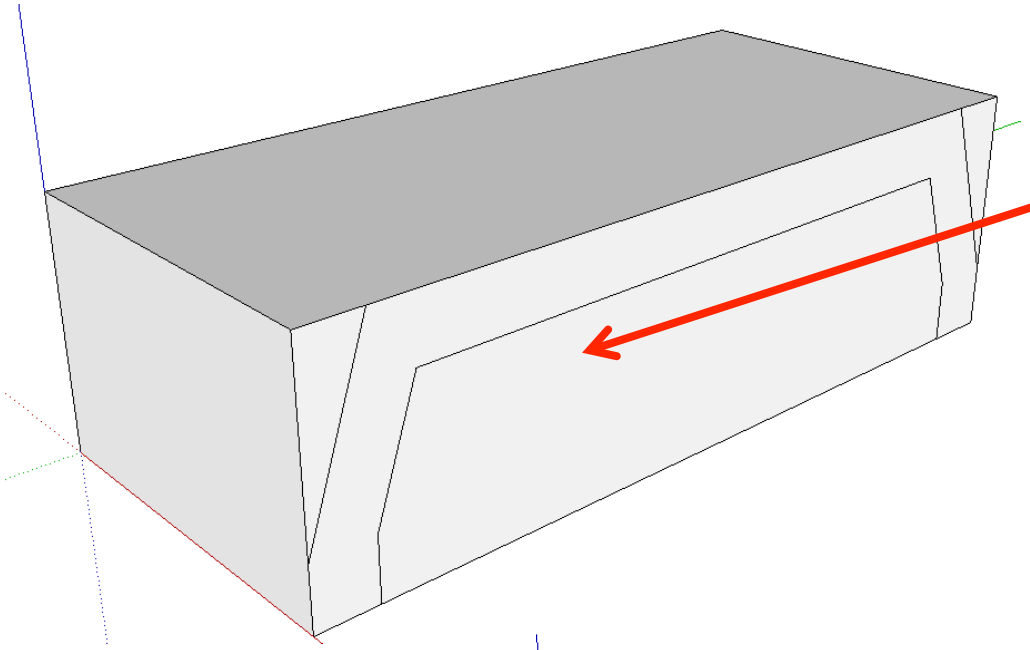
Repeat steps 8 to 15 on the opposite side.



16. Use the ***pencil tool*** and draw on the front and rear of the tank using the guide lines to assist.

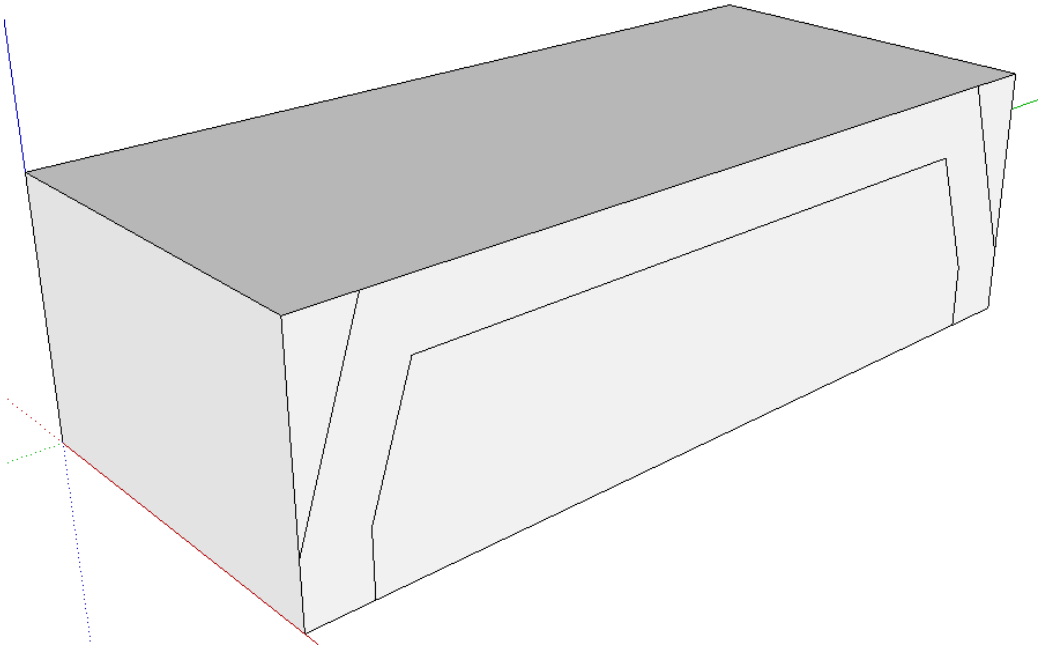
17. Use the ***pencil tool*** and draw on the line shown.

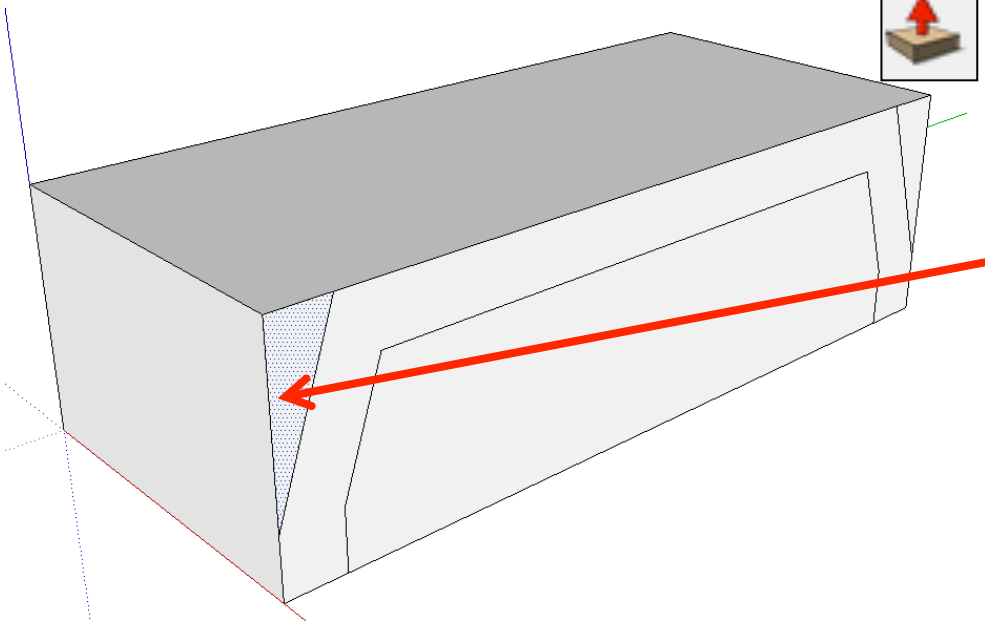




18. Use the ***eraser tool*** and delete the guide lines to leave the tank bod as shown..

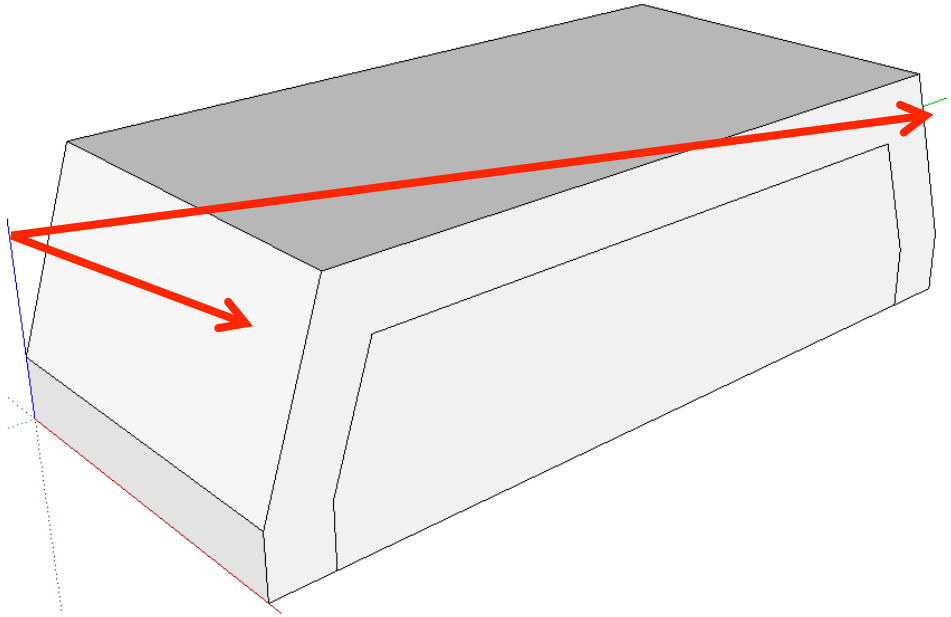
19. Select the ***push pull tool.***

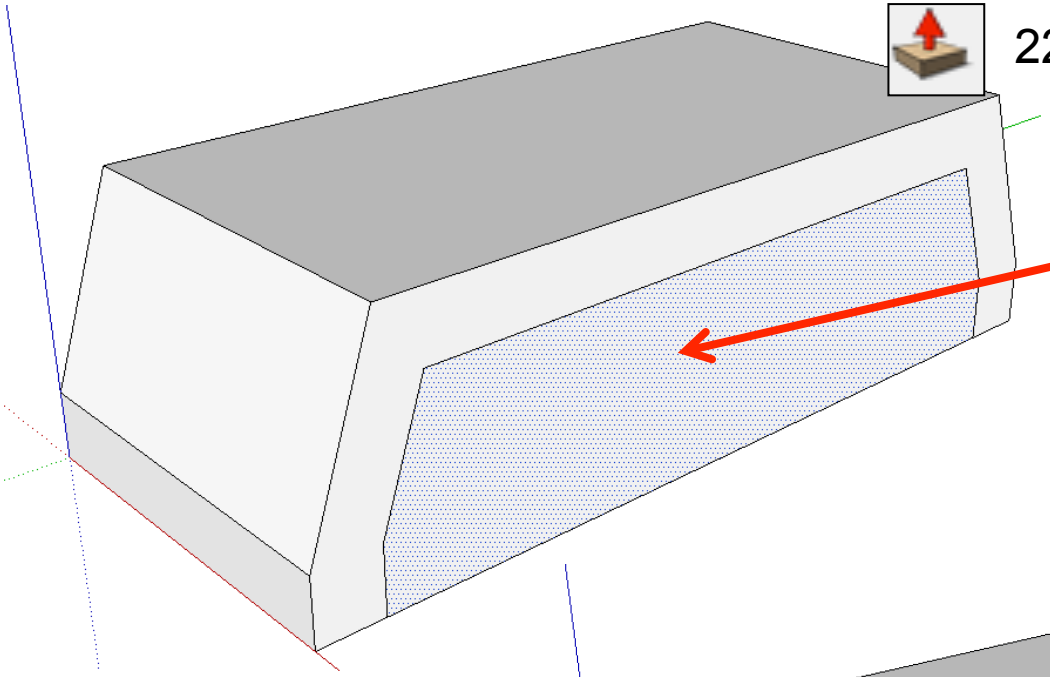




20. Select the ***push pull tool. Hover over the area shown.*** It will indicate you are over it by going ***dotted.***

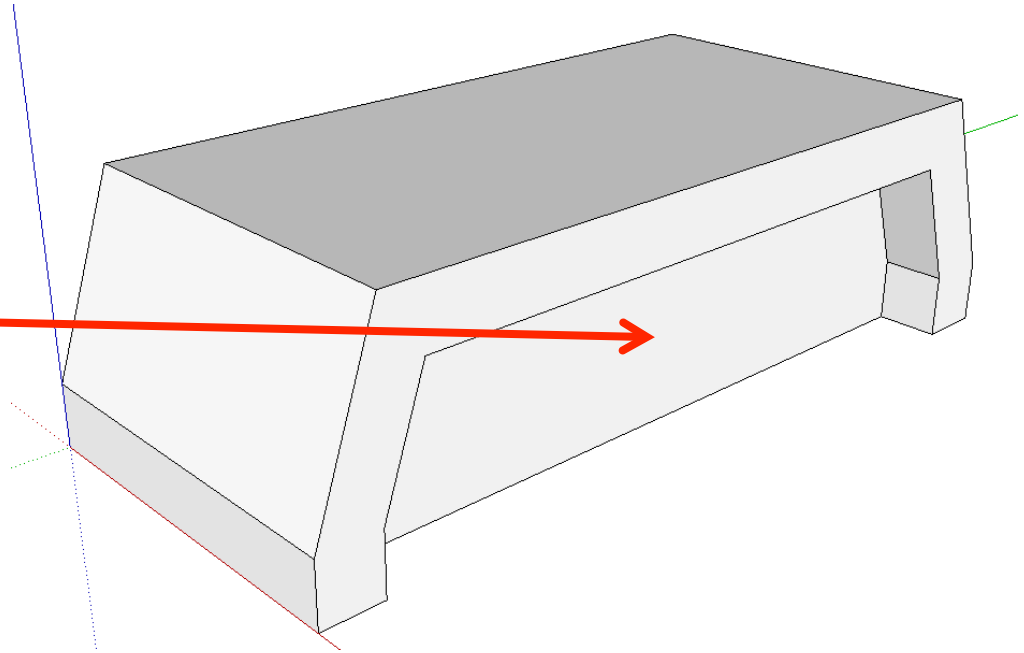
21. Using the ***push pull tool. Push the front and rear face away as shown.***

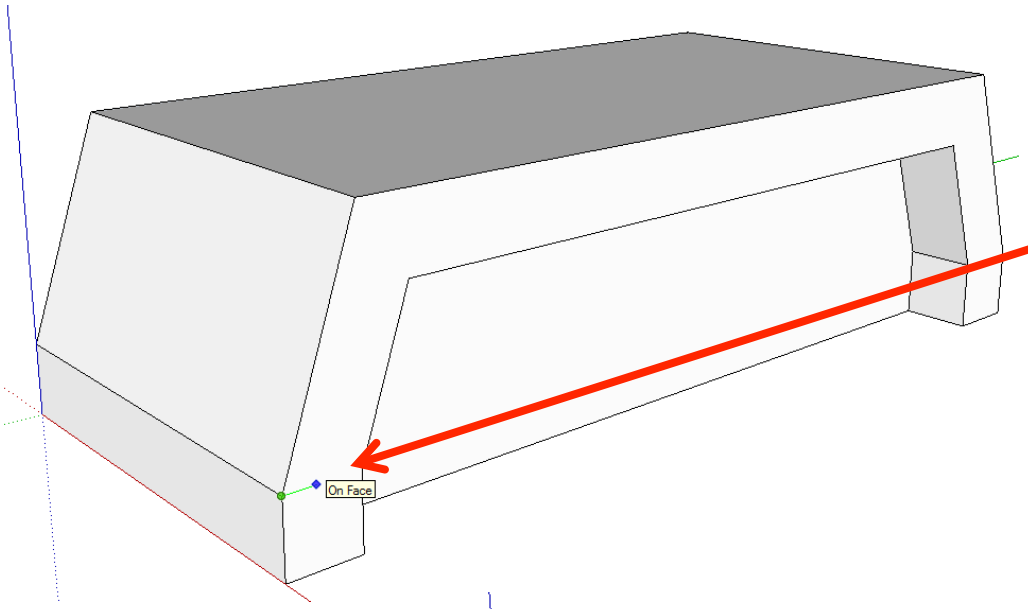




22. Select the ***push pull tool. Hover over the area shown.*** It will indicate you are over it by going ***dotted.***

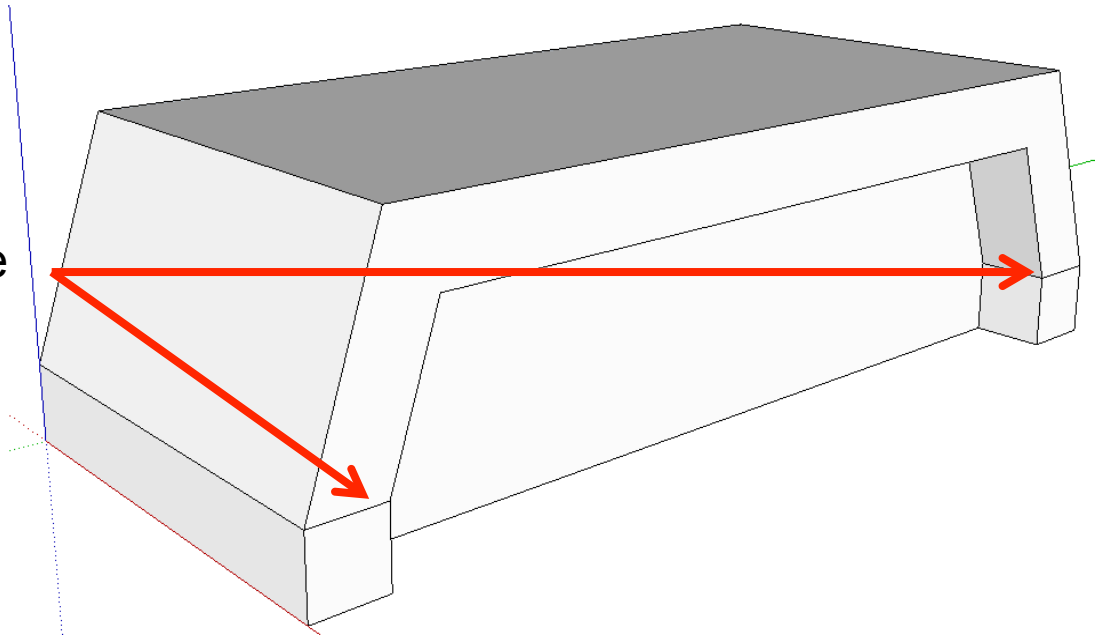
23. Using the ***push pull tool.*** Push the middle piece back. ***Type in 10 and press enter. Repeat this on the opposite side.***

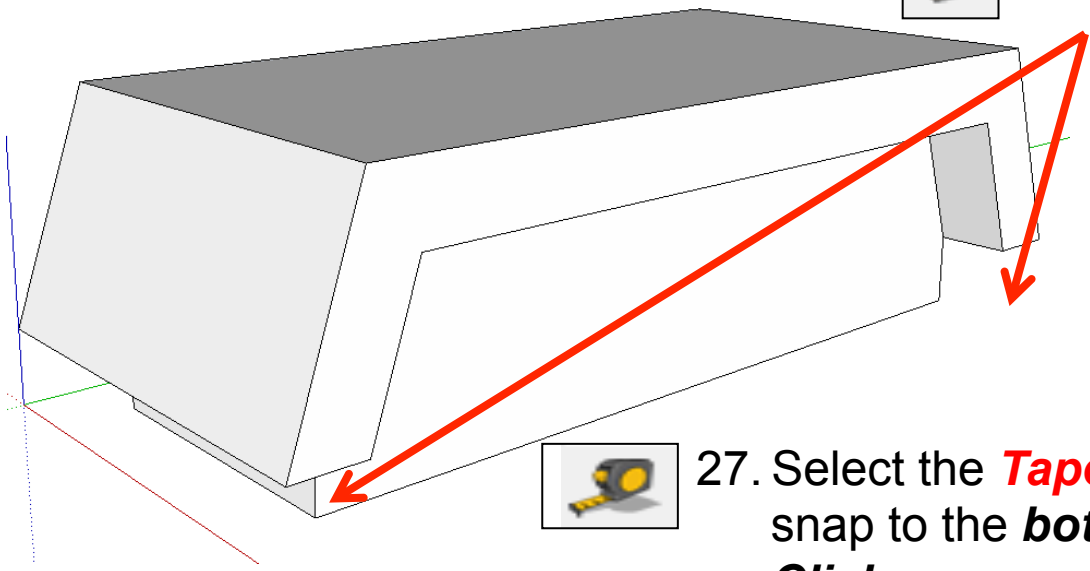




24. Use the ***pencil tool*** and snap the endpoint shown.

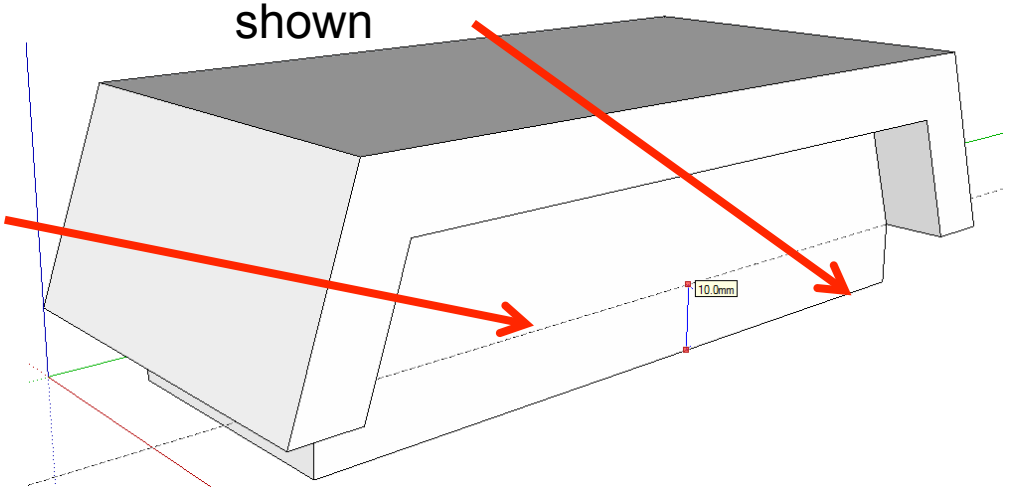
25. Using the ***pencil tool*** and drawn the line across on the green axis. Do the same on the back piece.





