



CAD SKILLS



CAD Tutorial 4: Design Tools

Level of Difficulty

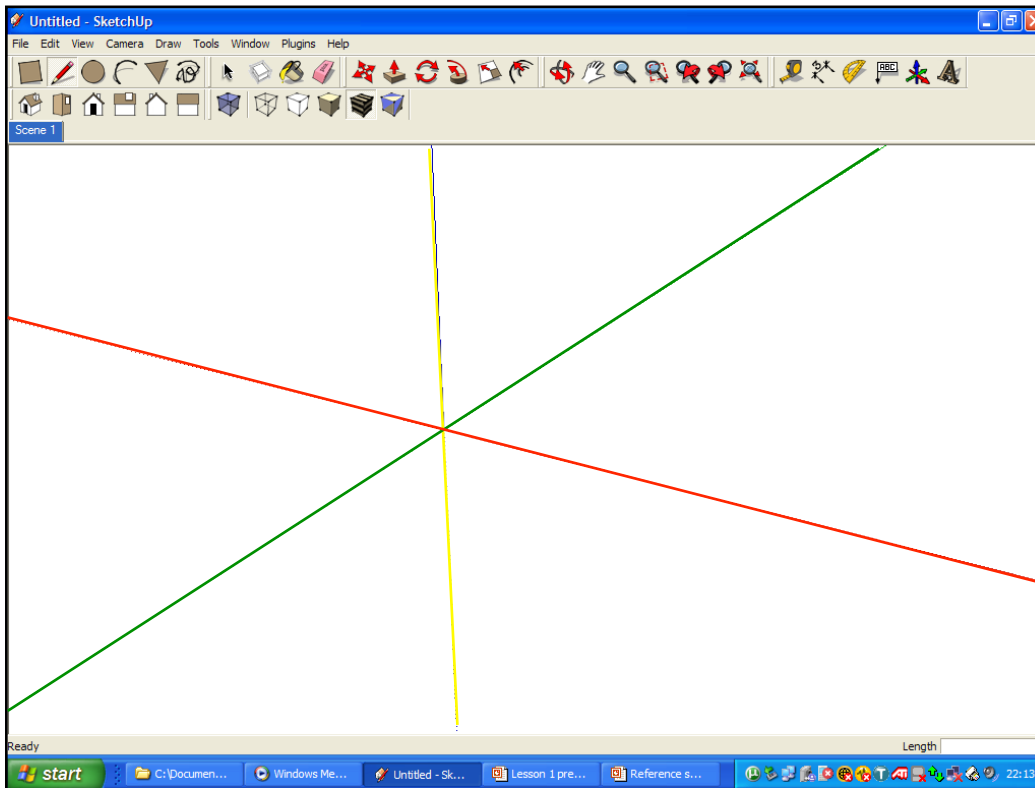


Time

Approximately 40–50 minutes

Starter

- What direction to the axis run in SketchUp?



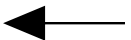
Vertical



Horizontal

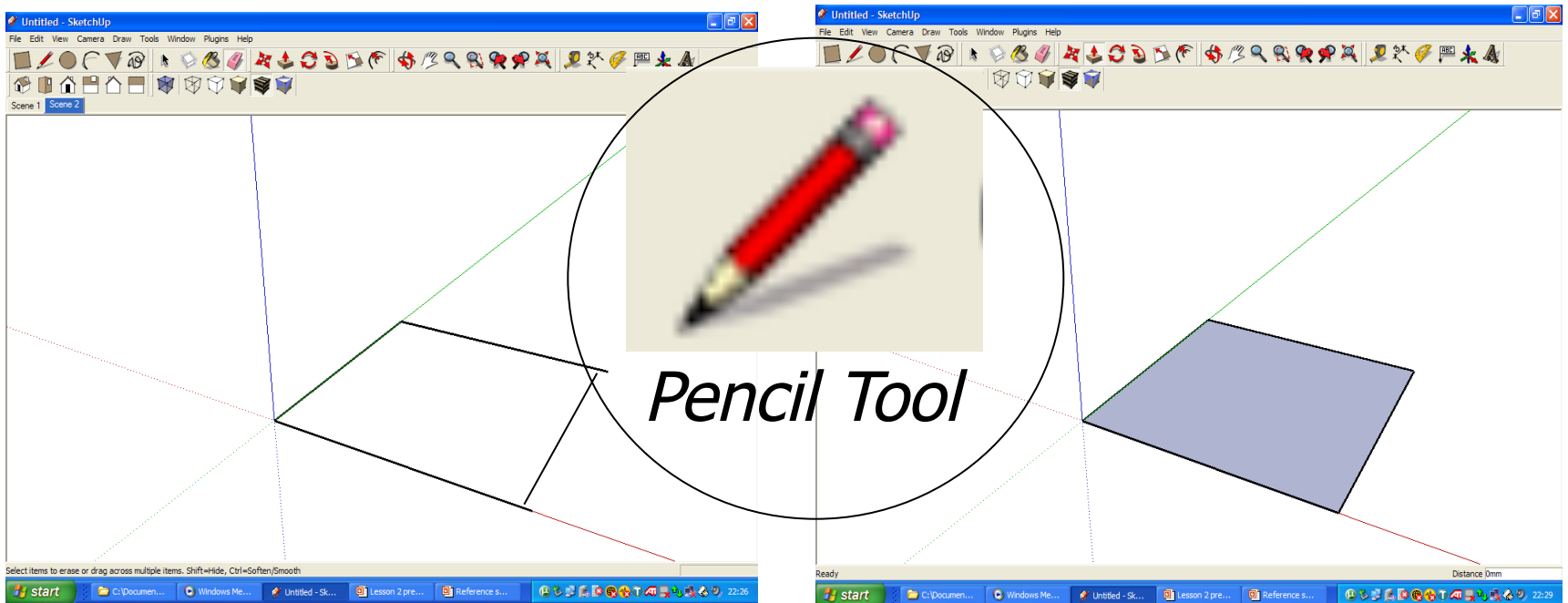


Horizontal (90°)



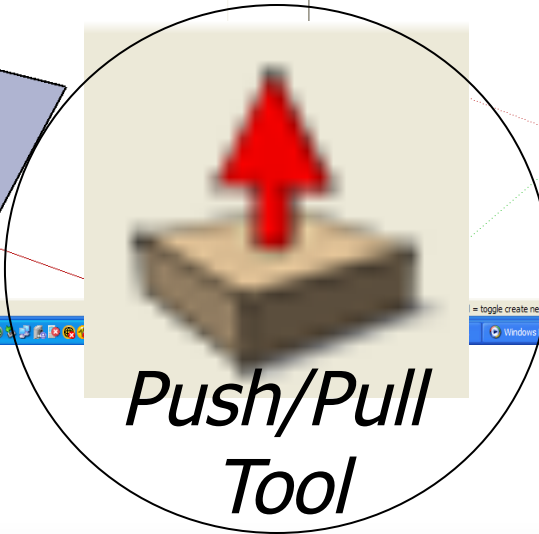
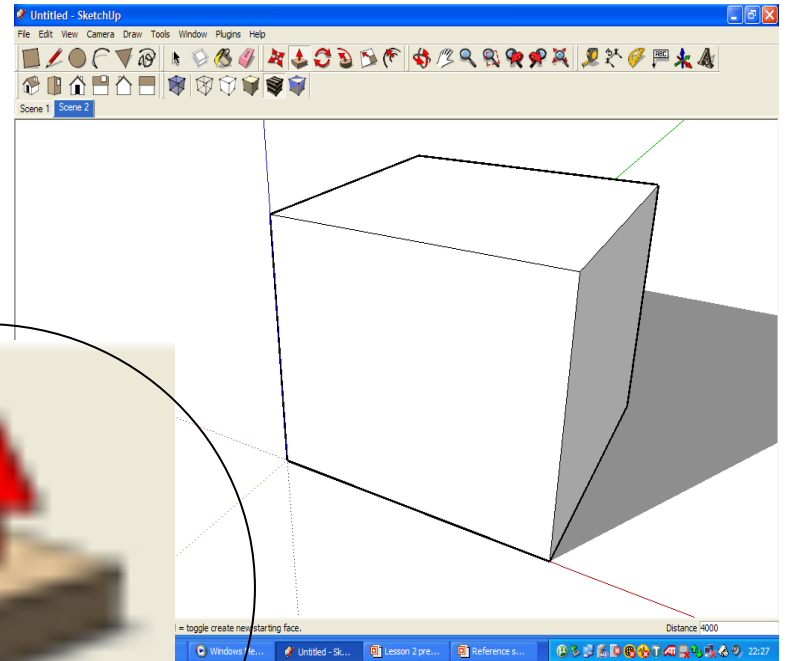
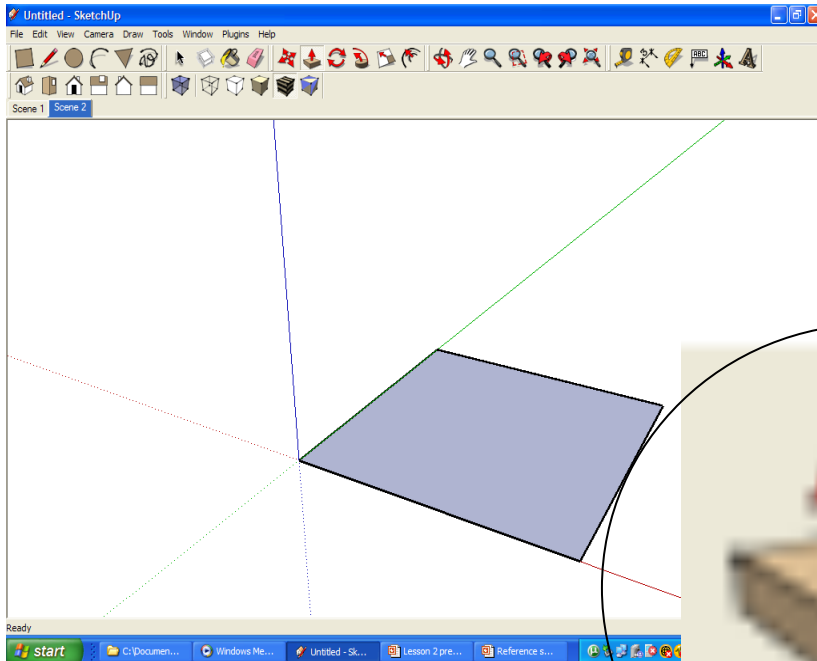
Starter

Which tool should I use to complete the drawing of a square?



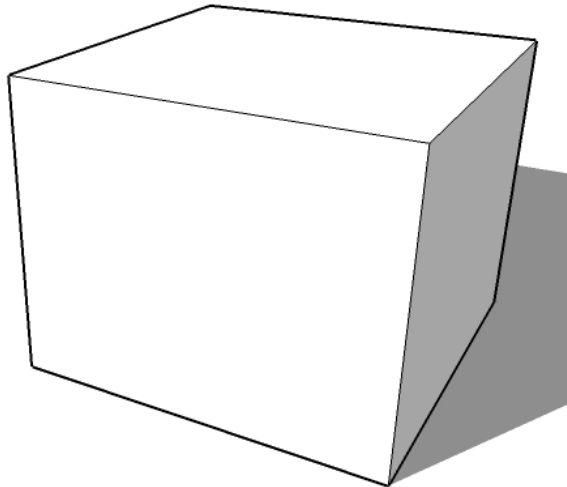
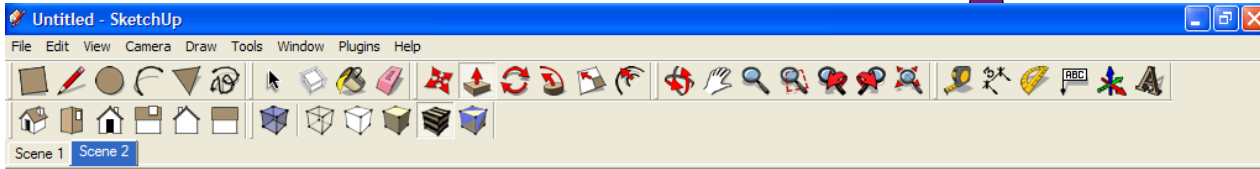
Starter

Which tool should I use create a cube from a flat surface/face?



Starter

Which tool should I use to view *ALL AROUND* the cube?



Lesson Objectives...

- To understand the basic tools used in SketchUp.
- To understand the advantages of using CAD
- To be able to successfully use CAD independently to complete a range of tutorials in 2D and 3D
- To develop advanced skills and problem solving skills when using Sketch Up
- To use correct dimensions when using sketch up to draw models that can be 3D printed or manufactured using CAM machines in school (i.e. Laser Cutter, 3D Router).

Lesson Outcomes...

