CAD SKILLS

CAD Tutorial 14: Flat-packed Lamp

Level of Difficulty
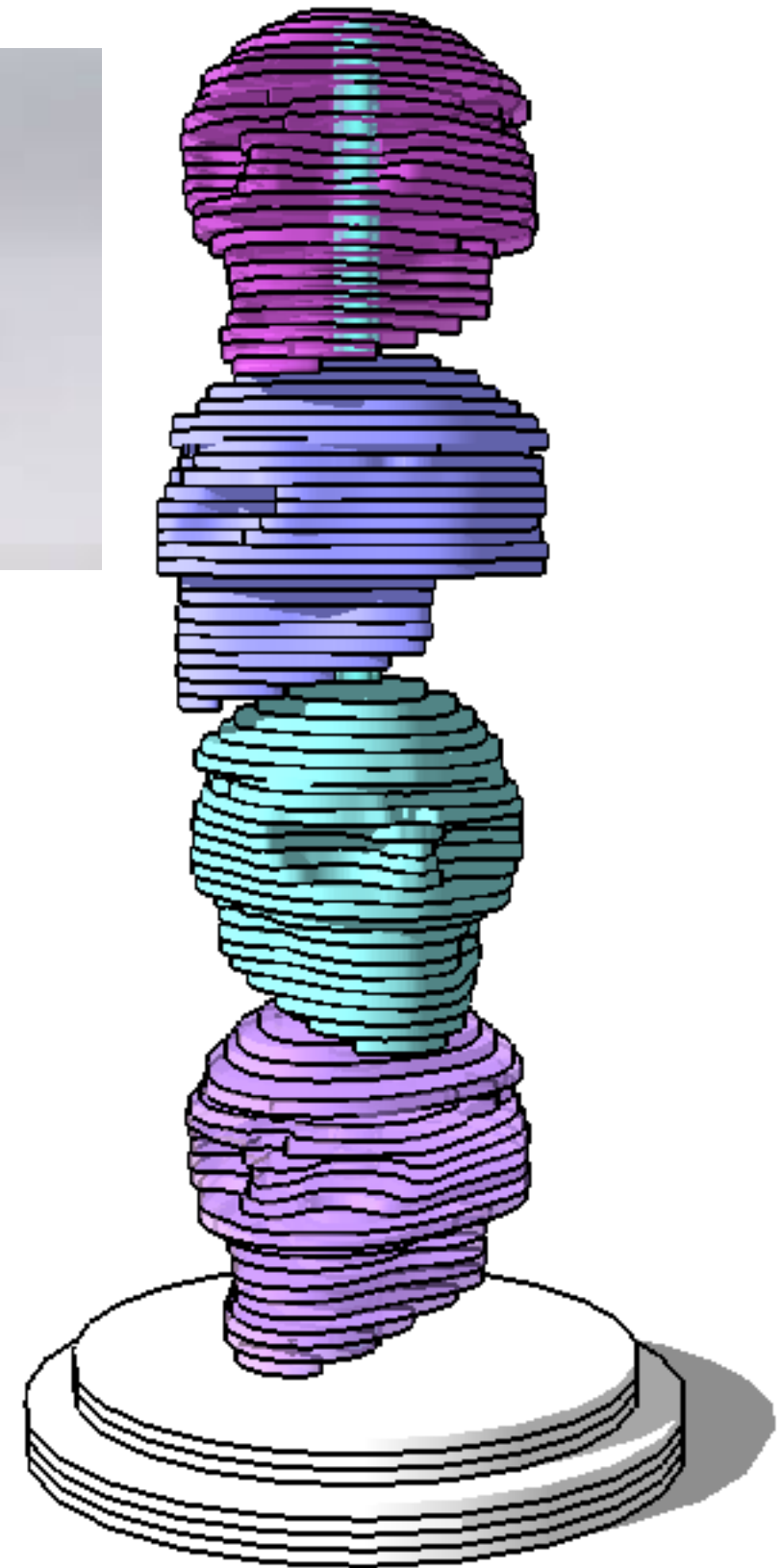
★ ★ ★ ★ ★

Time

Approximately 60–120 minutes

Starter Activity

- Design a wooden lamp using CAD.....

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
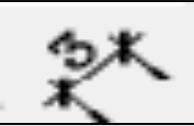
Visual : *Presentation*

Auditory: *Video*

Kinaesthetic: *Demonstration*
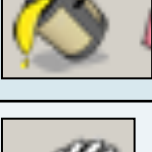
Sketchup Help Guide:

Computer Aided Engineering: 15. Drawing and Modification Commands

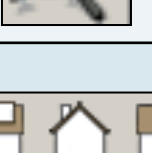| Drawing and Modification Tools	image	Description	Advantages
Modifying Tool 1. **Pencil tool**		used to draw lines in X, Y and Z direction. Can draw simple or complex shapes very quickly.	**Advantages:** Allows user to draw or modify shapes very quickly and can be used to construct 3D objects faster 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.*
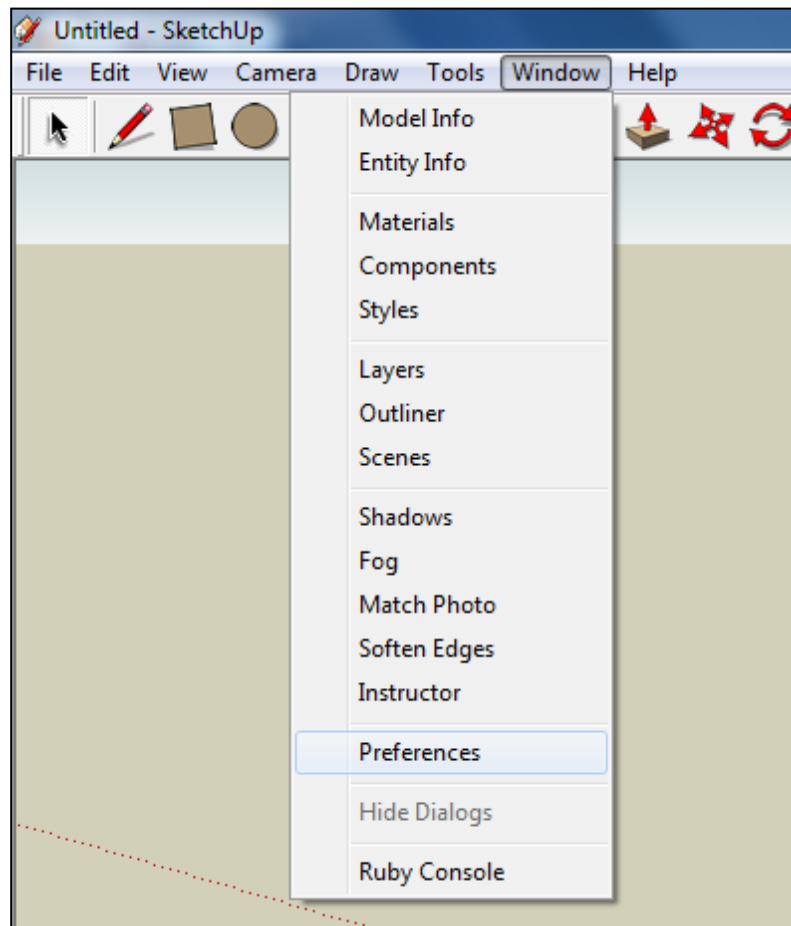
1. Open Library /Designoutthebox.com/ CAD Skills/ Lesson 14 / Aircraft Lamp

Open the sketch up drawing. Once you have opened SketchUp, go to **Window** and select **Model Info**
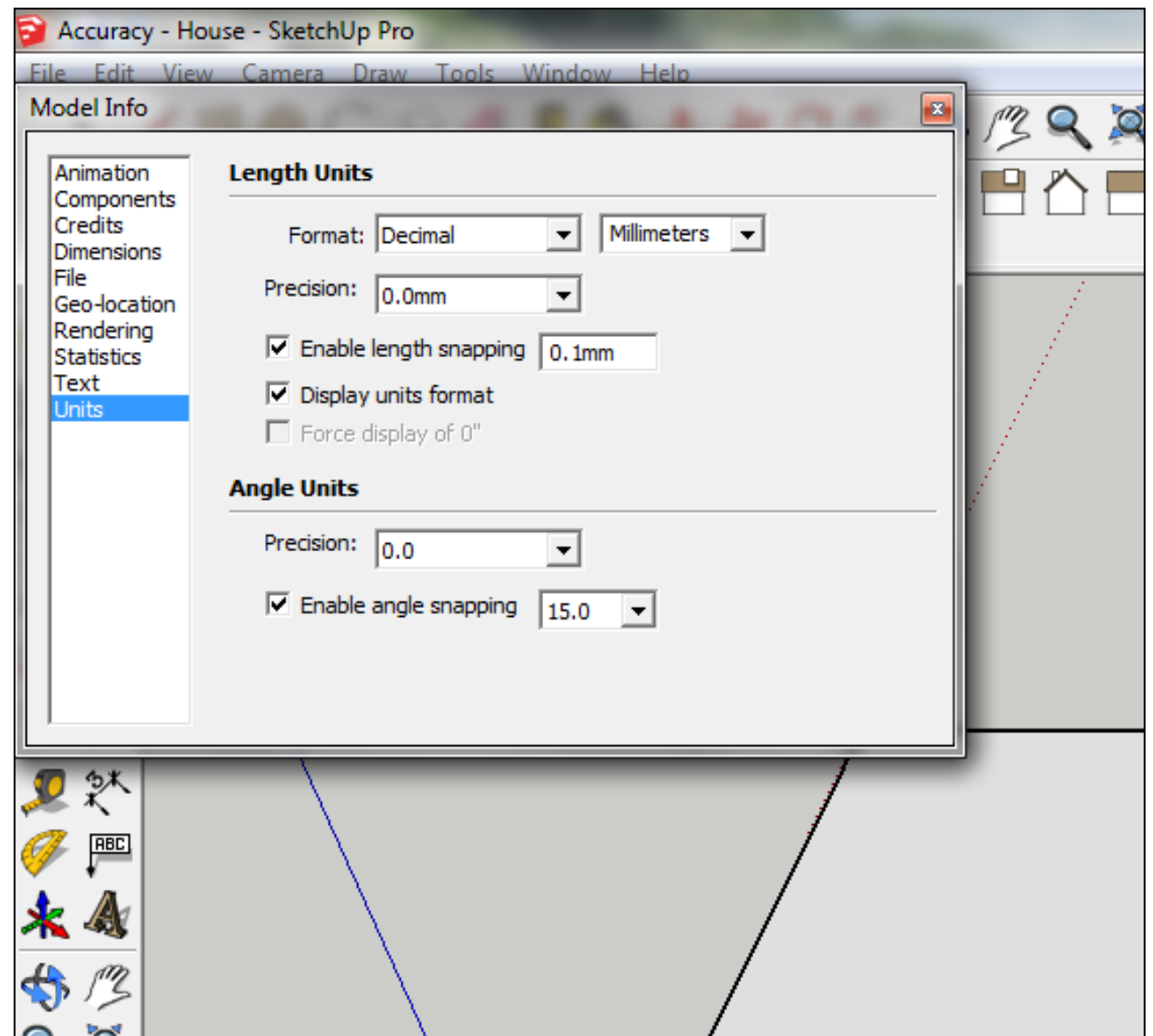
2. Select **Units** and choose **Decimal Millimetres**. We are using this template because we are doing a product design.