26. Select the ***push pull tool.*** Underneath the last two lines you have just drawn, push the front and back piece away.

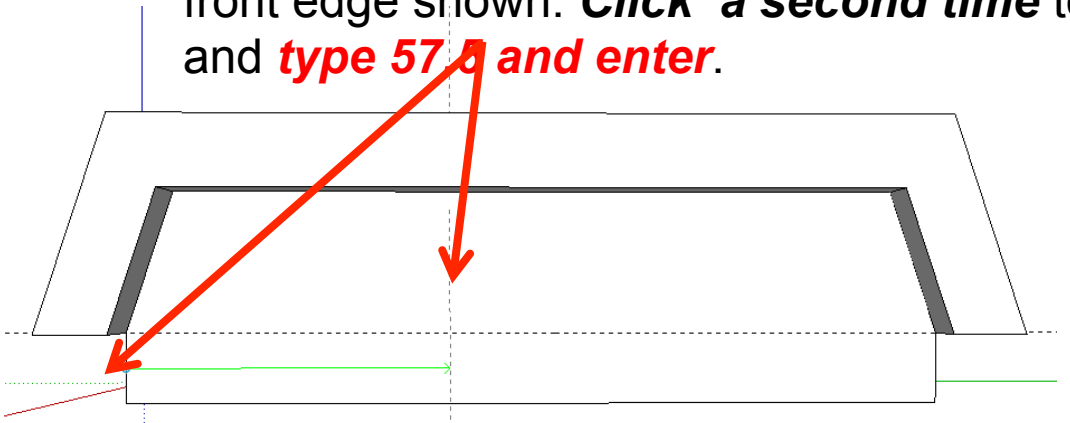
27. Select the ***Tape measure tool*** and snap to the ***bottom edge*** as shown. ***Click once*** and it will draw a dotted guide line from the bottom edge shown



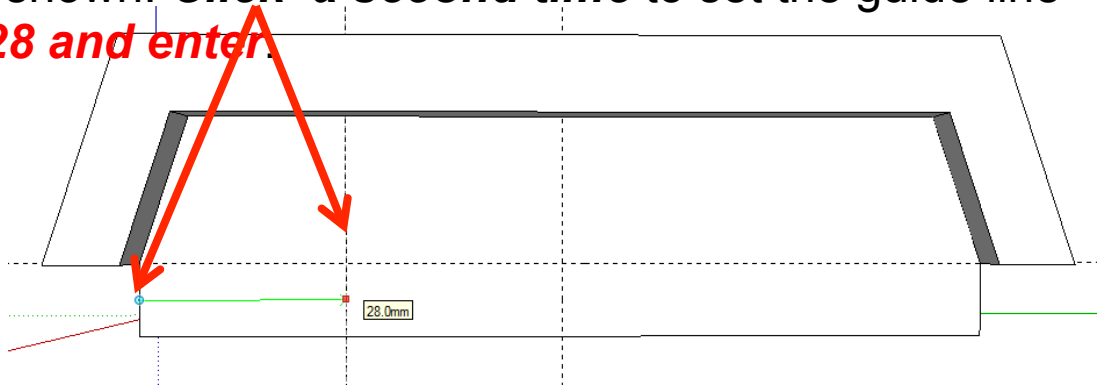
28. ***Click a second time*** to set the guide line and ***type 10 and enter***. You will have a guide line ***10mm*** in from the ***bottom edge***

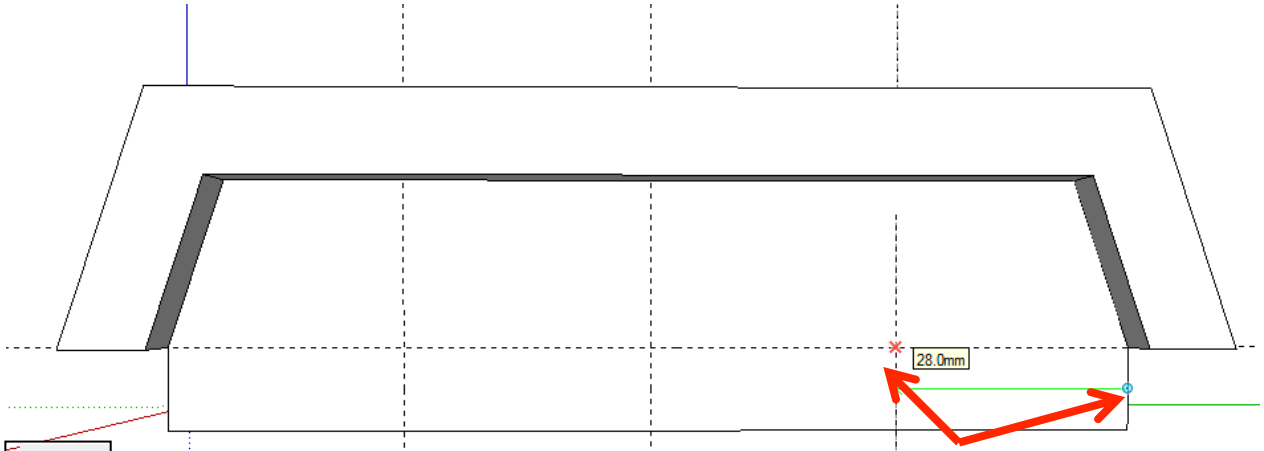
29. Select the orbit tool and ***rotate the tank*** ***so you can see its side profile***.

30. Select the ***Tape measure tool*** and snap to the ***front edge*** as shown. ***Click once*** and it will draw a dotted guide line from the front edge shown. ***Click a second time*** to set the guide line and ***type 57.0 and enter***.



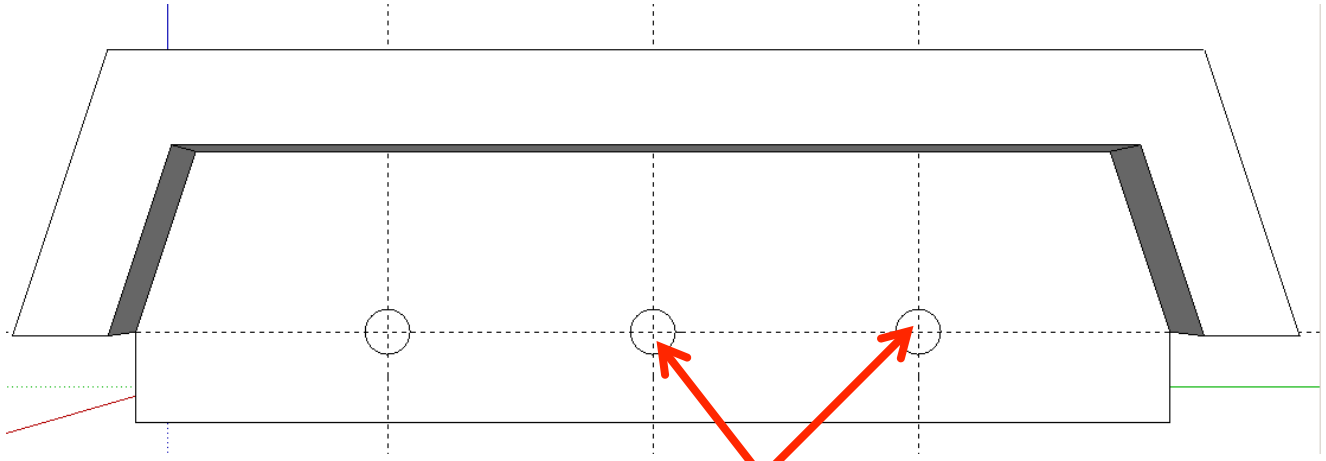
31. Select the ***Tape measure tool*** and snap to the ***front edge*** as shown. ***Click once*** and it will draw a dotted guide line from the front edge shown. ***Click a second time*** to set the guide line and ***type 28 and enter***.



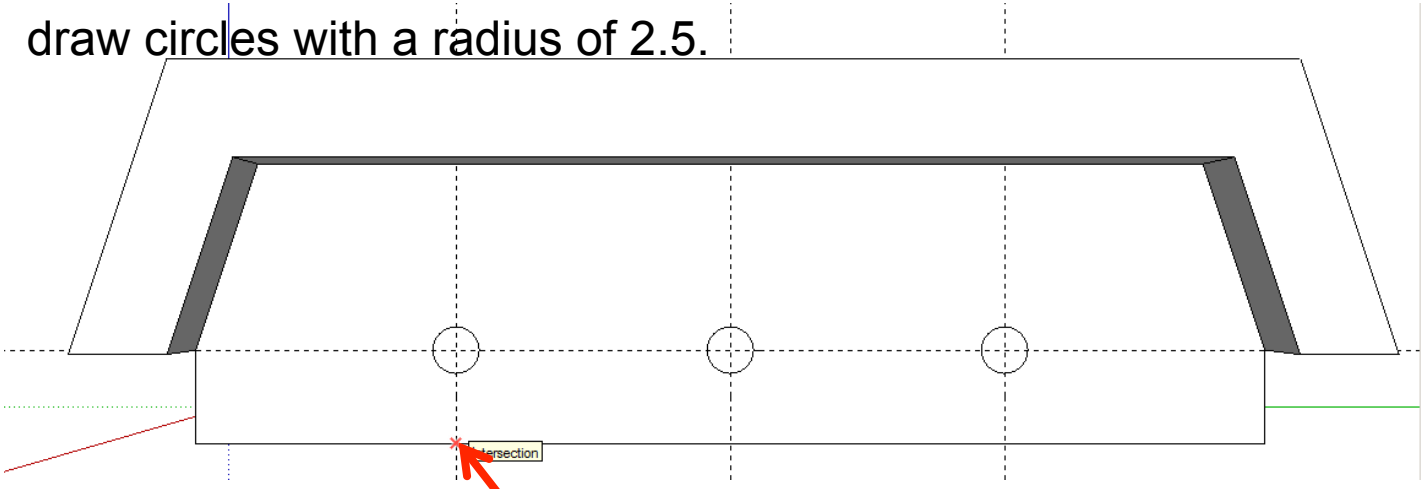


32. Select the ***Tape measure tool*** and snap to the ***back edge*** as shown. ***Click once*** and it will draw a dotted guide line from the back edge shown. ***Click a second time*** to set the guide line and ***type 28 and enter***.

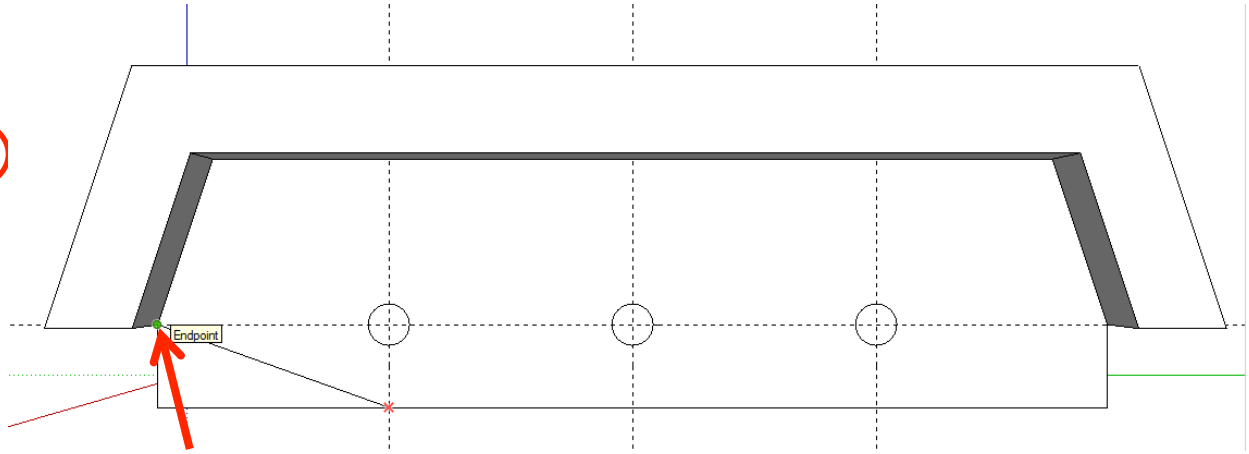
33. Select the ***circle tool*** and snap to the intersection shown. Draw a circle by clicking and dragging the cursor diagonally***.*** ***Type in 2.5 and press enter***



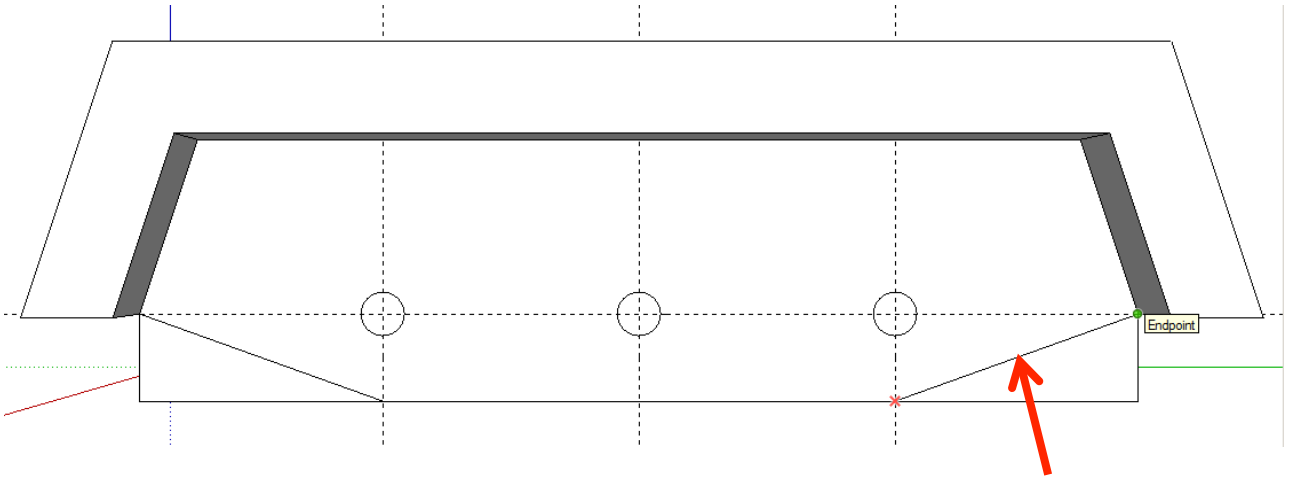
34. Using the ***circle tool,*** snap to each of the intersections shown and
draw circles with a radius of 2.5.



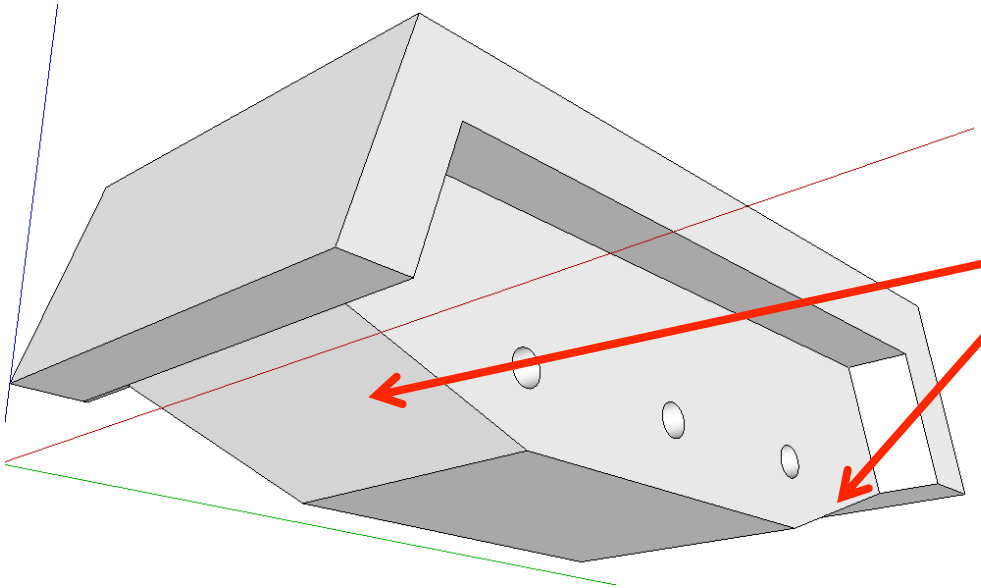
35. Using the ***pencil tool,*** snap to the ***intersection*** shown.



36. Using the ***pencil tool,*** draw a line to the ***endpoint*** shown.

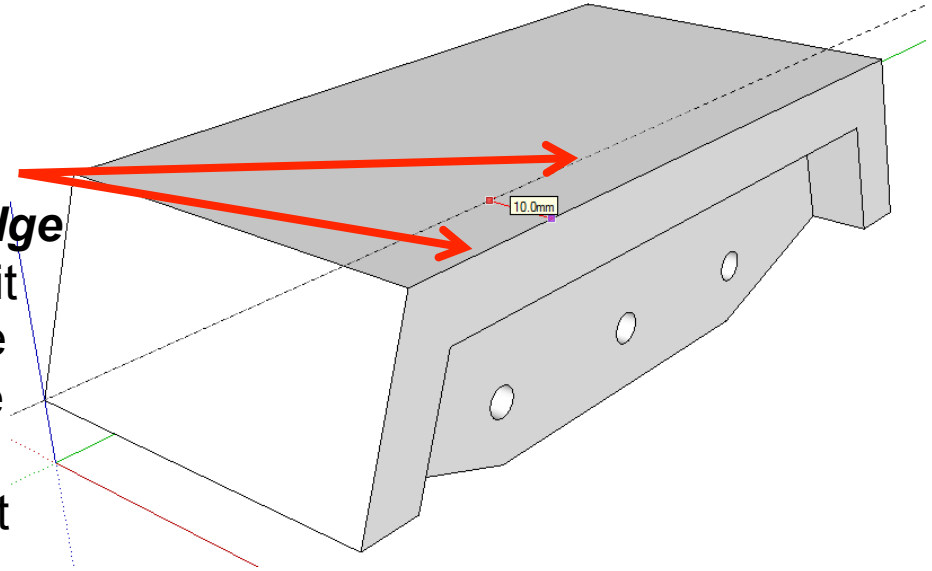


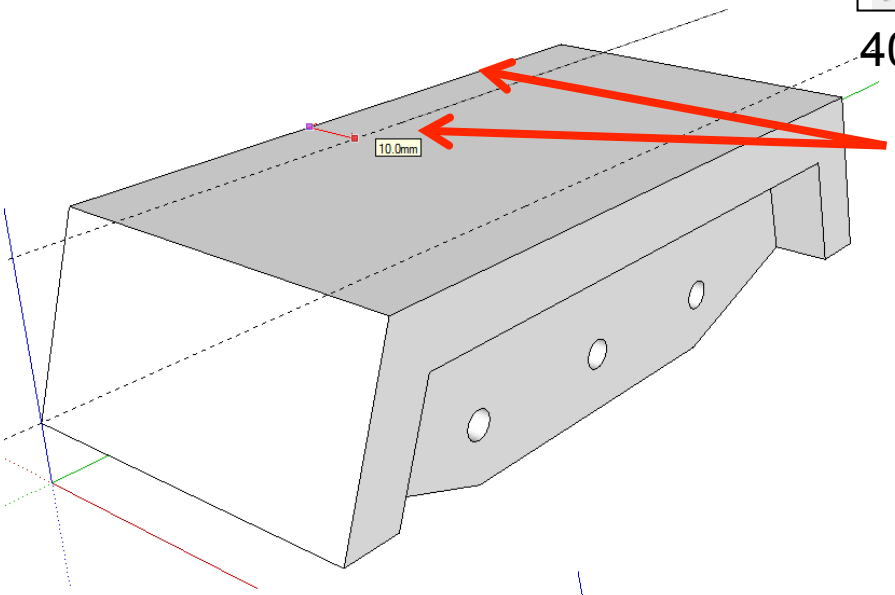
37. Using the ***pencil tool,*** repeat steps 35 and 36 and draw the line shown.