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

- Use the push pull and move tool
- Learn about centre lines
- Create, Move and Rotate components
- Use the offset tool to make objects and add detail
- Shape and form your design
- Draw your design to the correct size to enable it to be manufactured.

Skills to be used in this project...

Basic Skills	New and Higher Skills
Zoom tool	Rotate tool
Orbit tool	Move tool
Pan tool	Offset tool
Line tool	Arc tool
Rectangle tool	Follow Me tool
Circle tool	Paint Bucket tool
Eraser tool	Dimensions tool
Push/Pull tool	Making Components

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.

Learning Styles


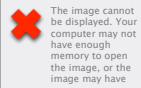


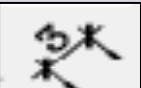





Visual : *Presentation*

Auditory: *Video*

Kinaesthetic: *Demonstration*








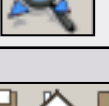

Sketchup Help Guide:

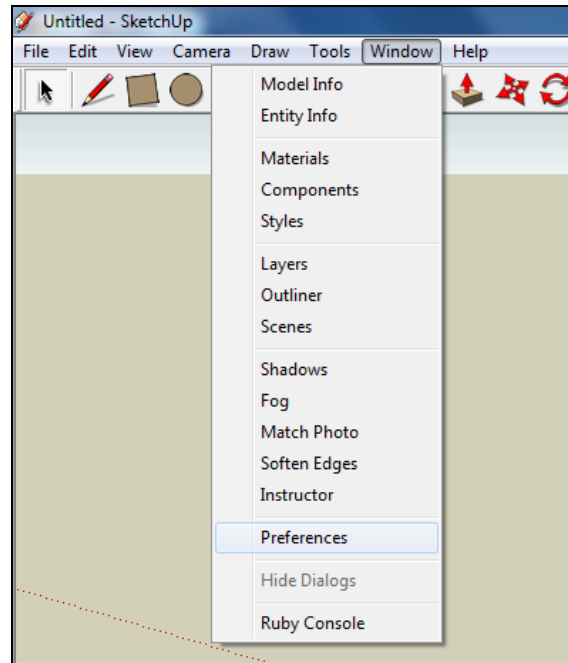
Computer Aided Engineering: 15. Drawing and Modification Commands

Drawing and Modification Tools	image	Description	Advantages
Modifying Tool 1. Pencil tool		used to draw lines in X, Y and Z direction. Can draw simple or complex shapes very quickly.	Advantages: Allows user to draw or modify shapes very quickly and can be used to construct 3D objects faster than traditional hand drawings
Modifying Tool 2. Trim tool		allows the user to remove overlapping elements.	Advantages: Allows user to erase overlapping lines and edges to draw complex 3D shapes very quickly.
Modifying Tool 3. Push/pull		tool used to turn solid objects into 3D objects instantaneously. Typing a size allows a user to extrude or pull an object to a certain size or height	Advantages: Allows user to draw or modify 3D shapes very quickly faster than traditional hand drawings. You can click on a face (plane) and adjust. Can be used to extrude shapes on 3D objects already drawn.
Modifying Tool 4. Move Tool		used to move entire shapes or pull lines on a drawing.	Advantages: Allows user to draw or modify shapes very quickly and can be used to construct unusual 3D shapes quickly
Modifying Tool 5. Dimensions tool		used to show sizes and radius of drawn objects	Advantages: Allows user to draw or modify 3D shapes very quickly faster than traditional hand drawings to correct size if drawn incorrectly. Drawing can be transferred onto the CNC machines directly
Modifying Tool 6 Extrusion Tool (follow me)		allows the user to highlight a path that turns blue. A chosen shape will then follow the chosen path	Advantages: Allows user to draw profiles of shapes and follow the path to draw complex 3D shapes very quickly.
Modifying Tool 7. Arch tool		You can use the arch tool to draw a radius from two given points. Can be used to draw corners etc..	Advantages: Allows user to rotate and position shapes quickly to draw complex 3D shapes very quickly.
Modifying Tool 8. Circle tool		allows the user to draw different sized radius circles and chamfered corners	Advantages: Allows user to draw profiles of shapes and follow the path to draw complex 3D shapes very quickly.
Modifying Tool 9. Orbit tool		You can use the Orbit tool to change the angle that you are viewing your design from. You can do the same by pressing the middle wheel of your mouse	Advantages: Allows user to rotate and see all angles of their design quickly
Modifying Tool 10. Tape measure tool		allows the user to draw guide lines to given sizes and mark out radius etc.	Advantages: Allows user to draw guides of shapes and draw complex 3D shapes very quickly.

Sketchup Help Guide:

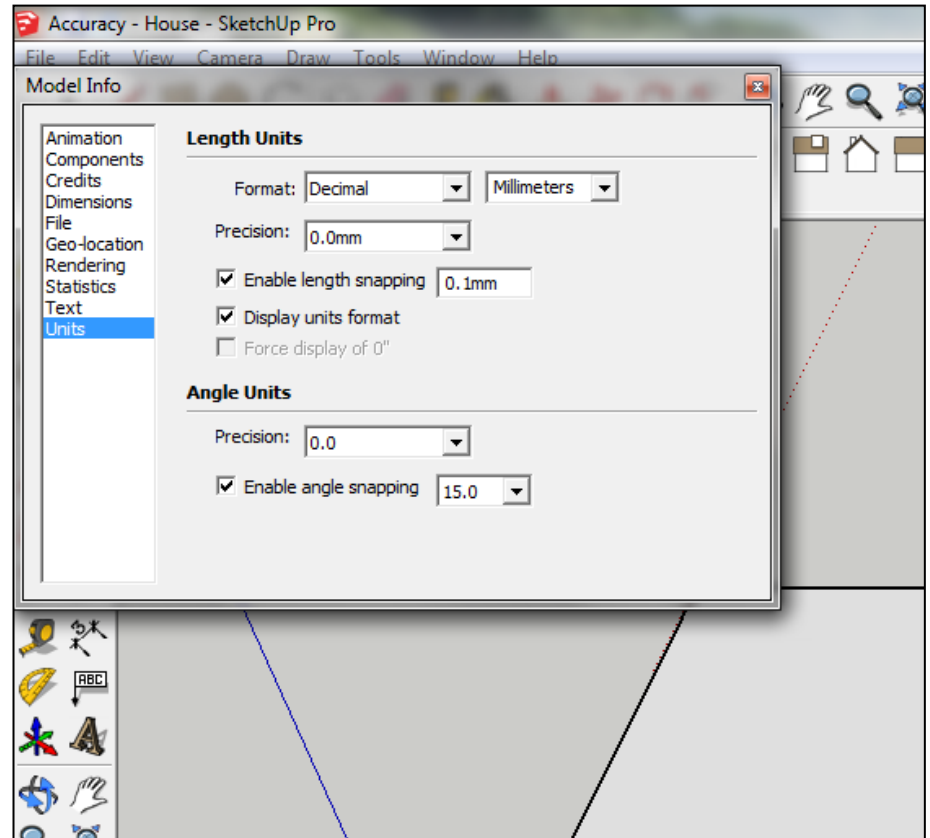
Computer Aided Engineering: 15. Drawing and Modification Commands

Drawing and Modification Tools	image	Description	Advantages
Modifying Tool 11. Square tool		used to draw squares and rectangles.	Advantages: Allows user to draw guides of shapes and draw complex 3D shapes very quickly.
Modifying Tool 12. Offset tool		You can use the contour tool to draw parallel lines or lines within lines.	Advantages: Allows user to draw duplicate lines and position them within shapes quickly to draw complex 3D shapes very quickly.
Modifying Tool 14. Rotate Tool		used to move rotate parts of a shape or entire shapes on x, y and Z co-ordinates.	Advantages: Allows user to draw or modify shapes very quickly and can be used to construct unusual 3D shapes quickly
Modifying Tool 15 Scale Tool		allows the user to select an object or part of an object and increase its size from the base point.	Advantages: Allows user to quickly resize objects to draw complex 3D shapes very quickly.
Modifying Tool 16 Paint Bucket Tool		allows the user to select a colour or materials to produce photo-realistic drawing of their object. Shadows etc. can be added.	Advantages: Allows user to quickly draw objects like using materials, textures etc...
Modifying Tool 17 Pan Tool		You can use the Pan tool to grab and move your object around the screen. Alternatively, you can pan by pressing the Shift key and holding down the mouse's middle wheel.	Advantages: Allows user to move and position their object quickly
Modifying Tool 18 Text Tool		You can use the text tool to add text to your object.	Advantages: Allows user to add 3D text by clicking on the extrude button or 2D text
Modifying Tool 19 Zoom Extents Tool		You can use this tool to automatically zoom into your entire project.	Advantages: Allows user to quickly navigate to the entire drawing if they get lost.
Modifying Tool 20 View Tool		You can use the view tool to quickly look at front side and top views as well as 3D views	Advantages: Allows user to complete working drawings quickly as well as enabling them to show a top view for exporting onto the laser cutter.



1. Open Library /[Designoutthebox.com/](https://www.designoutthebox.com/) CAD Skills/ Lesson 4 / Design Tools

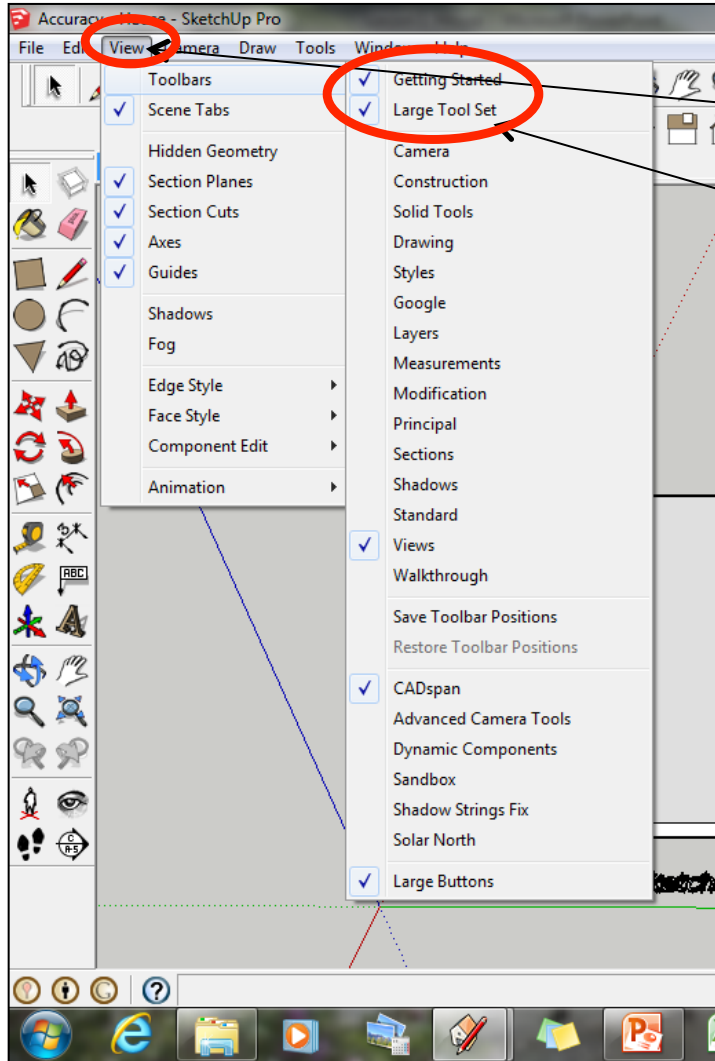
Open the sketch up drawing. Once you have opened SketchUp, go to **Window** and select **Model Info**