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

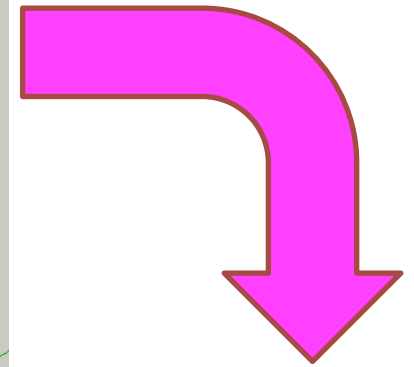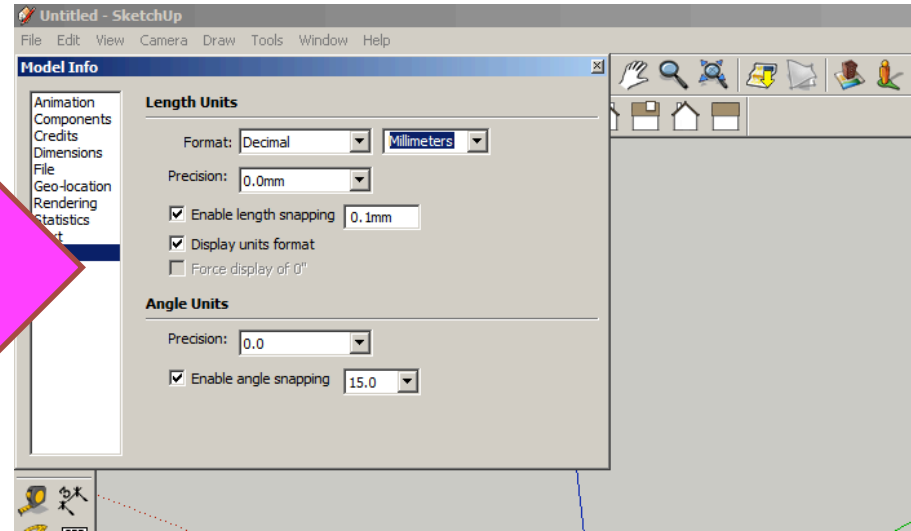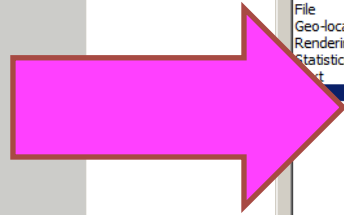3. Now select the **View** then **toolbars** and ensure **Getting Started** and **Large Tool Set** are ticked
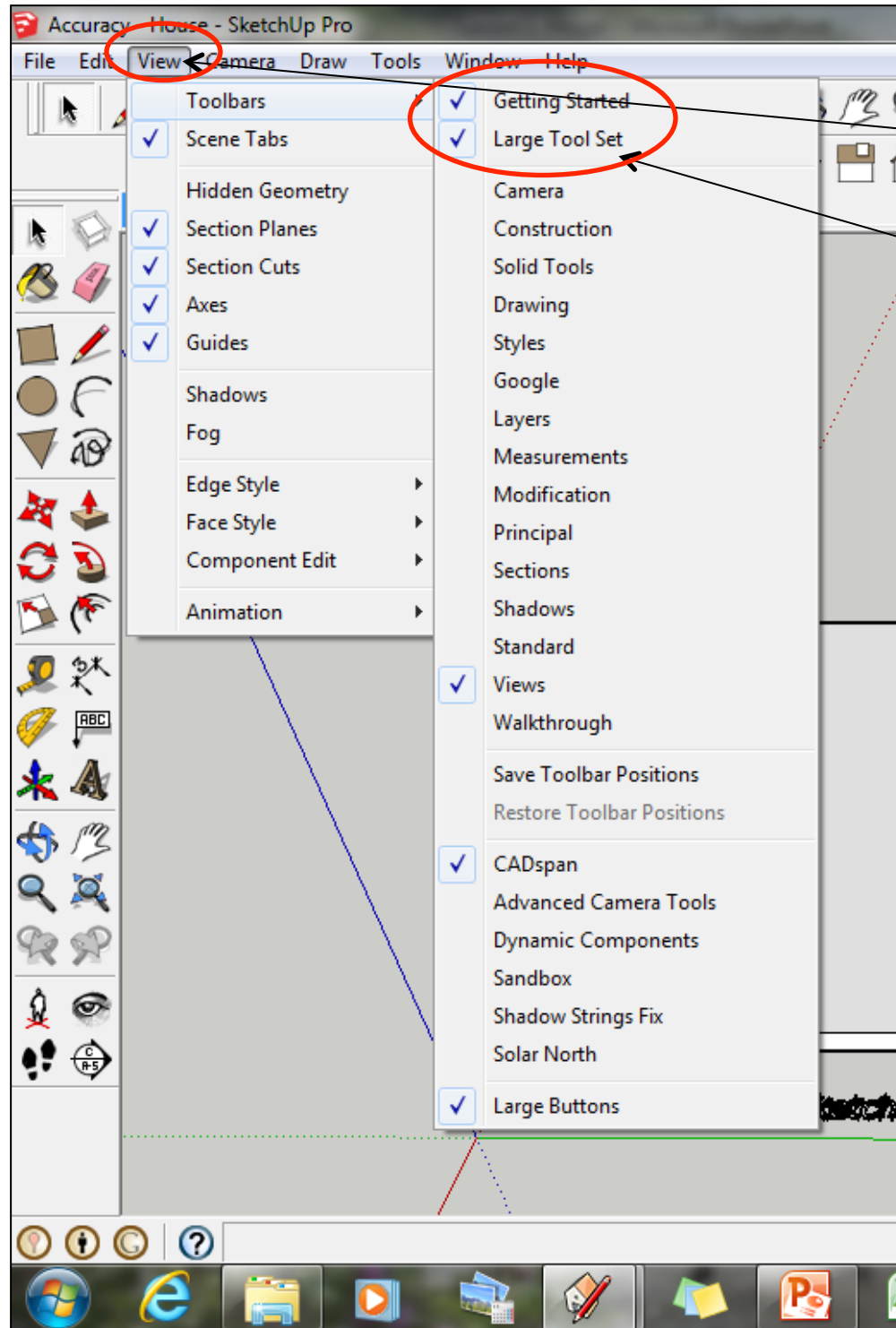
3a Select **View**

3b Tick Getting Started
3c Tick Large Tool Set

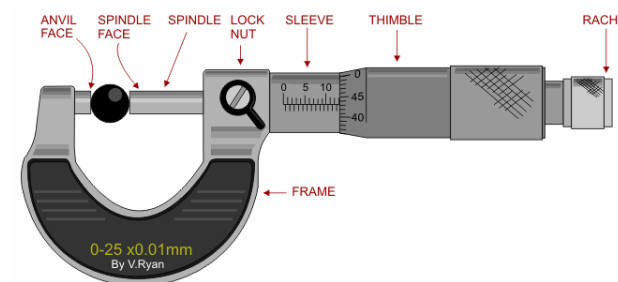*Note: this will place a tool bar across the top (getting started) and the side (Large Tool Set)*

Computer Aided Design: Aircraft Lamp

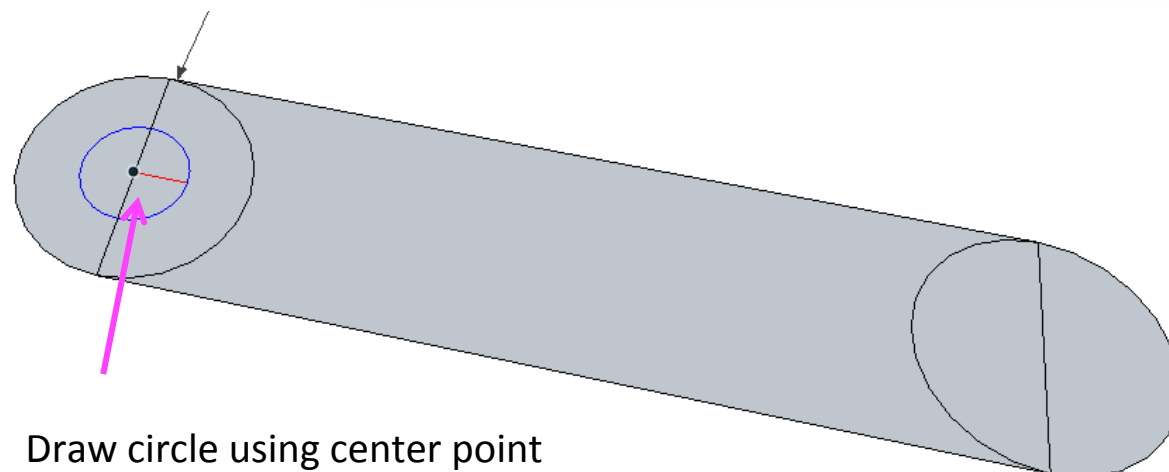## Computer Aided Engineering: Step by Step Guide to Lamp Construction
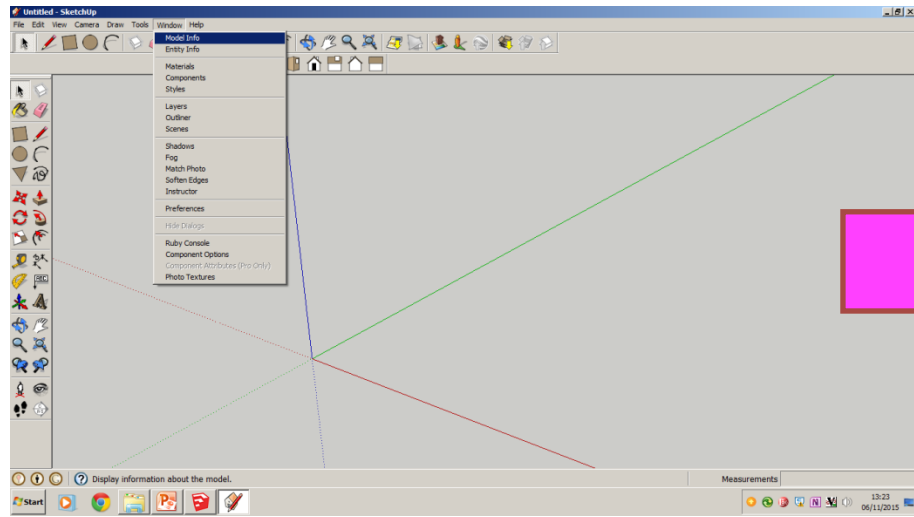
Start by stetting up *window/ model info*.

Select Units and change to *decimal - millimetres*

Select engineering Style allows me to use the following equipment in school

CNC router
CNC laser cutter
CNC 3D Printer

CNC means computer numerically controlled and converts CAD drawings to co-ordinates and codes to be cut out by a machine.

