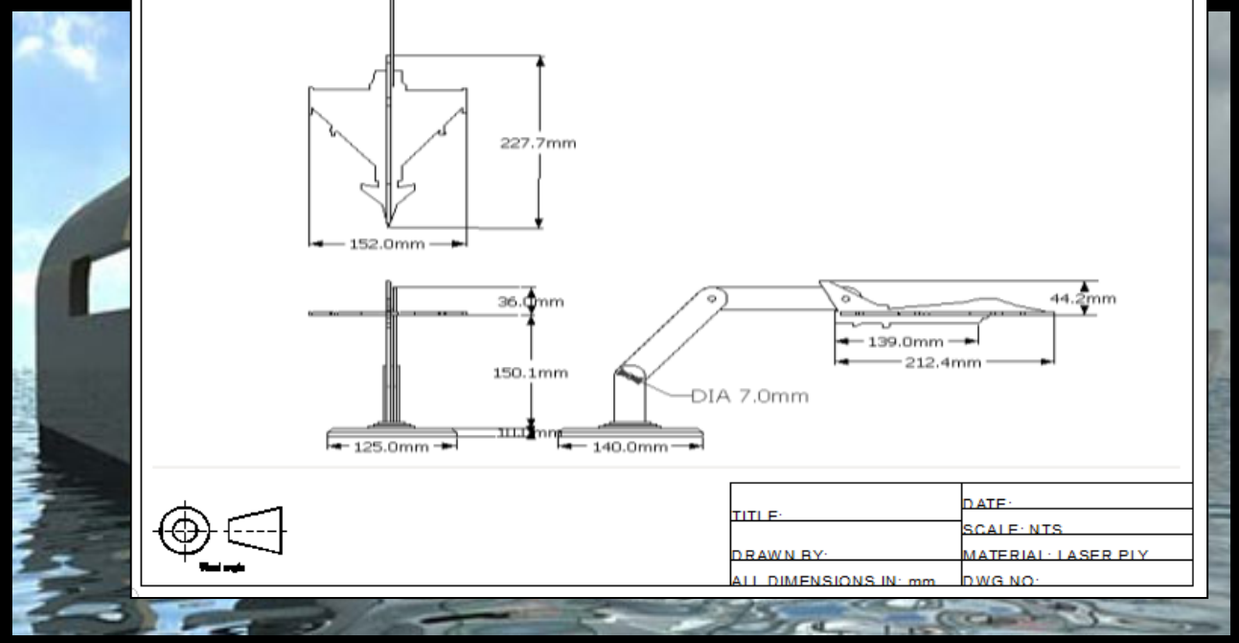
CAD TUTORIAL 17: WORKING DRAWING



CAD SKILLS

CAD Tutorial 17: Working Drawing

Level of Difficulty

★★★★★

Time

Approximately 60–120 minutes

Computer Aided Design: Aircraft Lamp

Lesson Objectives…

Computer Aided Engineering: Step by Step Guide to Lamp Construction

- 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).

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.

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.

Learning Styles

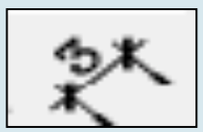
Visual : ***Presentation***

Auditory: ***Video***

Kinaesthetic: ***Demonstration***

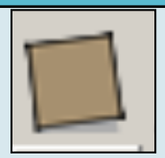
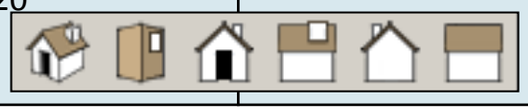
Sketchup Help Guide:

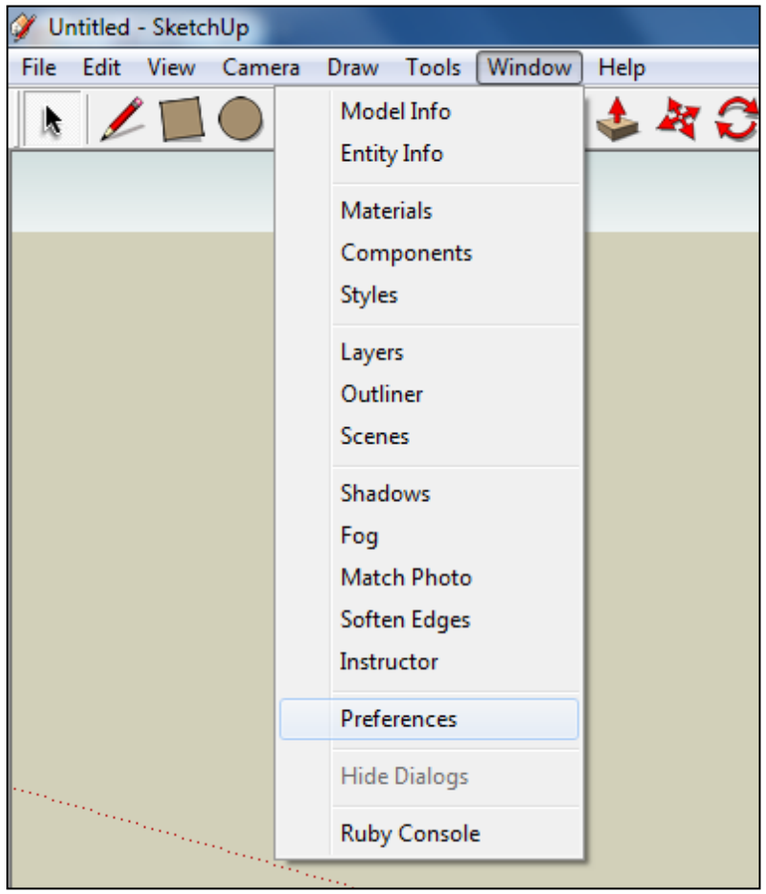
Computer Aided Engineering: 15. Drawing and Modification Commands

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:

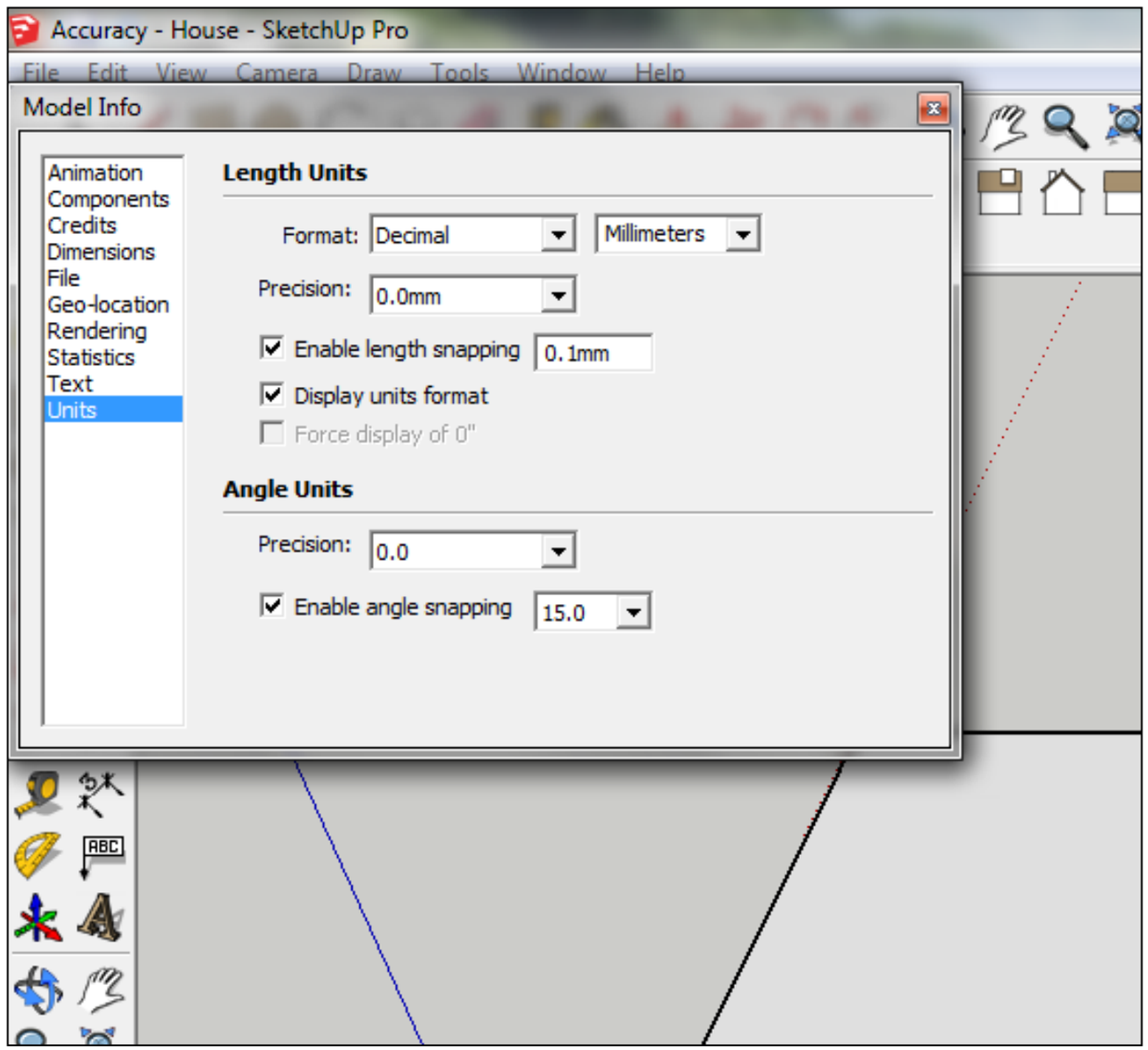
Computer Aided Engineering: 15. Drawing and Modification Commands

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 sixe 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 life 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/ CAD Skills/ Lesson 15 / Big Ben