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



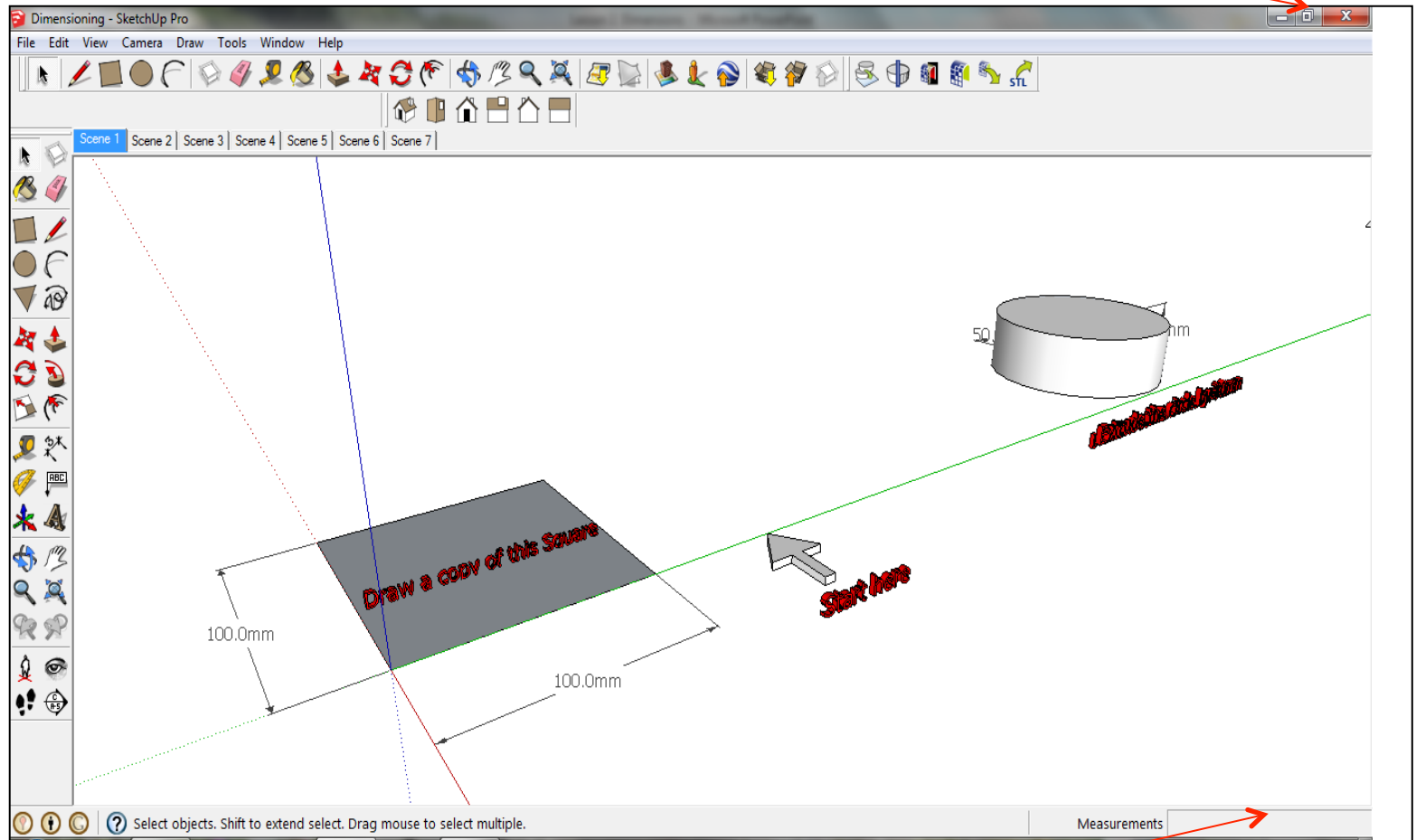
3a Select **View**

3b Tick Getting Started

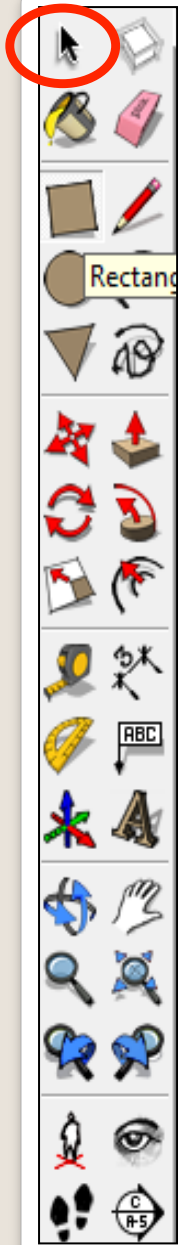
3c Tick Large Tool Set

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

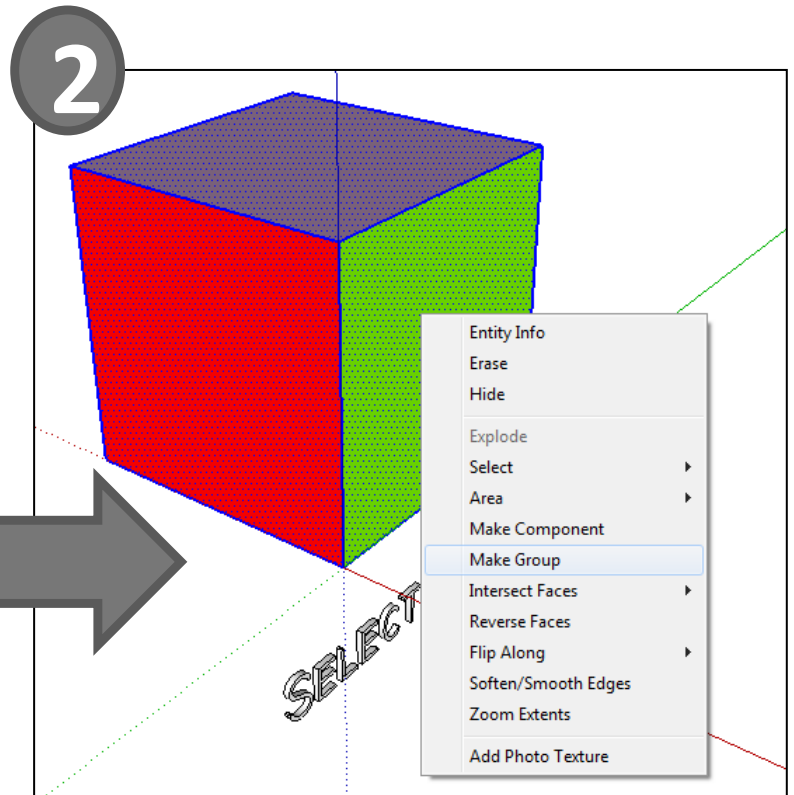
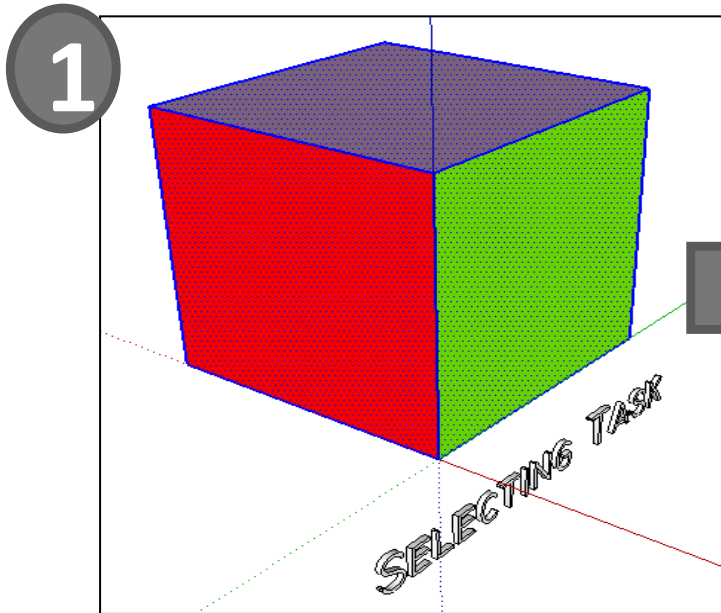
4. Ensure you can see the measurements / dimensions / tool bar in the **bottom right hand corner**. If not click on the **middle square** top right hand corner until it appears



Measurements tool bar

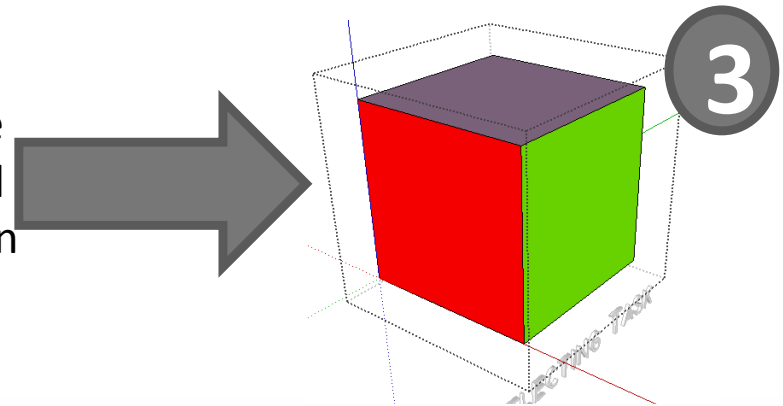


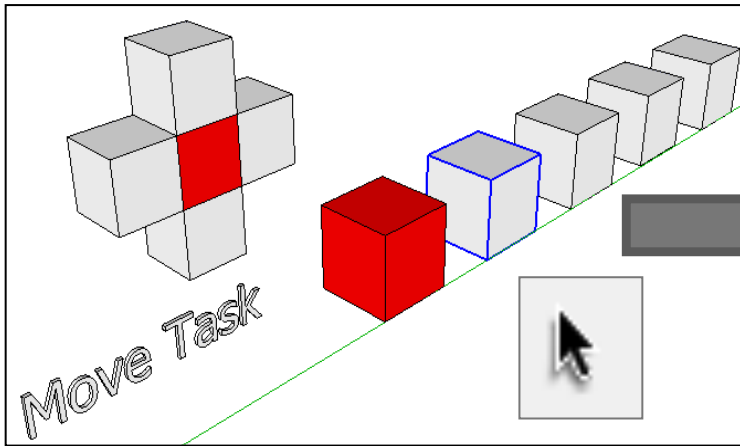
5. Click on **Scene 1**. To select an object click it 3 times. The entire object should be highlighted with dots as shown in 1.



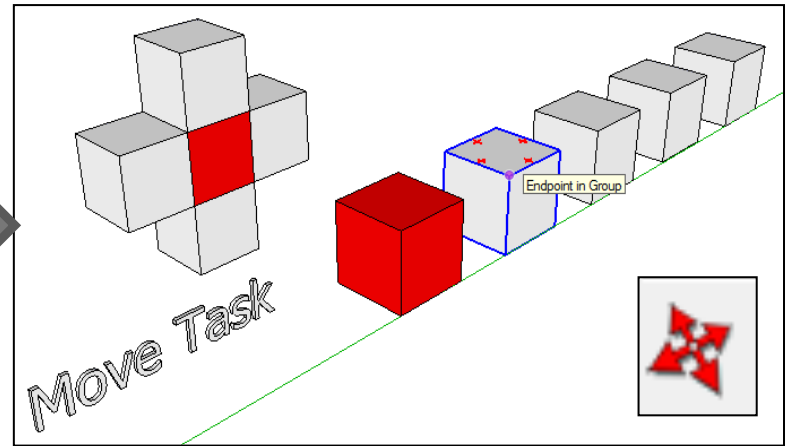
6. Right Click and make group

7. When an object is grouped you will notice you cannot edit it by using the push pull tool etc. **Double click** it and then try using the push pull tool. When finished click off the object and you will notice it's still grouped

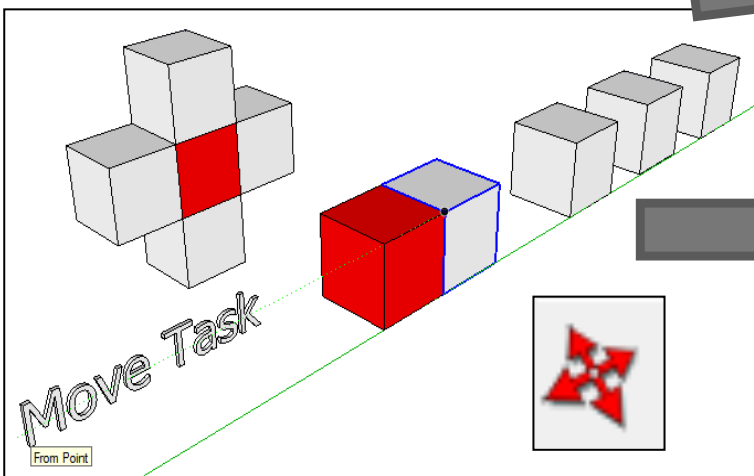




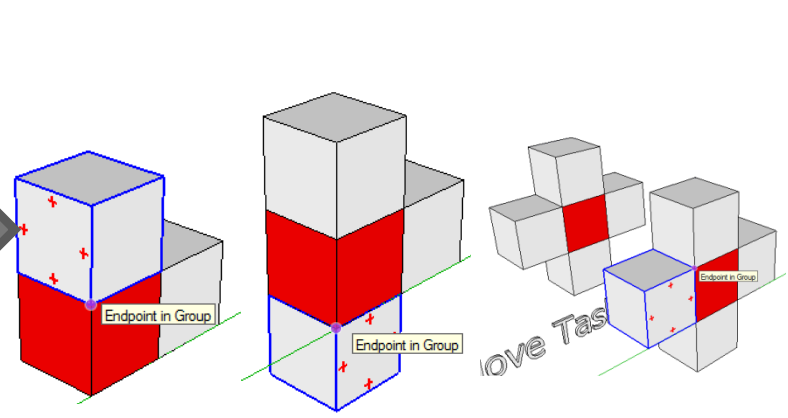
8. Click on **Scene 2**. Move the white squares around the red one to make a cross with the red square in the middle.