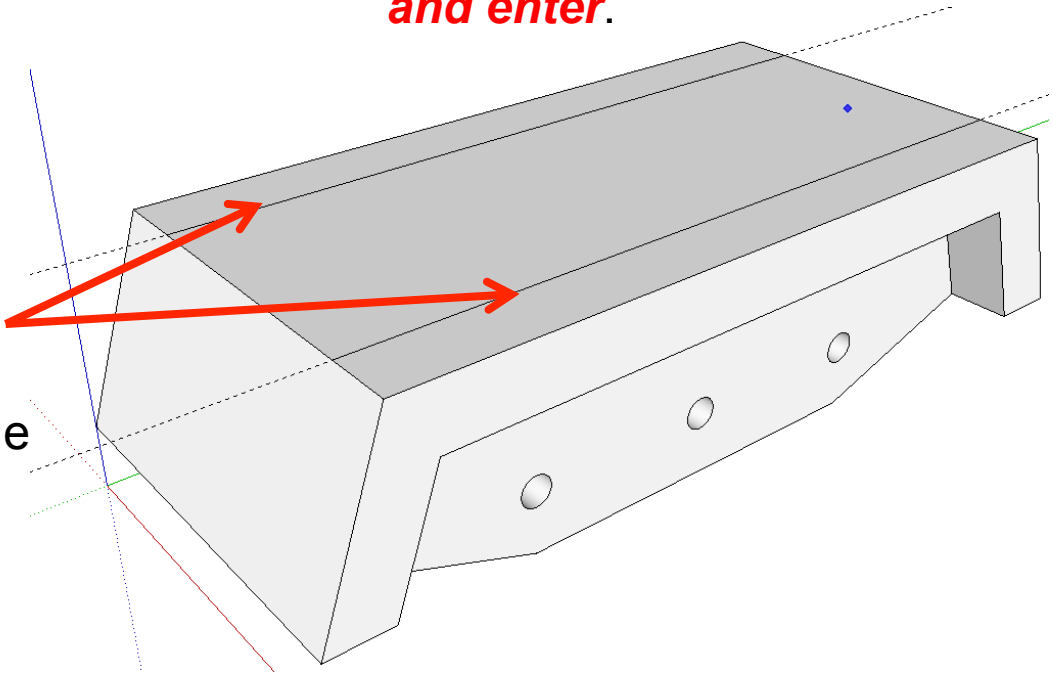
38. Using the ***push pull tool.*** Push the triangular piece back under the last two lines you have drawn

39. Select the ***Tape measure tool*** and snap to the ***top edge*** as shown. ***Click once*** and it will draw a dotted guide line from the top edge along the top of the tank as shown. ***Click a second time*** to set the guide line and ***type 10 and enter***.

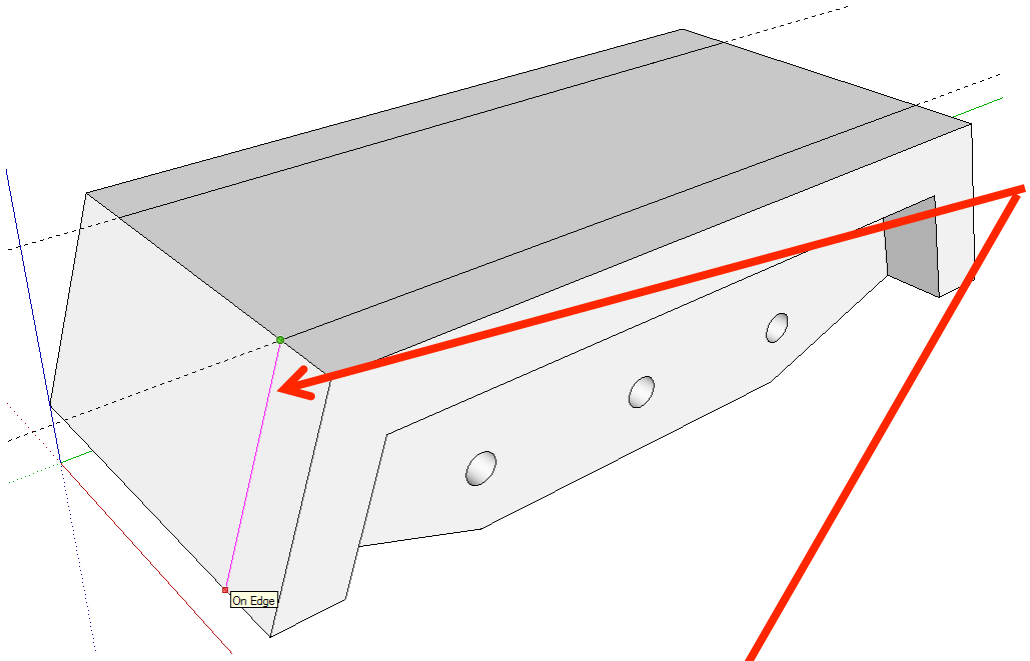




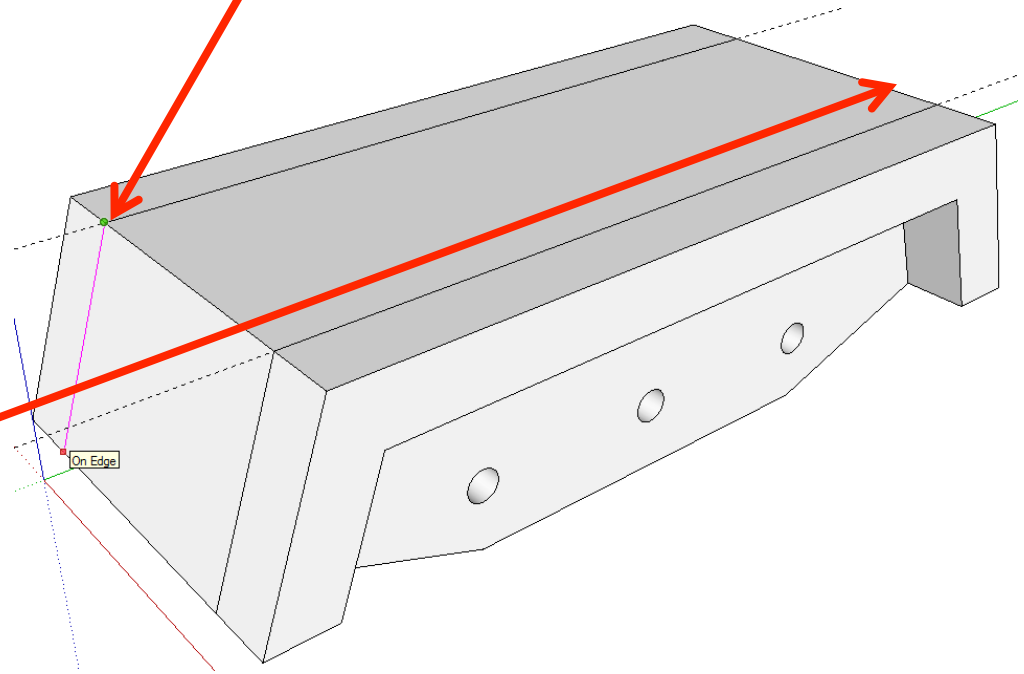
40. Select the ***Tape measure tool*** and snap to the ***top edge*** as shown. ***Click once*** and it will draw a dotted guide line from the top edge along the top of the tank as shown. ***Click a second time*** to set the guide line and ***type 10 and enter***.



41. Using the ***pencil tool,*** draw two lines over each of the guide lines you have just drawn.

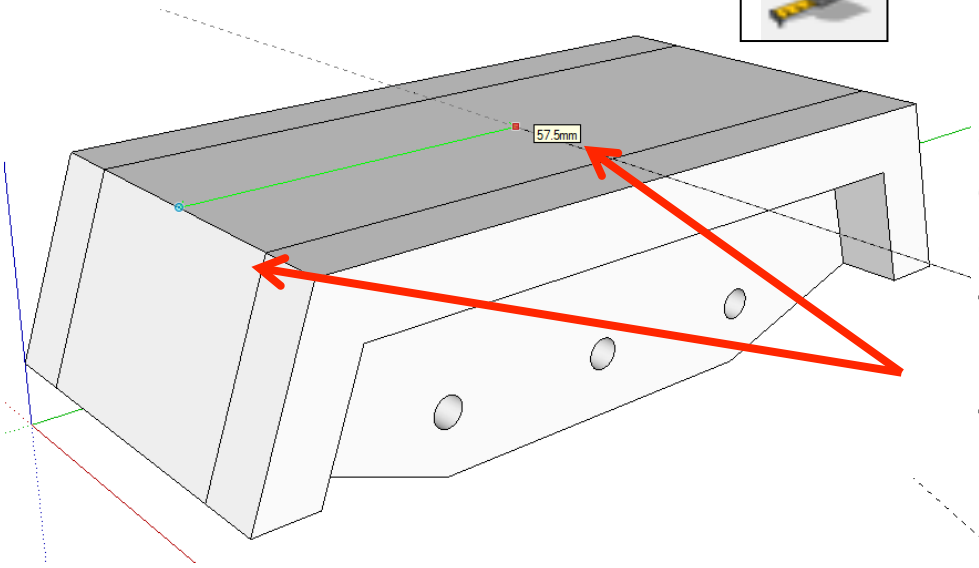


42. Using the ***pencil tool,*** draw two lines down the front of the tank. They will turn pink to indicate they are parallel to the edge.



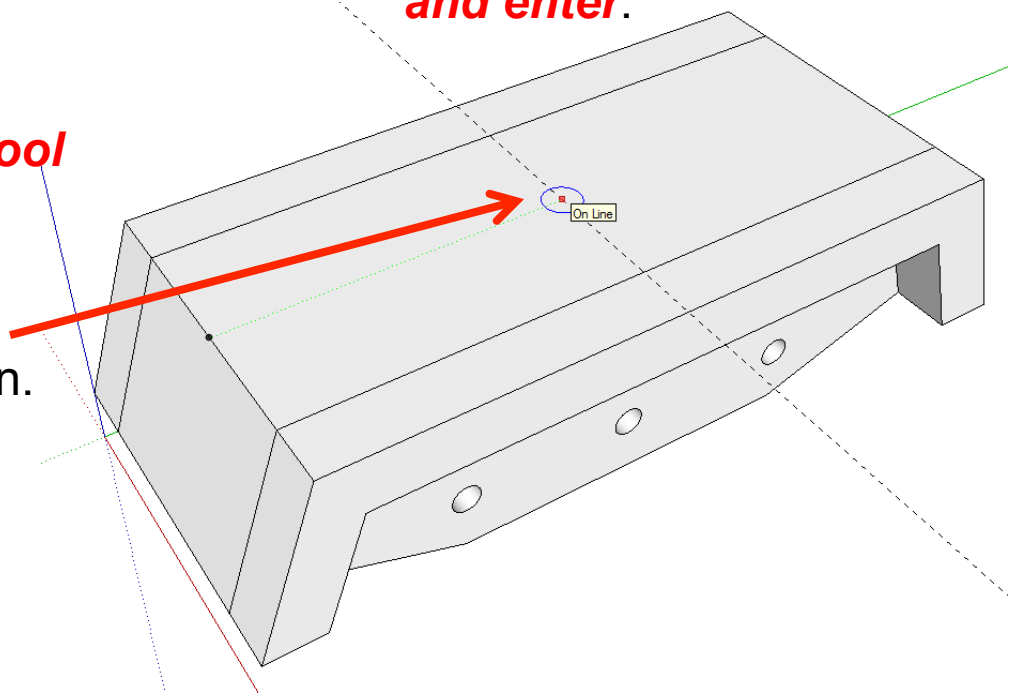
43. Repeat at the back

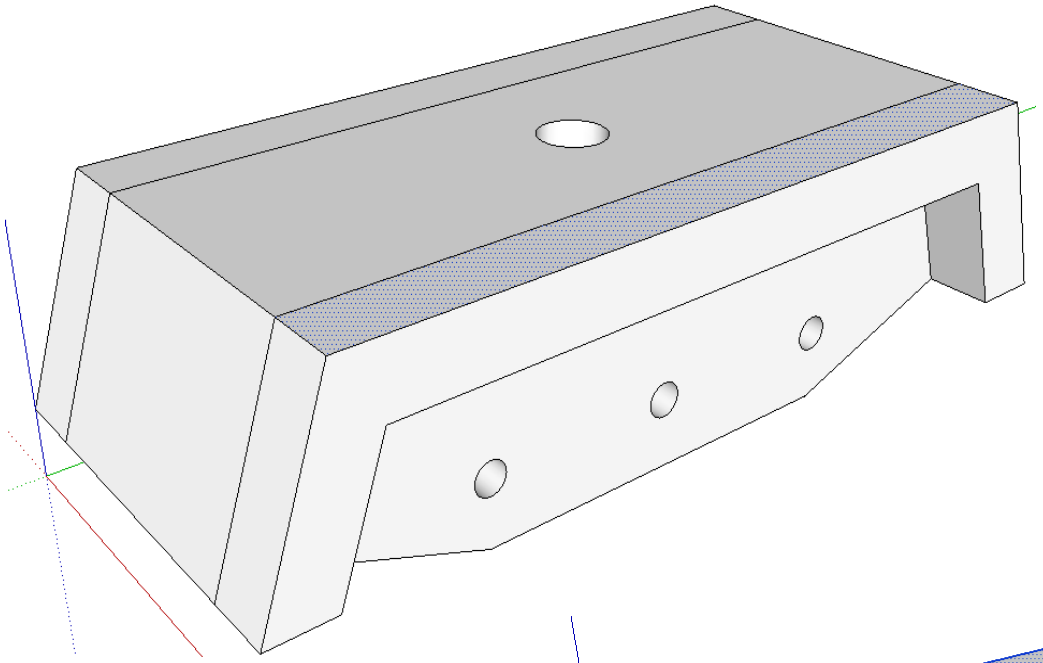
44. Select the ***Tape measure tool*** and snap to the ***front edge*** as shown. ***Click once*** and it will draw a dotted guide line from the front edge pulling back along the top of the tank as shown. ***Click a second time*** to set the guide line and ***type 57.5 and enter***.



45. Select the ***circle tool*** and snap to the centre point on the intersection shown. Draw a circle by clicking and dragging the cursor diagonally***.***

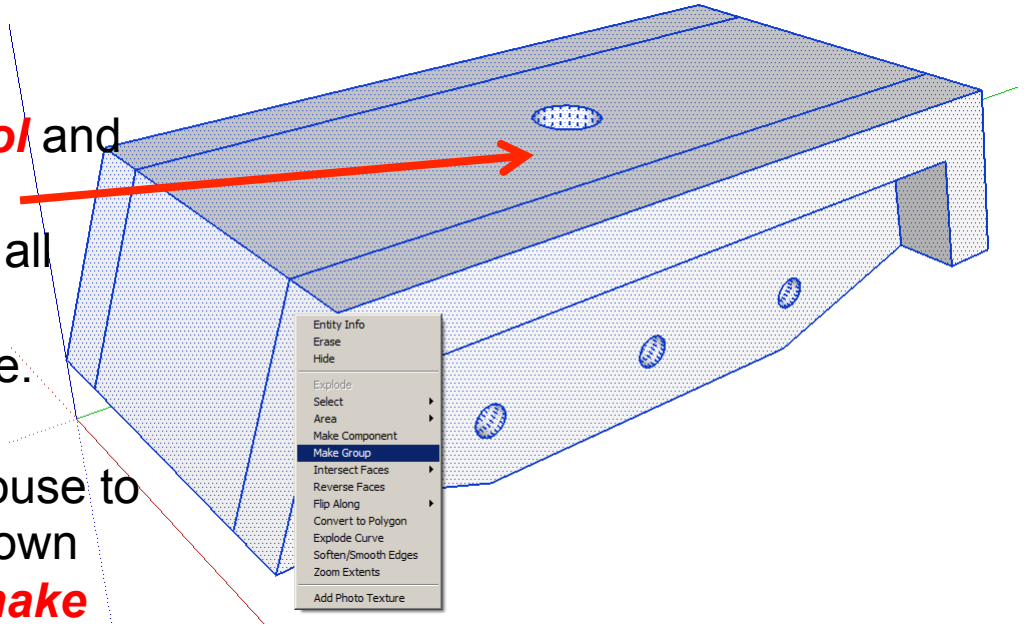
Type in 5 and press





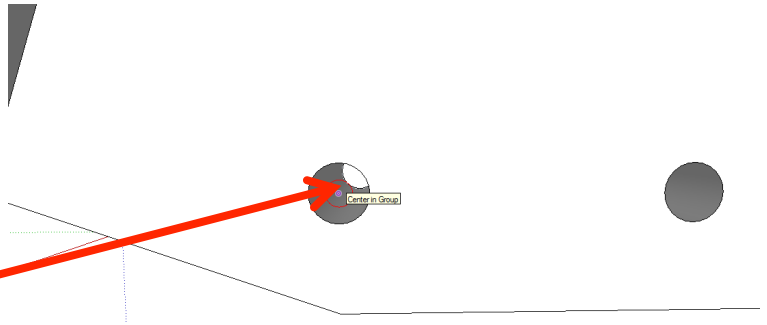
46. Using the ***push pull tool.*** Push the circular piece down, type in ***20 and press enter.***

47. Use the ***select tool*** and keep clicking on the tank until it is all selected and highlighted in blue.



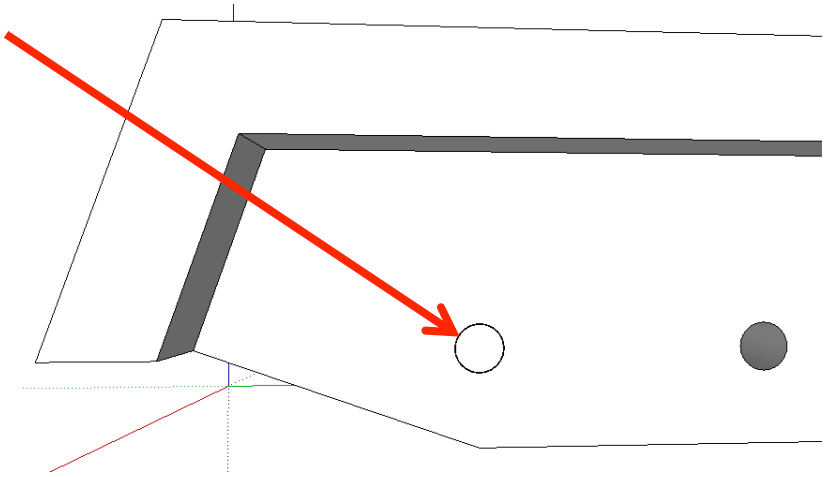
48. ***Right click*** on the mouse to produce the menu shown above and ***click*** on ***make group***

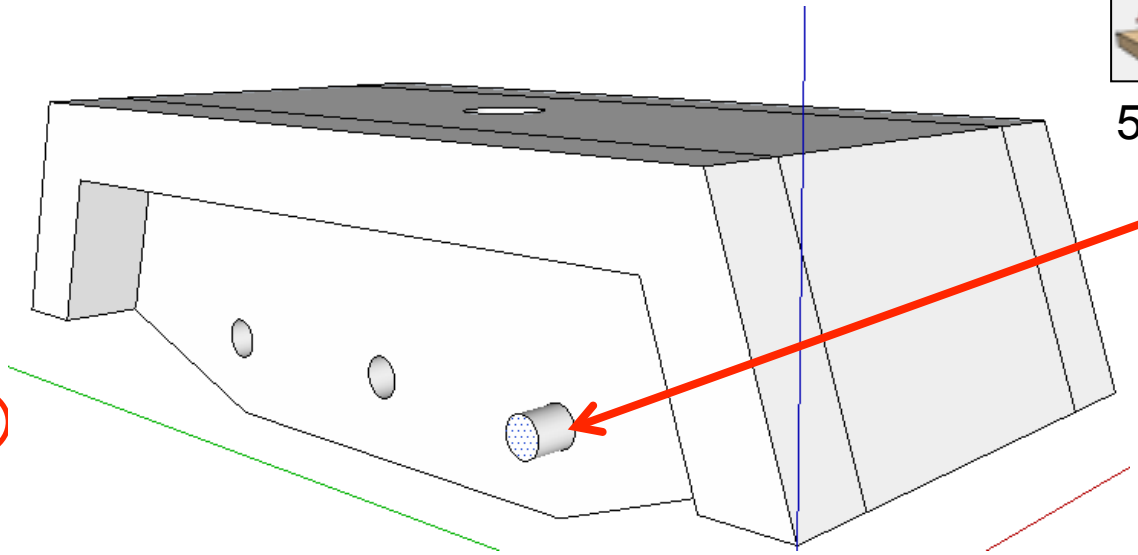
49. Select the ***Circle tool*** again and start by finding the middle of the hole. *It helps to hover over the outer edges of the hole first, then the centre will be indicated by a dark blue dot and a prompt box saying* ***Centre****.* Click here to start drawing the circle.