3D printers

3D printers print 3D models, using a process called additive manufacturing or AM. This process uses computer control to lay successive layers of material to build a 3D model.
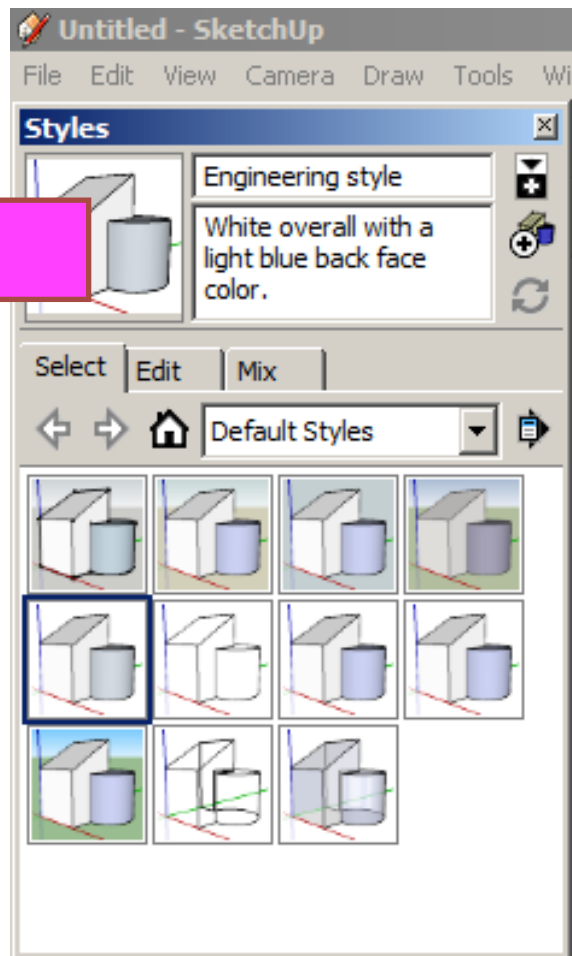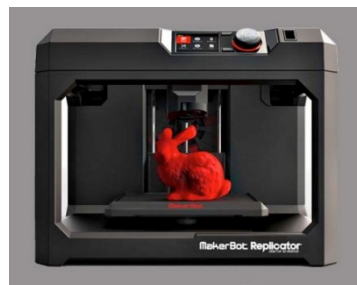
Select *engineering* Style
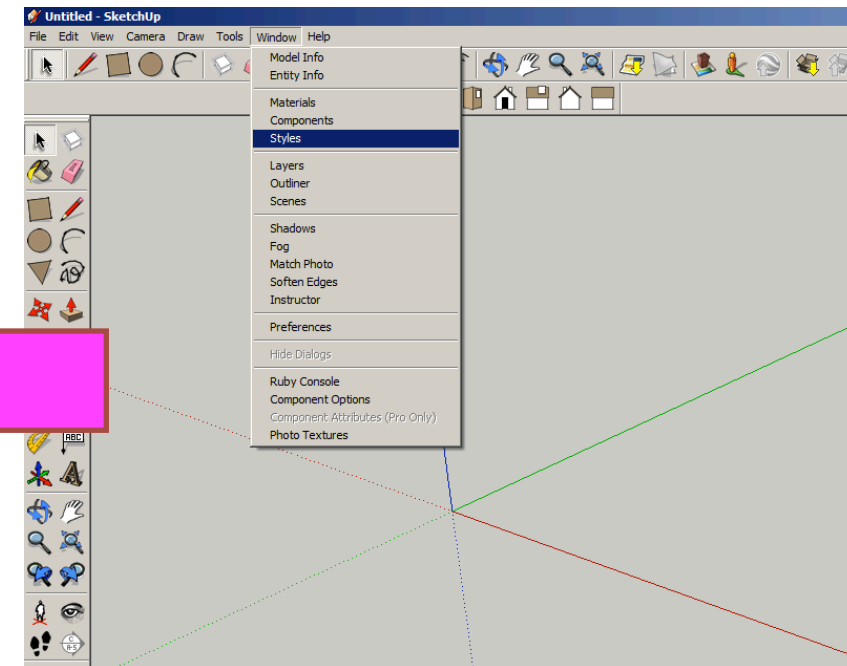
Select *Window-Styles*

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

CNC Router

A **CNC router** is a computer controlled cutting machine related to the hand held **router** used for cutting various hard materials, such as wood, composites, aluminium, steel, plastics, and foams. **CNC** stands for computer numerical control.

CNC Laser cutter

Laser cutting is a technology that uses a **laser** to **cut** materials, and is typically used for industrial manufacturing applications, but is also starting to be used by schools, small businesses, and hobbyists. **Laser cutting** works by directing the output of a high-power **laser** most commonly through optics
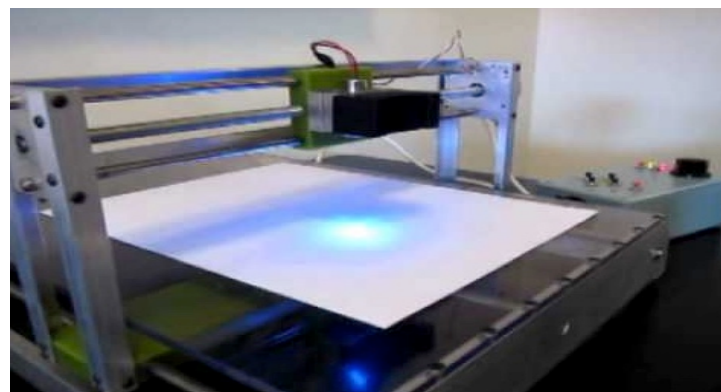
Products which are designed for self-assembly are popular for many reasons and help to keep costs as low as possible. An international furniture warehouse chain is constantly on the look-out for fresh ideas for their lighting sections. They are particularly interested in cutting edge designs which allow the customer to assemble the products in a variety of ways.

Design and make a lamp based around a famous buildings, structures or a retro theme . The product will need to be manufactured in full-scale and will need assembly instructions which do not rely upon text. The use of commercial knock-down fittings and/or standard components might be a key feature of the product. Accuracy will be a vital requirement and manufacturing aids such as drilling jigs or the use of CAM should be regarded as essential.

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

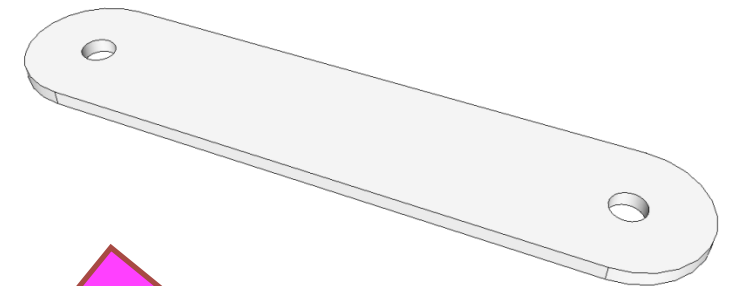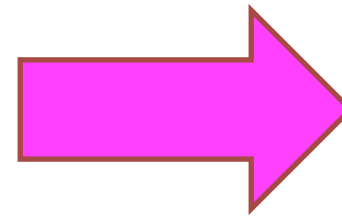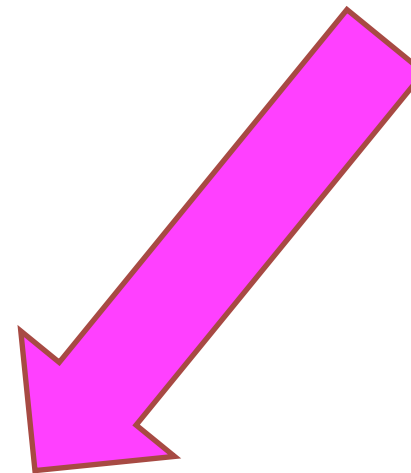**Dimensions** tool used to show sizes and radius of drawn objects

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.
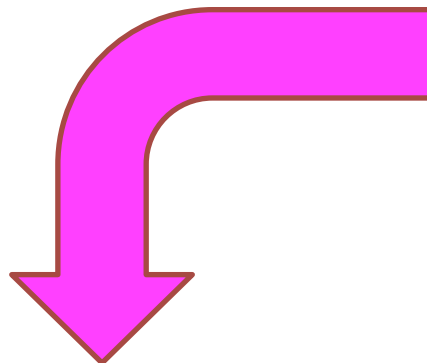
110.0000mm

30.0000mm

Start by stetting up laser cutter bed size ***300mm x 500mm.***

Using ***square tool*** draw a rectangle measuring ***110mm x 30mm.***

Laser Cutter bed: 300x500mm

R15.0000mm

R15.0000mm

Using the ***circle tool*** draw a circle end piece with a radius of ***15mm.***

The centre point of the circle should be the midpoint on the end of the rectangle

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.
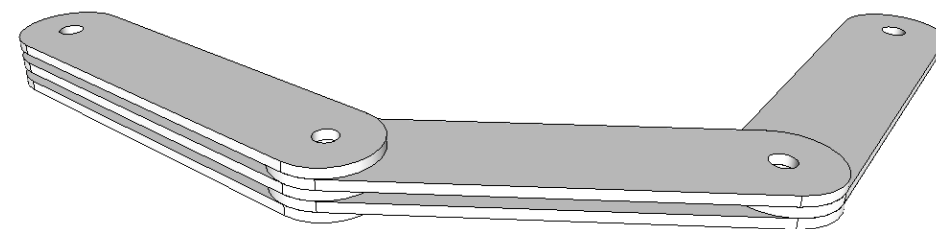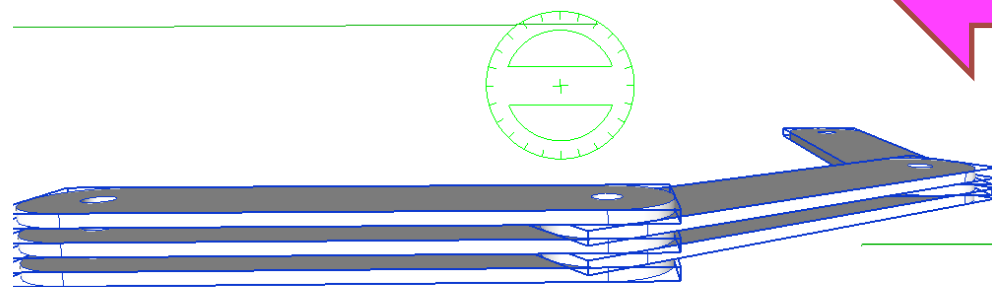
Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

The micrometer is a precision measuring instrument, used by engineers. Each revolution of the rachet moves the spindle face 0.5mm towards the anvil face. The object to be measured is placed between the anvil face and the spindle face. The rachet is turned clockwise until the object is 'trapped' between these two surfaces and the rachet makes a 'clicking' noise. This means that the rachet cannot be tightened any more and the measurement can be read.
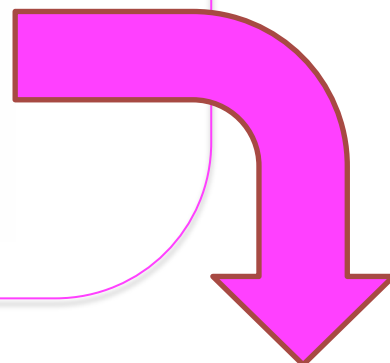
To allow the lamp to move I am going
To use a wing nut and bolt for the arms to rotate around. I will need to measure the bolt to get the radius to allow it to go through the lamp arms

We can figure out the radius by dividing the diameter in half. The radius is one-half the measure of the diameter.