9. Using the move tool click on **corner of the square**. It will go **purple** and say endpoint in the group.



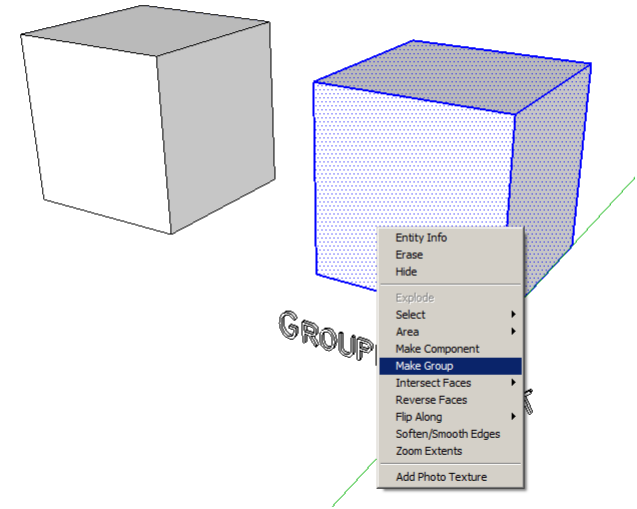
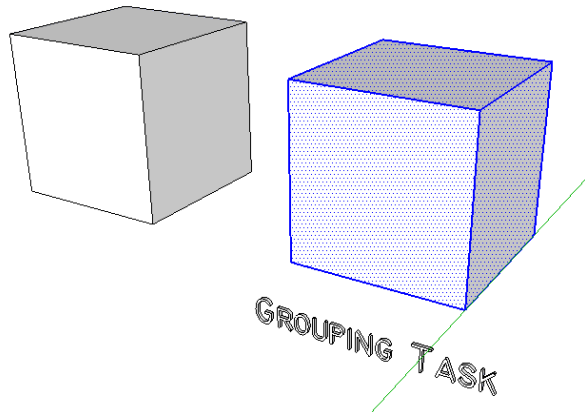
10. Move the white square to meet a corresponding corner on the red square.



11. You will need to click on different corners of the white squares and orbit around the red square to get them to fit in place.



12. Click on **Scene 3**.

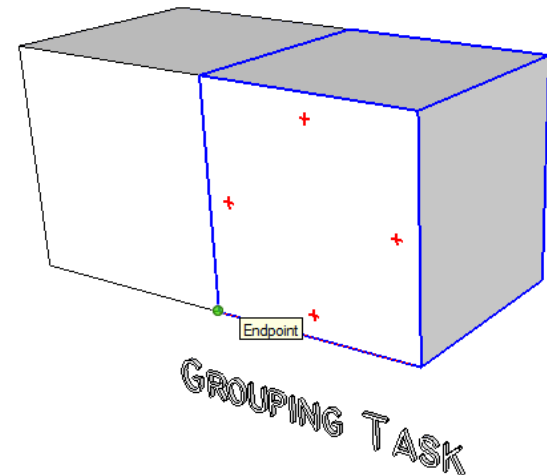


13. Click on square **three times** and **right click and group**.



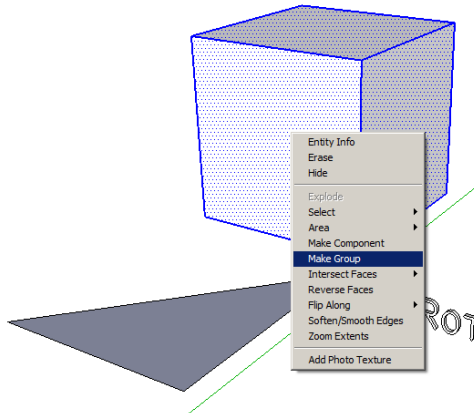
15. Click on **move tool bar**. Then click on the corner of one of the squares (**it should say endpoint**) and move to the corresponding corner on the other square.

14. Repeat the process for the other square

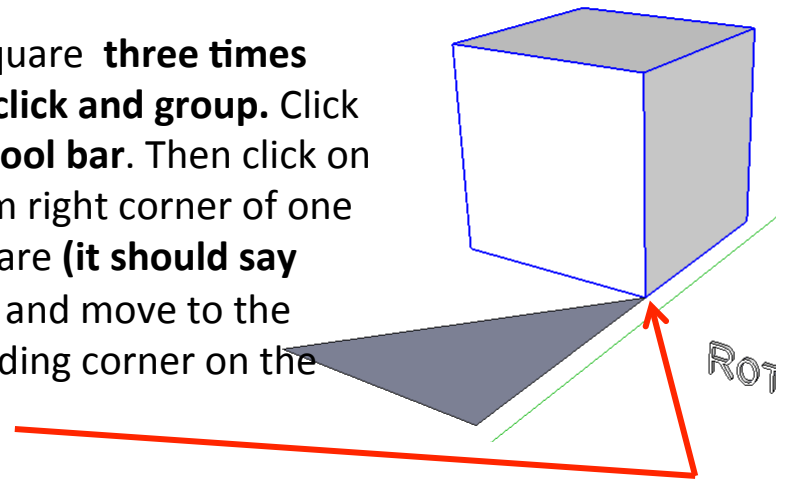




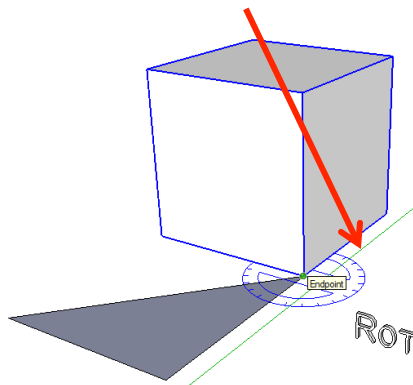
16. Click on **Scene 4**.



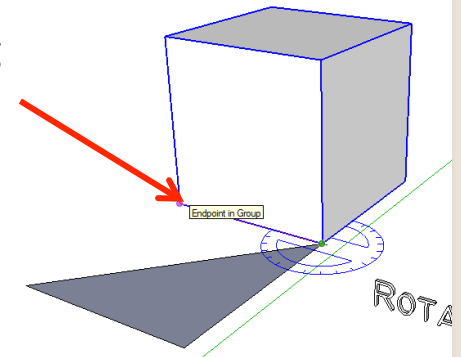
17. Click on square **three times and right click and group**. Click on **move tool bar**. Then click on the bottom right corner of one of the square (**it should say endpoint**) and move to the corresponding corner on the triangle



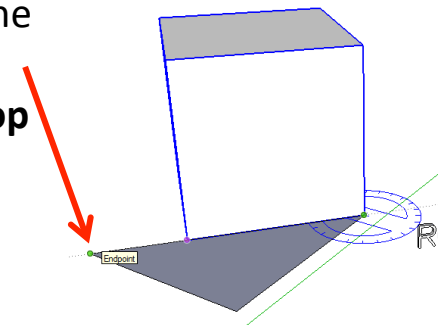
18. Click on **rotate tool bar**. Move it to the corner of the triangle where it touches the square and click to set it in place. The rotate protractor must be **BLUE** when you click it into place.



19. To start the rotate move the line coming out of the protractor to the **back corner (endpoint)** of the square and **click** to start rotating

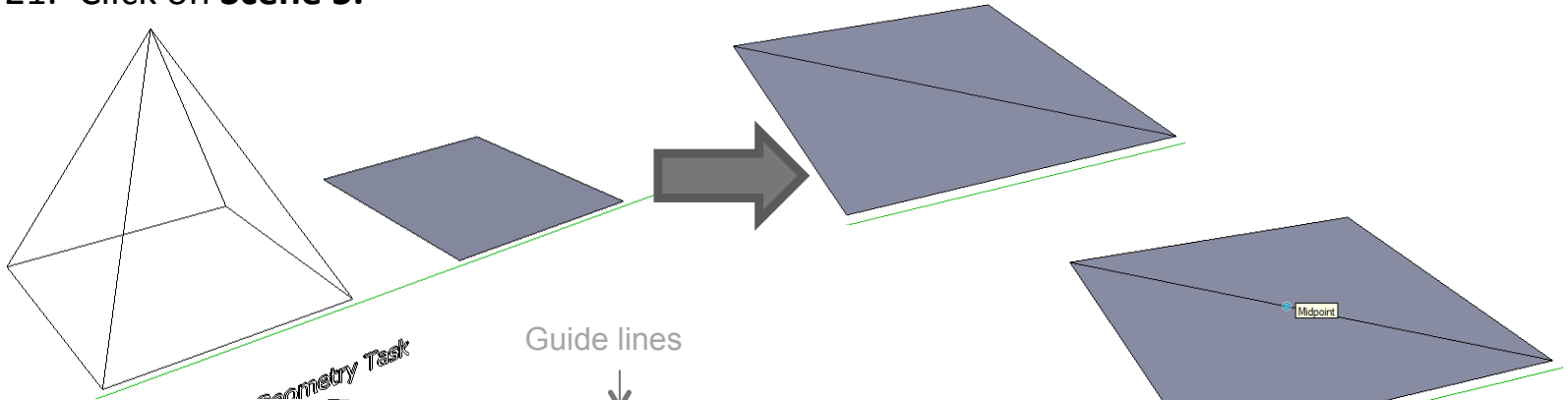


20. Rotate the square until the line coming out of the protractor touches the **top left hand corner (endpoint)** and click to set place

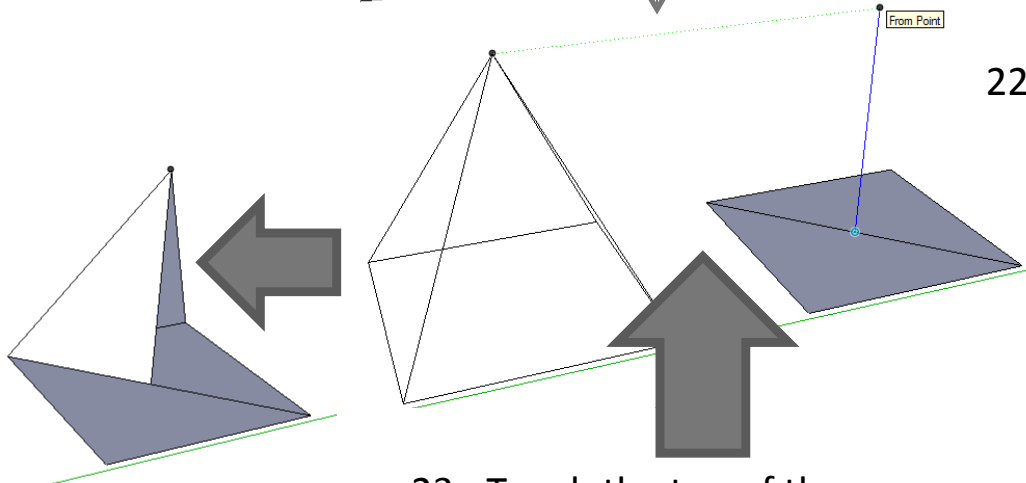




21. Click on **Scene 5**.

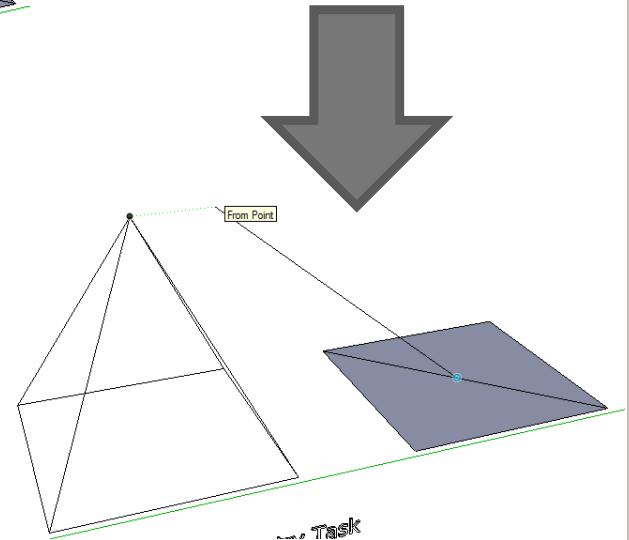


22. Using the **pencil tool**. Draw a line from corner to corner. Find the **centre point** and start drawing a line upwards