50. Drag out a small circle and

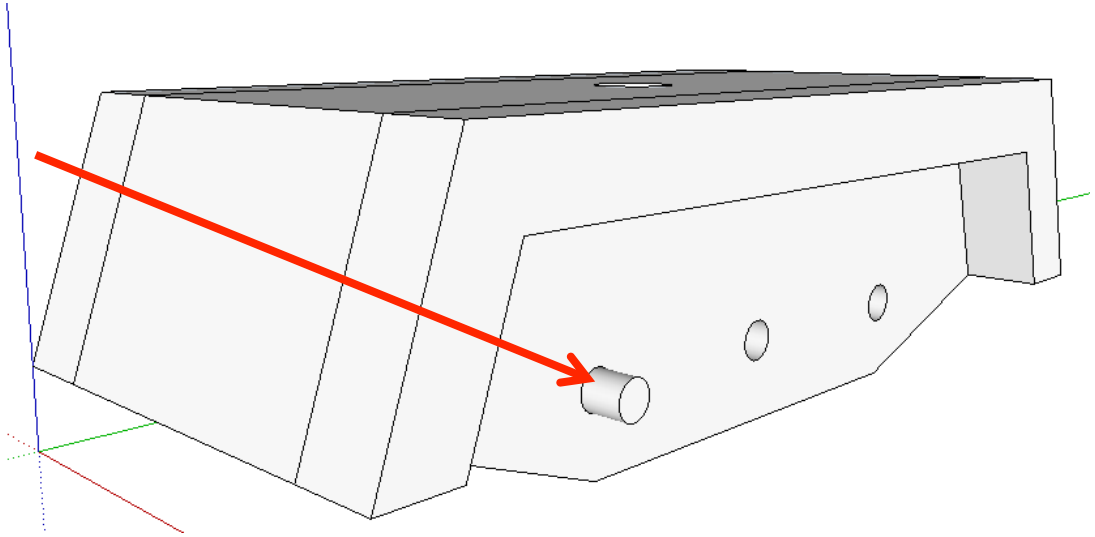
type '2.4' and press enter

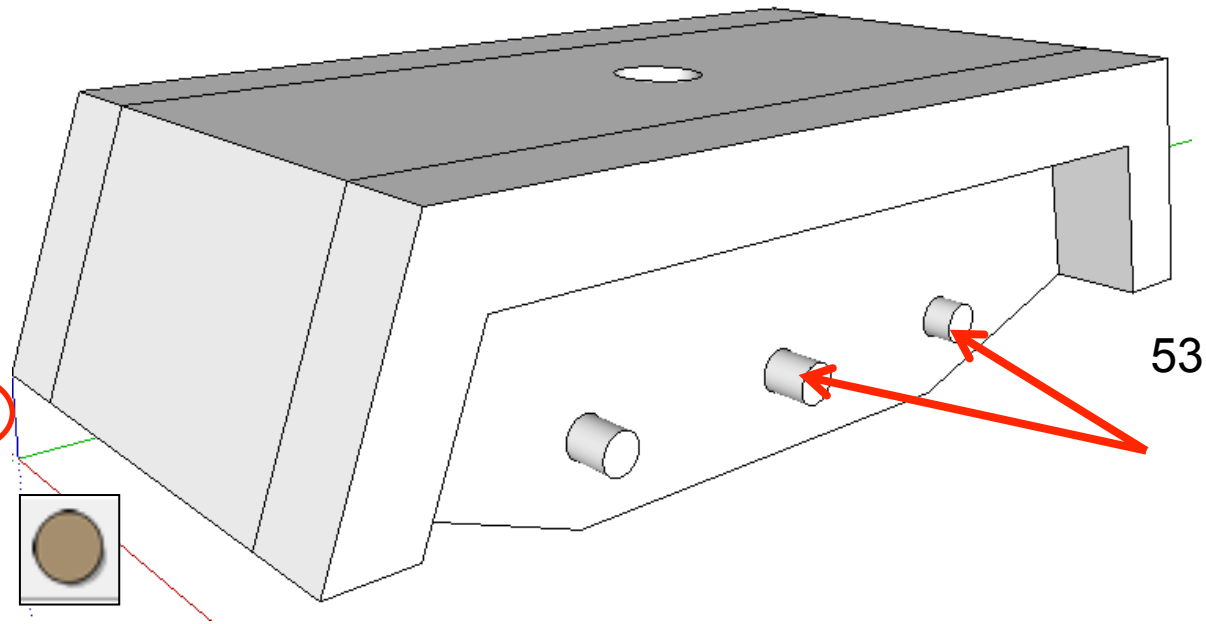




51. Using the ***push pull tool.*** Push the circular through the tank body, type in ***45 and press enter.*** It should stick out the other side as shown.

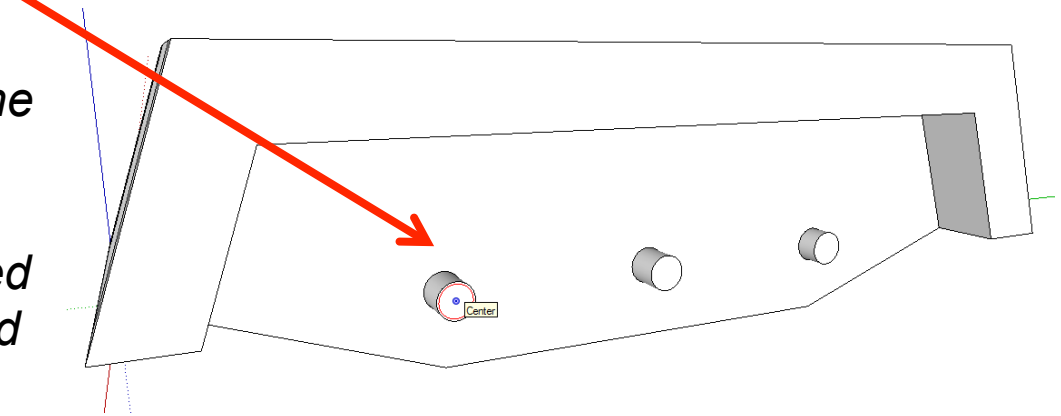
52. Back on the other side where the circle is level with the body use the ***push pull tool*** to pull the circle out and type in ***5 and press enter.*** It should stick out the other side as shown.

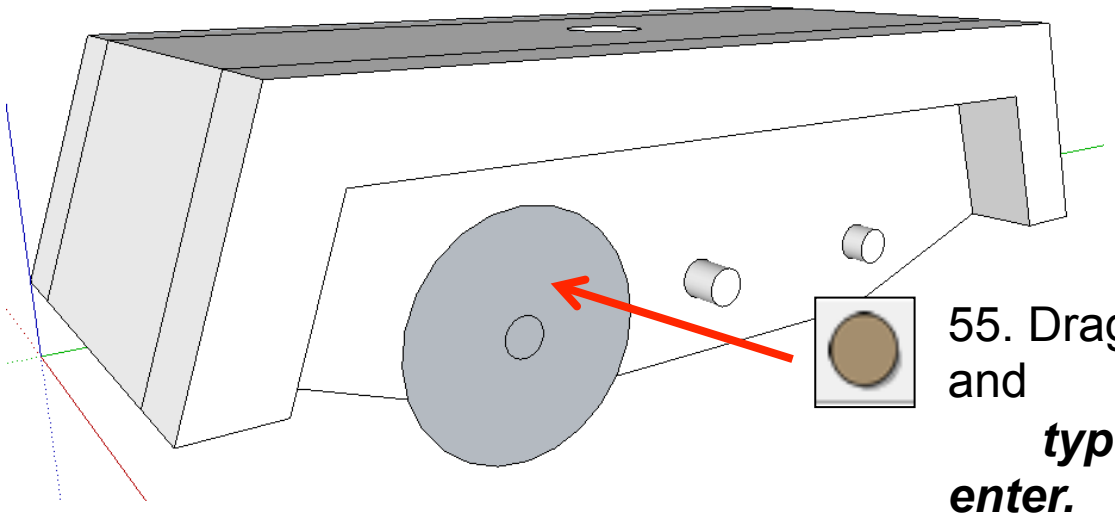




53. ***Repeat steps 49, 50, 51 and 52*** to draw the other two wheel axles as shown

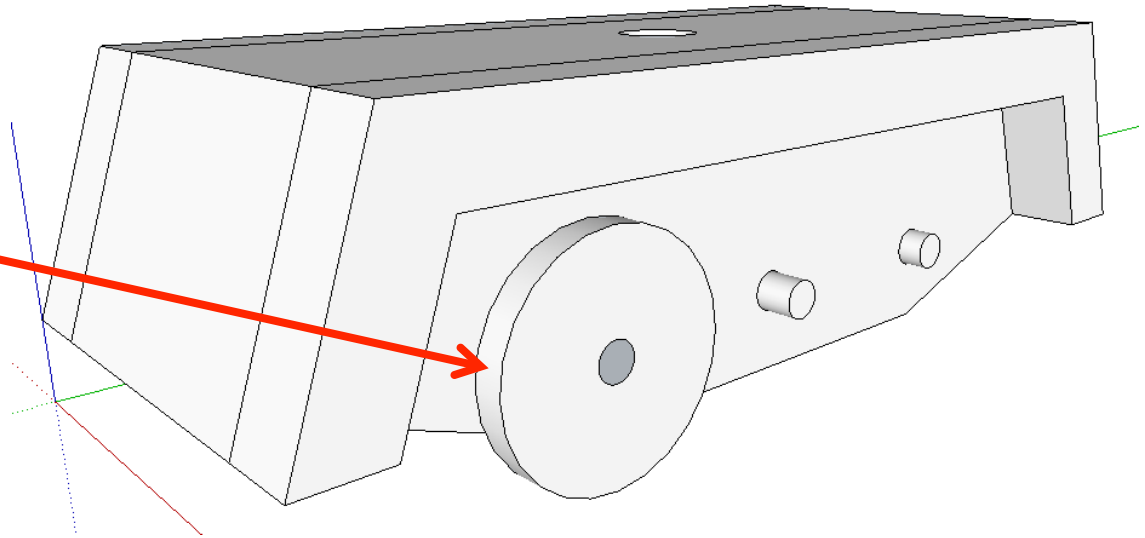
54. Select the ***Circle tool*** again and start by finding the middle of the circle shown. *It helps to hover over the outer edges of the circle first, then the centre will be indicated by a dark blue dot and a prompt box saying* ***Centre****.* Click here to start drawing the circle.

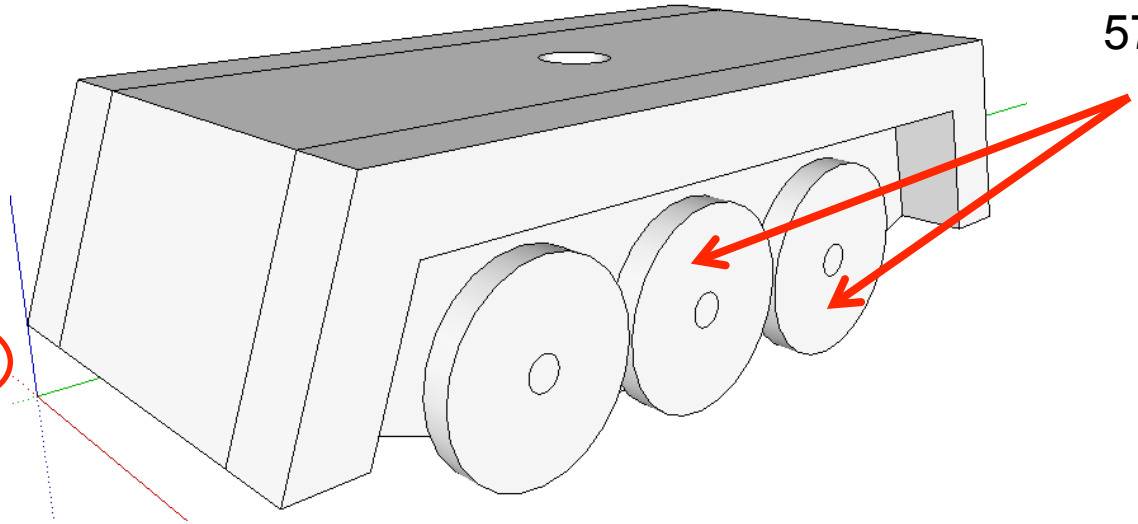




55. Drag out a small circle and ***type '14.5' and press enter.***

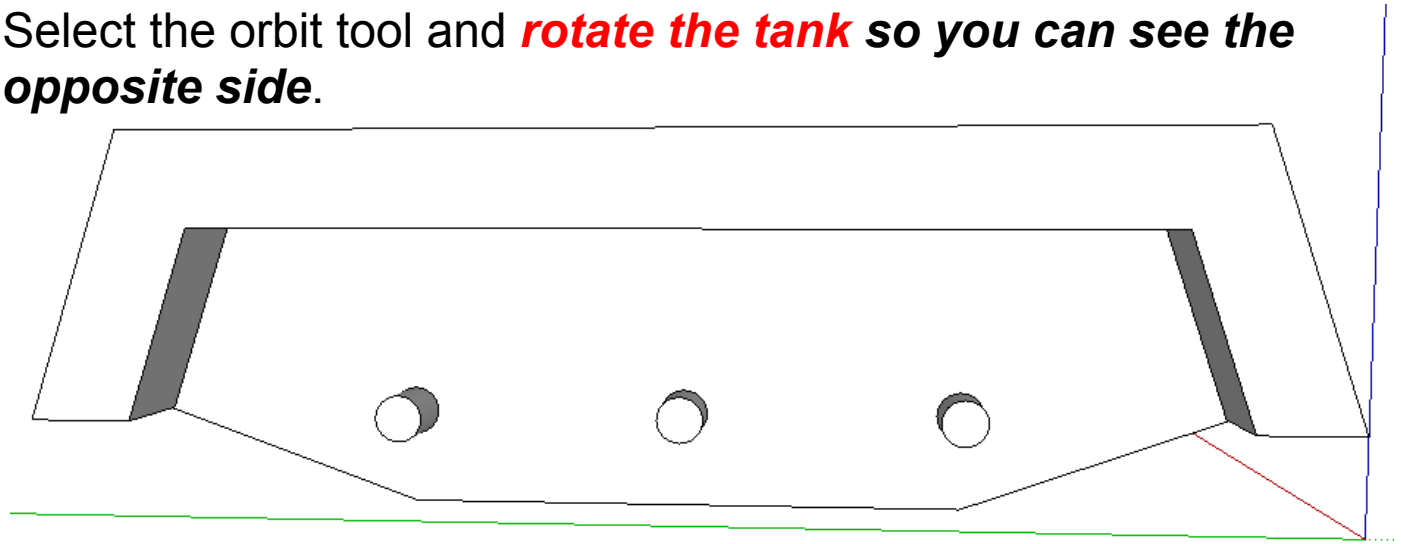
56. Using the ***push pull tool.*** Push the wheel back to give it thickness, type in ***4 and press enter.***

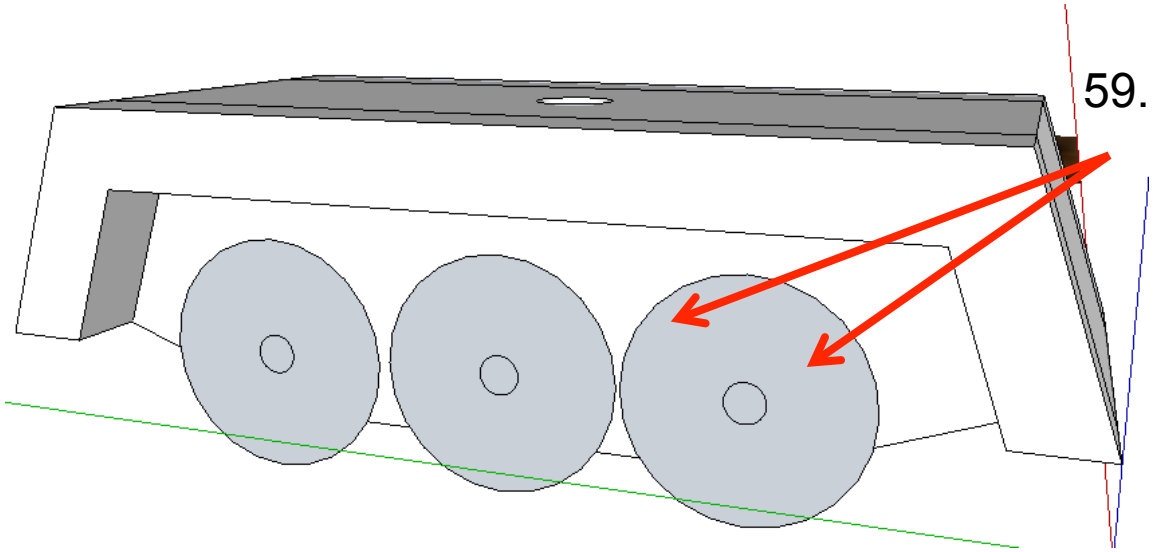




57. ***Repeat steps 54, 55 and 56*** to draw the other two wheel as shown

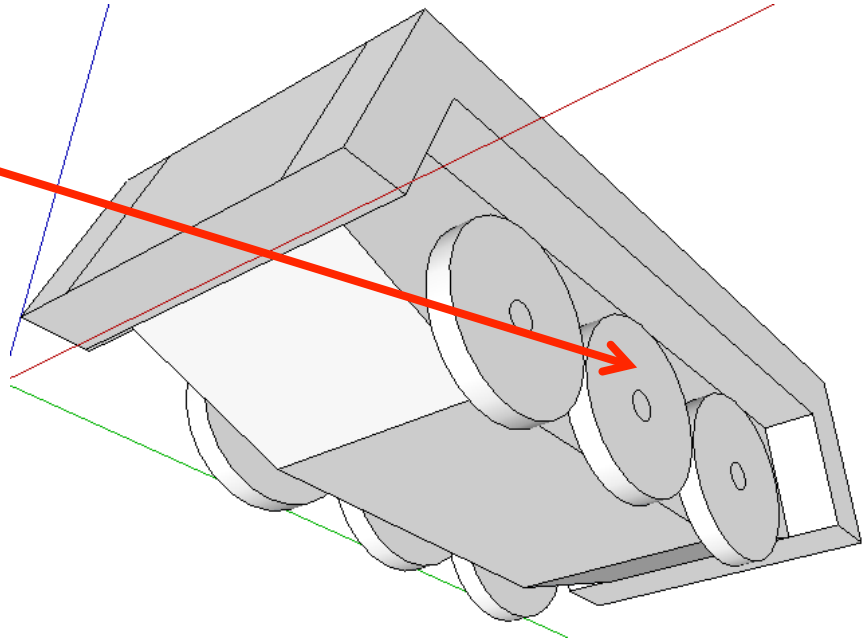
58. Select the orbit tool and ***rotate the tank*** ***so you can see the opposite side***.