7.35/2= 3.675mm

The radius of the circle is 3.675mm.
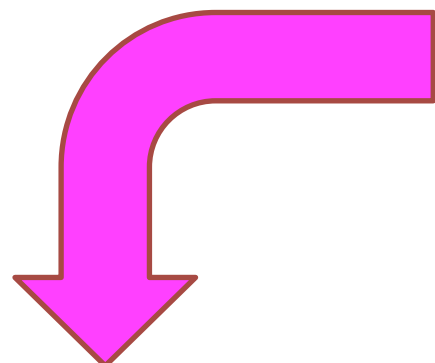
Draw circle using center point shown. Type in radius 3.675

Radius 3.675

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

R15.0000mm

DIA 7.3500mm
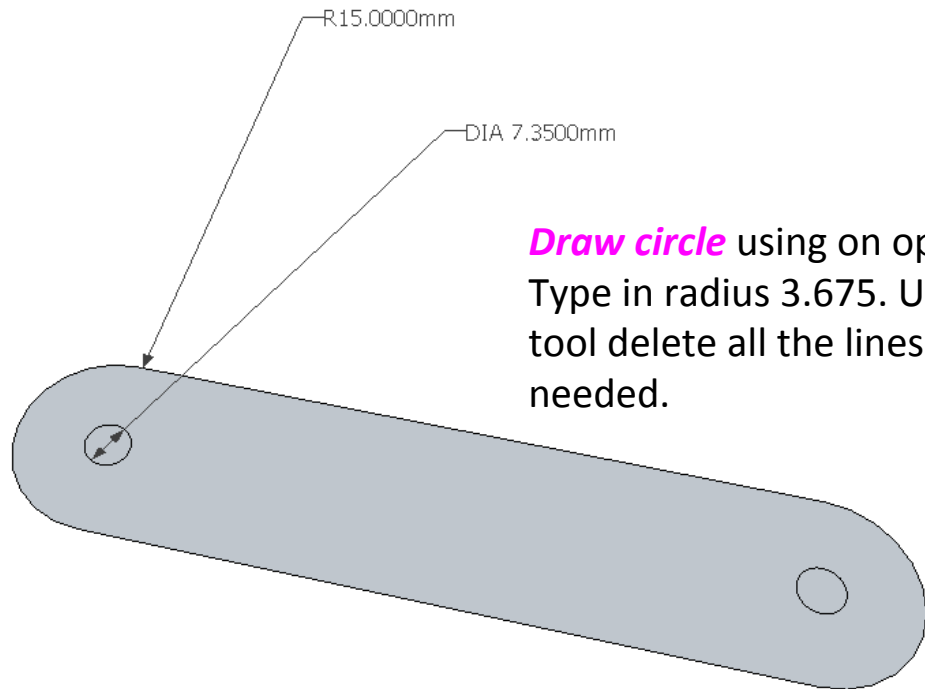
*Draw circle* using on opposite side . Type in radius 3.675. Using trim tool delete all the lines no longer needed.

<u>Trim tool</u> allows the user to remove overlapping elements.

Advantages:
Allows user to erase overlapping lines and edges to draw complex 3D shapes very quickly.

<u>Offset tool</u> *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.

At the moment the radius on the arm of my lamp is an **interference** fit.

I want the arm of the lamp to rotate to change the shape so I am going to need to add **clearance** to enable the arm to rotate.

Use the *Offset tool* to add a clearance of 0.25mm on both circles
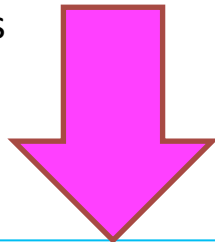
Clearance / Tolerance

Manufactured parts are very frequently required to mate with one another. They may also be designed to slide freely against one another or they may be designed to bind together to form a single unit. The most common fit found in the machine shop is that of a shaft in a hole.

There are three general categories of fits:

1) **Clearance** fits for when it may be desirable for the shaft to rotate or slide freely within the hole.

2) **Transition** fits for when it is desirable that the shaft to be held precisely, yet not so tightly that it cannot be disassembled, this is usually referred to as a Location or Transition fit.

3) **Interference** fits, for when it is desirable for the shaft to be securely held within the hole and it is acceptable that some force be necessary for assembly

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

DIA 7.8543mm

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
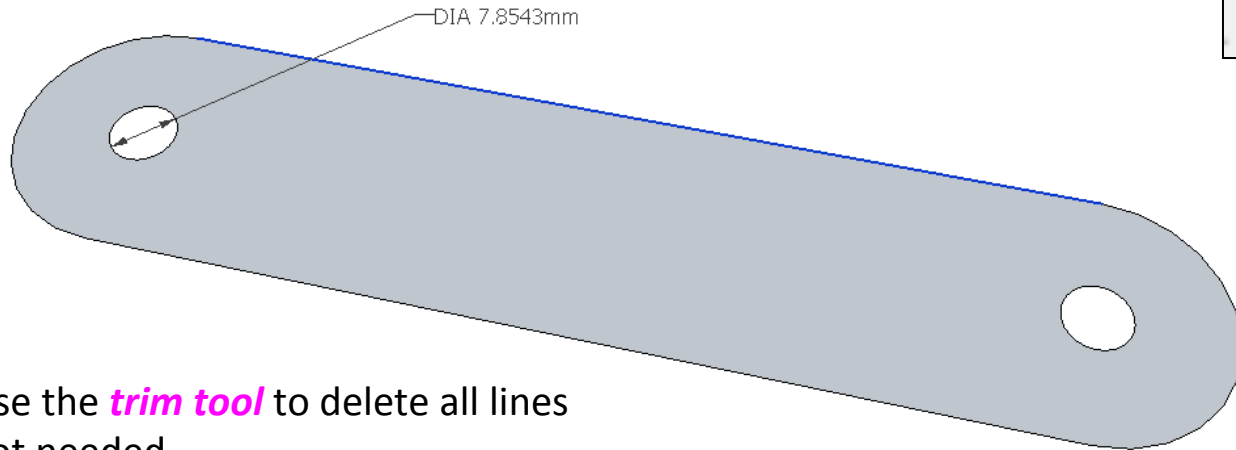
Use the *trim tool* to delete all lines not needed.

Use the *dimensions tool* to check the radius has increase to provide **clearance**

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

Highlight the arm, click on the move tool and press *Ctrl* to copy. Move so that the arms are in a row joining each circle together
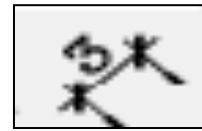
Constrained on Line from Point

Use the *PUSH PULL* tool to give the arm thickness of 3mm for acrylic.

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.

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

On Face in Group
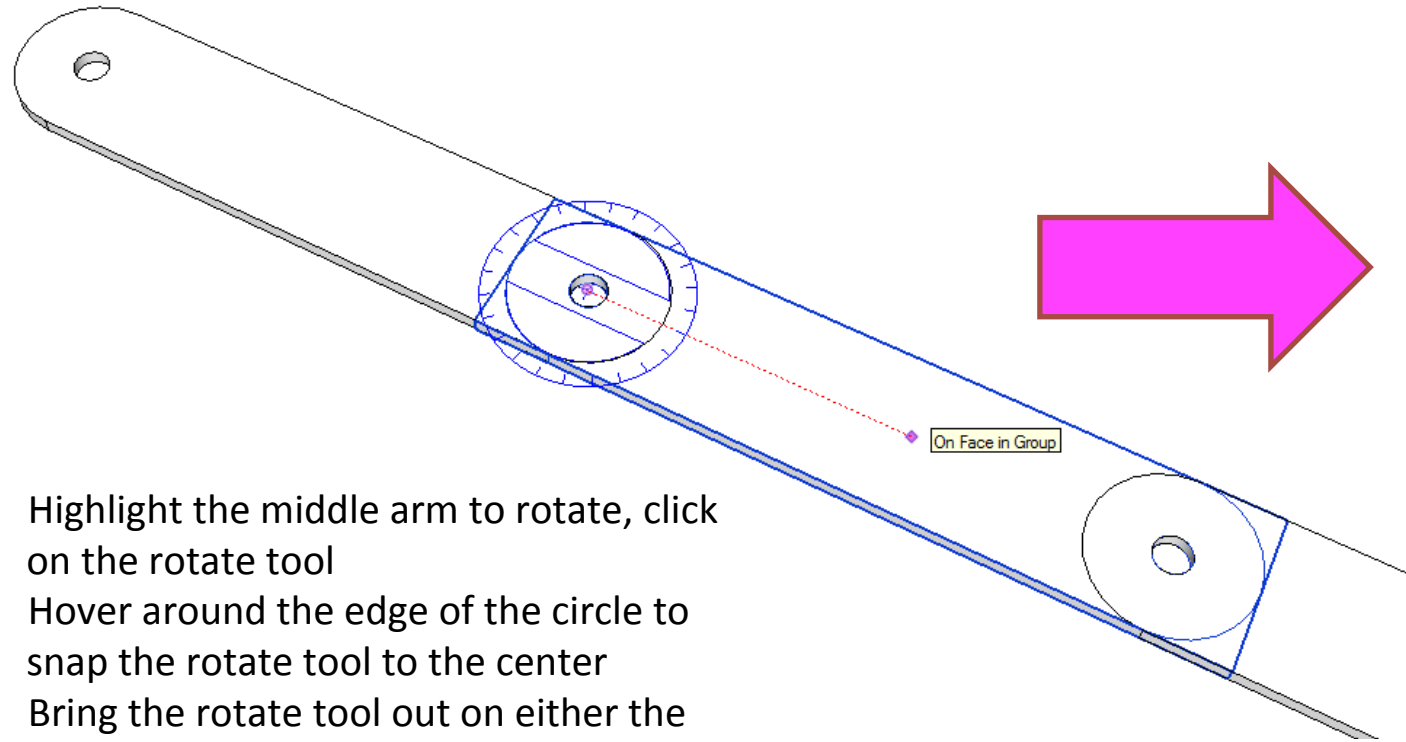
- Highlight the middle arm to rotate, click on the rotate tool
- Hover around the edge of the circle to snap the rotate tool to the center
- Bring the rotate tool out on either the green or red axis
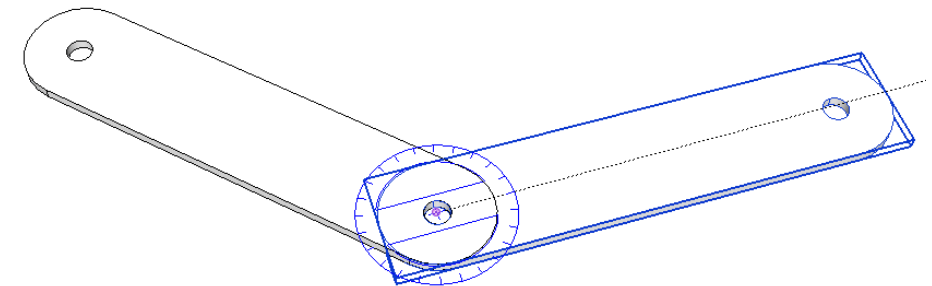
- Rotate the arm
- **Type in 45 and press enter**