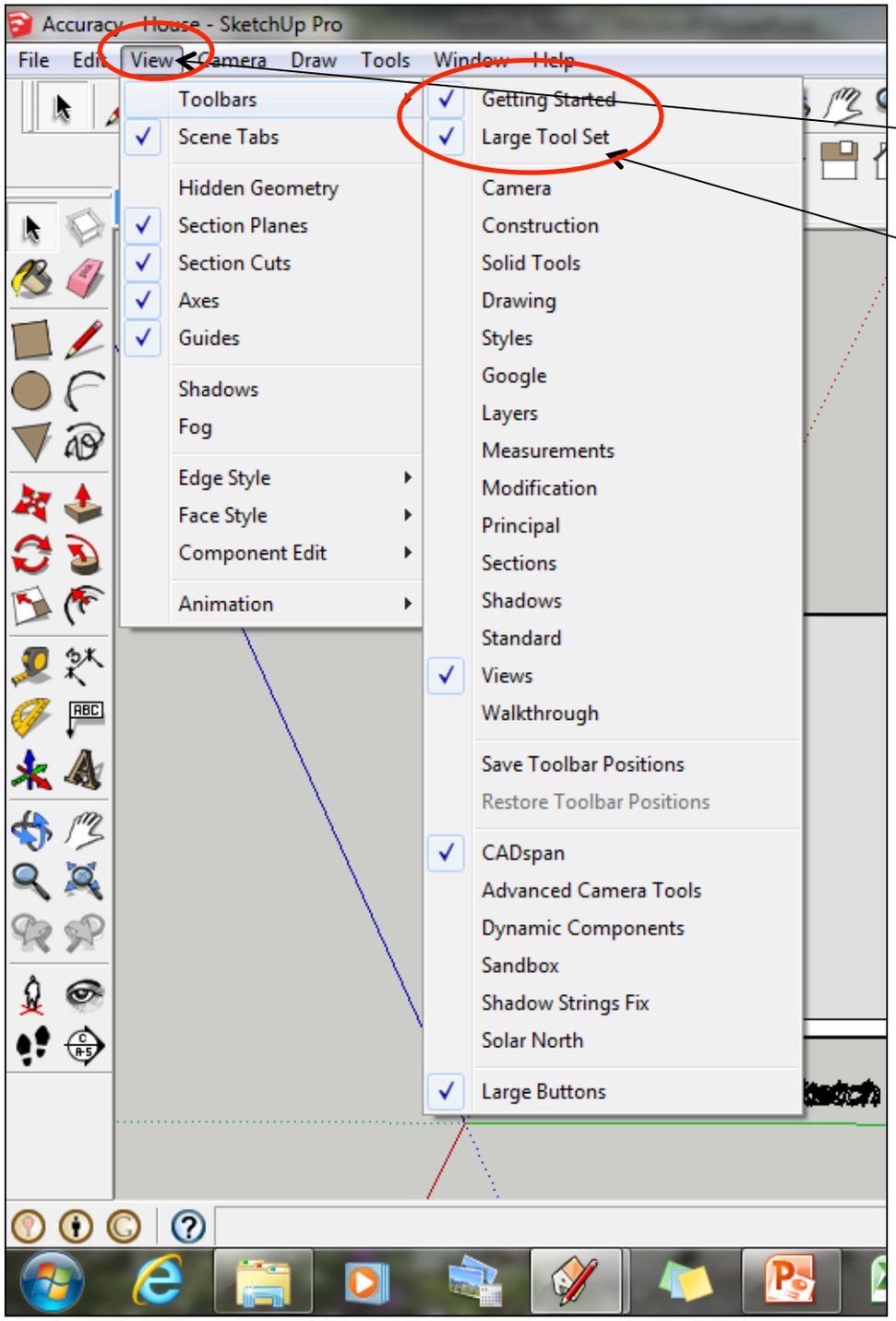
Open the sketch up drawing. Once you have opened SketchUp, go to **Window** and select **Model Info**



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**

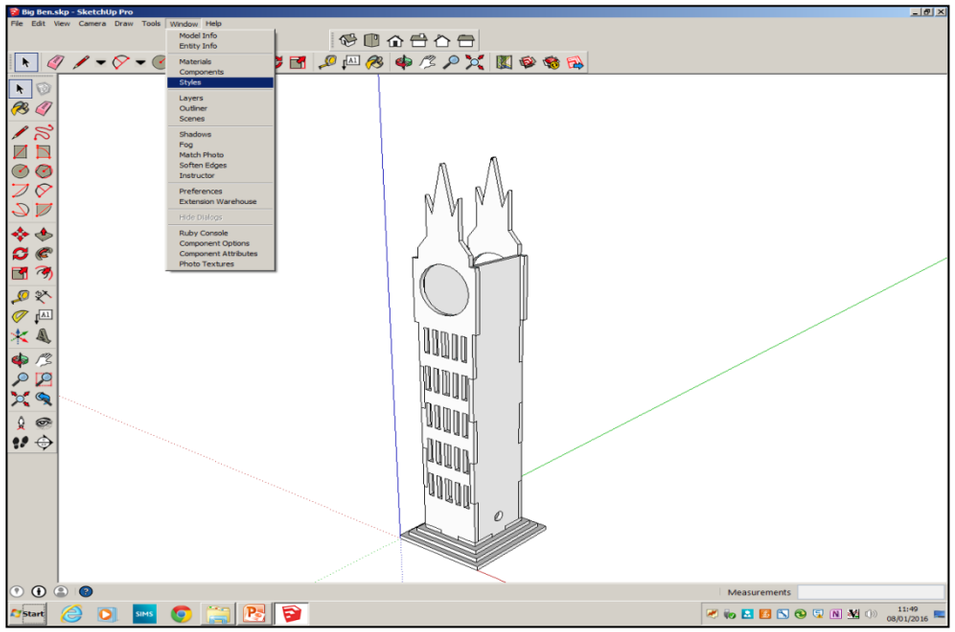
3b Tick Getting Started

3c Tick Large Tool Set

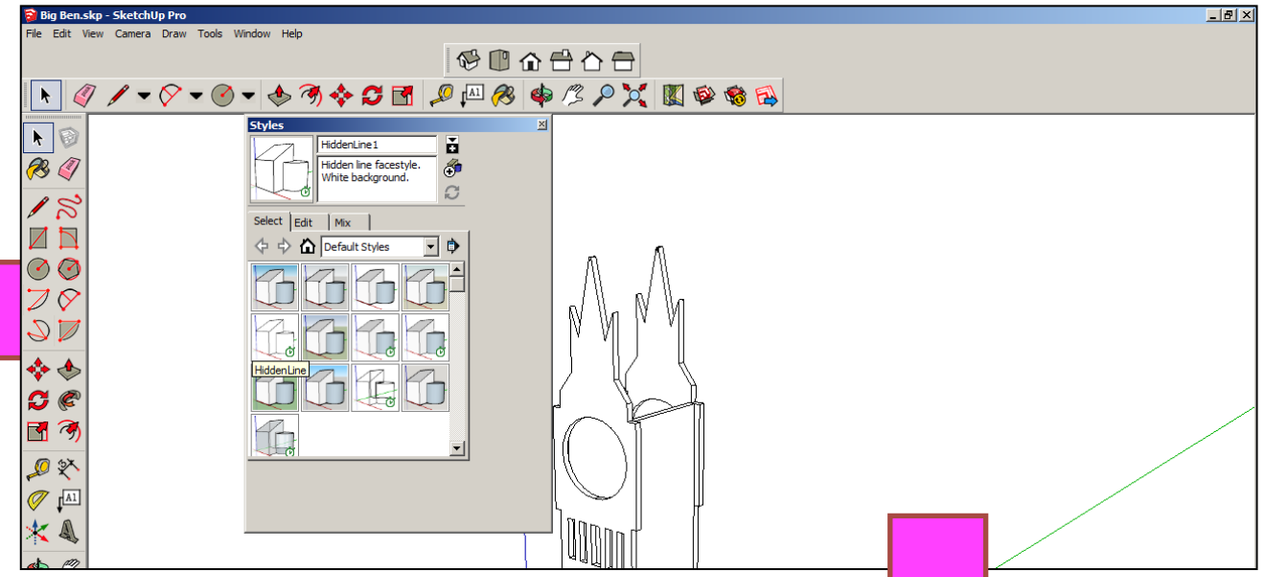
Note**: this will place a tool bar across the top **(getting started)** and the side **(Large Tool Set)

Computer Aided Design: Working Drawing Guide

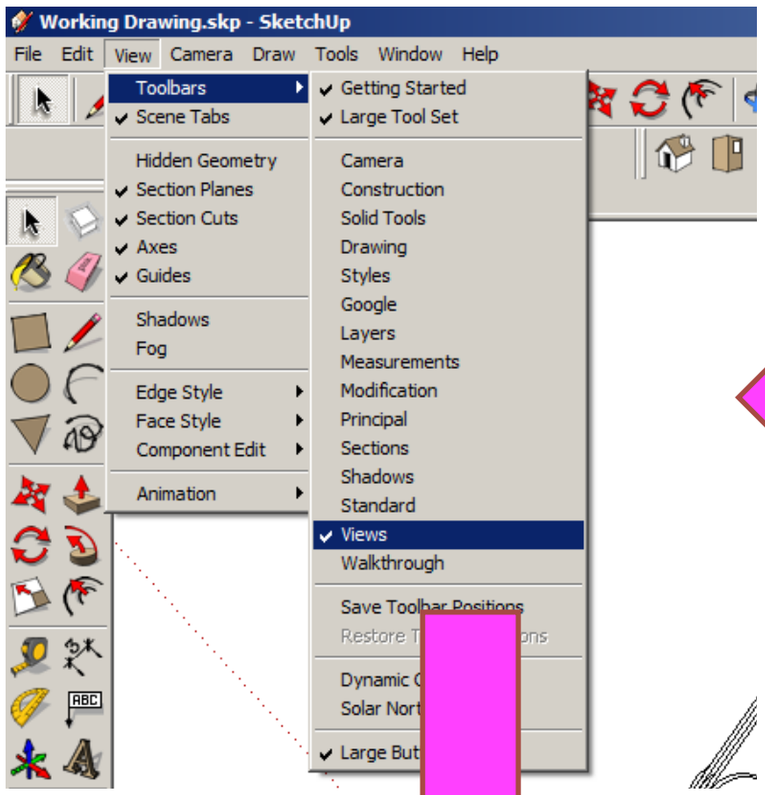
Computer Aided Engineering: 1. Working Drawing Instructions (Setting up Correct Format)

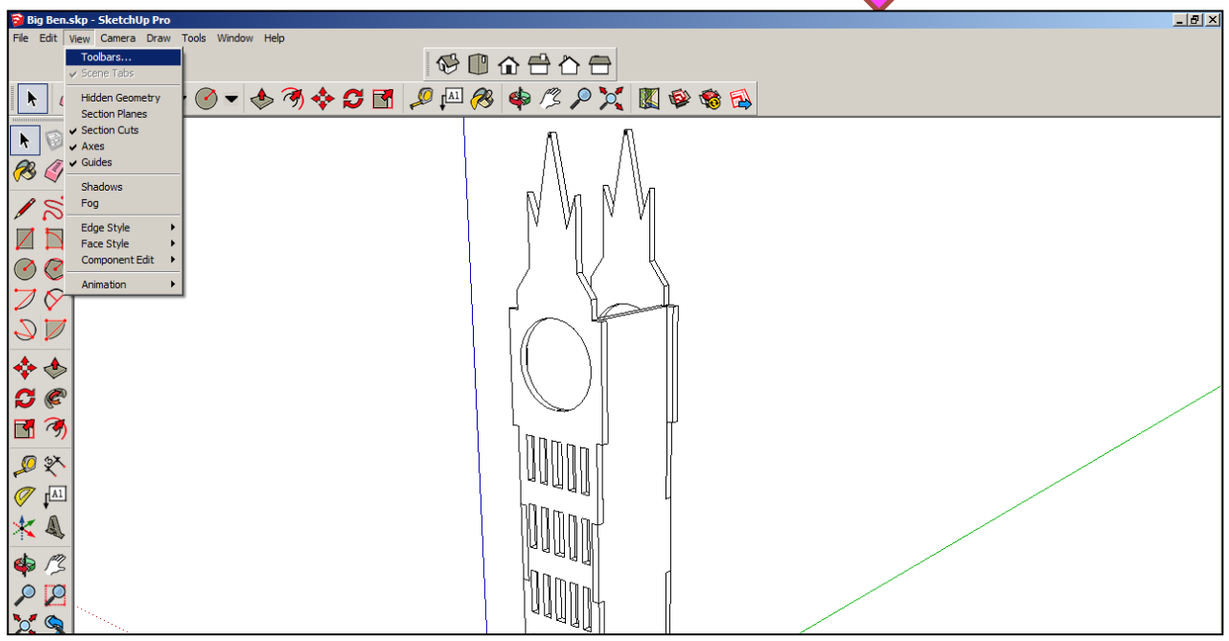


Now its time to convert your drawing into a working drawing (NB this ***must be exact*** to achieve a level 2. ***Click windows / styles***