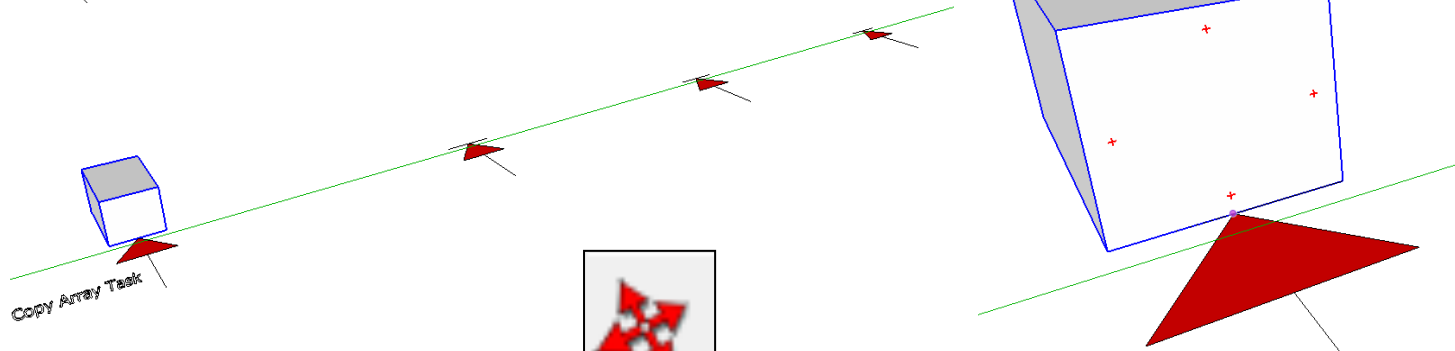
23. Touch the top of the pyramid next to the square and pull the line back. It will provide you with dotted guidelines for the height you need. Pull the line back until it goes blue and click to set in place


24. Draw lines down from the top of the line to each of the four corners to complete



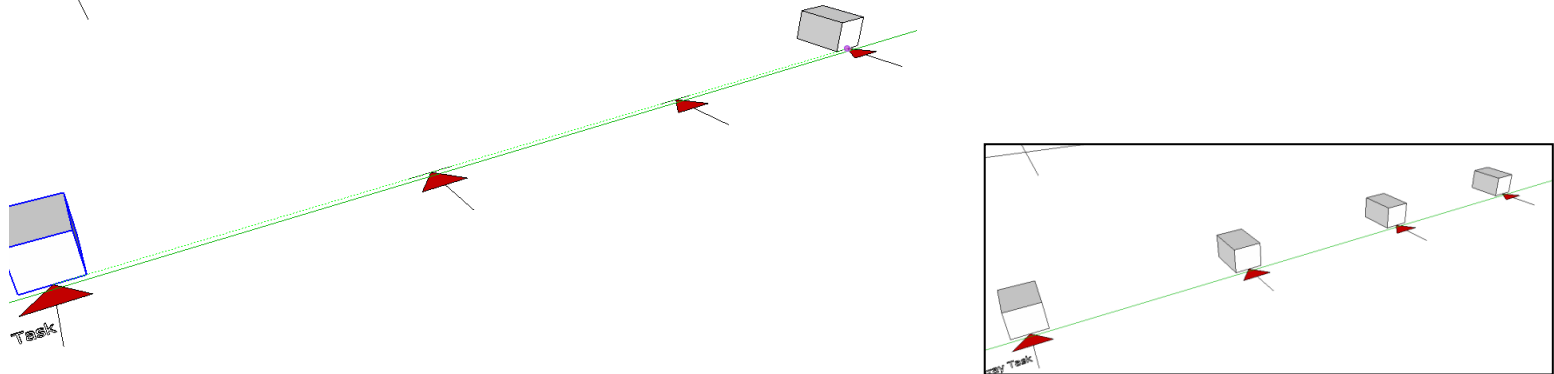


25. Click on **Scene 6**. Highlight the square

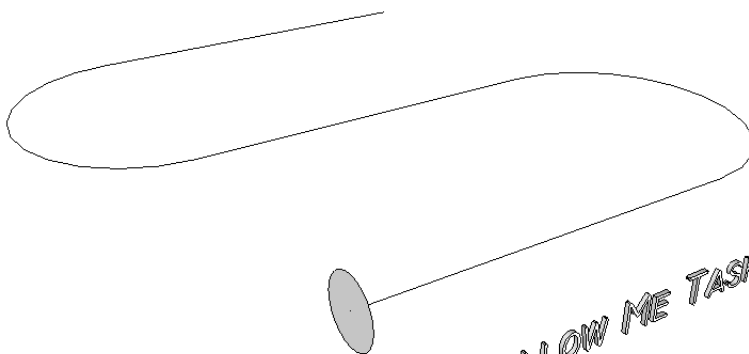


26. Click on **move tool bar**  then click on the square where it touches the point of the arrow.

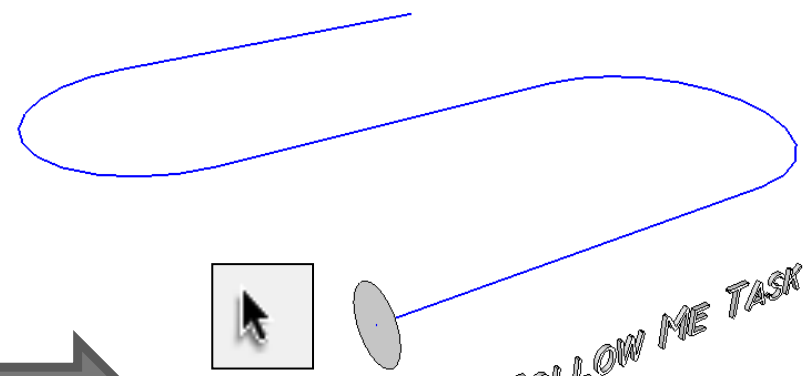
27. Press **Ctrl (copy)** on your keyboard. Move it to the centre of the last



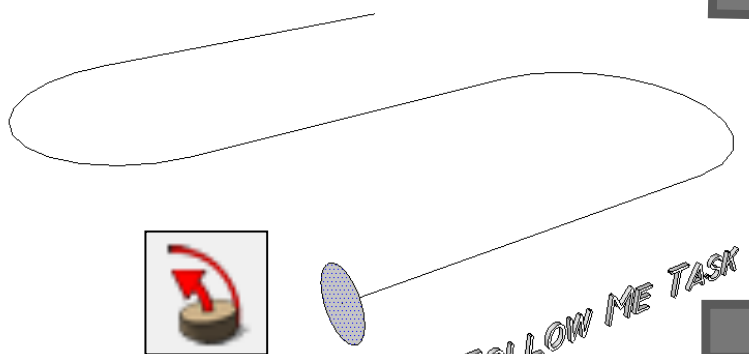
28. Start typing **/3** and press **enter**. It will then space 3 squares out in front of the last one you have just drawn. This is known as a copy array and can be done in the same fashion with the rotation tool.



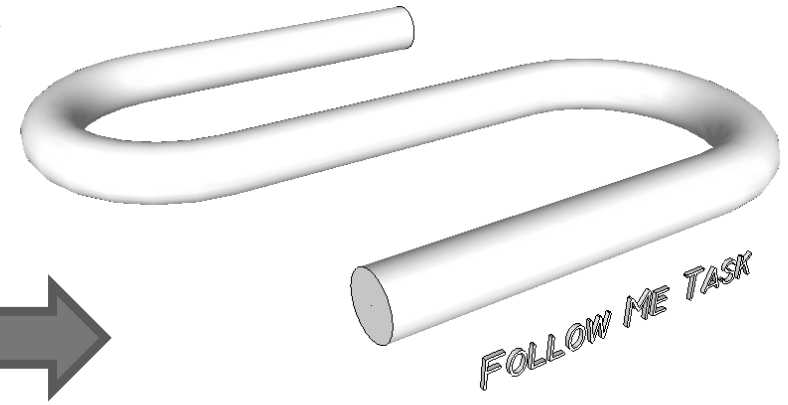
29. Click on **Scene 7**.



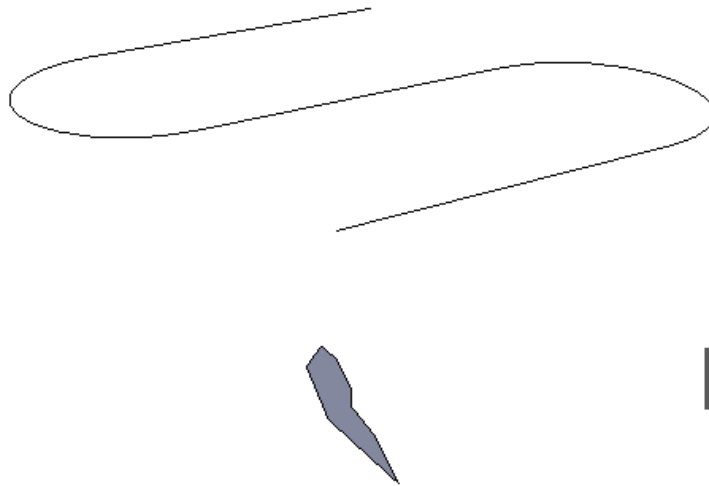
30. Click 3 times on the path (line) to highlight it all. **It should go BLUE**



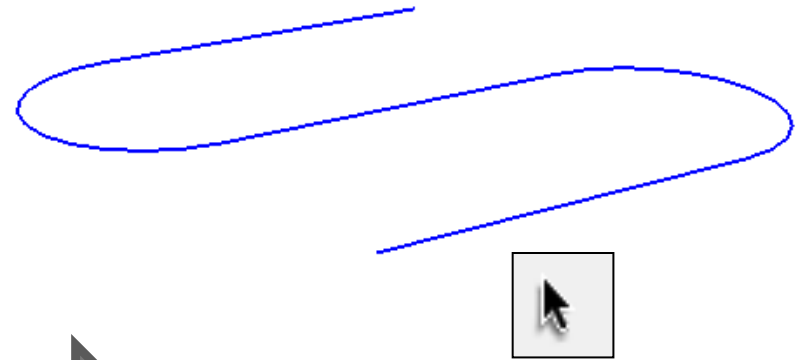
31. Click on the **follow me tool bar** and then the circle.



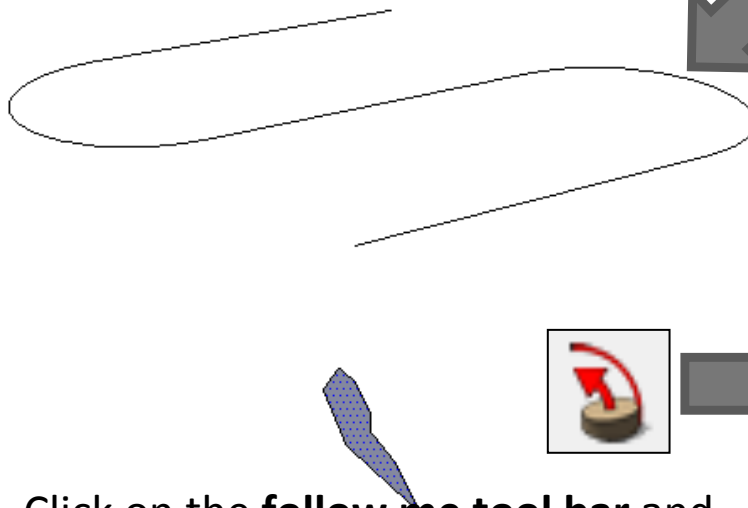
32. The circle should follow the path you highlighted earlier



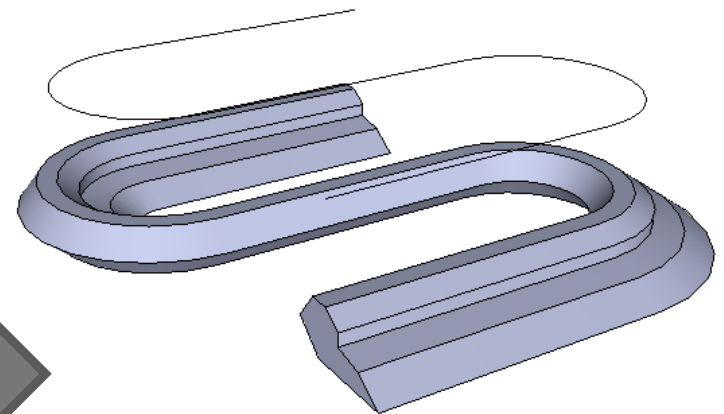
33. Click on **Scene 8**.