Endpoint in Group
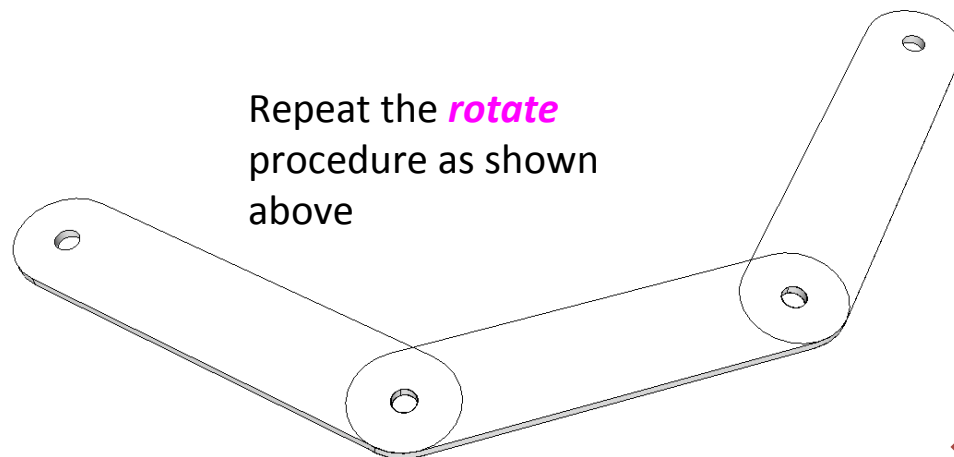
Repeat the *rotate* procedure as shown above
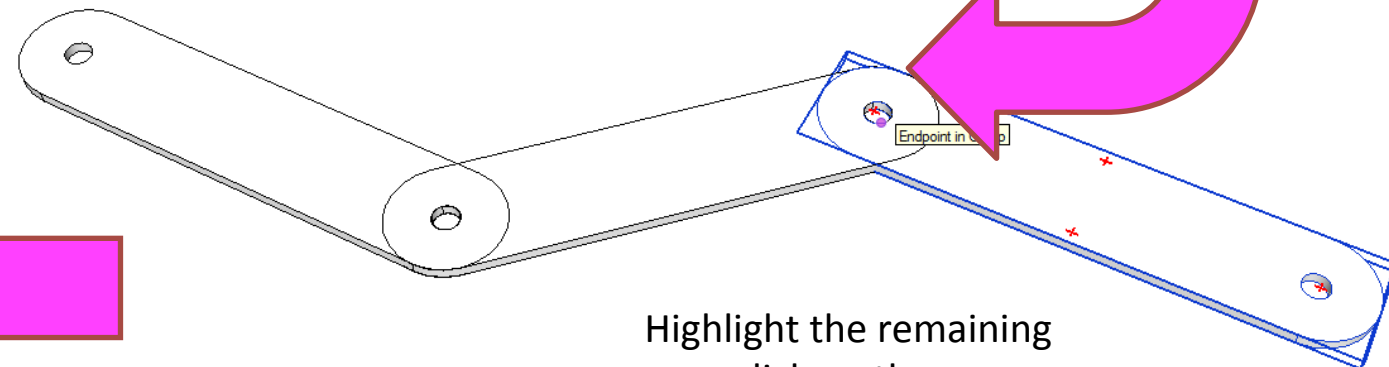
Highlight the remaining arm, click on the move tool. Move so that the arms are in a row joining the circles shown together
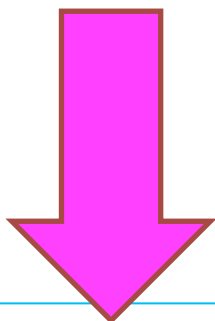
Computer Aided Design: Aircraft Lamp

## Computer Aided Engineering: Step by Step Guide to Lamp Construction
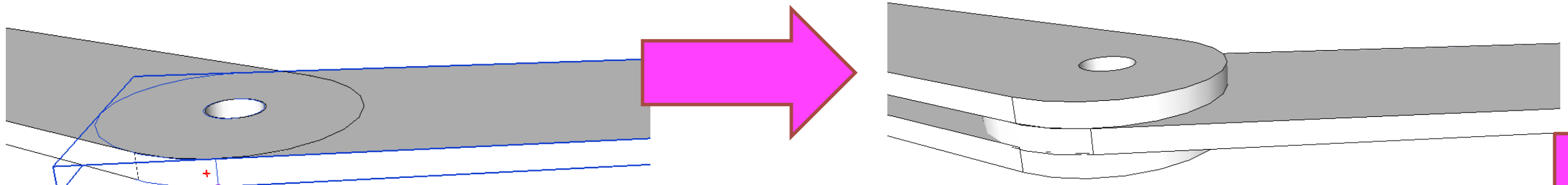
Highlight the middle arm, click on the move tool. Click on and edge and move the arm up so it sits on the bottom arm as shown above. *Hint you can type in the height you want to move it 3mm – 4mm. Make sure you are moving directly vertical on the* blue axis

Highlight the bottom arm this time, click on the move tool. Click on and edge and move the arm up so it sits on top of the arm shown. *Make sure you are moving directly vertical on the* blue axis

Repeat the process until your lamp looks like this.
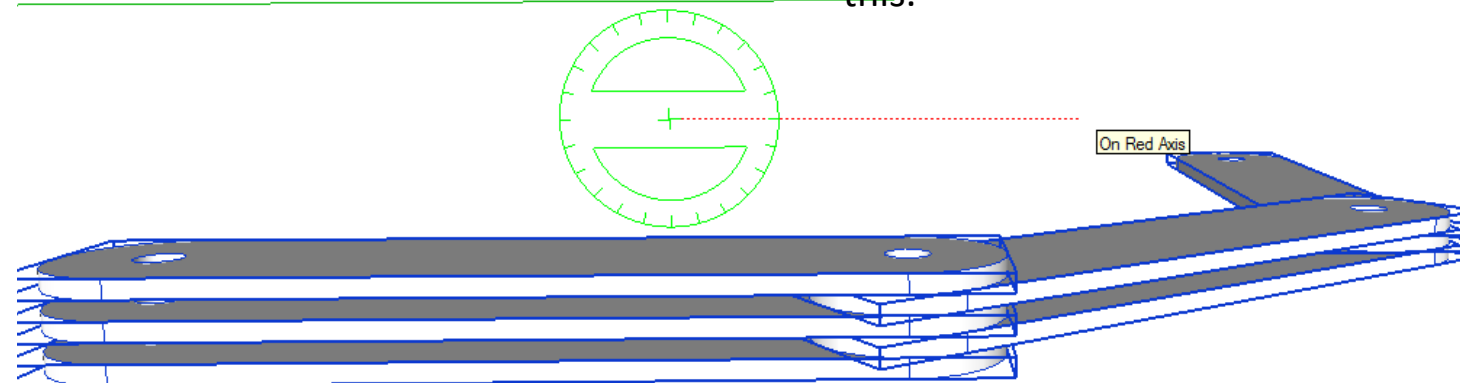
Highlight the entire lamp. Click on the rotate tool. When it is either **green** or red click to set it.

On Red Axis

Pull the line out on either the **green** or red axis. Click on the rotate tool. Type in 90 to rotate the lamp 90 degrees.

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction
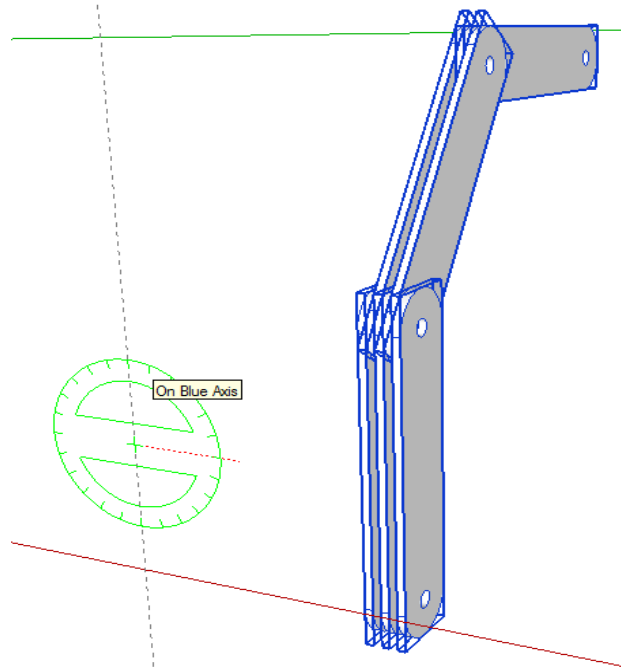
Rotate tool *You can use the **rotate** tool to rotate an object along the x,y or Z axis.*

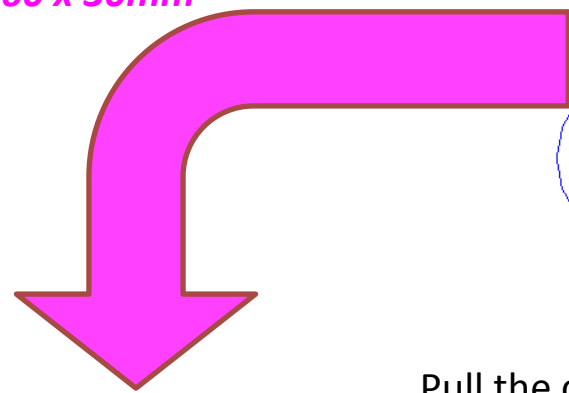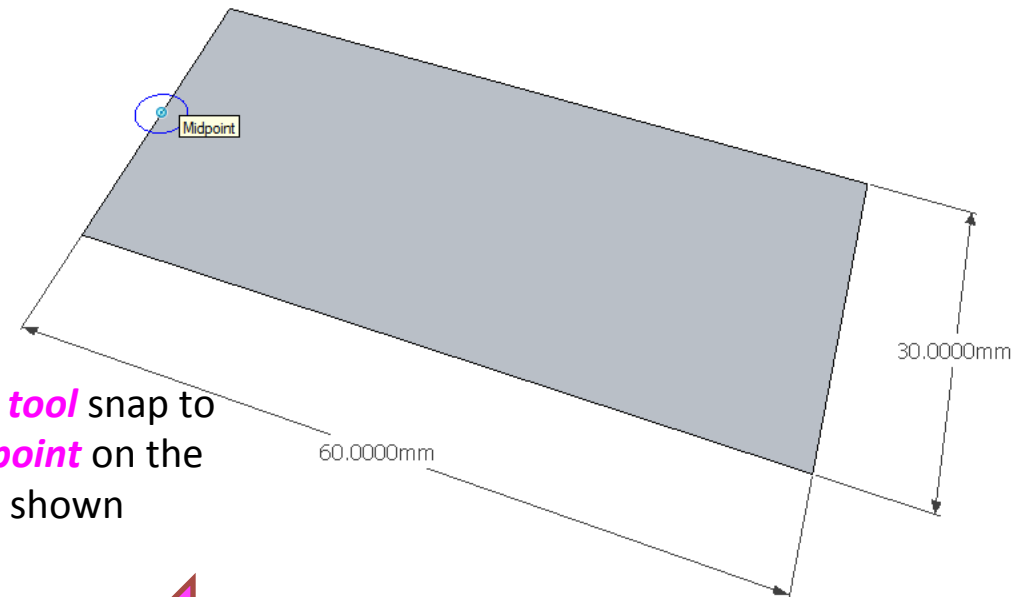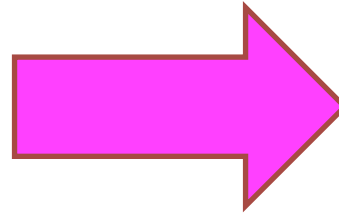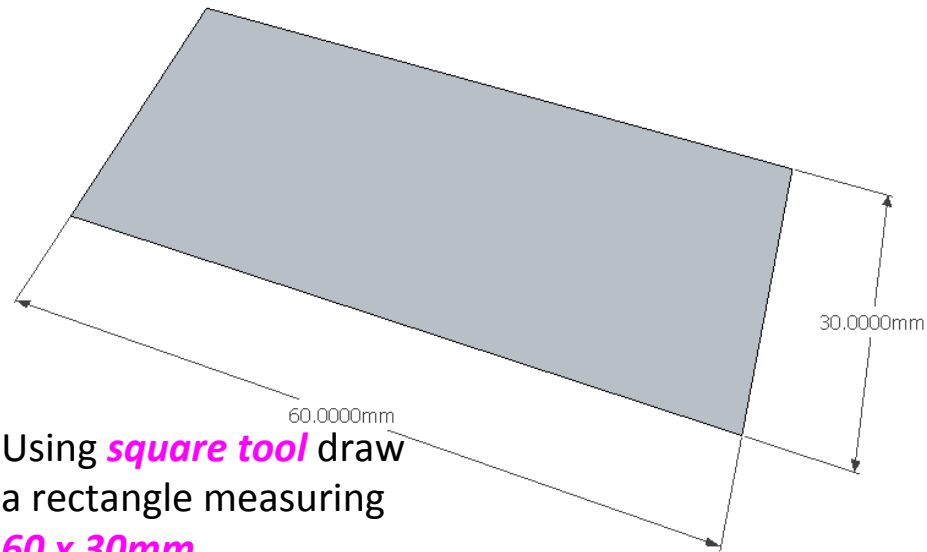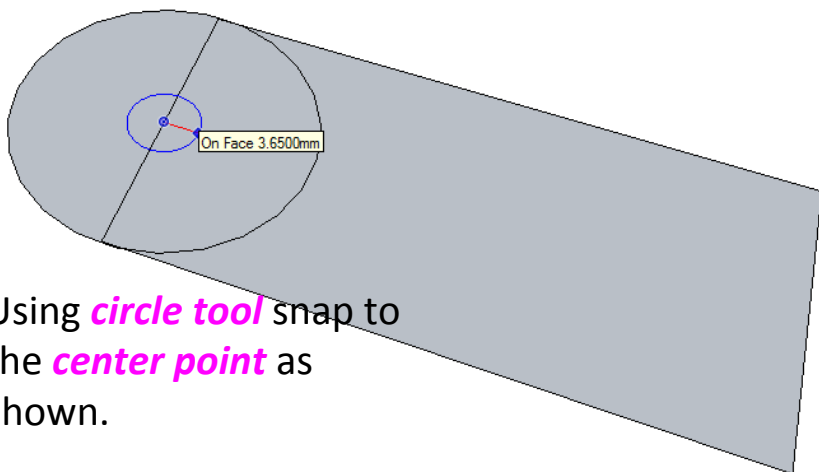***Advantages:***
Allows user to rotate and position shapes quickly to draw complex 3D shapes very quickly.