Click on Windows / Default / hidden line

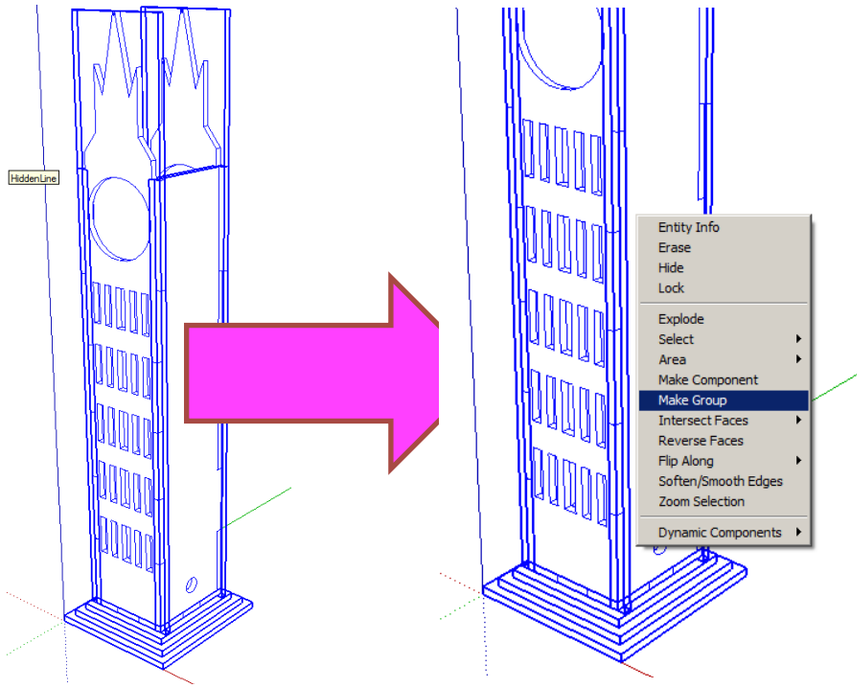




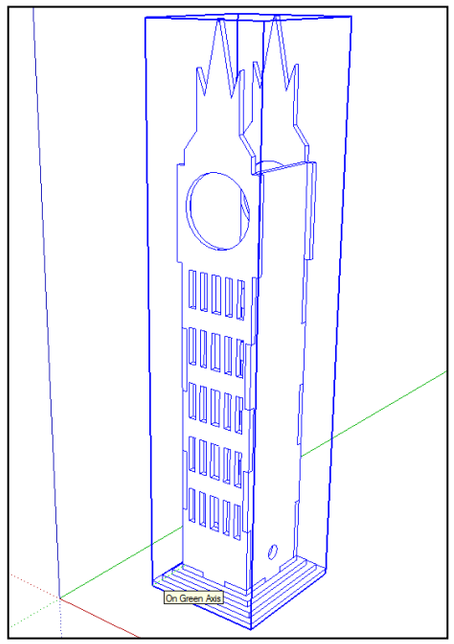
Click on Toolbars / Views

Computer Aided Design: Working Drawing Guide

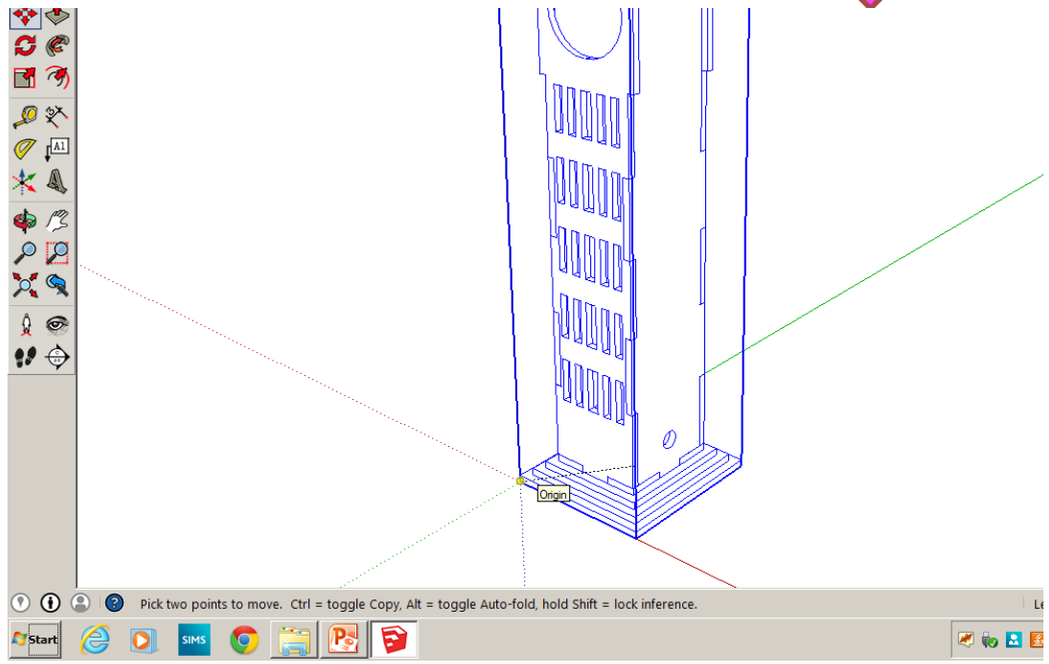
Computer Aided Engineering: 1. Working Drawing Instructions (Setting up Correct Format)



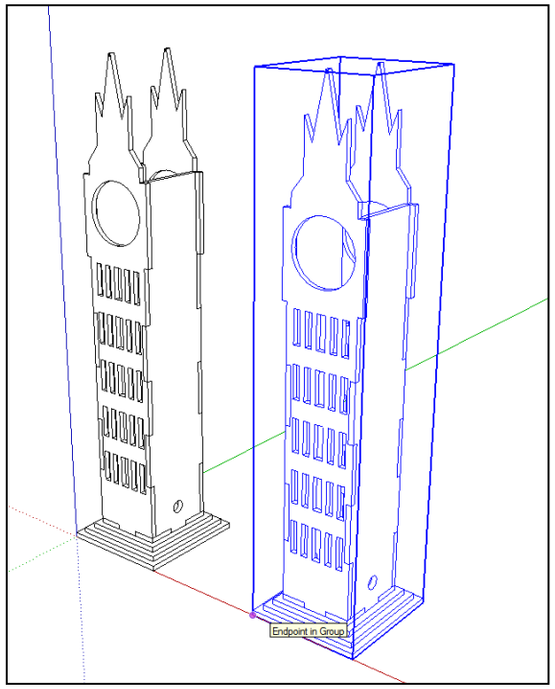
Highlight the entire lamp and right click **make group**



Click on bottom left **corner of lamp using the move tool**



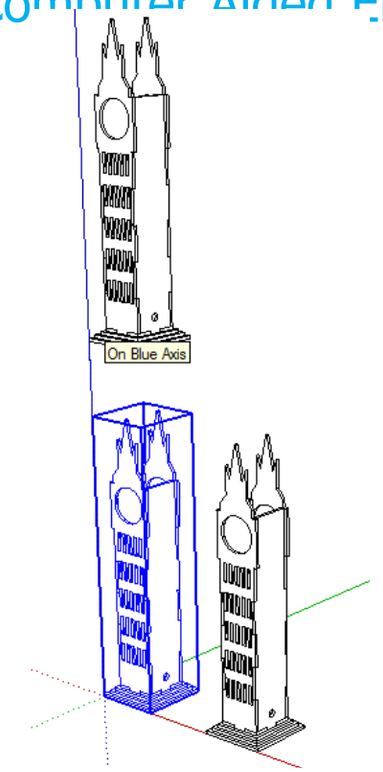
Click on the **move tool** and move the lamp so the corner is on the origin



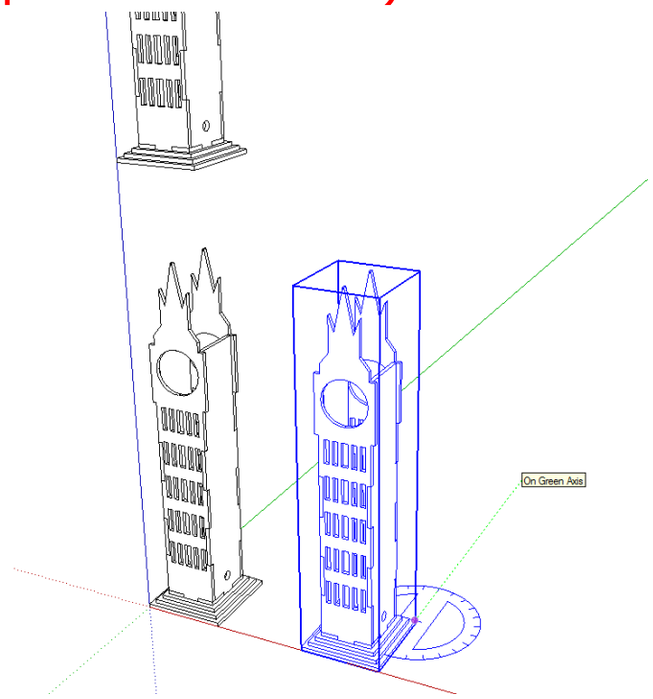
Copy and move a second lamp along the **red axis**

Computer Aided Design: Working Drawing Guide

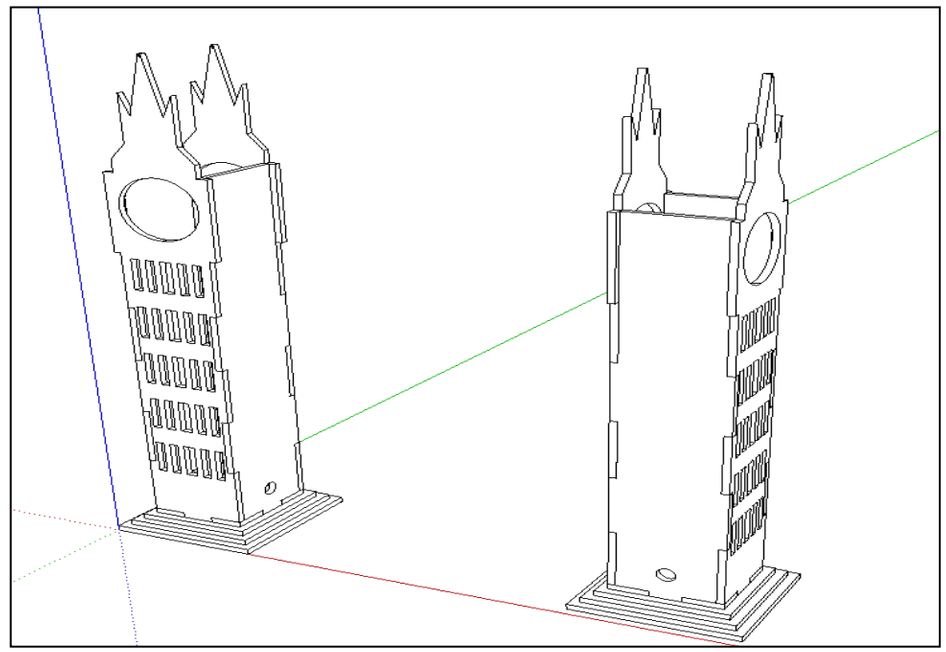
Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)