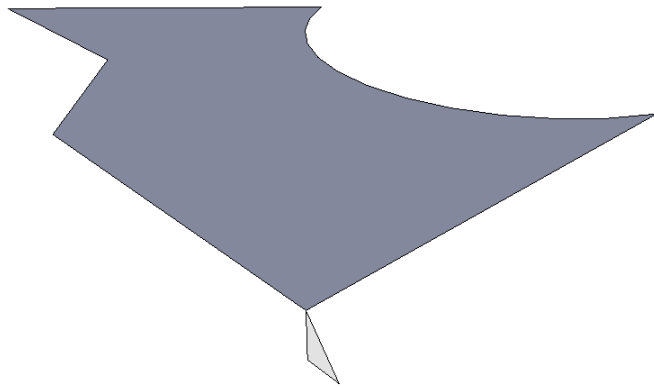
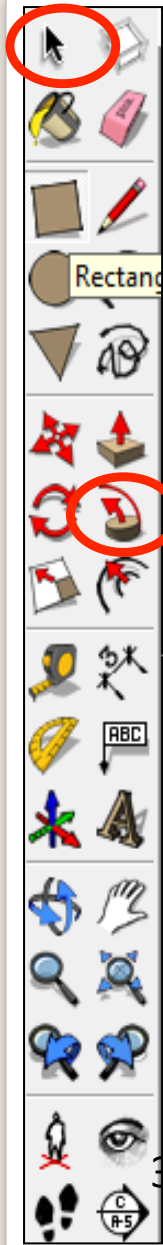
34. Click 3 times on the path (line) to highlight it all. **It should go BLUE**



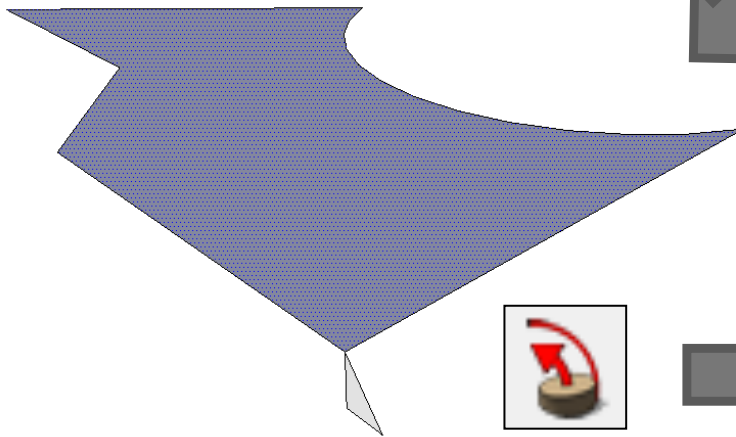
35. Click on the **follow me tool bar** and then the shape.



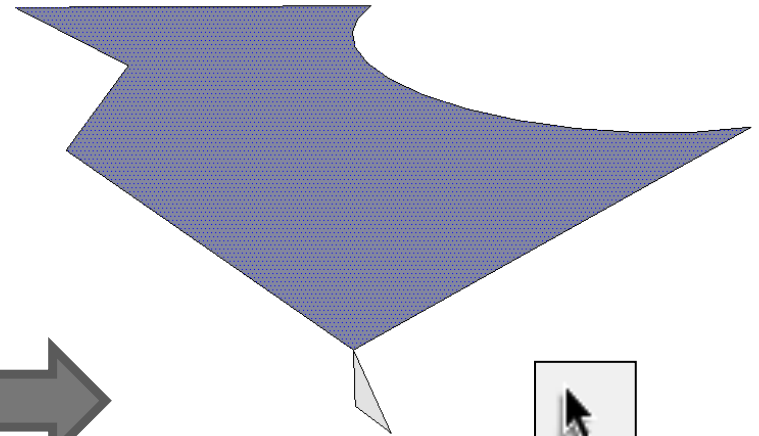
36. The shape should follow the path you highlighted earlier



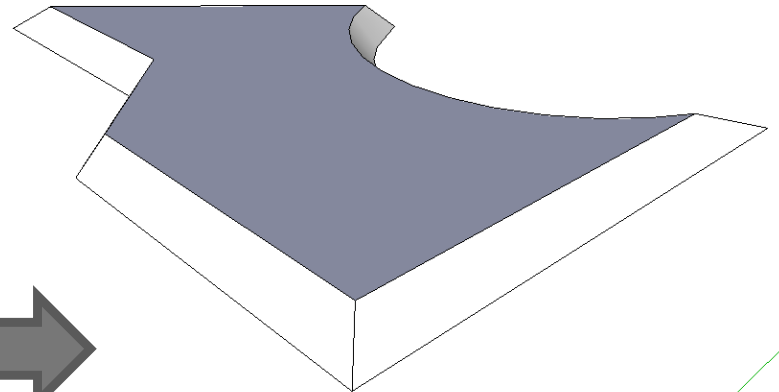
37. Click on **Scene 9**.



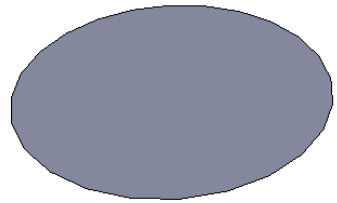
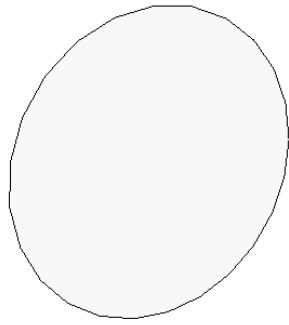
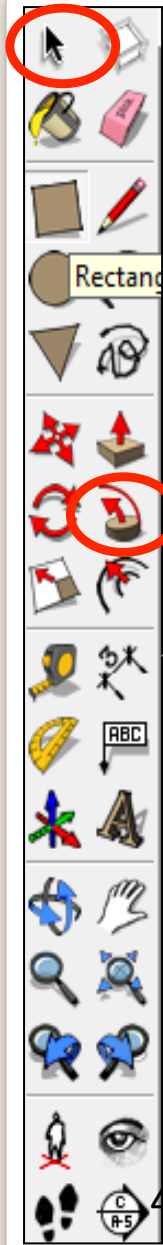
39. Click on the **follow me tool bar** and then the triangle shape.



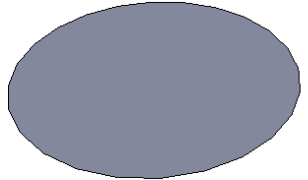
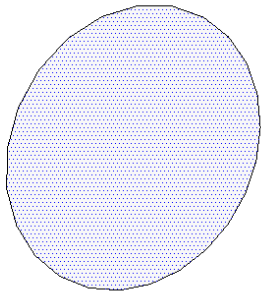
38. Click on the large grey shape to highlight it all. **It should go dotted**



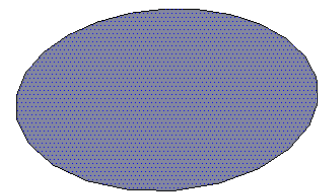
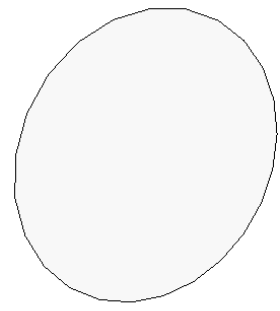
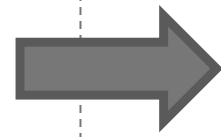
40. The Triangle shape should follow the path you highlighted earlier



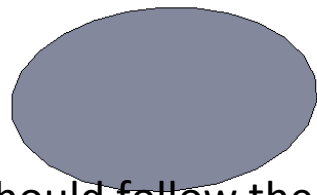
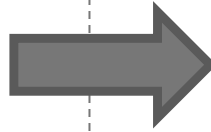
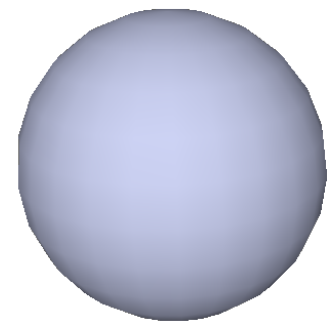
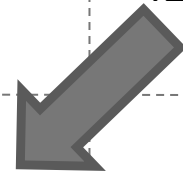
41. Click on **Scene 10**.



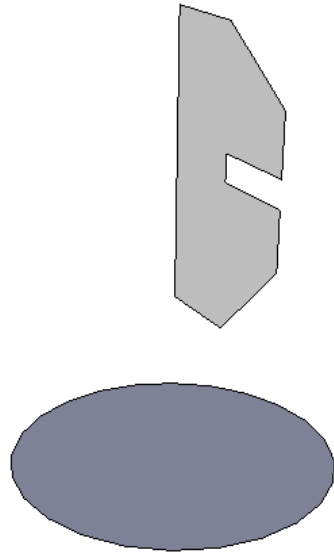
43. Click on the **follow me tool bar** and then the lighter grey circle.



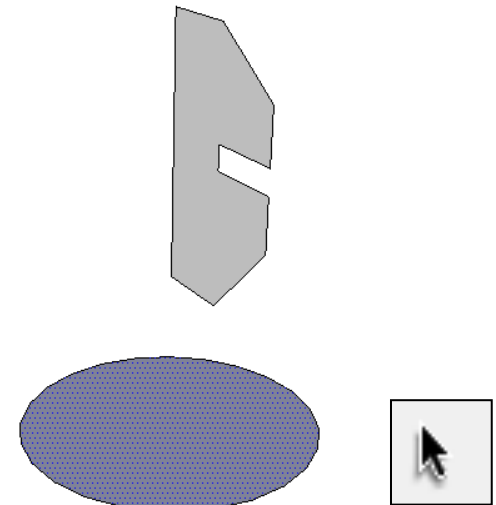
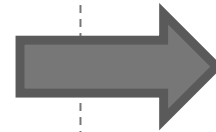
42. Click on the dark grey circle to highlight it all. **It should go dotted**



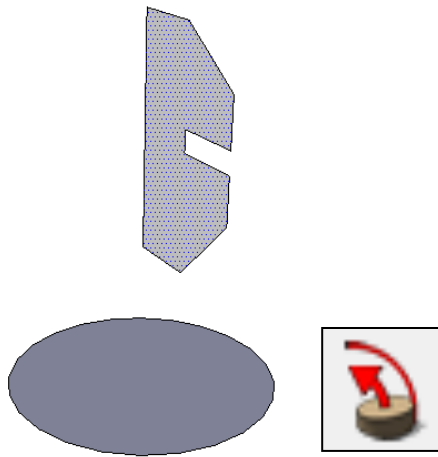
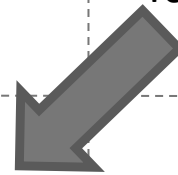
44. The circle should follow the path you highlighted earlier



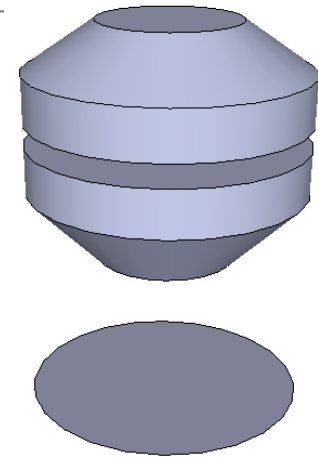
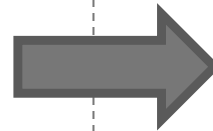
45. Click on **Scene 11**.



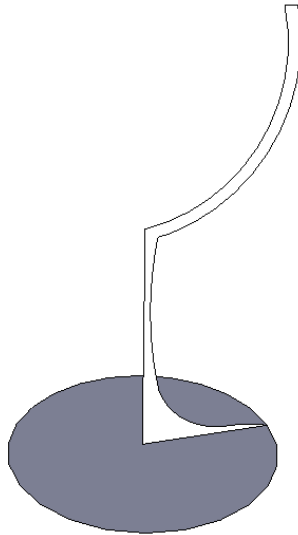
46. Click on the dark grey circle to highlight it all. **It should go dotted**



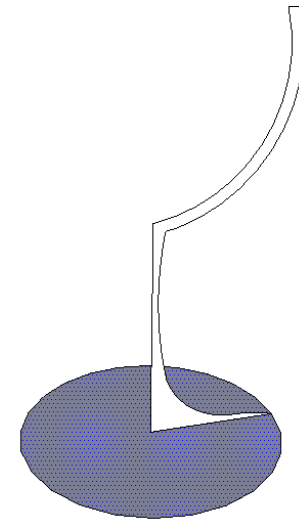
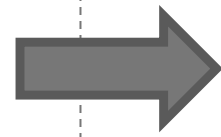
47. Click on the **follow me tool bar** and then the lighter shape above.