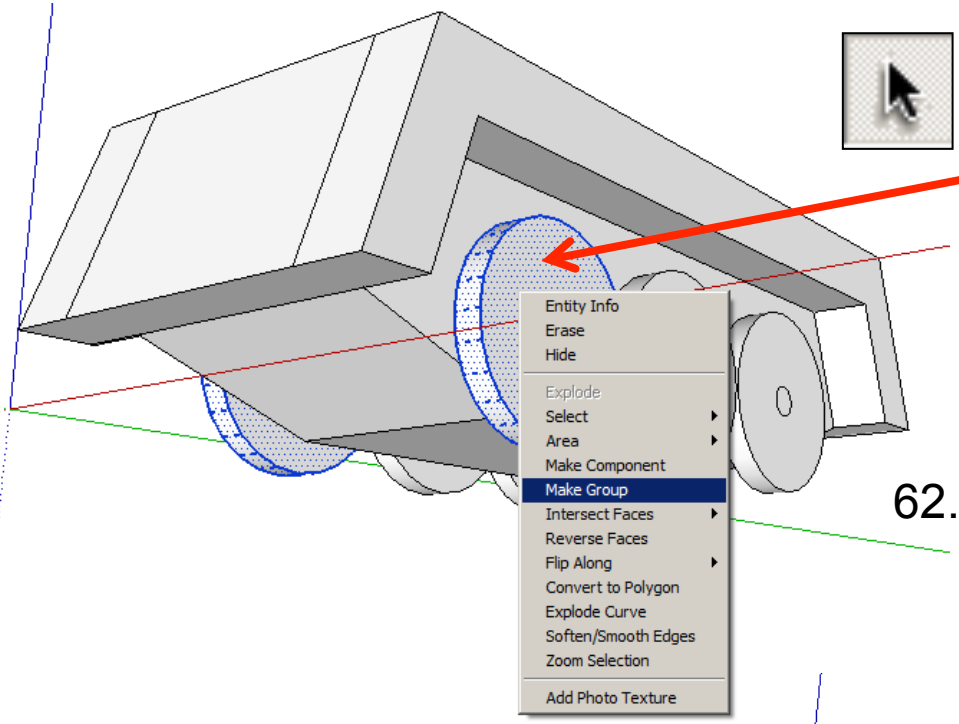




59. ***Repeat steps 54, 55 and 56*** to draw the wheels on the opposite side as shown

60. ***Remember*** to give the wheels a thickness of ***4mm***

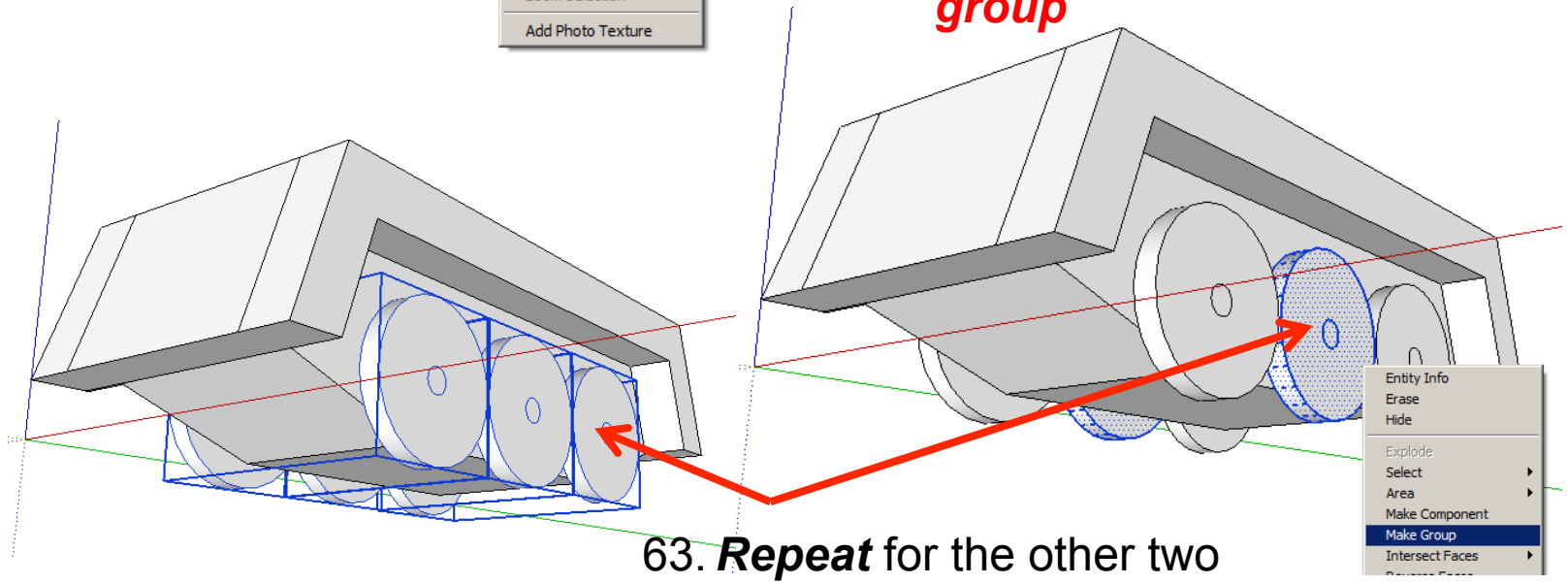




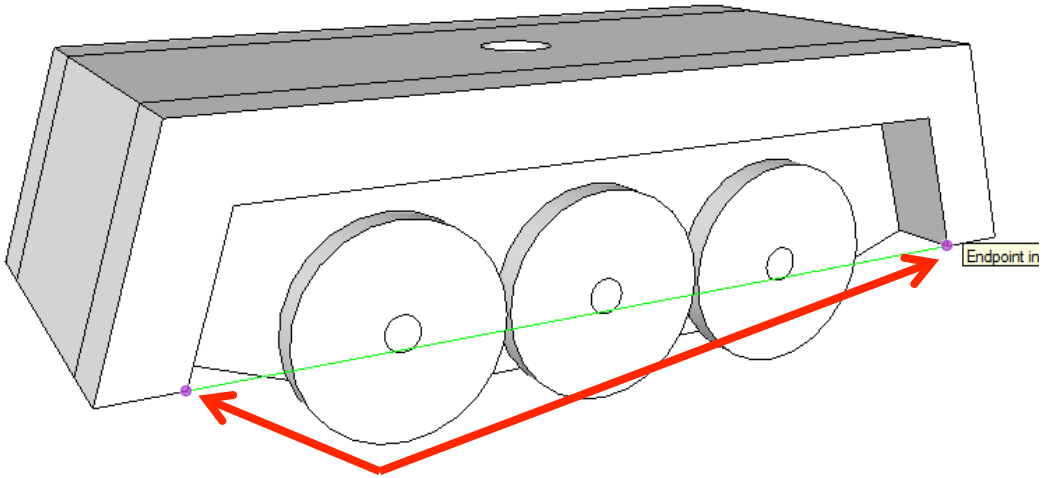
61. Use the ***select tool*** and keep clicking on the first wheel until it is all

selected and highlighted in blue on both sides

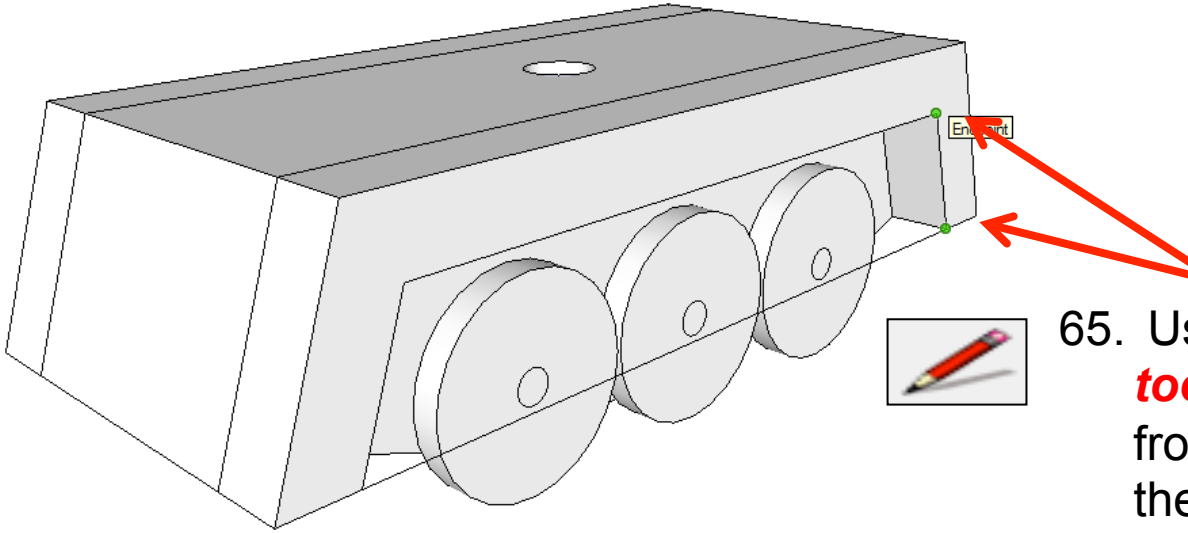
62. ***Right click*** on the mouse to produce the menu shown above and ***click*** on ***make group***



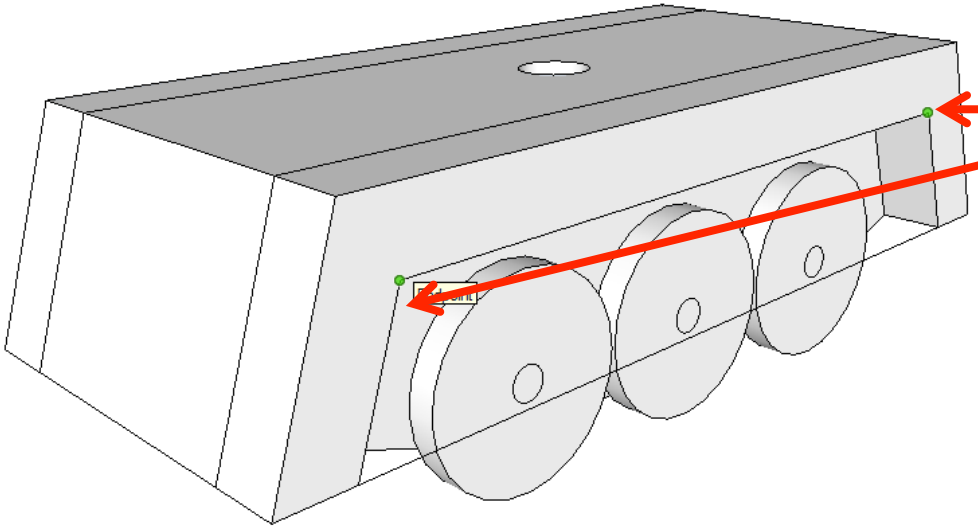
63. ***Repeat*** for the other two wheels



64. Using the ***pencil tool,*** Draw a line from one endpoint to the other shown above..

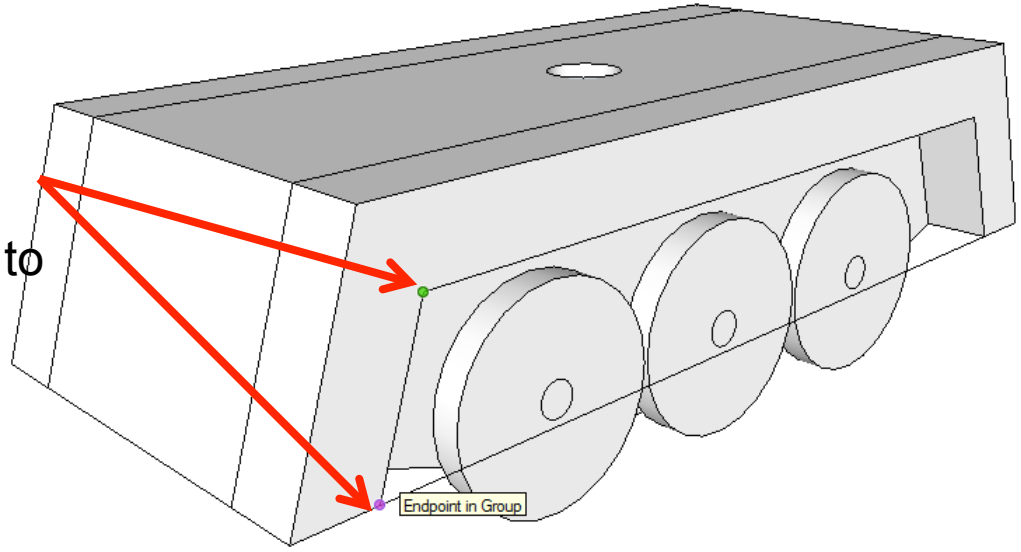


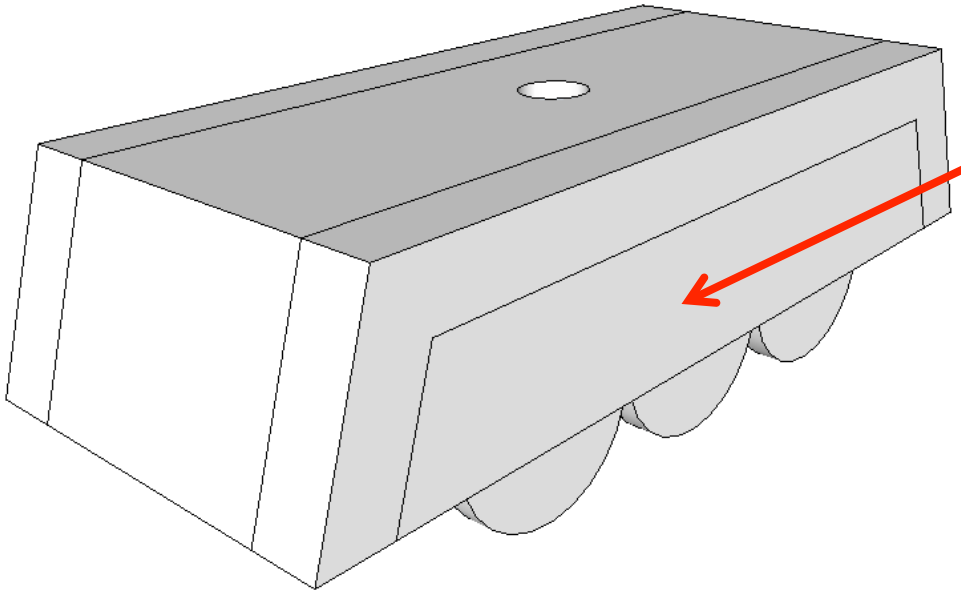
65. Using the ***pencil tool,*** Draw a line from one endpoint to the other shown above..



66. Using the ***pencil tool,*** Draw a line from one endpoint to the other shown above..

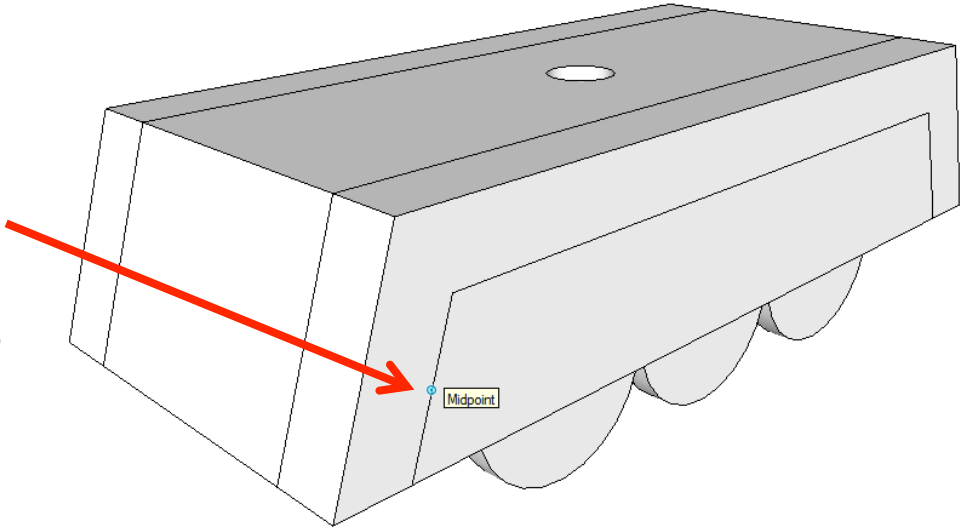
67. Using the ***pencil tool,*** Draw a line from one endpoint to the other shown above..

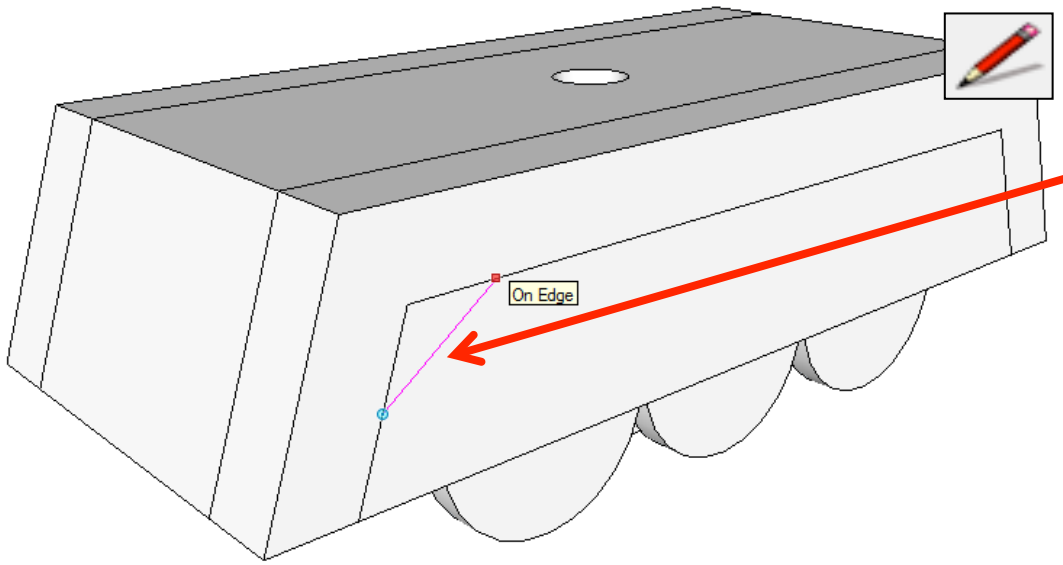




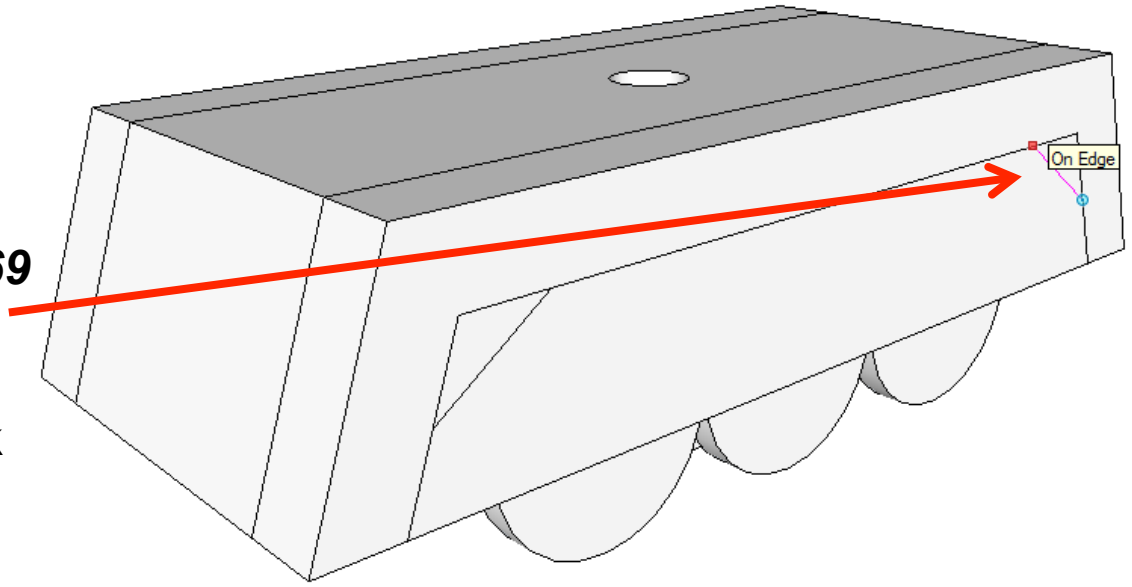
68. If you have drawn it correctly the shape should fill in as shown opposite.