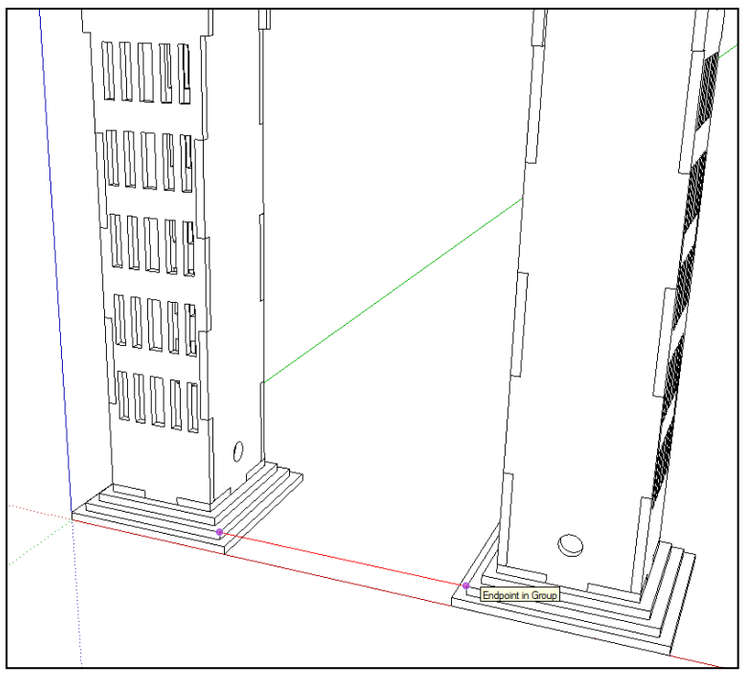
Copy and move a second lamp along the **blue axis**



Click on the rotate tool and turn the lamp **around 90 degrees as shown below**



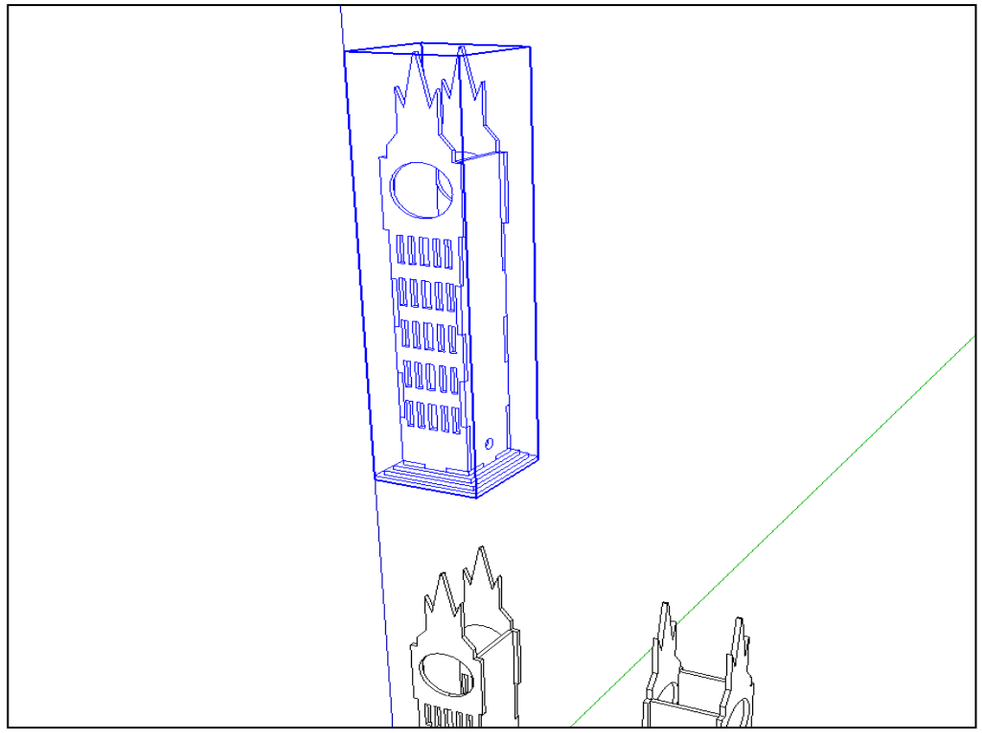
Click on the **move tool** and move the lamp so the corners of the base meet

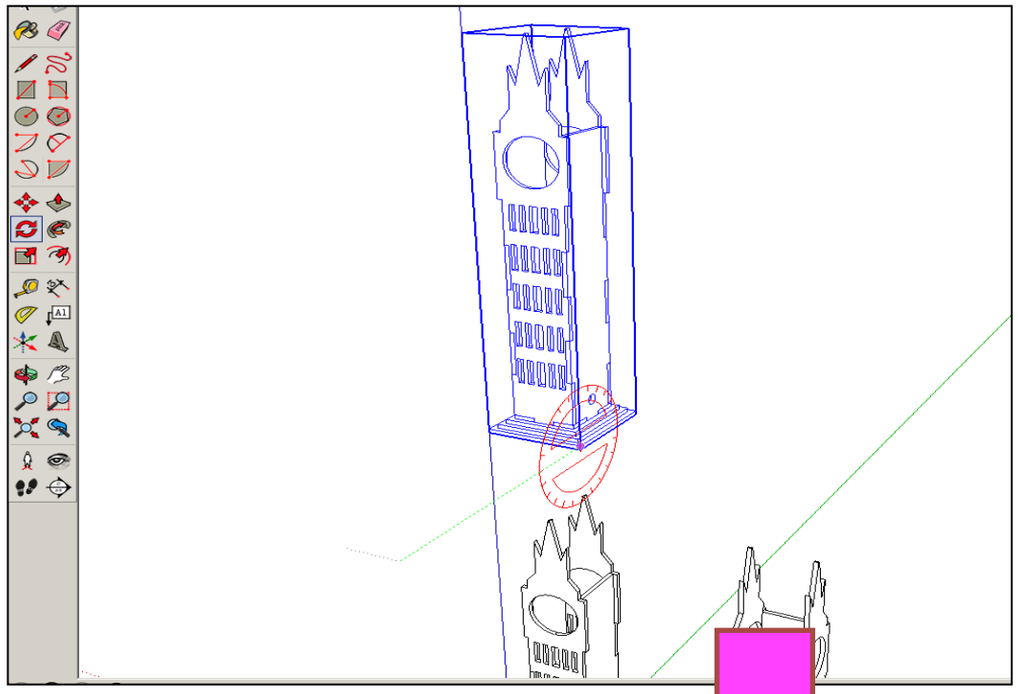


Click on the **move tool** along the red axis. You should be able to draw a line that turns red from corner to corner to indicate it lines up exactly

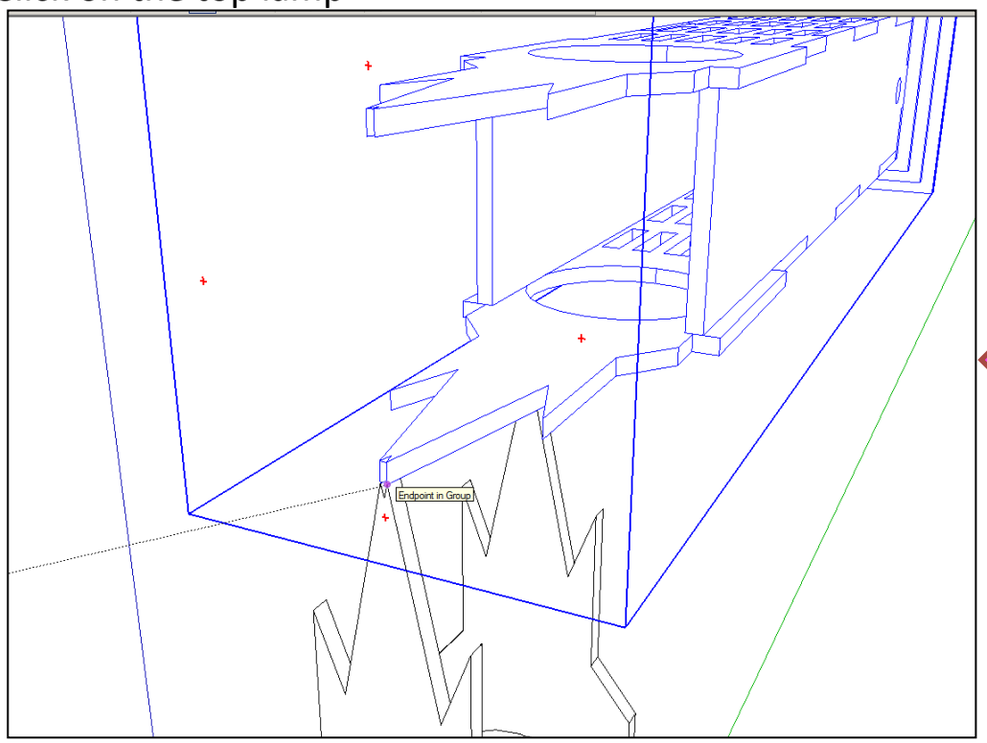
Computer Aided Design: Working Drawing Guide

Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)