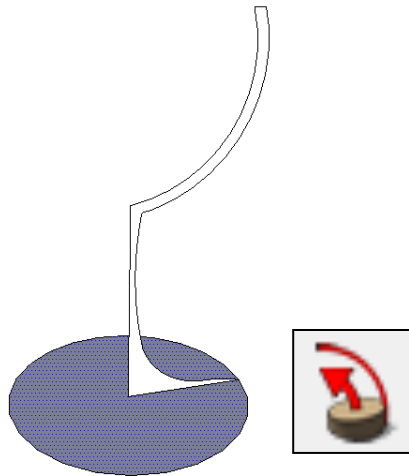
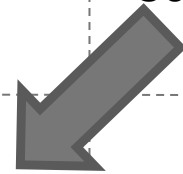
48. The shape should follow the path you highlighted earlier



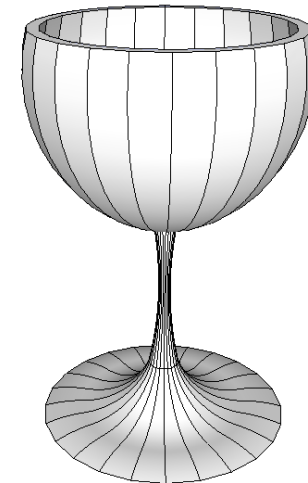
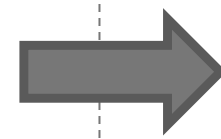
49. Click on **Scene 12**.



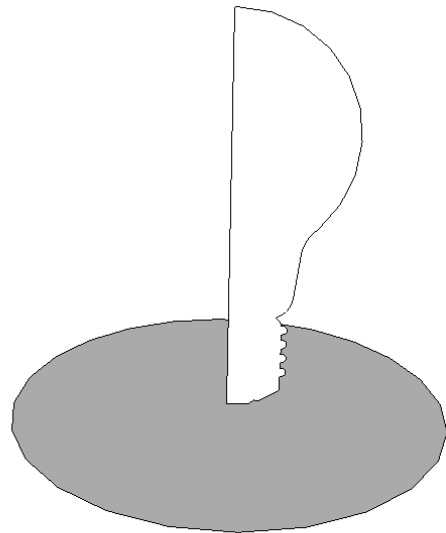
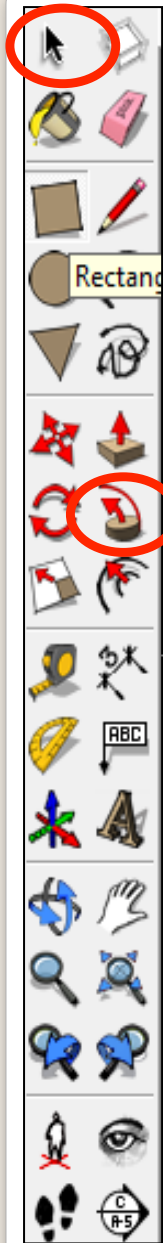
50. Click on the dark grey circle to highlight it all. **It should go dotted**



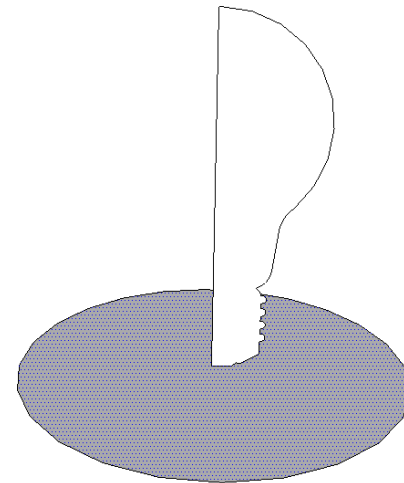
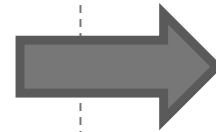
51. Click on the **follow me tool bar** and then the lighter shape above.



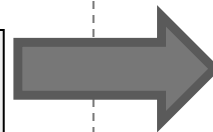
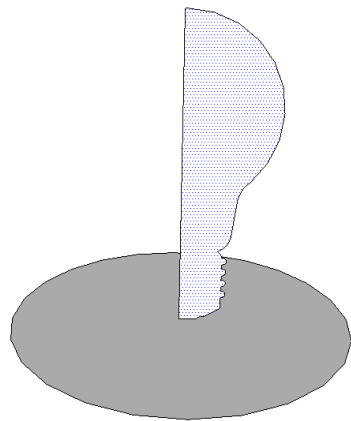
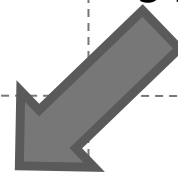
52. The shape should follow the path you highlighted earlier



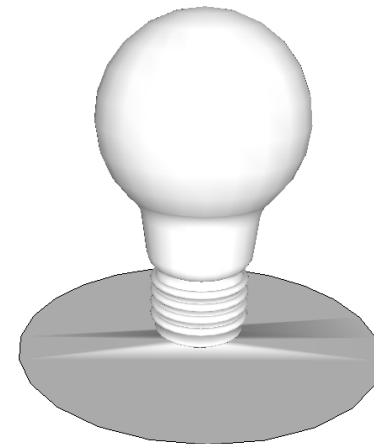
53. Click on **Scene 13**.



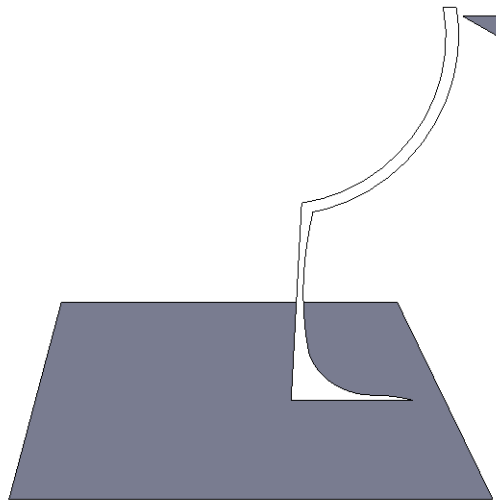
54. Click on the dark grey circle to highlight it all. **It should go dotted**



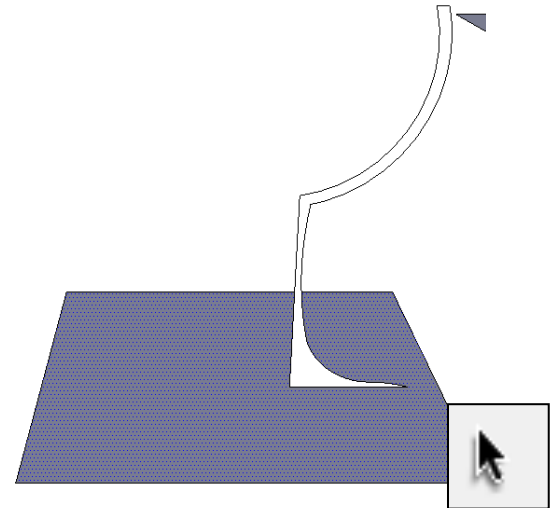
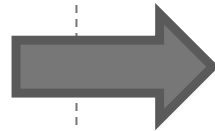
55. Click on the **follow me tool bar** and then the light bulb shape above.



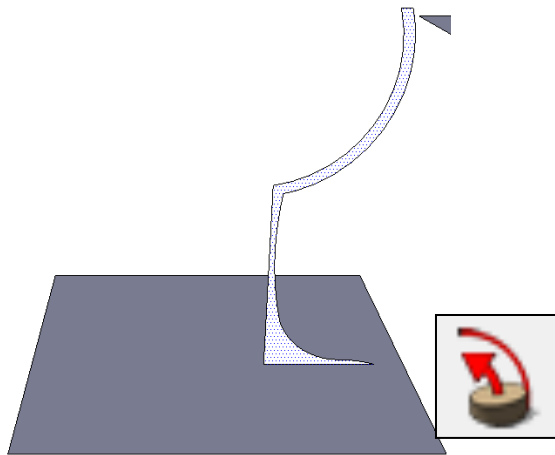
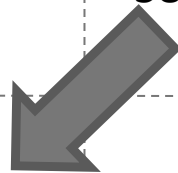
56. The shape should follow the path you highlighted earlier



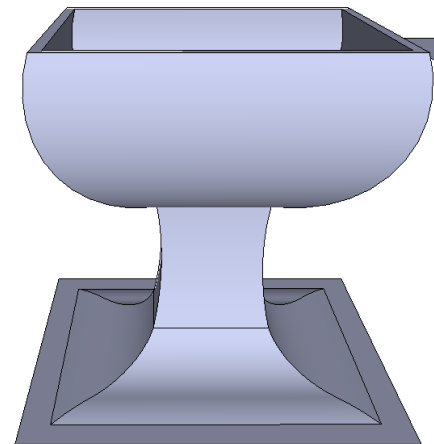
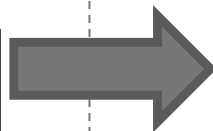
57. Click on **Scene 14**.



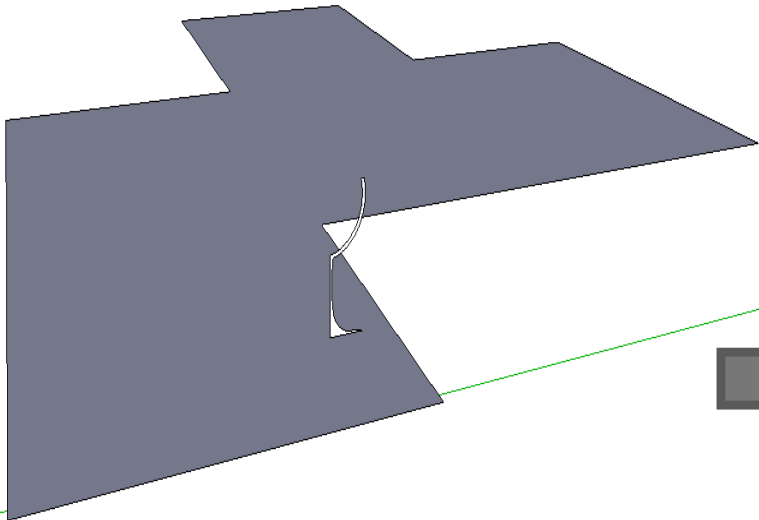
58. Click on the dark grey square to highlight it all. **It should go dotted**



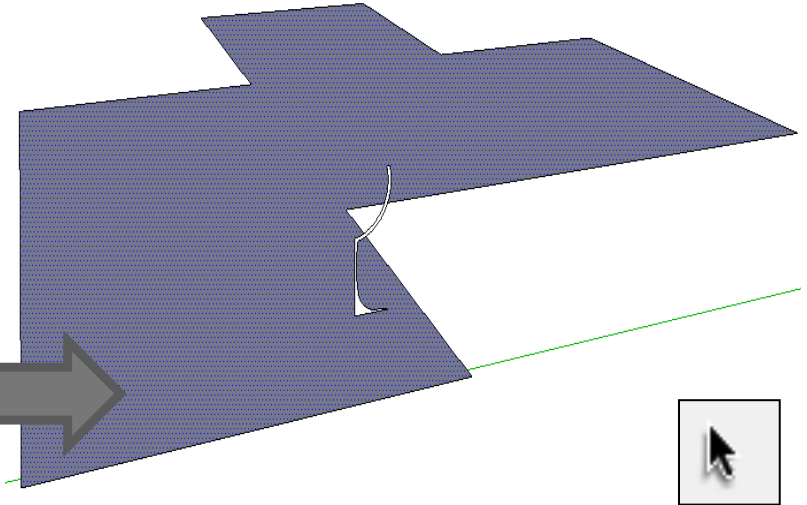
59. Click on the **follow me tool bar** and then the lighter shape above.



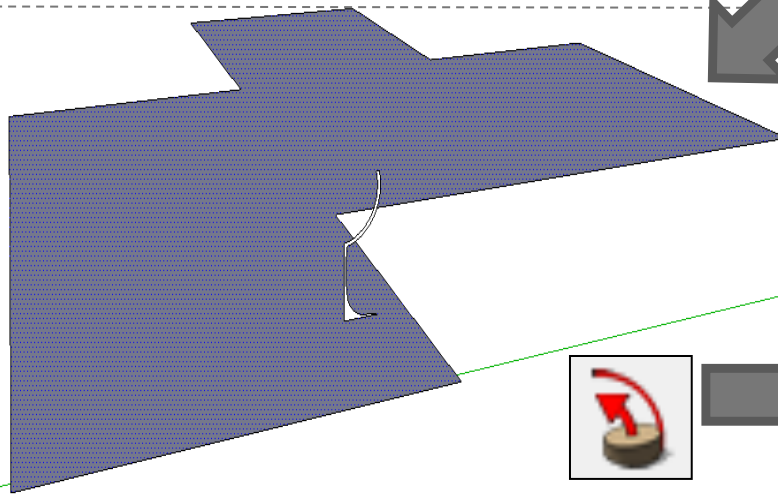
60. The shape should follow the path you highlighted earlier



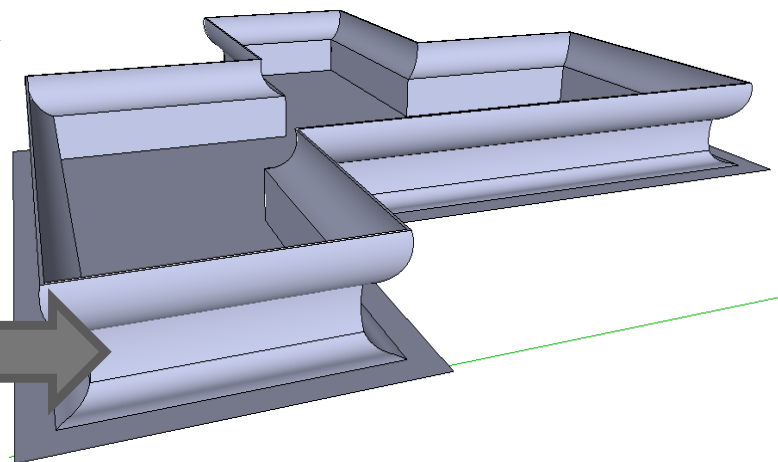
61. Click on **Scene 15**.