On Blue Axis
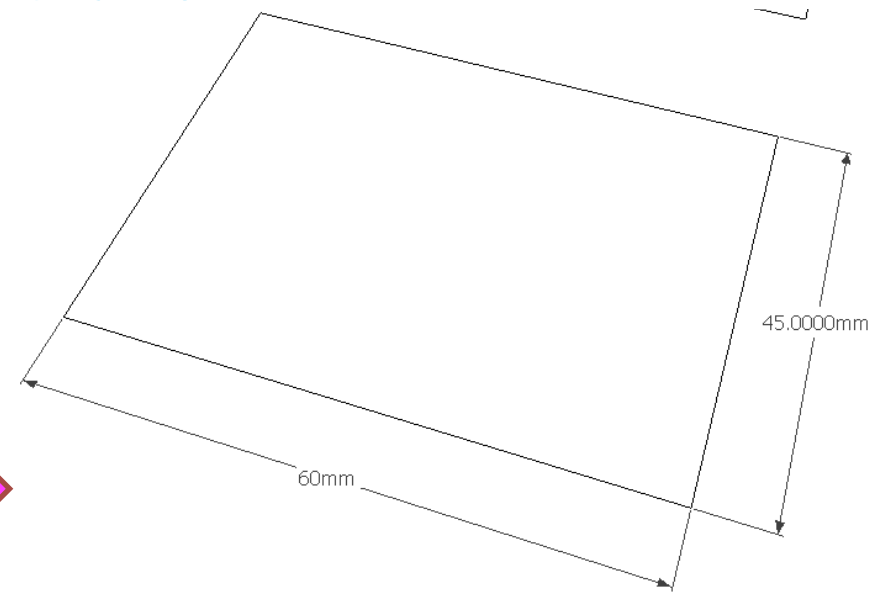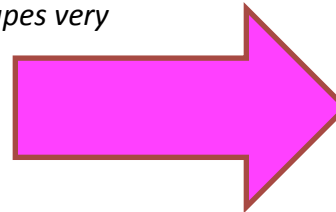
Use the ***rectangle tool*** to draw a rectangle that measures ***60mm x 45mm***
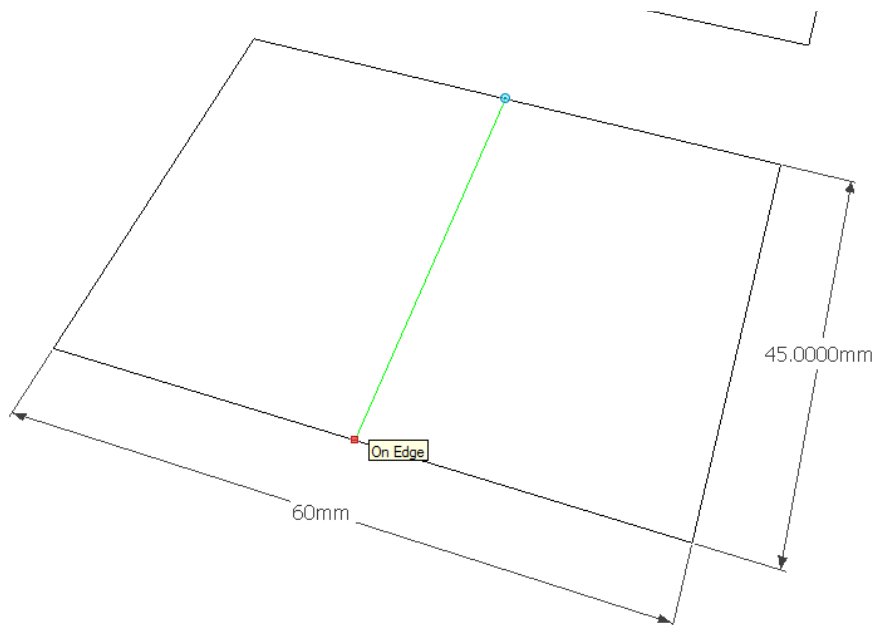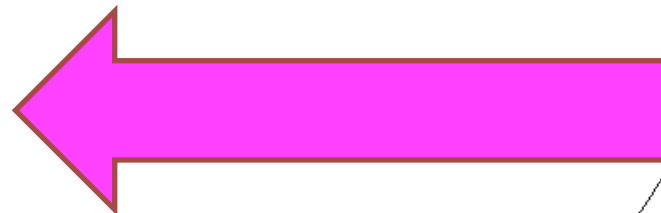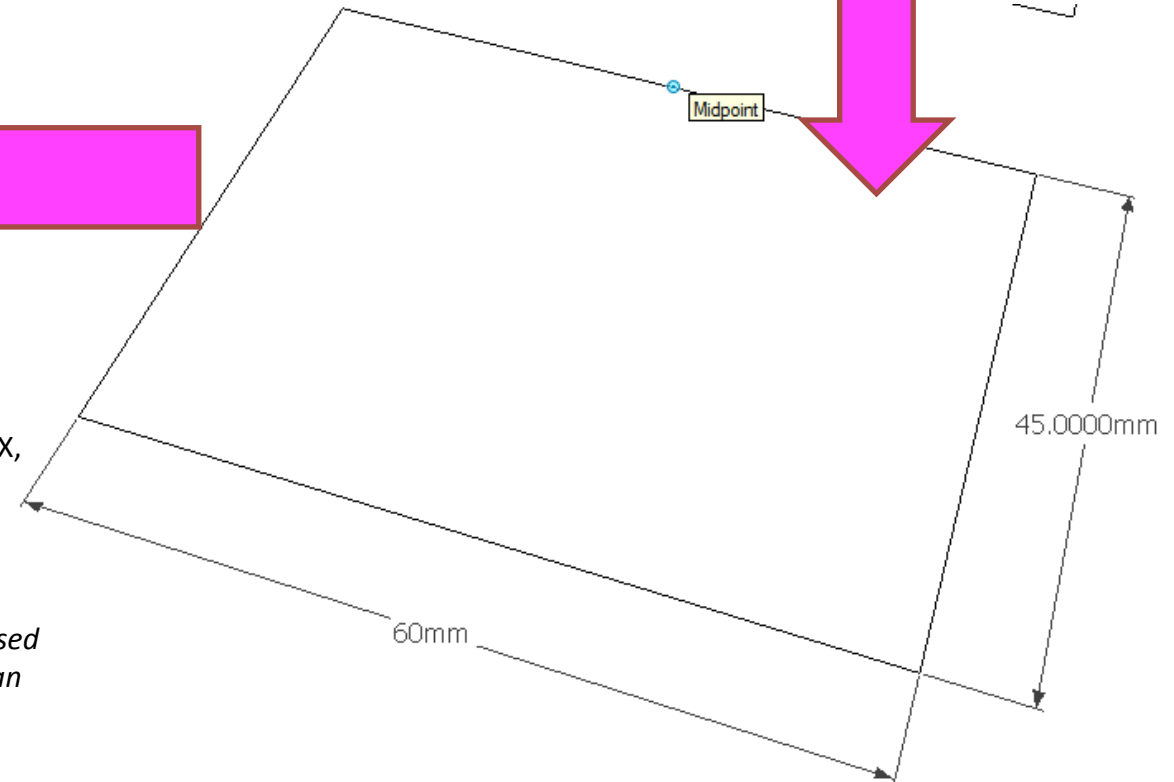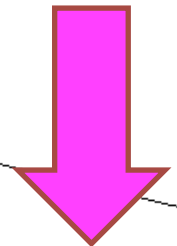
45.0000mm

60mm

Midpoint

45.0000mm

60mm

Pencil tool used to draw lines in X, Y and Z direction.

Advantages:
Allows user to draw or modify shapes very quickly and can be used to construct 3D objects faster than traditional hand drawings

45.0000mm

60mm

On Edge

Draw a line across the **green** or red axis to the opposite midpoint

Use the ***pencil tool,*** run it along one of the edges until it snaps to midpoint.