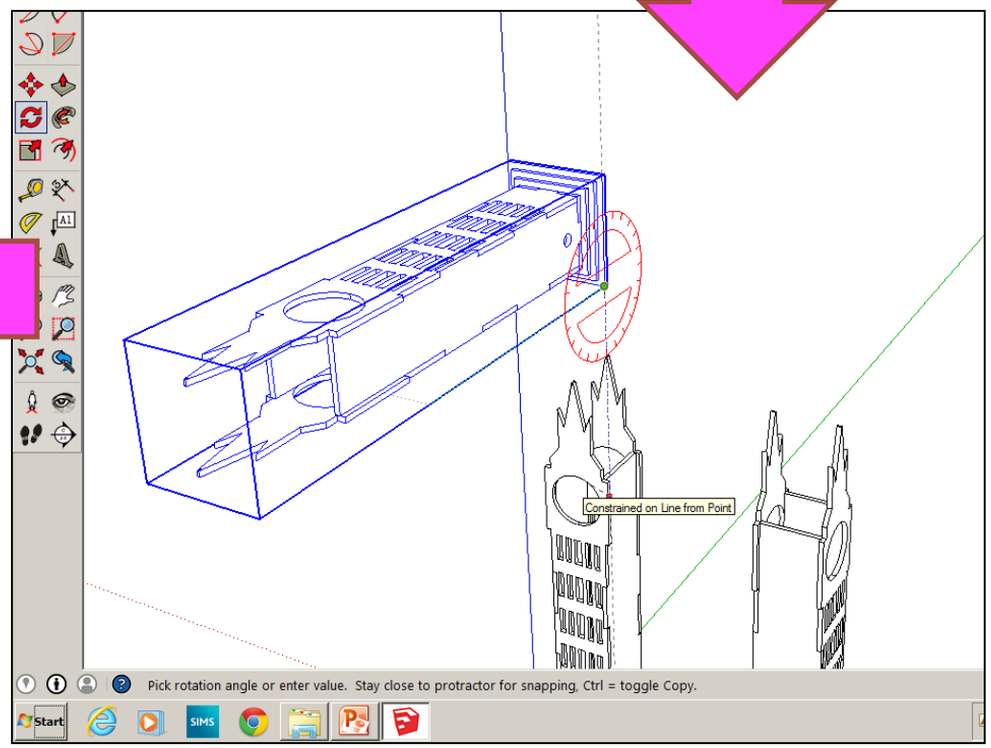


Click on the top lamp



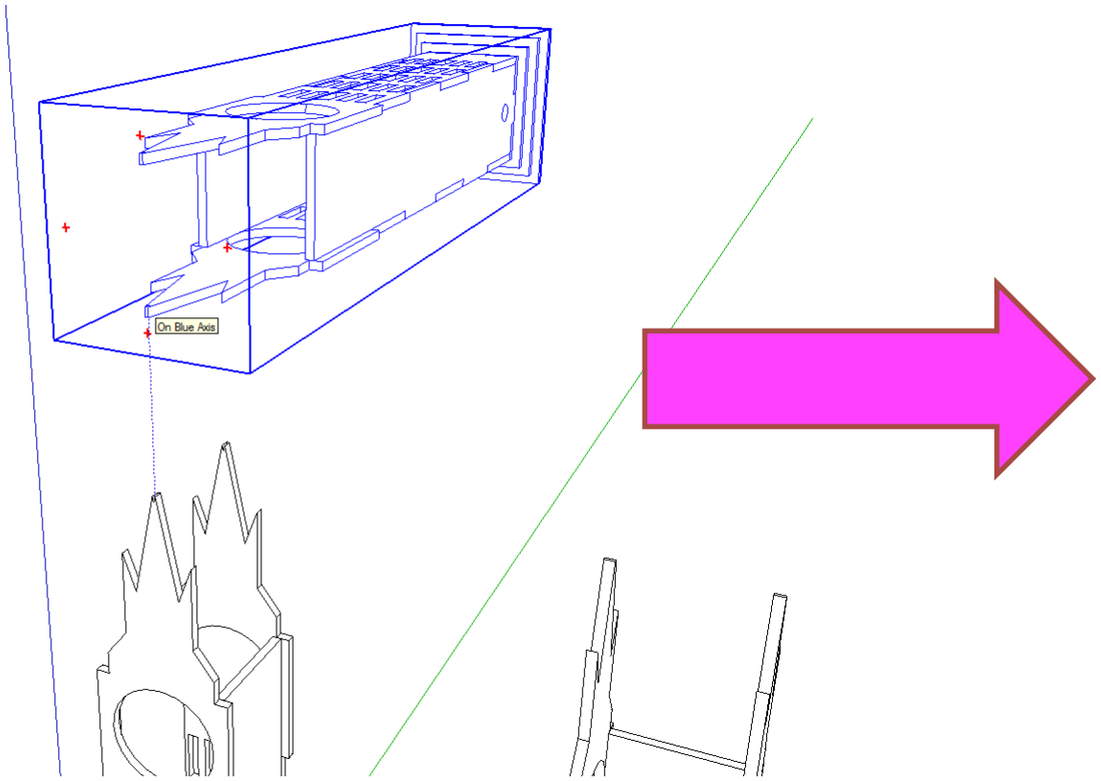
Click on the **move tool** and move the lamp so the corners of the base meet

Click on the rotate tool and turn the lamp **around 90 degrees as shown below**

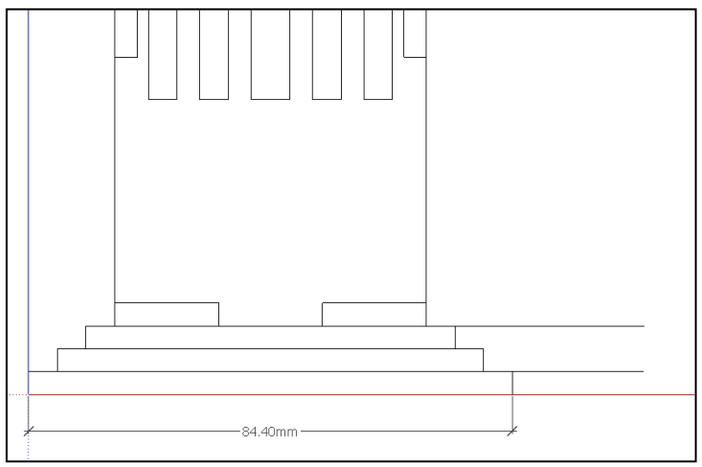


Computer Aided Design: Working Drawing Guide

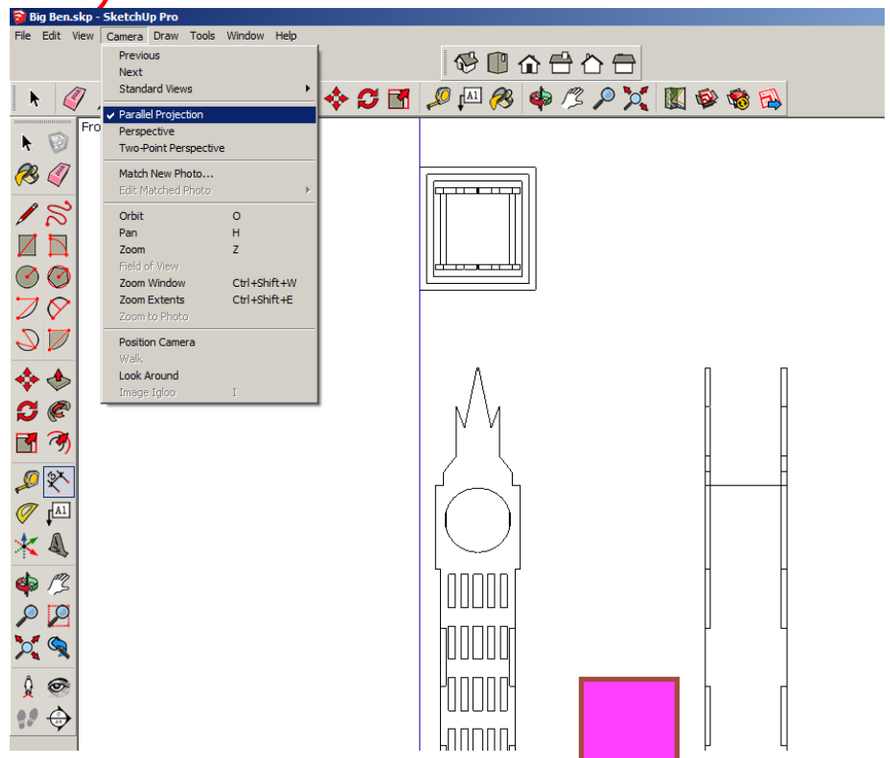
Computer Aided Engineering: 2. Working Drawing (Adding Dimensions)



Click on the **move tool** and move the lamp so the corners of the base meet and then separate again

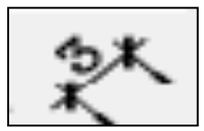


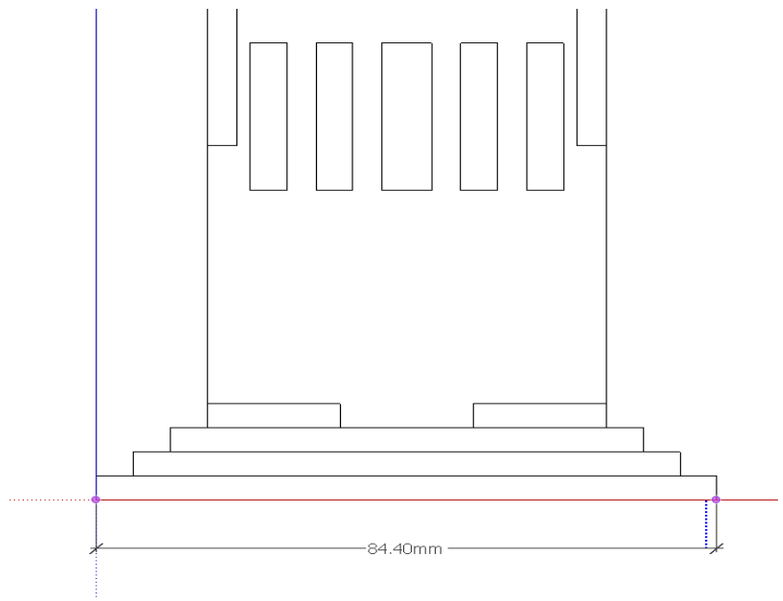
Certain points are difficult to add sizes using the pencil tool to line up edges as shown above.



Click on the **front view using the view toolbar and the camera parallel projection**

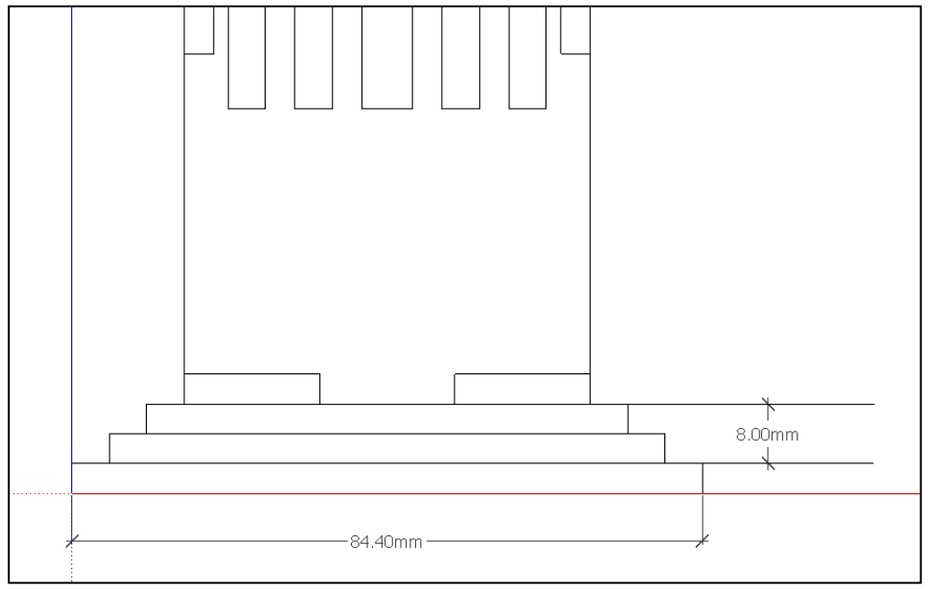
Click on the **dimensions tool bar** and add sizes. All sizes should be below and to the right. Never on the left hand side or on the top