69. Using the ***pencil tool,*** snap to the midpoint on the line shown.

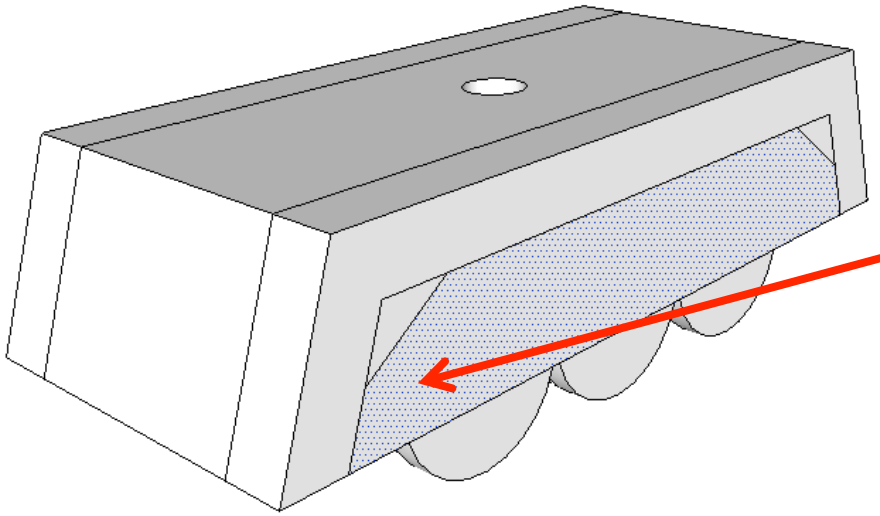




70. Using the ***pencil tool,*** draw a line on the diagonal as shown. It will go pink to indicate its at 45 degrees.

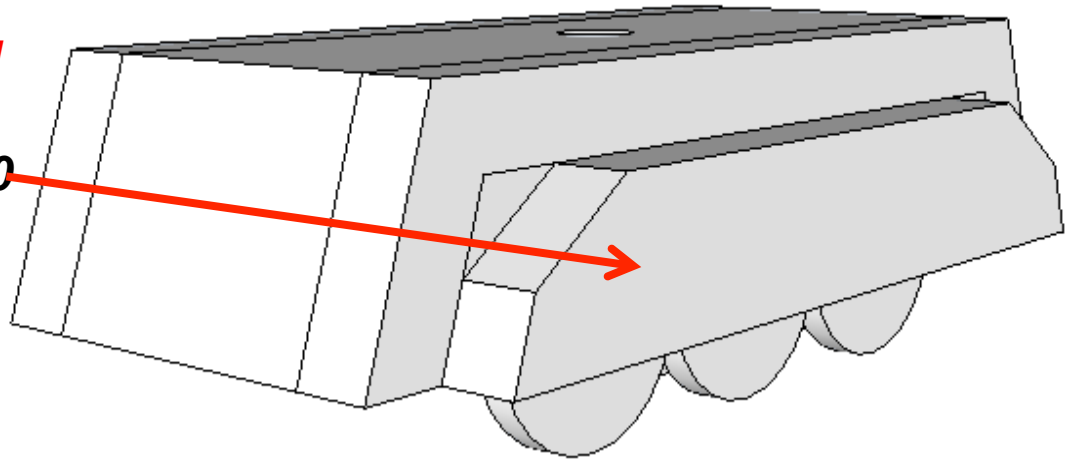


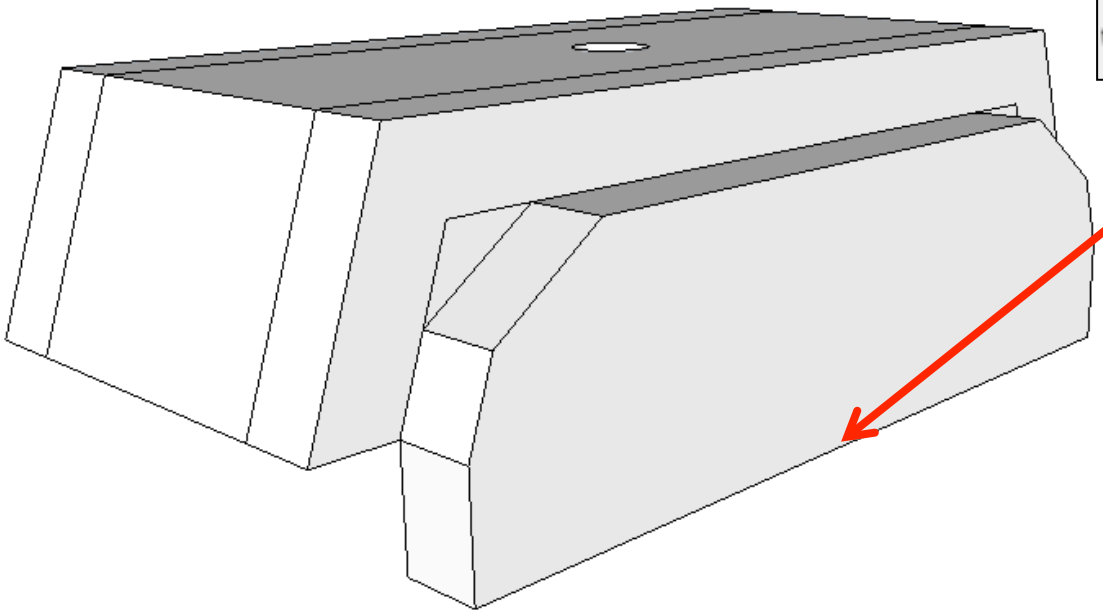
71. ***Repeat steps 69 and 70*** to draw the line on the back of the tank as shown



72. Using the ***push pull tool.*** Hover over the shape indicated. It will go dotted as you hover over it.

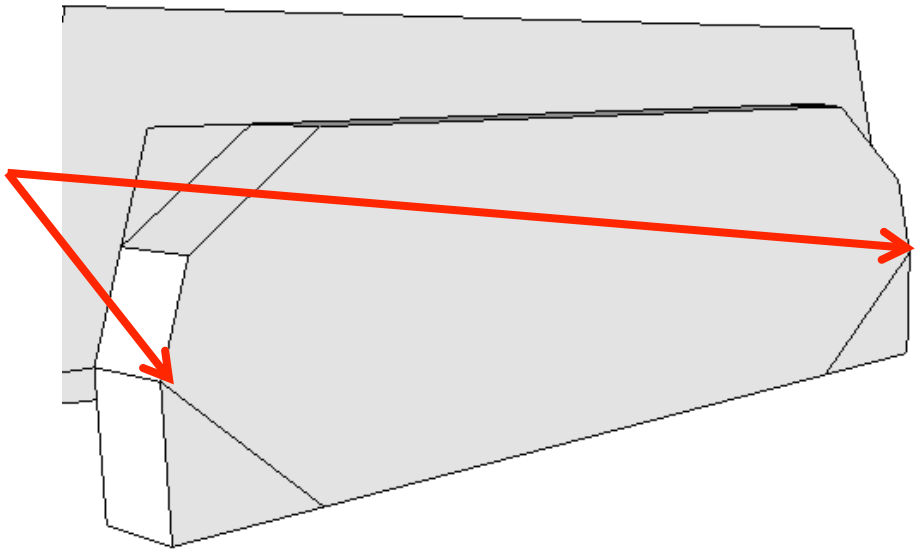
73. Using the ***push pull tool.*** Pull the shape outwards. Type in ***10 and press enter.***

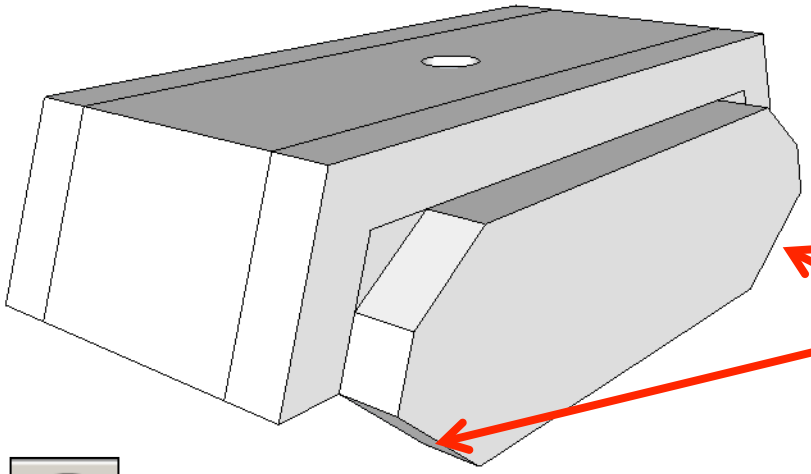




74. Using the ***push pull tool.*** Pull the underneath of the shape down. Type in ***14 and press enter.*** You may need to orbit below the tank

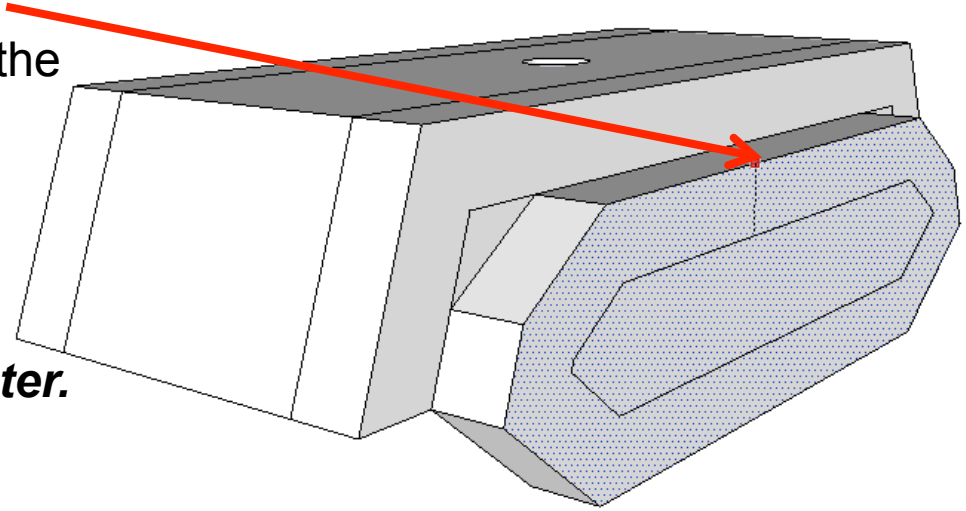
75. Using the ***pencil tool,*** Draw a line from the two endpoints shown to the base of that tank track



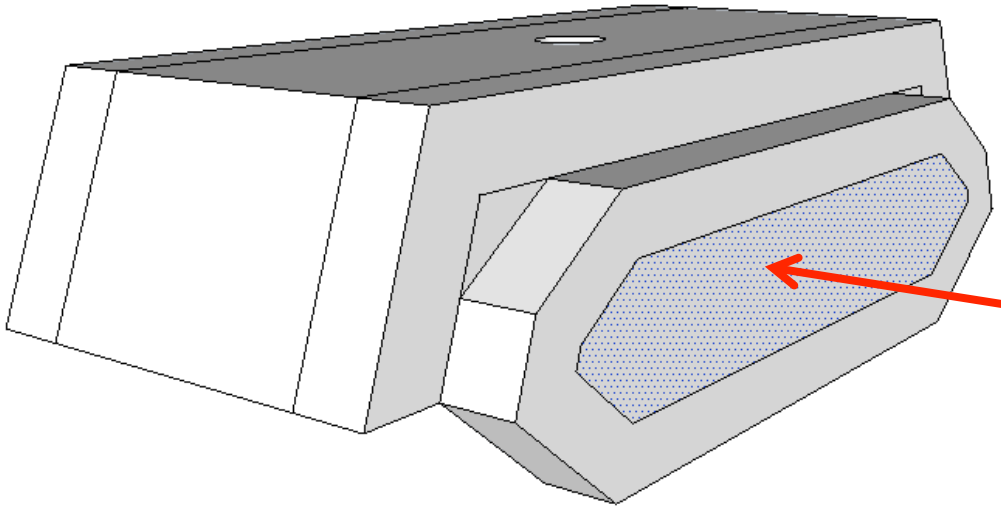


76. Using the ***push pull tool.*** Push the underneath triangle away. Type in ***10 and press enter.*** Repeat front and back

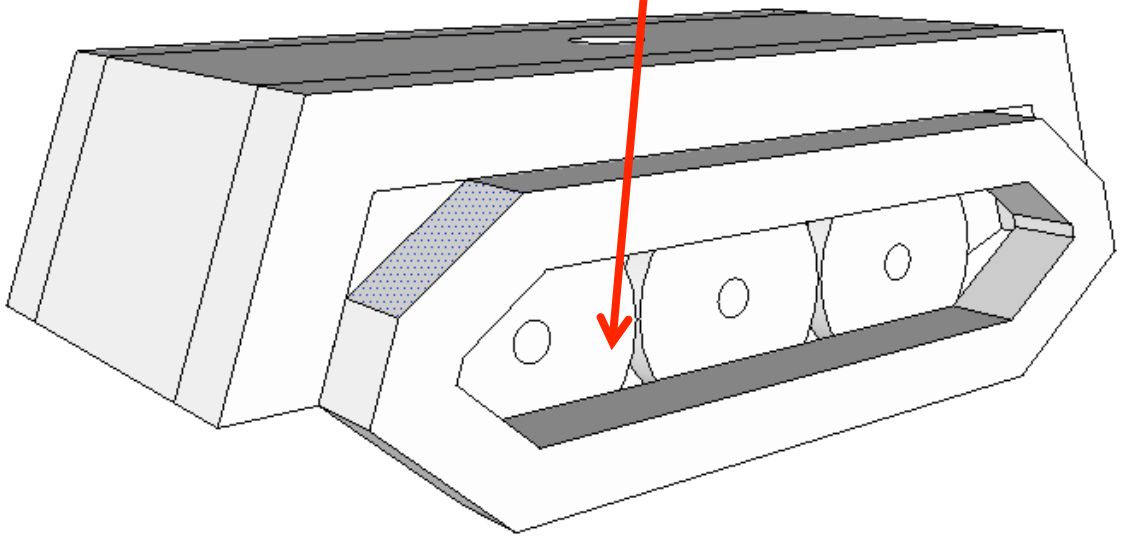
77. Use the ***offset tool*** to select the edge shown. Pull a parallel line from the top edge inwards as shown.

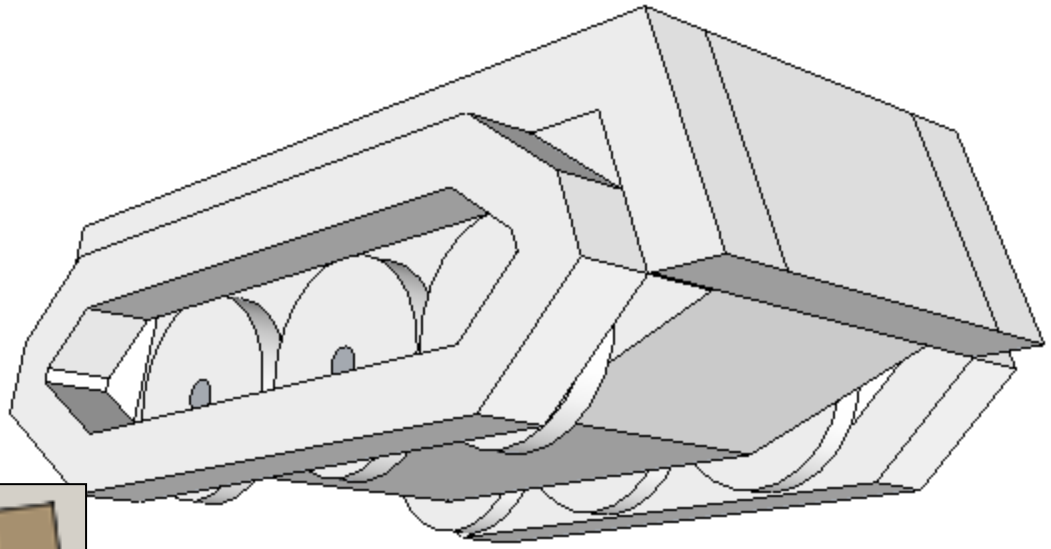


78. Type in ***8*** and press ***enter.***

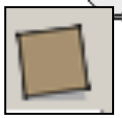


79. Using the ***push pull tool.*** Push the middle of the track in to expose the wheels. Type in ***10 and press enter.***

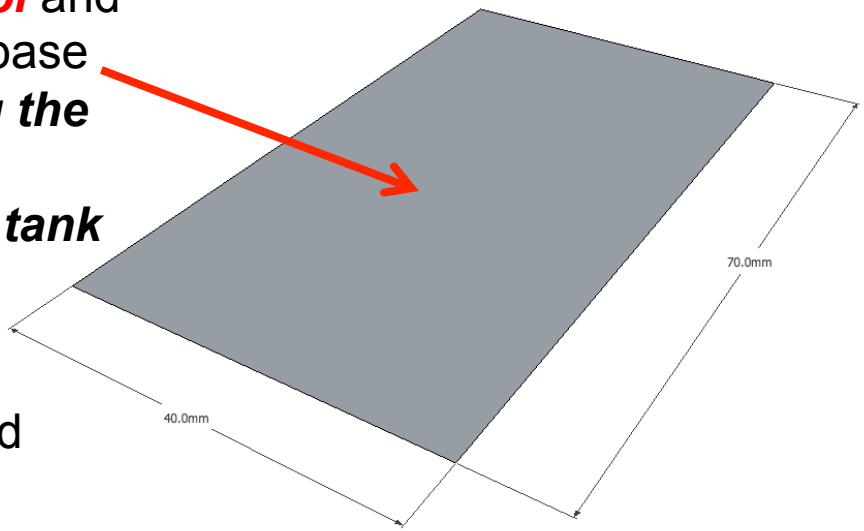




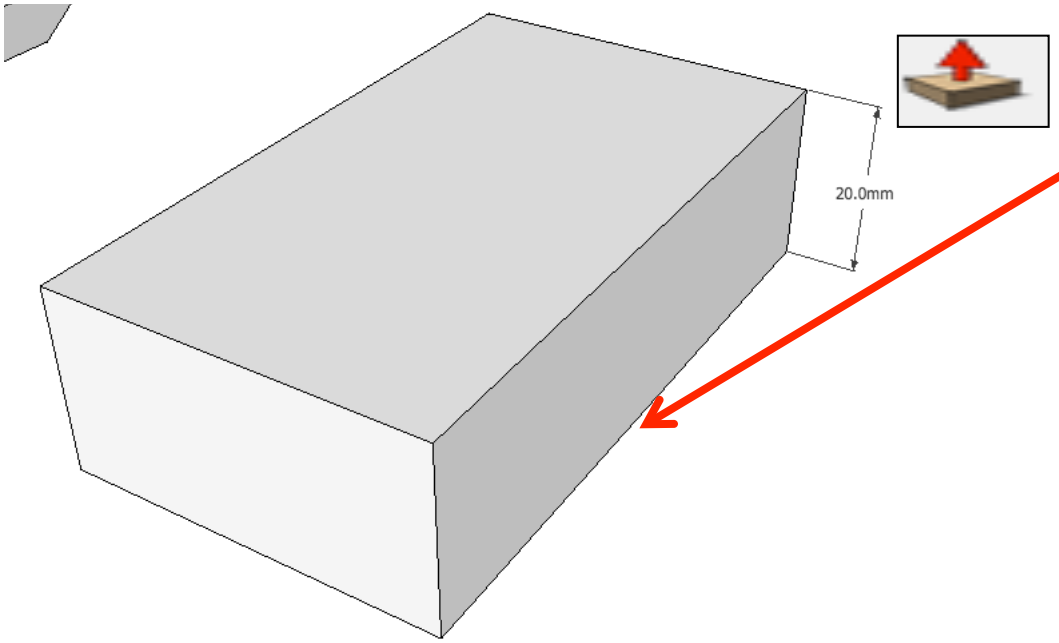
80. ***Repeat steps 64 to 79*** to draw the track on the back of the tank as shown. Or if confident copy and paste it from the opposite side.