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

Midpoint
45.0000mm

60mm

Endpoint

Length 5.0000mm

or enter value.
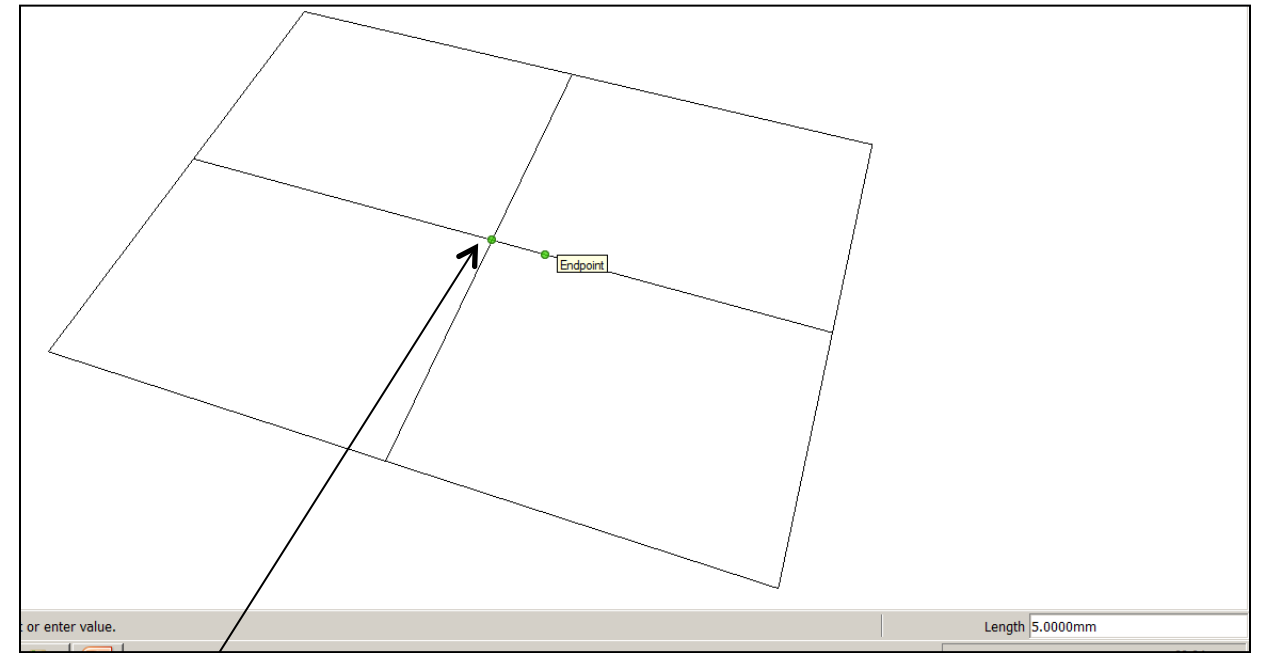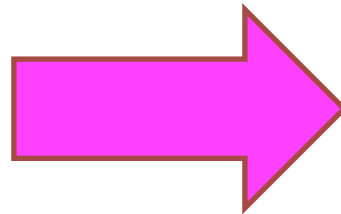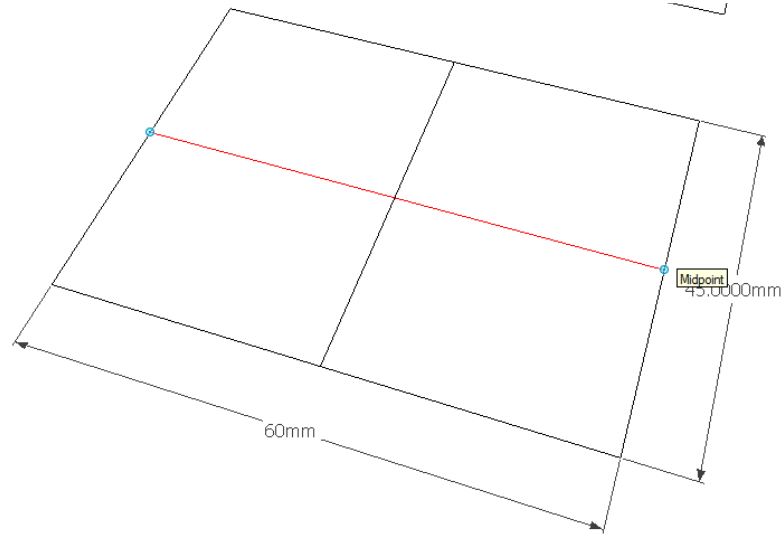
Repeat the process on the other edge

Use the *pencil tool.* Draw a line out from the center.
Type in *5*
Press *enter*
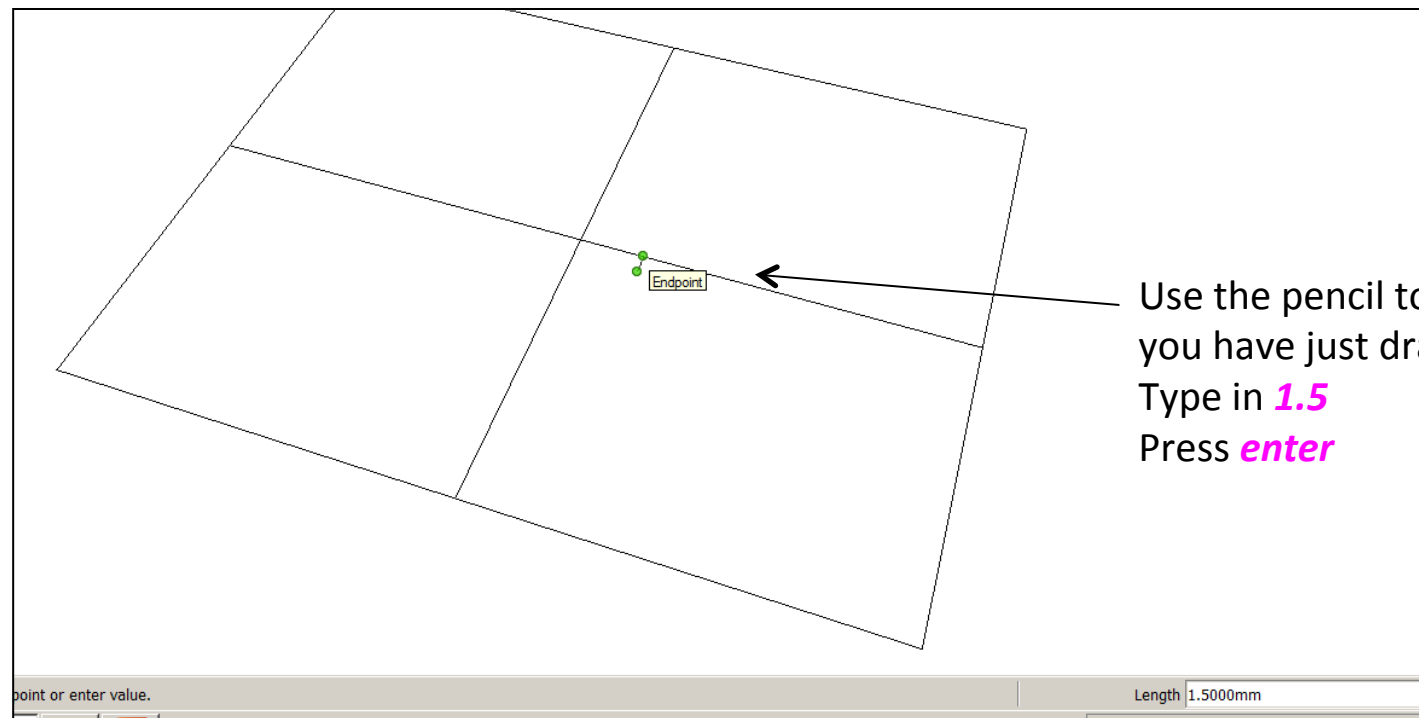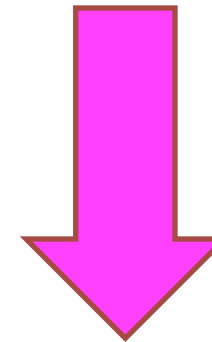
Endpoint

Use the pencil tool. Draw a line down from the endpoint of the last line you have just drawn.
Type in *1.5*
Press *enter*

point or enter value.