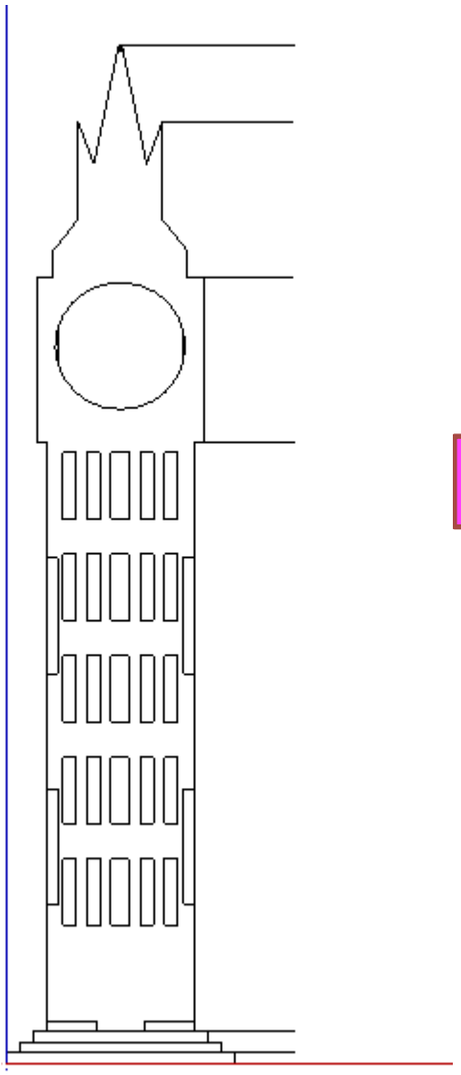


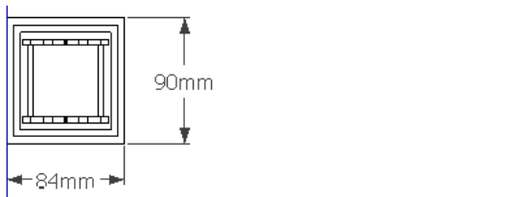
Computer Aided Design: Working Drawing Guide

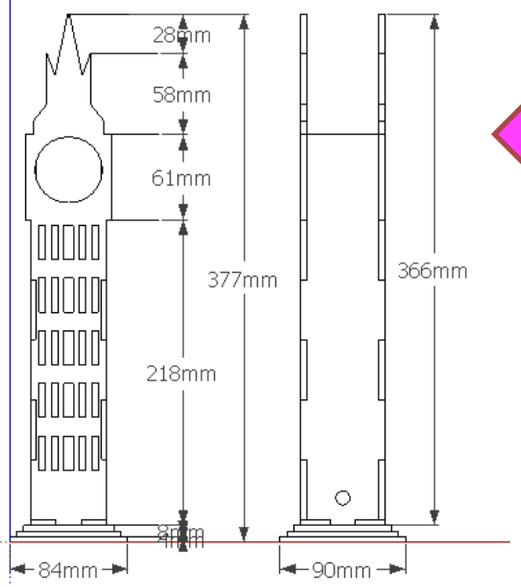
Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)



Add sizes to show height, width and any other important sizes. You will compare these to the lamp later on

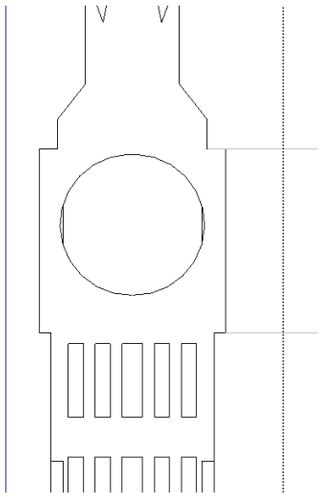




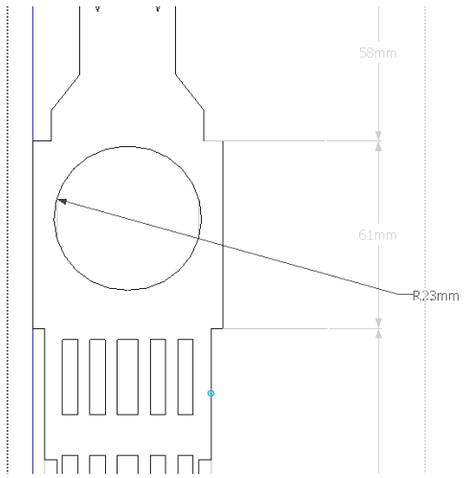


Computer Aided Design: Working Drawing Guide

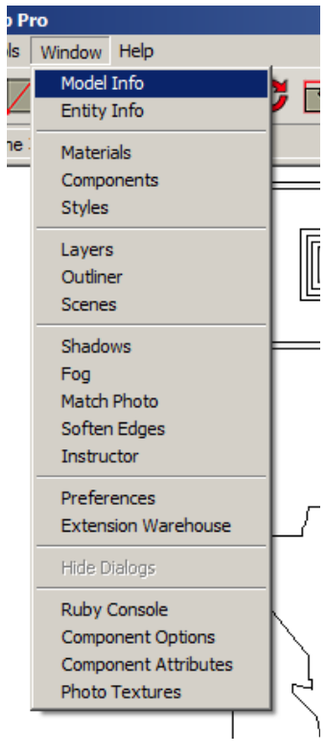
Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)



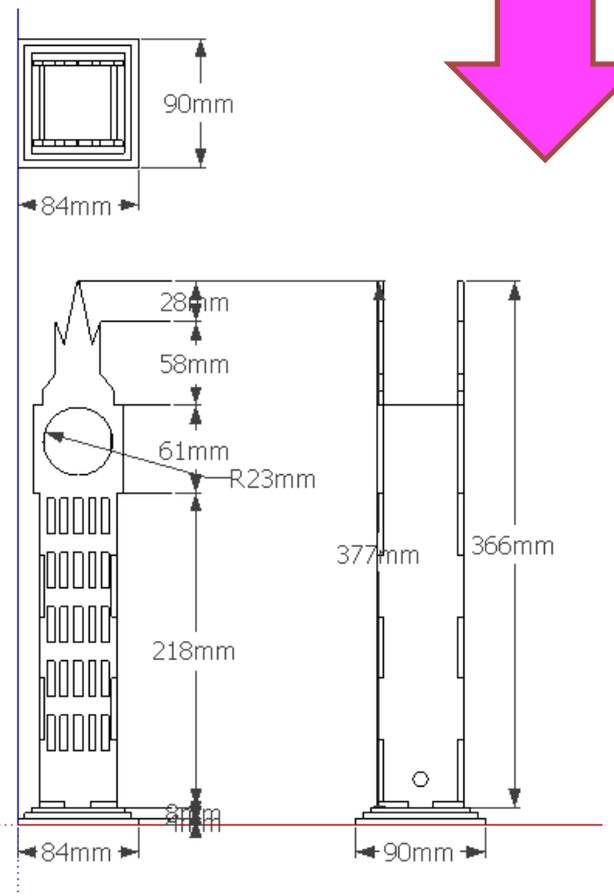
If the object is grouped you may need to double click to add some sizes and radius



Add sizes to the three drawings Front, Side and Plan

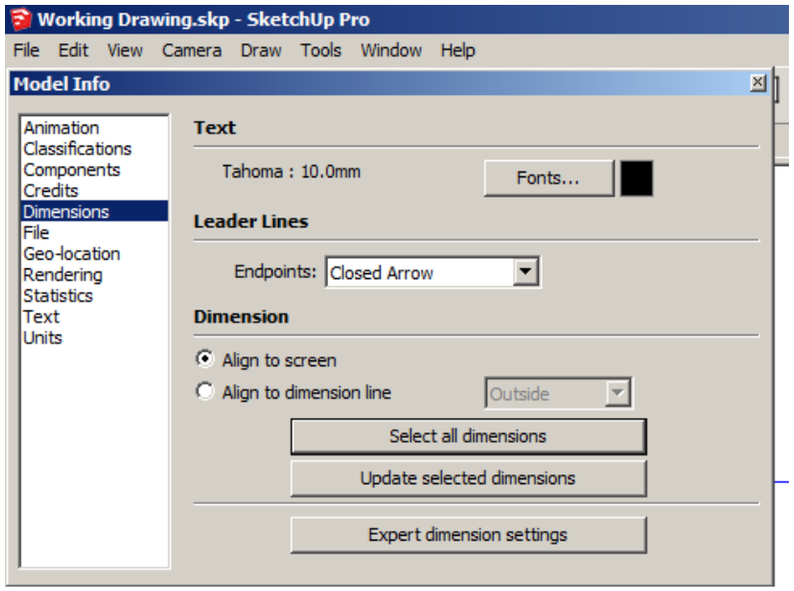


Click on ***Window / Model Info***

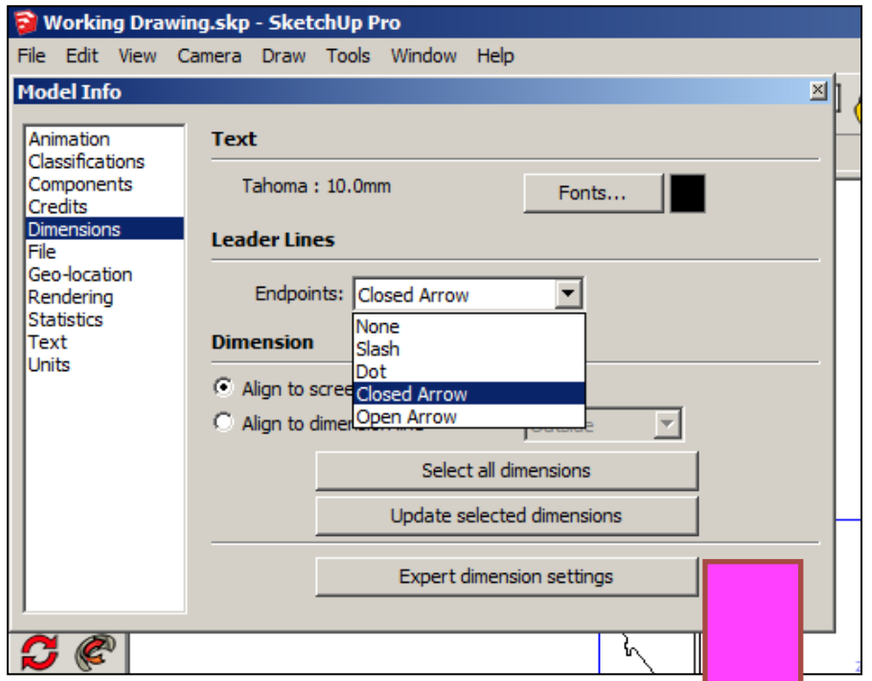


Computer Aided Design: Working Drawing Guide

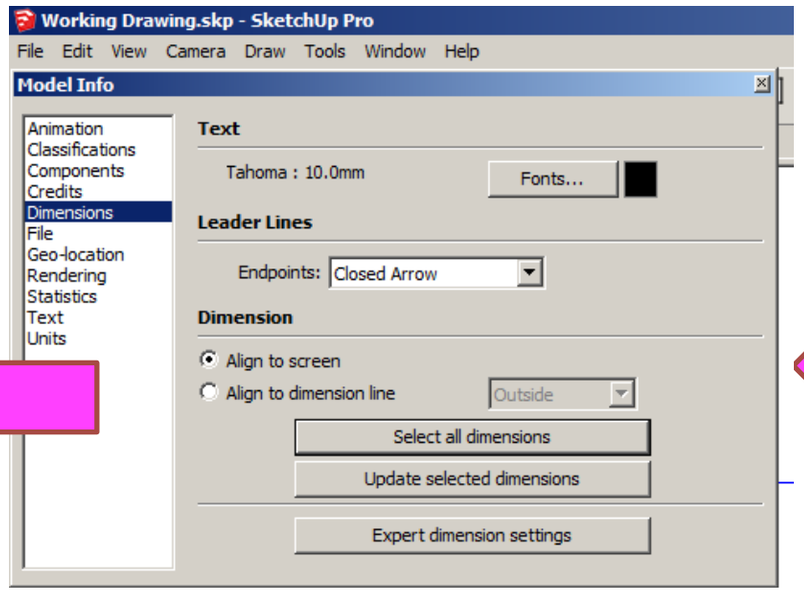
Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)