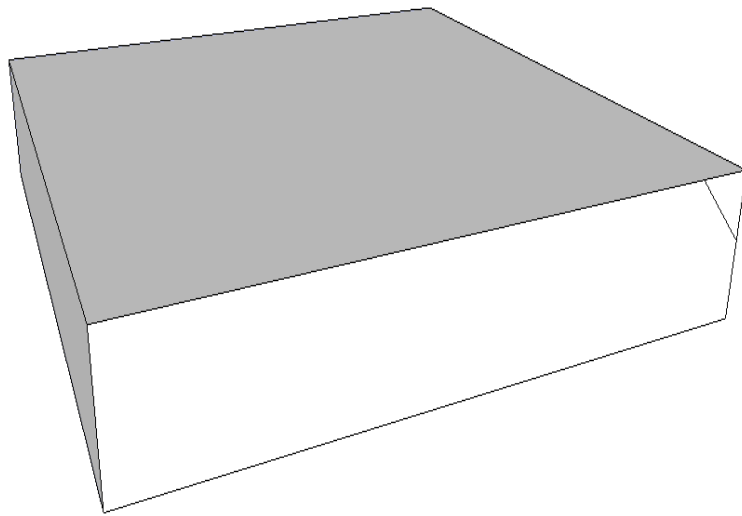
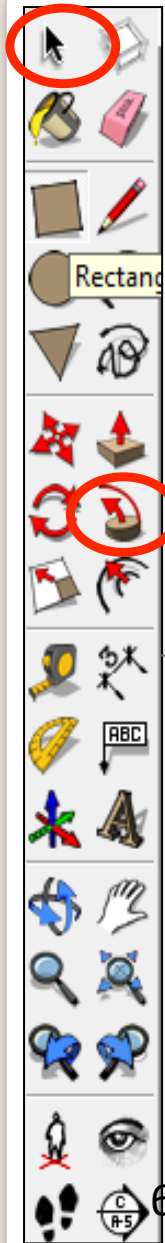
62. Click on the large dark shape to highlight it all. **It should go dotted**



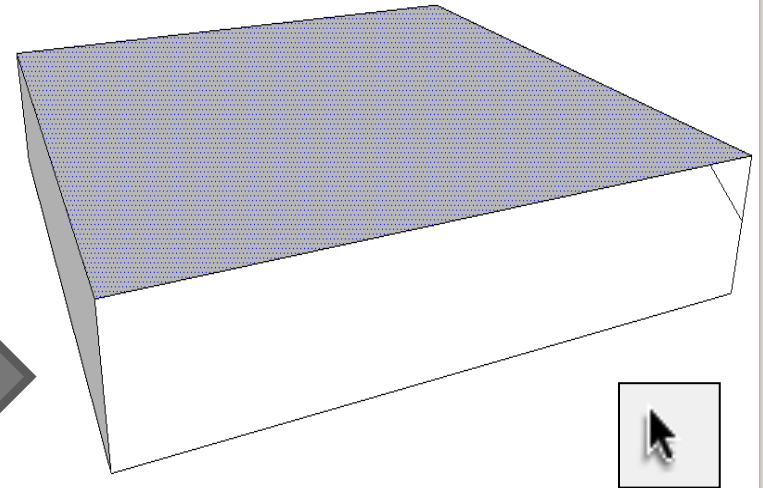
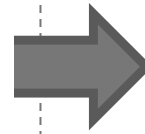
63. Click on the **follow me tool bar** and then the lighter shape above.



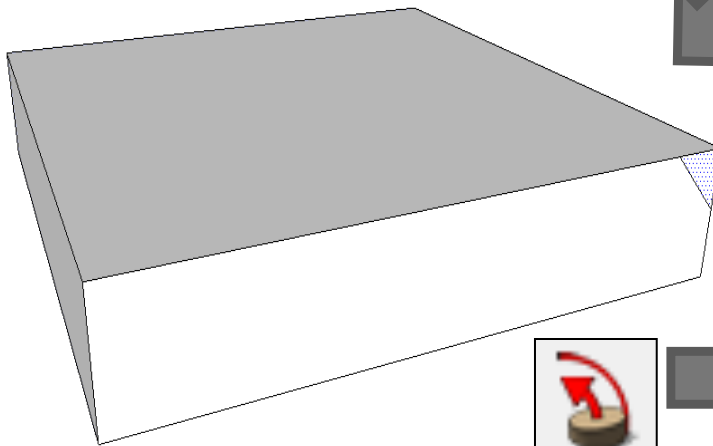
64. The shape should follow the path you highlighted earlier



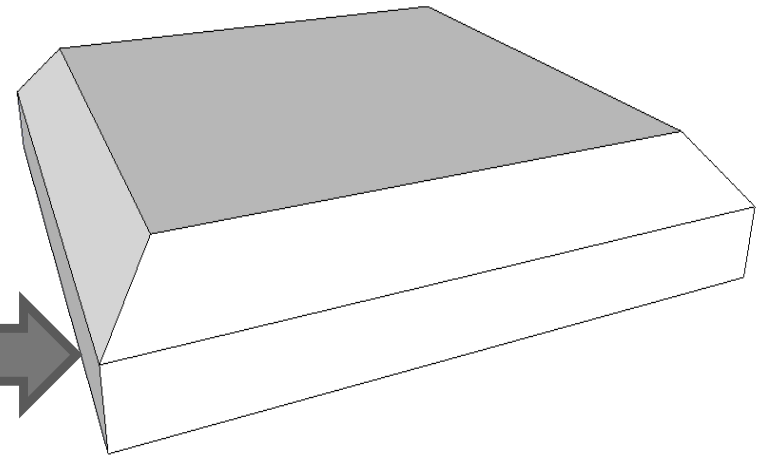
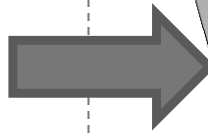
65. Click on **Scene 16**.



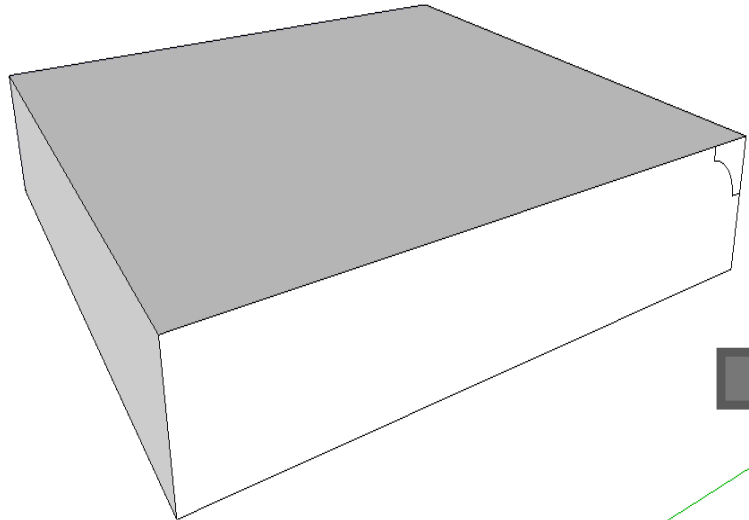
66. Click on the top of the shape to highlight it all. **It should go dotted**



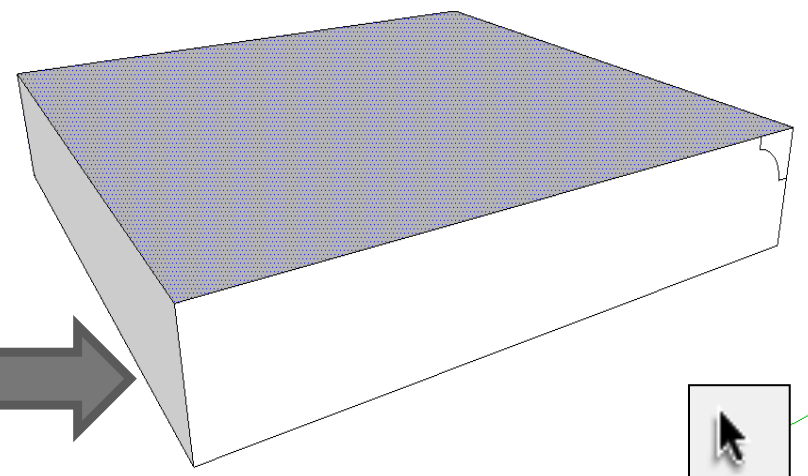
67. Click on the **follow me tool bar** and then the small shape on the side.



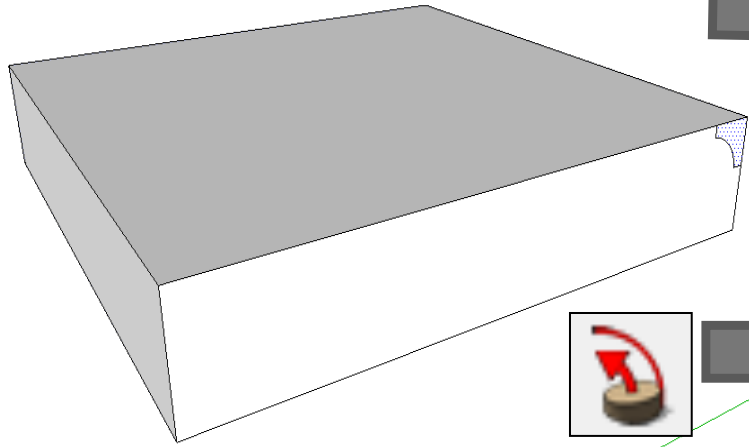
68. The shape should follow the path you highlighted earlier



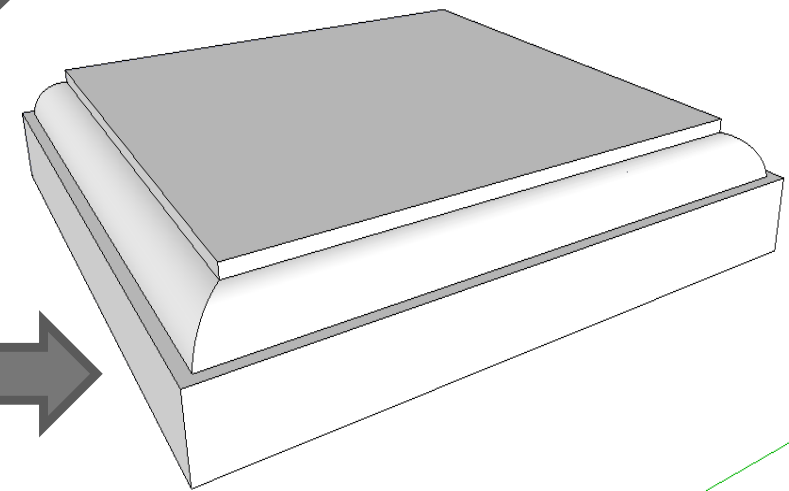
69. Click on **Scene 16**.



70. Click on the top of the shape to highlight it all. **It should go dotted**



71. Click on the **follow me tool bar** and then the small shape on the side.



72. The shape should follow the path you highlighted earlier

Extension

- Sketch Up can be used to design in the same way that Sculptor uses a piece of stone to produce a statue



Design Task

- To Design a contemporary arm chair. The chair will be made entirely from 20mm thick plywood.
- You will use SketchUp to develop your Ideas and present your final idea. The final presentation will include a variety of drawings including a plan, elevation, exploded and 3D views.



Plywood



Plywood



Plywood



Plywood



Plywood



Plywood



Plywood



Plywood



Plywood



Plywood



Plywood



Plywood



Assembling & Disassembling



Playing



Folding



Desk & Chair

Plywood