81. Select the ***Rectangle tool*** and draw a rectangle on the base by clicking and ***dragging the cursor diagonally somewhere next to the tank body.***

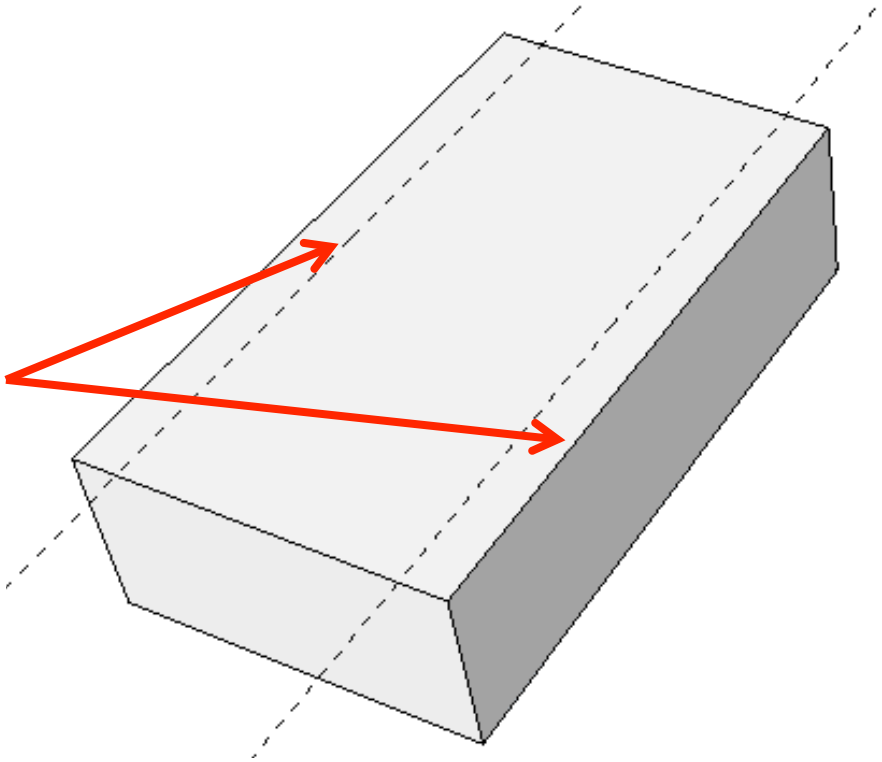


82. Once you have drawn the rectangle, enter ***'40, 70'*** and then press ***Enter***.



83. Using the ***push pull tool*** to raise each shape up. Type in ***20 and press enter.***

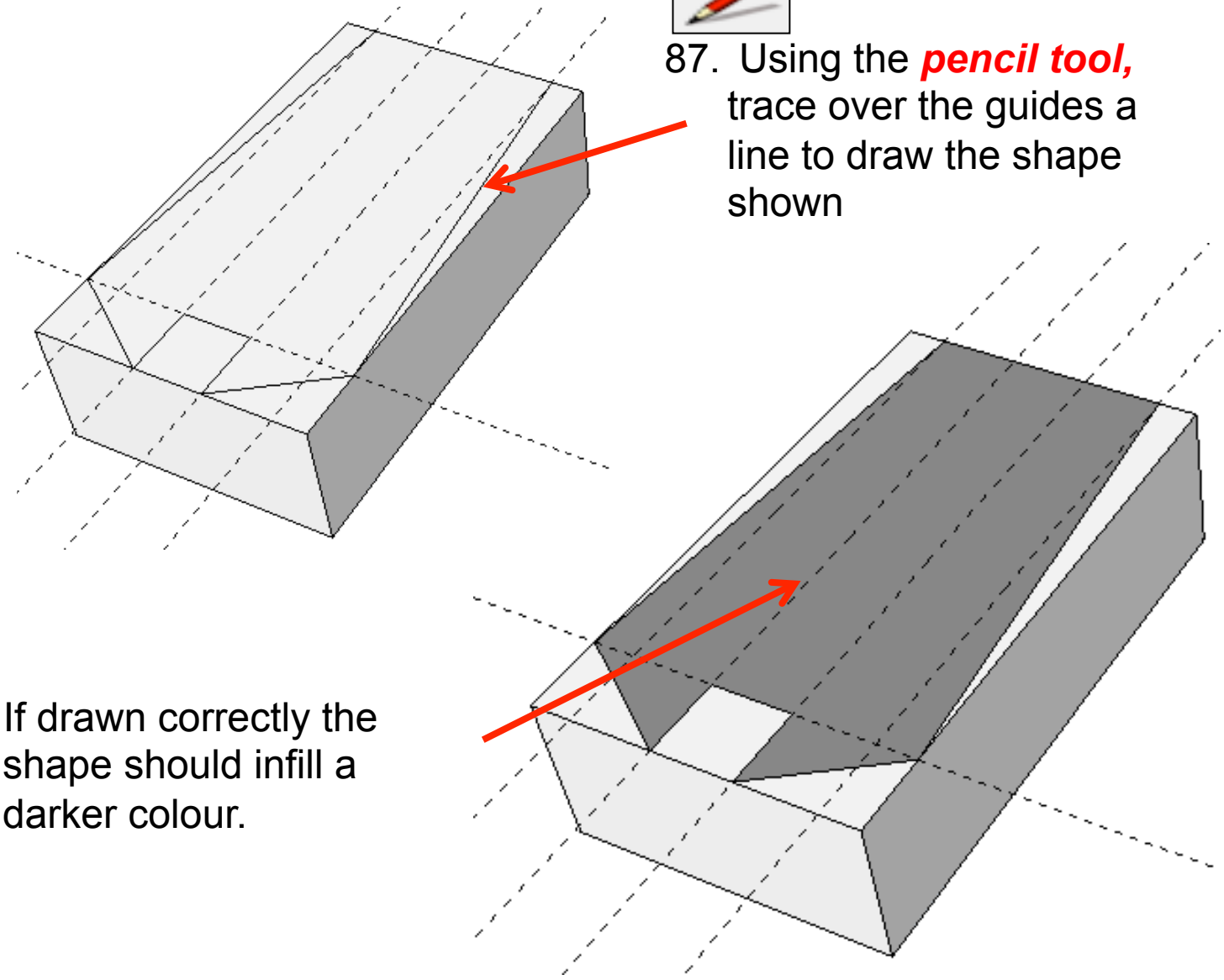
84. Select the ***Tape measure tool.*** Click on the edges of the rectangle shown one at a time. Pull a guide into the middle. ***Type 5 and press enter***. Repeat this on both sides.



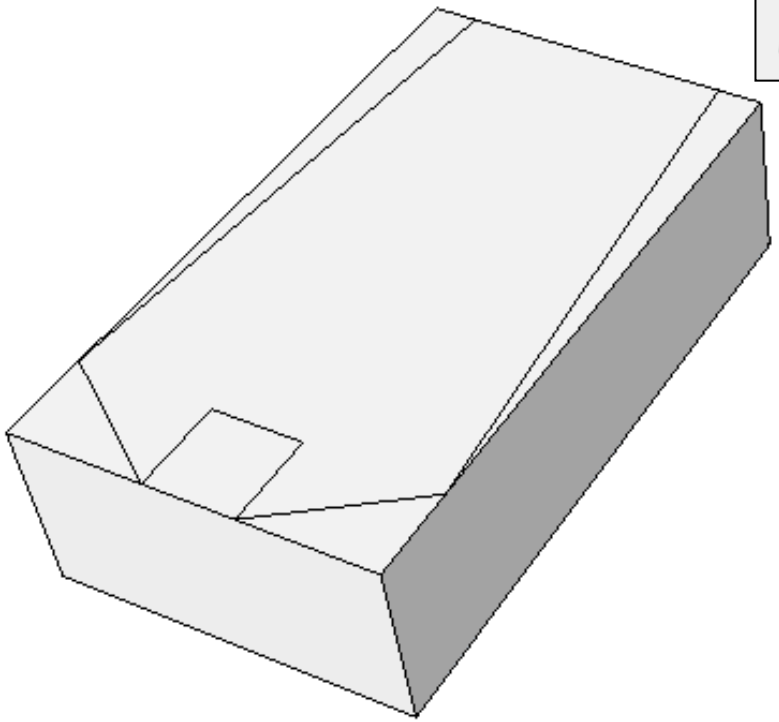
85. Select the ***Tape measure tool.*** Click on the front edge shown. Pull a guide into the middle***. Type 10 and press enter***.

86. Select the ***Tape measure tool.*** Click on the side edges of the rectangle shown one at a time. Pull a guide into the middle***. Type 15 and press enter***. Repeat this on both sides.

87. Using the ***pencil tool,*** trace over the guides a line to draw the shape shown

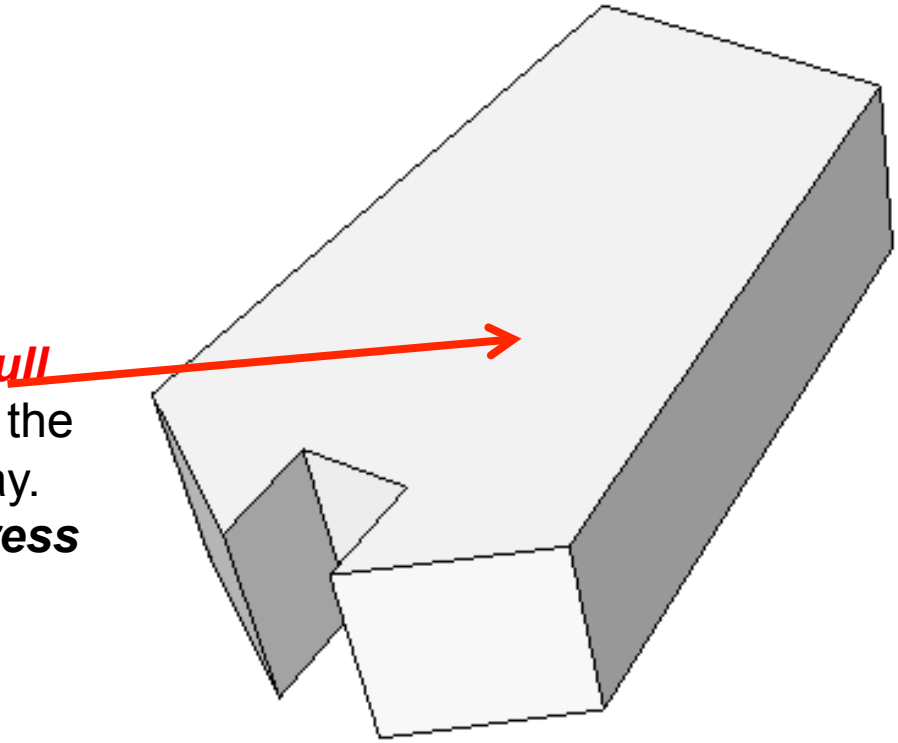


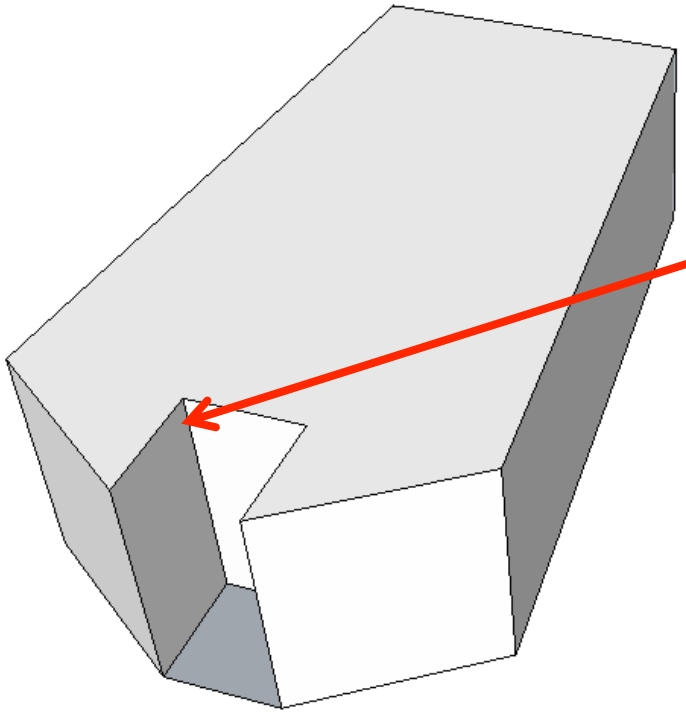
88. If drawn correctly the shape should infill a darker colour.

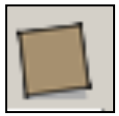


89. Use the ***rubber tool*** to erase the guidelines made by the tape measure.

90. Using the ***push pull tool*** to raise push the excess waste away. Type in ***20 and press enter.***

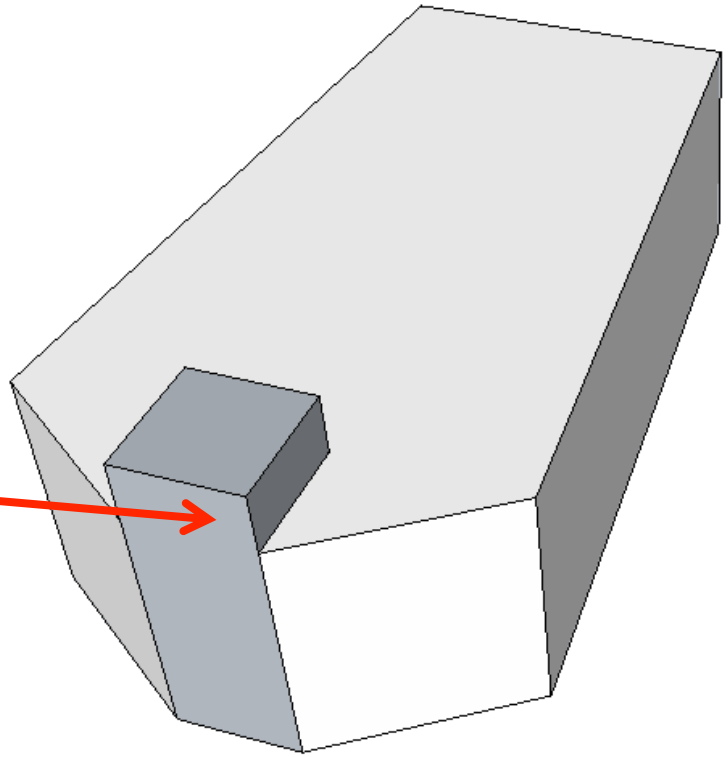




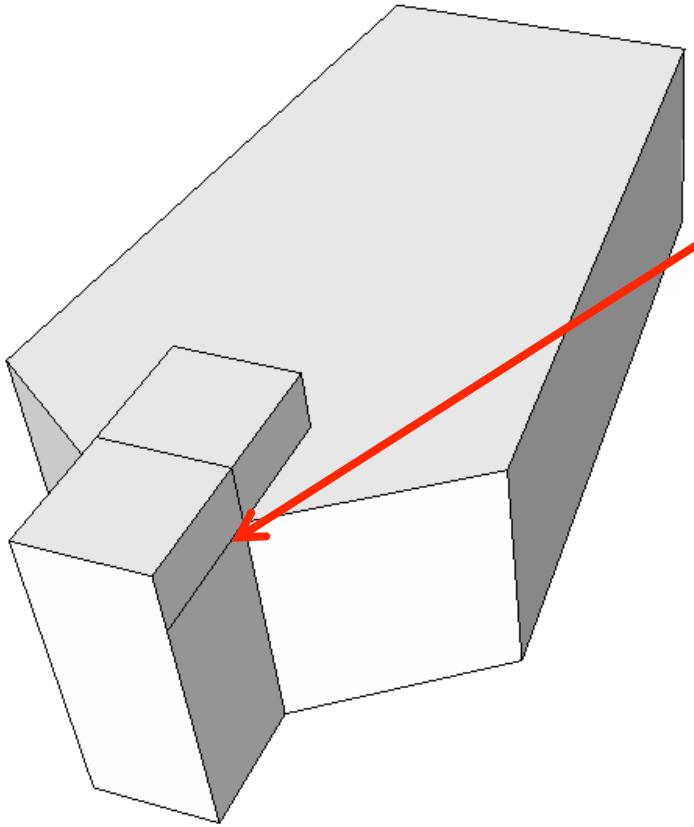


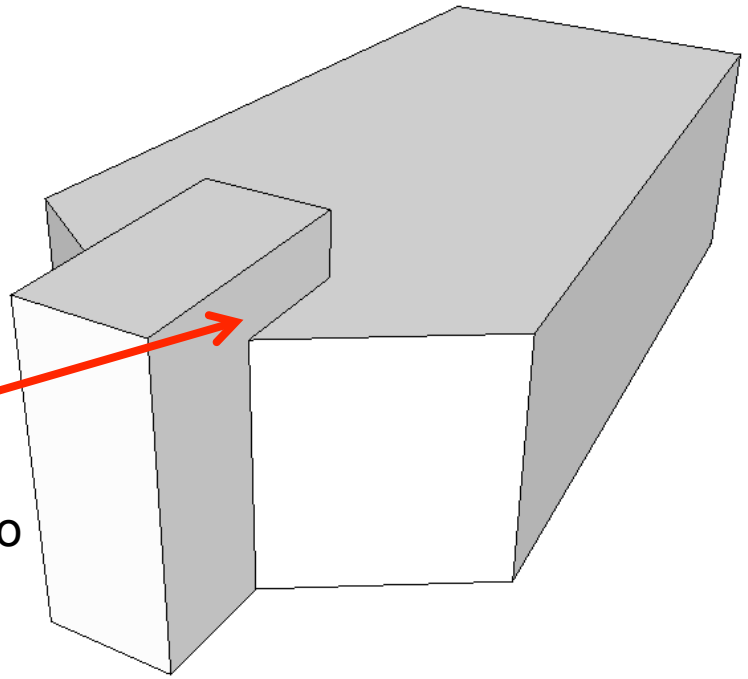
91. Select the ***Rectangle tool*** and draw a rectangle on the endpoints shown by clicking and ***dragging the cursor diagonally to draw the square***

92. Using the ***push pull tool*** to raise push the excess waste away. Type in ***25 and press enter.***



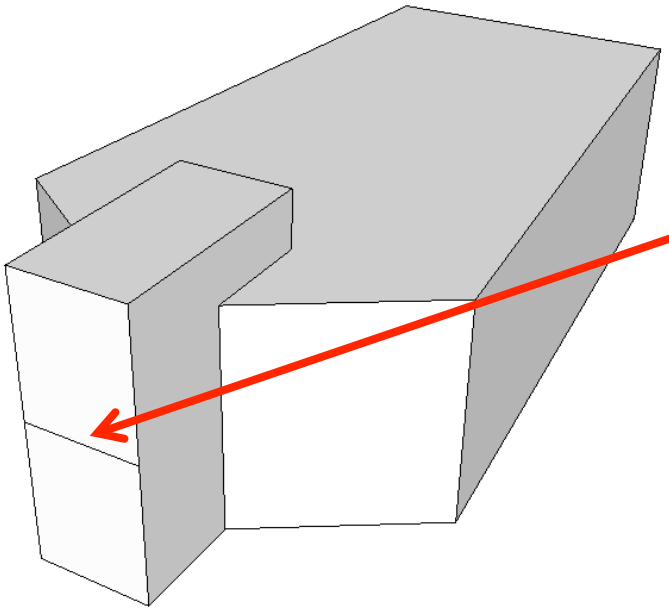
93. Using the ***pencil tool*** and ***push pull tool*** to draw a line on the side as shown and on the back of the shape you have just drawn and pull. Type in ***10 and press enter.***



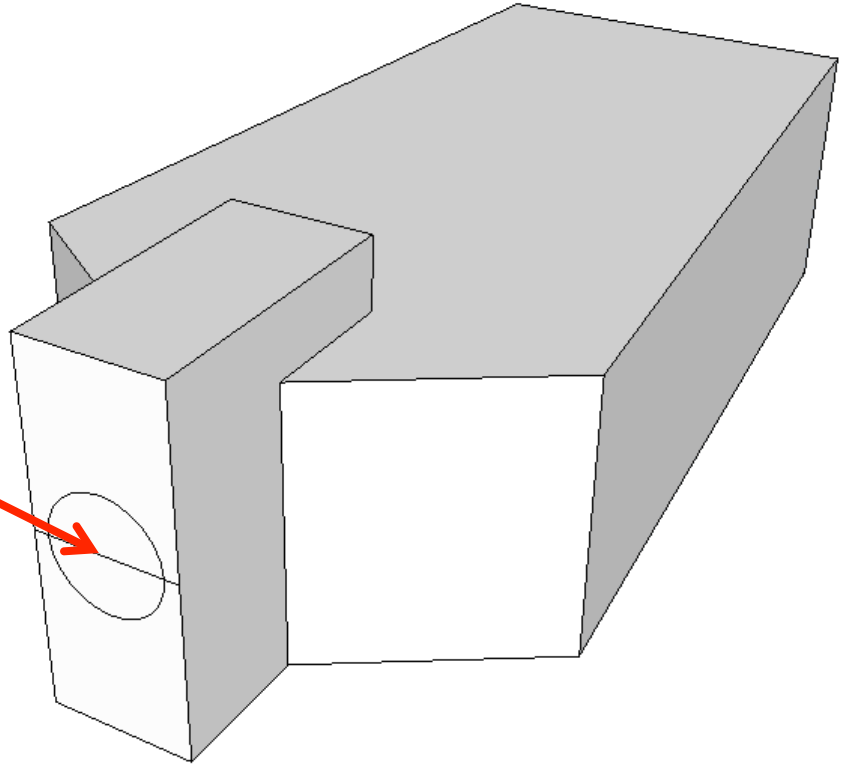


94. Use the ***rubber tool*** to erase the guidelines

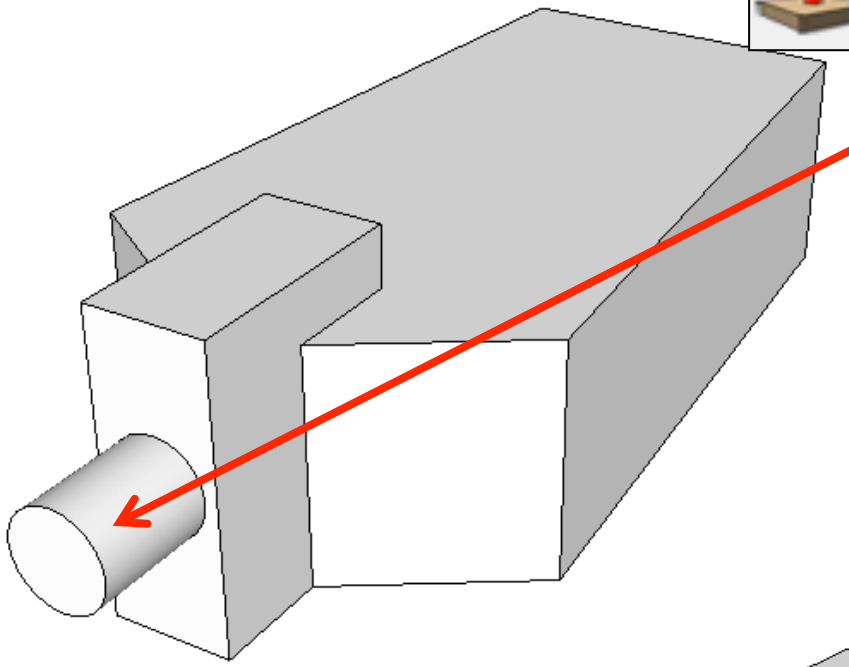
95. Using the ***pencil tool,*** snap to the midpoint and draw a line across to the opposite midpoint.