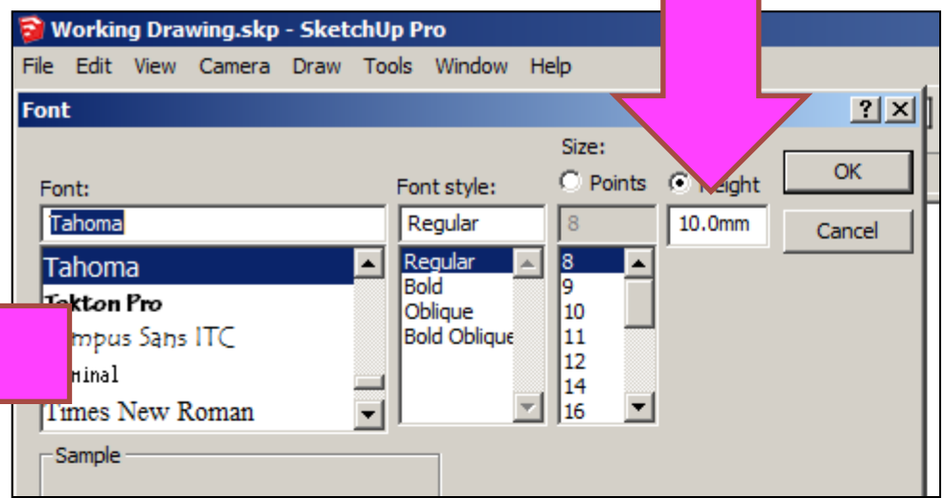
Click on ***Dimension*** and select all dimensions



Click on ***Endpoints*** and select closed arrow from the drop down menu



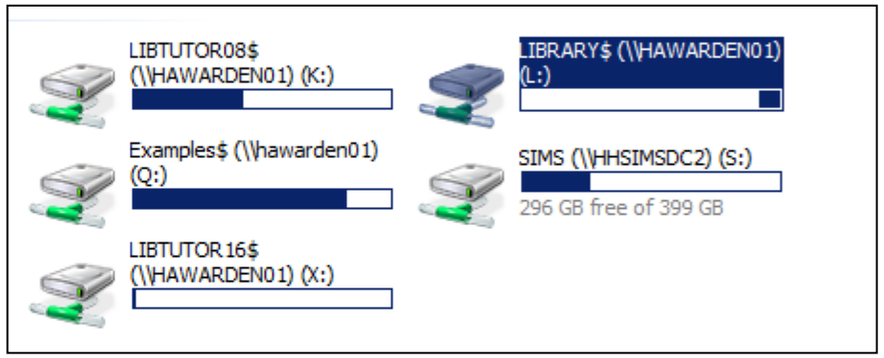
Click on ***Update all dimensions.*** The dimensions should change on the screen. When your happy close window down.



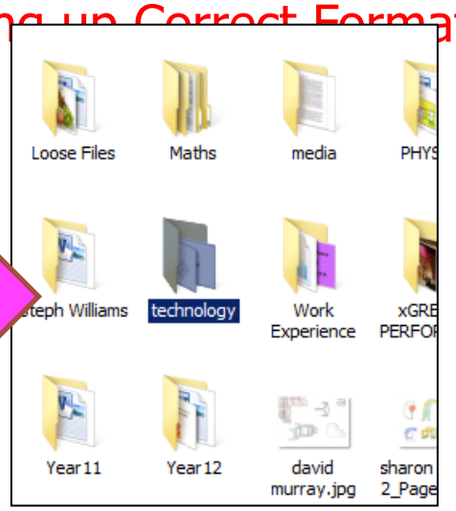
Click on ***Fonts*** and select a suitable size to be able to read the sizes on your drawing. You may have to repeat the above steps until your happy.

Computer Aided Design: Working Drawing Guide

Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)

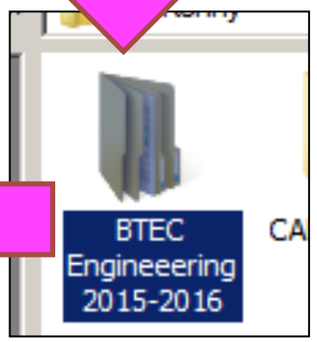


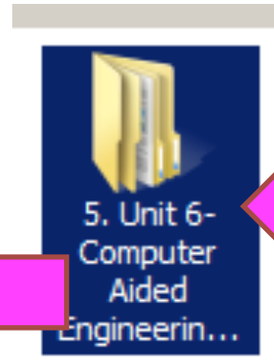
Click on ***Library.***

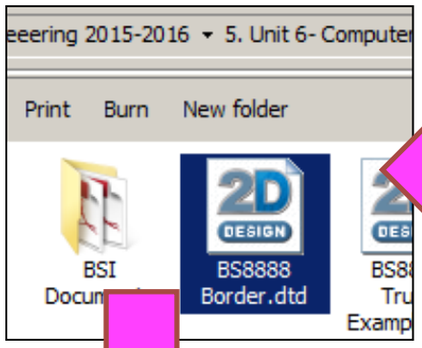


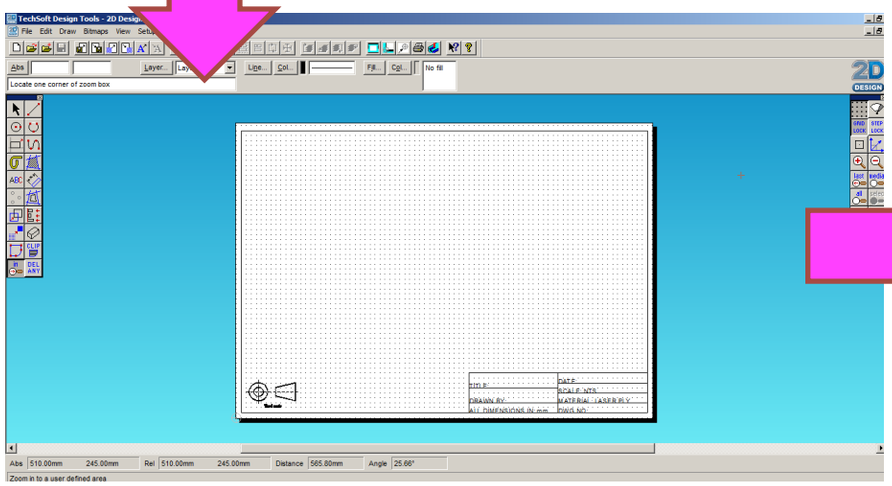
Click on ***Technology.***

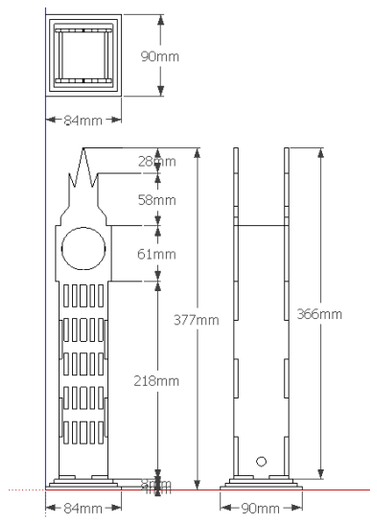
Click on ***Mr Kenny.***







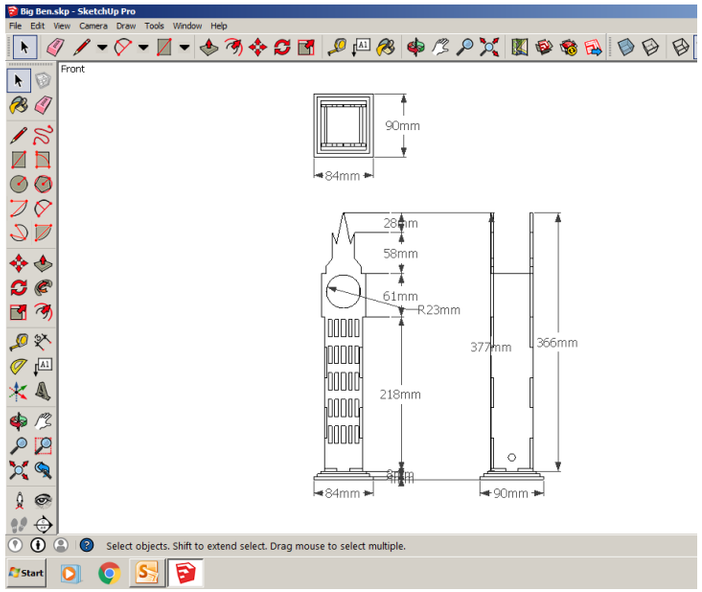




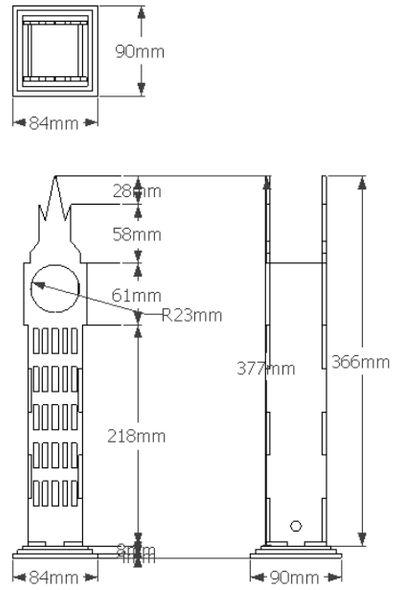
Go back to your working drawing***. Click on camera / Parallel projection, then view and click the axis off and then press print screen***

Computer Aided Design: Working Drawing Guide

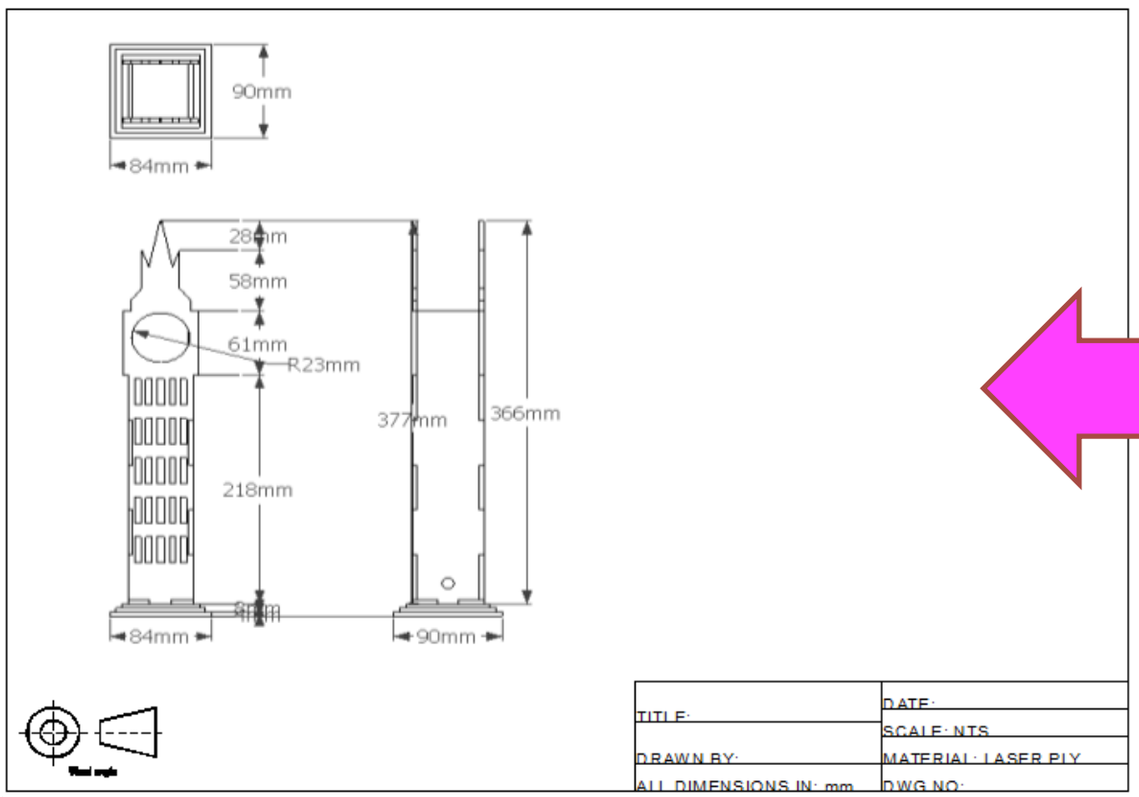
Computer Aided Engineering: 2. Working Drawing (Importing DXF into 2D Design)



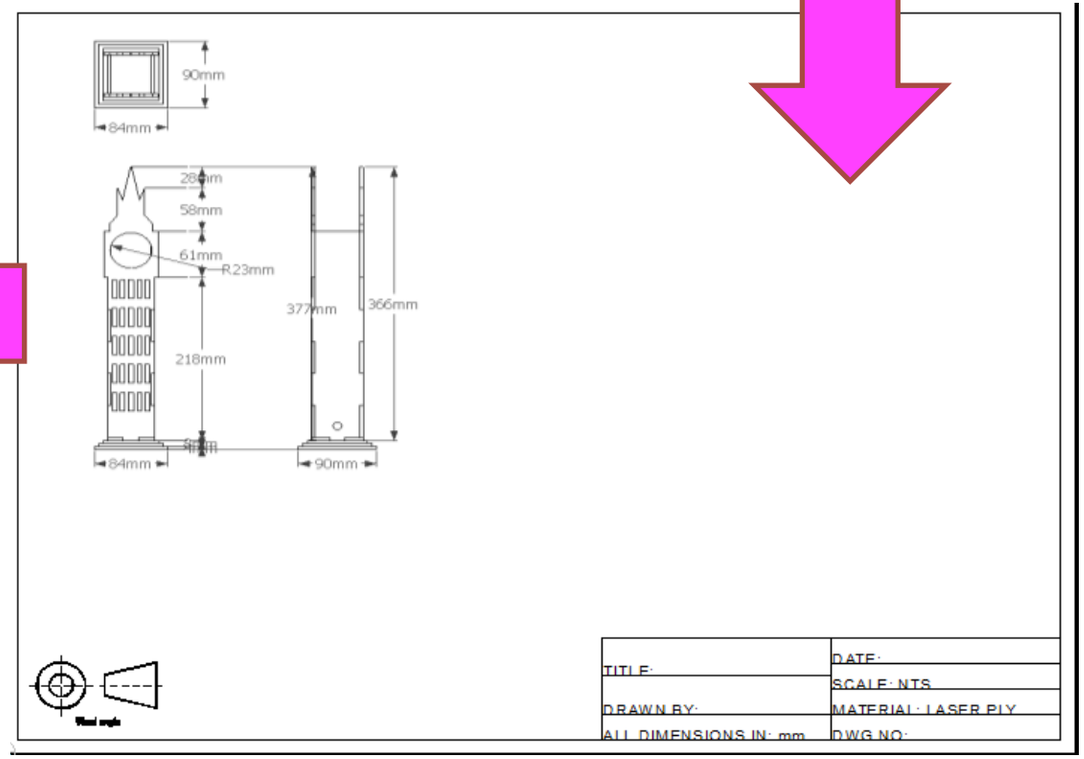
Paste into Power point first and then crop.



Press print screen again.

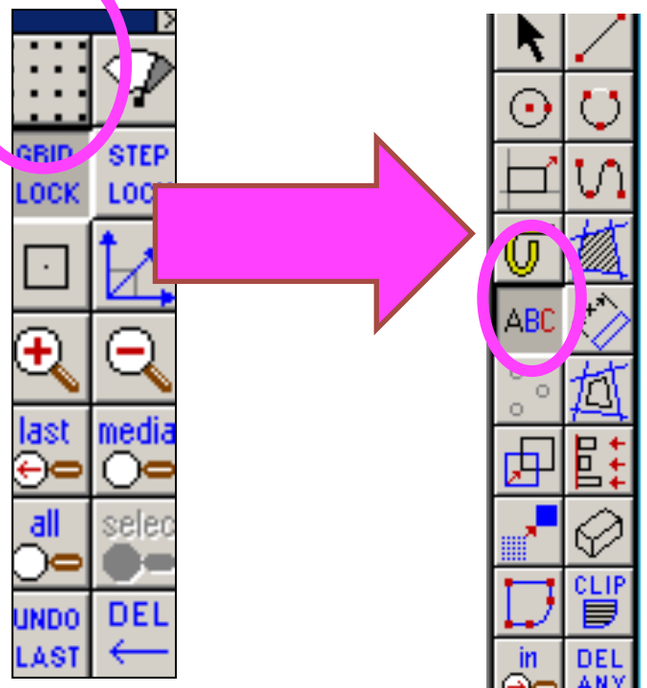


Resize appropriately



Computer Aided Design: Working Drawing Guide

Computer Aided Engineering: 2. Working Drawing (Importing DXF into 2D Design)



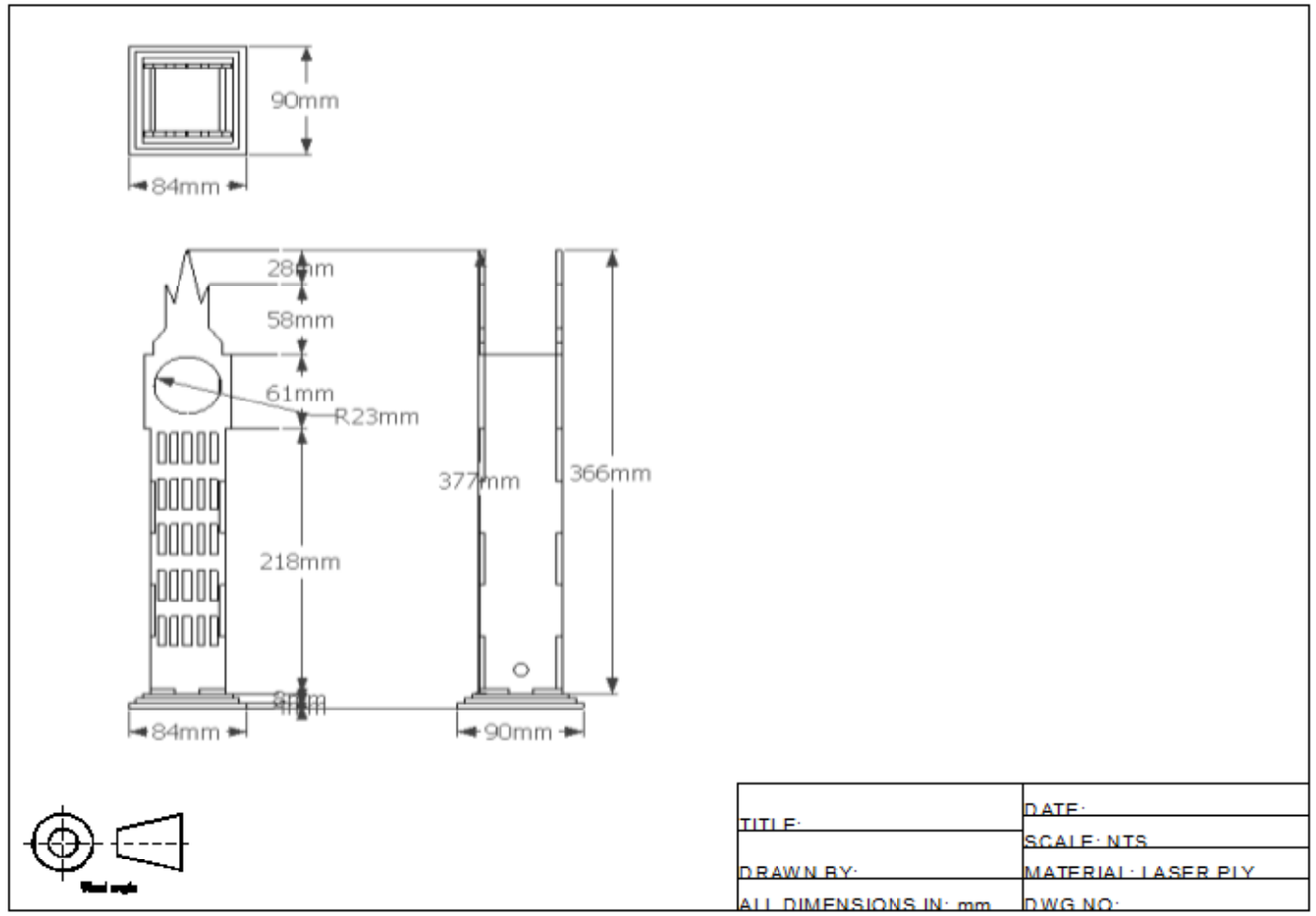
Click the dots **OFF**

Complete the border at the bottom of the page

Title

Drawn by

Date



Print screen and paste into your folder. Drawing on the next page represents a correct Engineered Lamp drawing. If yours **does not look like this you cannot achieve a level 2**

Computer Aided Design: Working Drawing Guide

Computer Aided Engineering: 2. Working Drawing (Importing DXF into 2D Design)