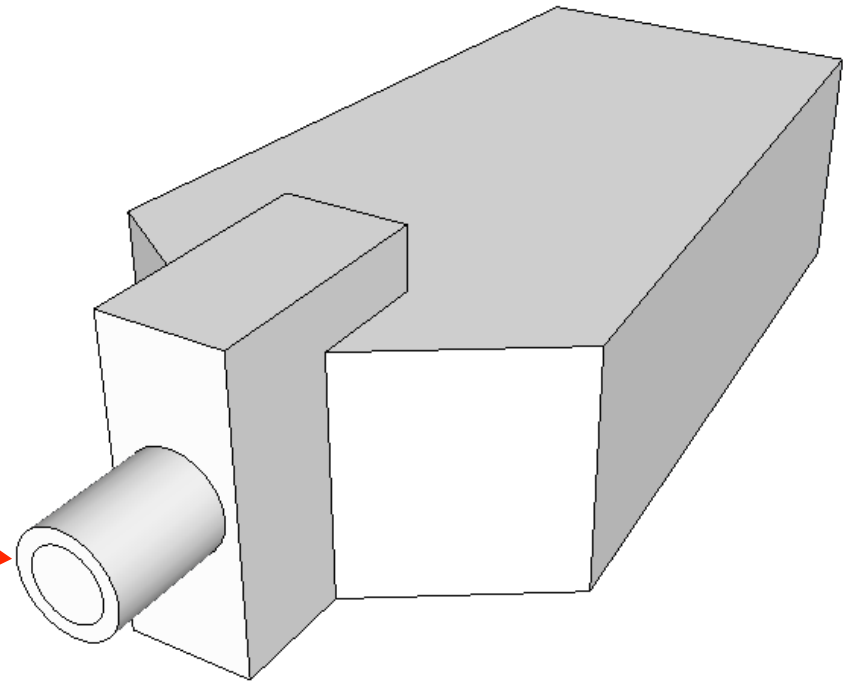
96. Using the ***circle tool,*** snap to the midpoint of the last line you have just drawn. Pull the circle out as shown.



97. Using the ***push pull tool*** pull the circle out. Type in ***10 and press enter.***

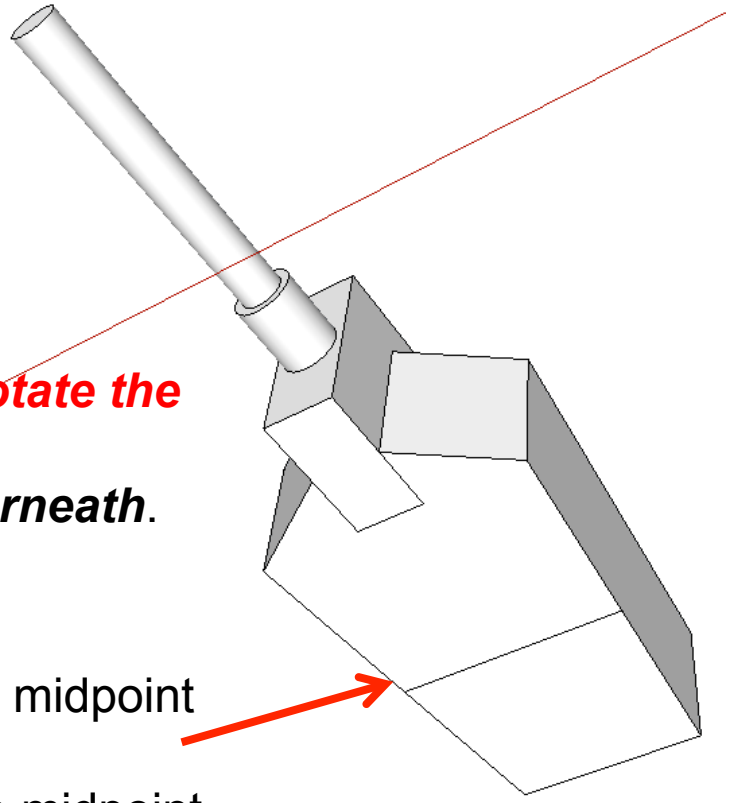


98. Use the ***offset tool*** to select the edge shown. Pull a parallel line from the edge inwards as shown.

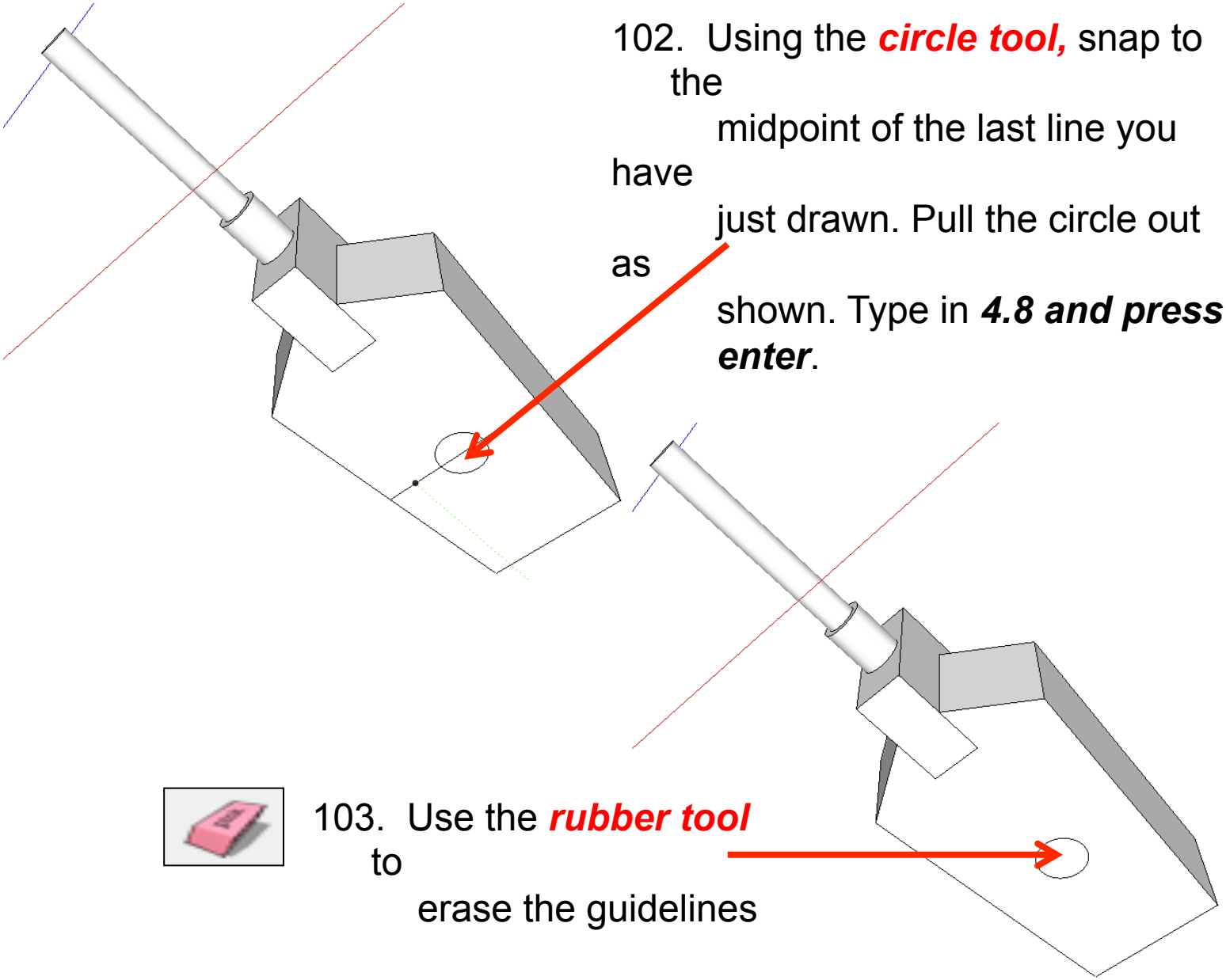


99. Using the ***push pull tool*** pull the circle out. Type in ***40 and press enter.***

100. Select the orbit tool and ***rotate the tank***
so you can see its underneath.



101. Using the ***pencil tool,*** snap to the midpoint and
draw a line across to the opposite midpoint.



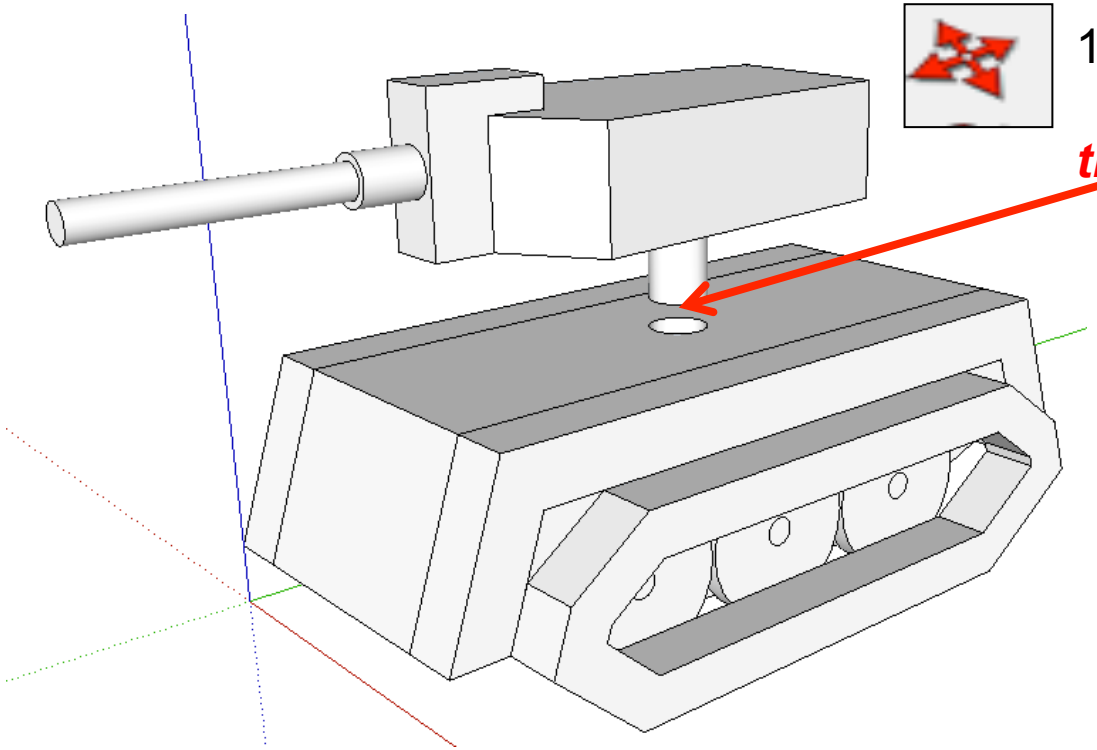
102. Using the ***circle tool,*** snap to the midpoint of the last line you have just drawn. Pull the circle out as shown. Type in ***4.8 and press enter***.

103. Use the ***rubber tool*** to erase the guidelines

104. Using the ***push pull tool*** pull the circle out. Type in ***18*** ***and*** ***press enter.***

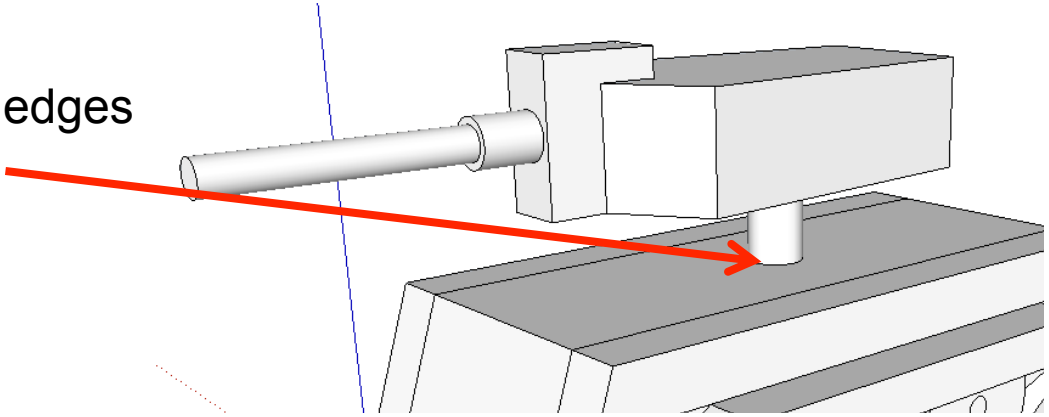
105 Use the ***select tool*** and keep clicking on the tank until it is all selected and highlighted in blue.

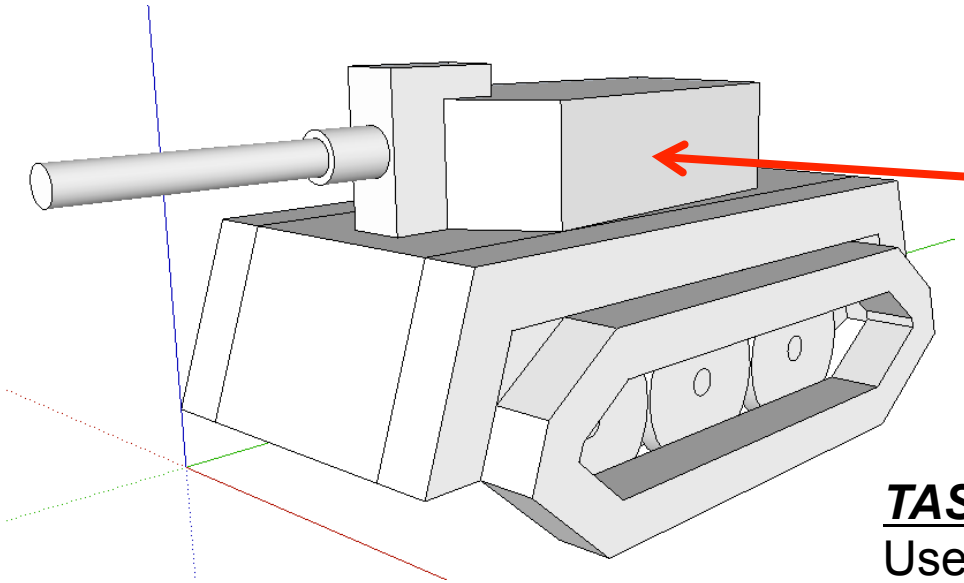
106 ***Right click*** on the mouse to produce the menu shown above and ***click*** on ***make group***



107. Select the ***move tool*** and ***grab the point shown***

108 ***Position*** the two edges together as shown



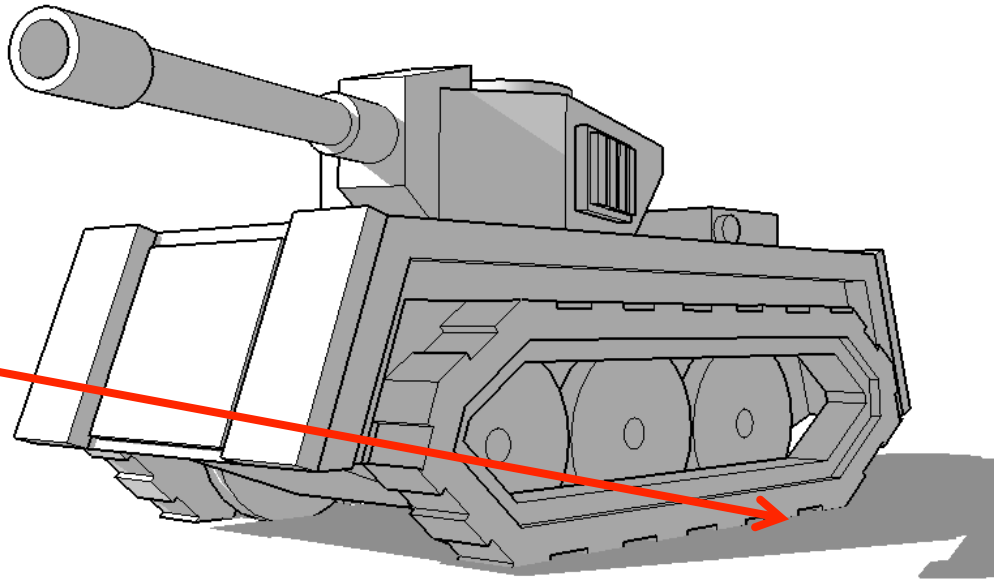


109. Using the ***move tool*** move the turret into place as shown on the ***blue axis***

TASK

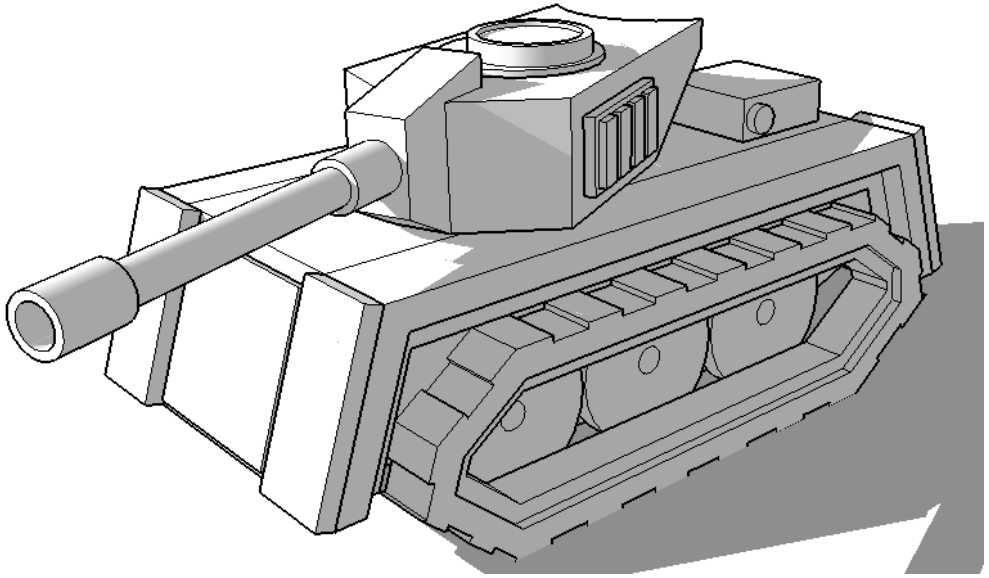
Use your own skills to add more details

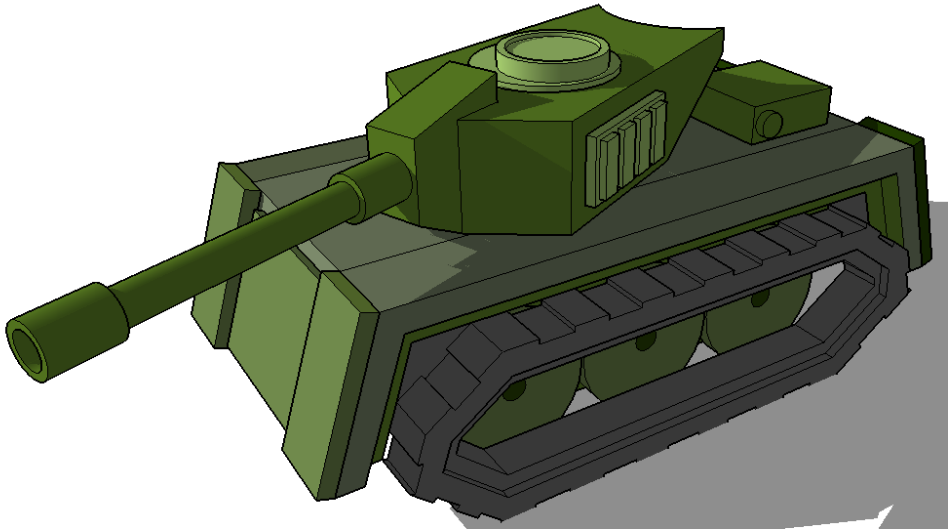
Click ***View – toolbars*** and un-tick axis. Place a tick next to shadows



Tasks:

- Put other details on the tank such as gun turret details, tank tracks, opening hatch etc..
- Experiment with colours and materials for rendering.






ABC