Length 1.5000mm

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

On Face

int or enter value.   Length 1.5
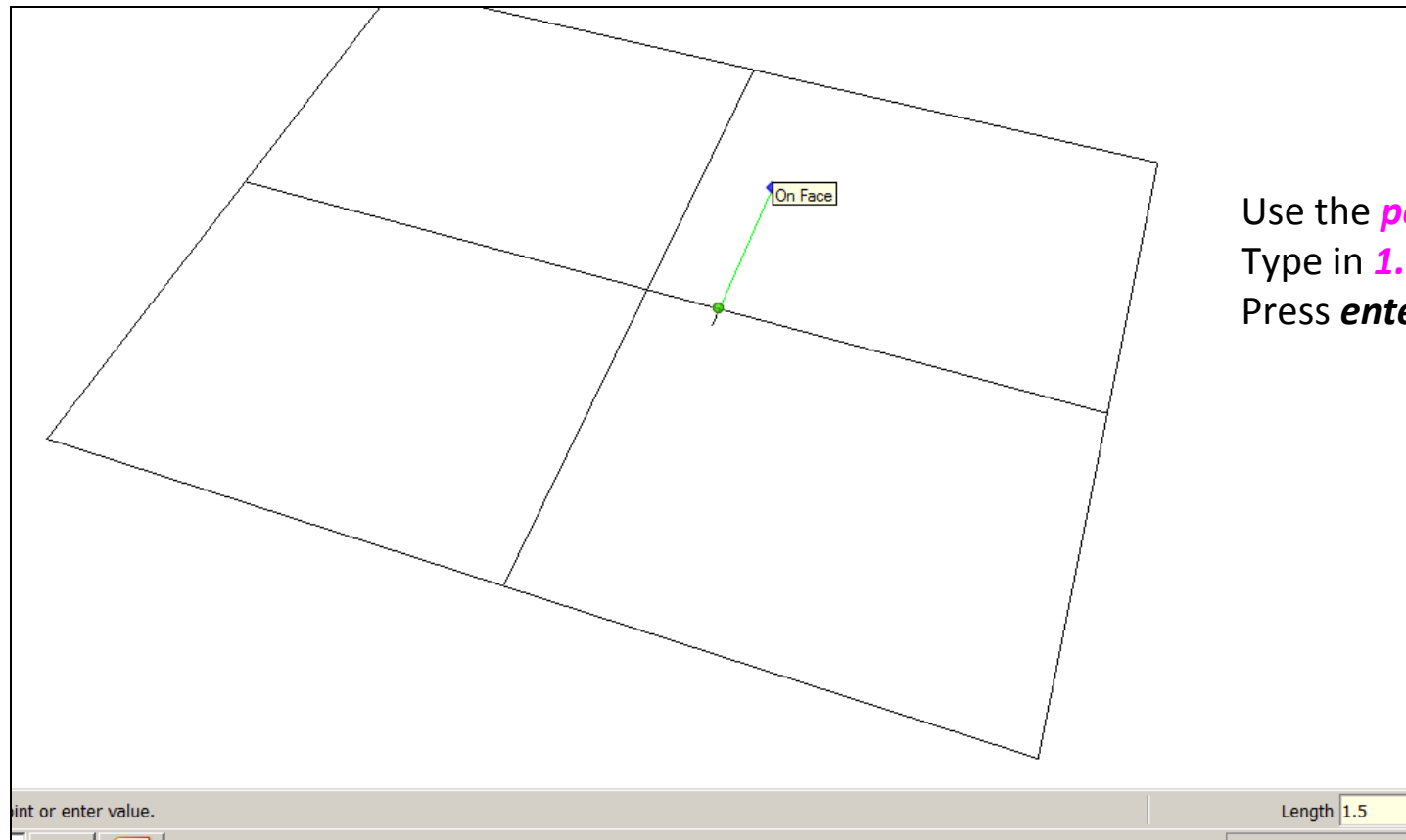
Use the **pencil tool**. Draw a line up this time from the center point.
Type in **1.5**
Press **enter**
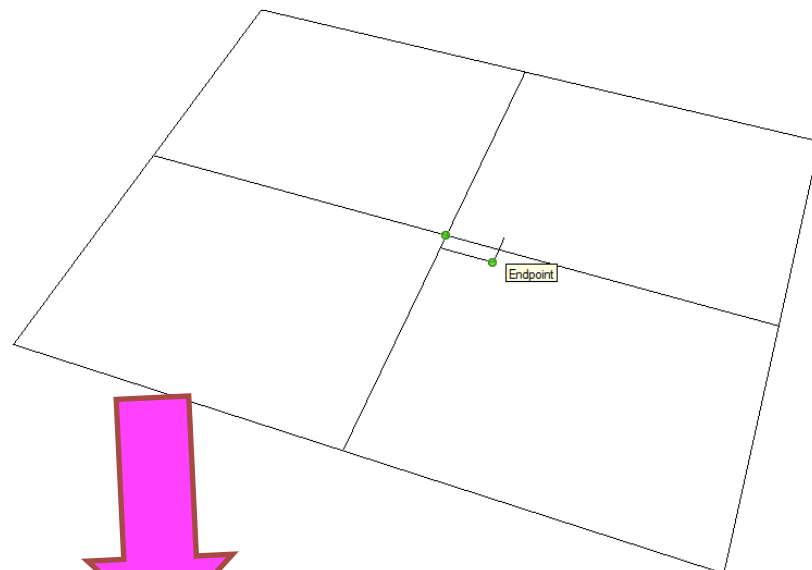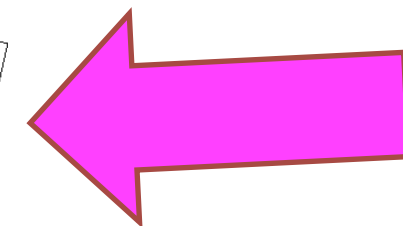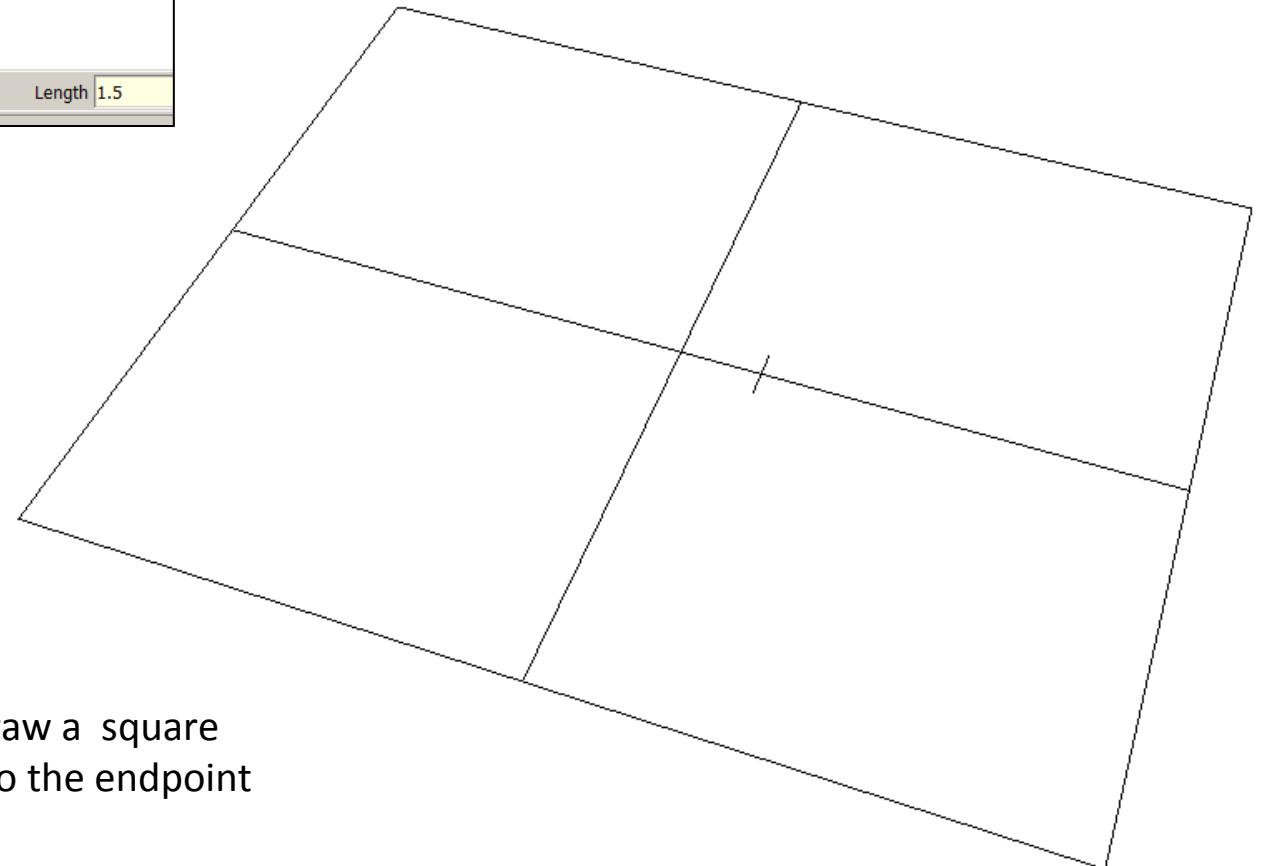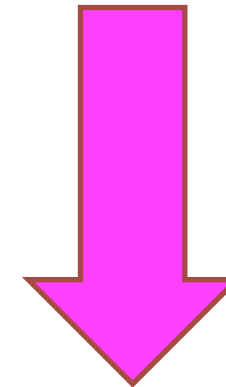
Endpoint

Use the **square tool.** Draw a square from the center point to the endpoint of one of the lines.
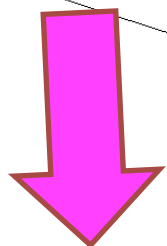
Computer Aided Design: Aircraft Lamp

Endpoint

On Face 5.0000mm
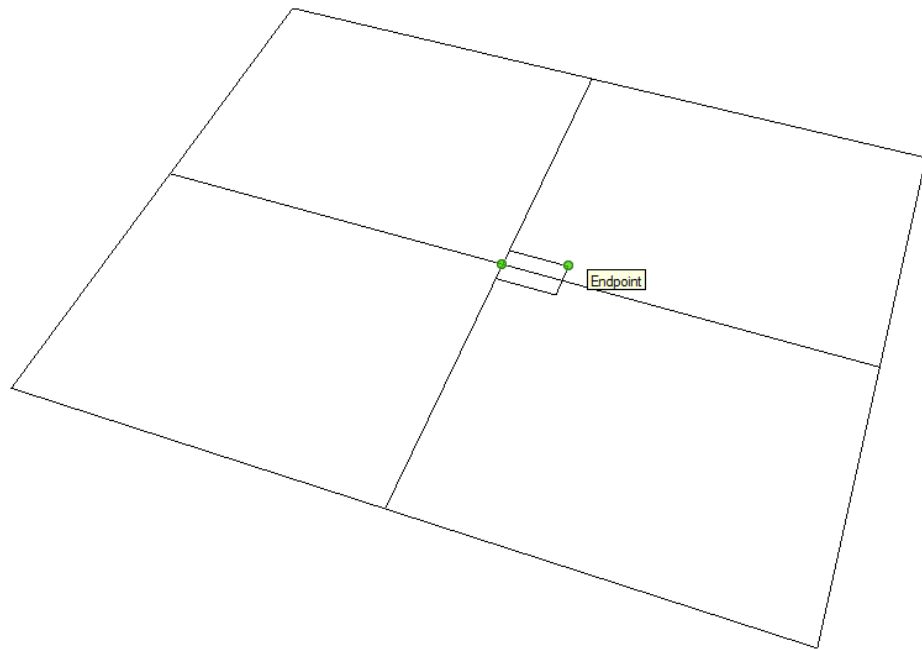
Use the *square tool*. Draw a square from the center point to the endpoint of other line
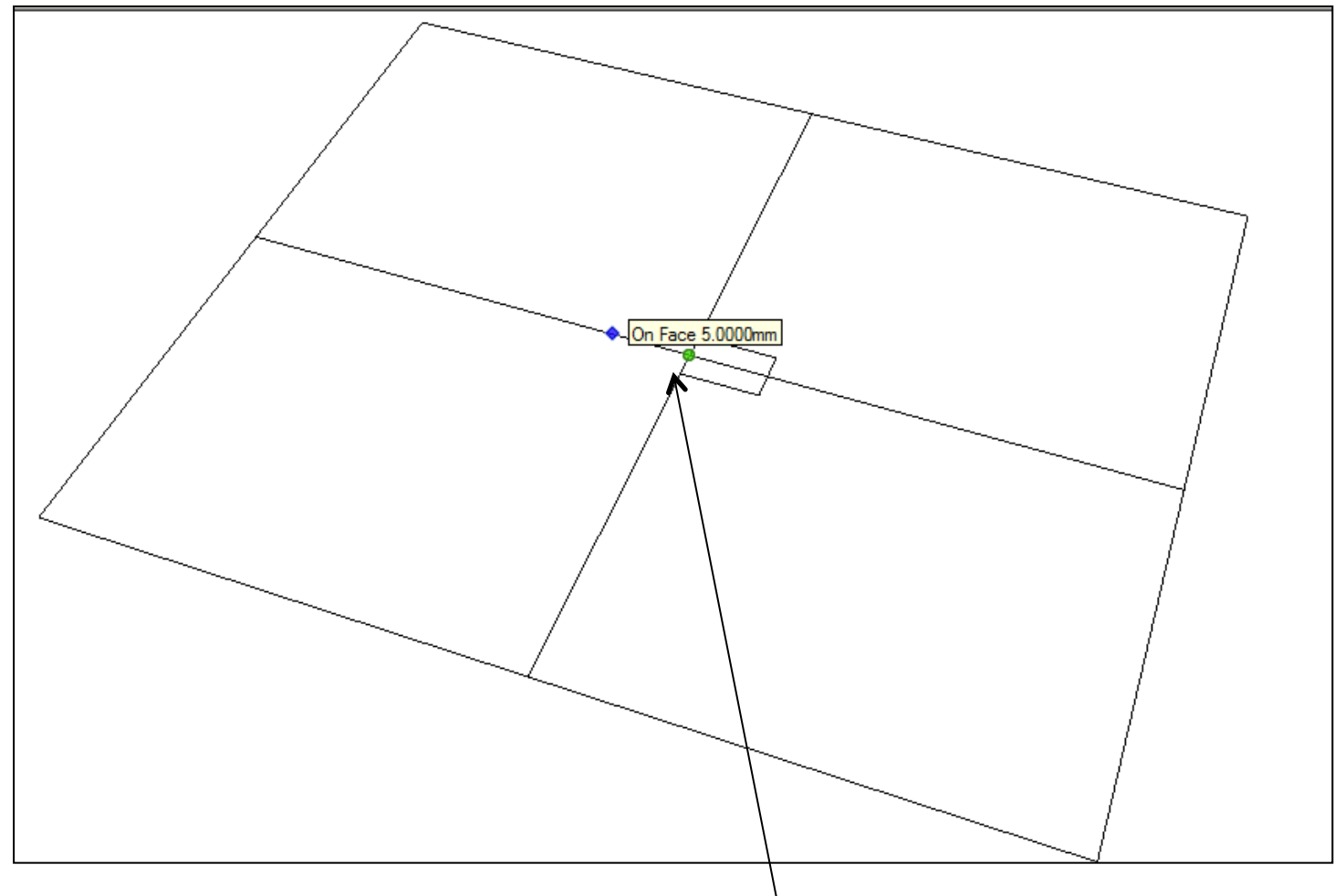
Use the *pencil tool.* Draw a line out from the center on the left hand side.
Type in *5*
Press *enter*

Endpoint
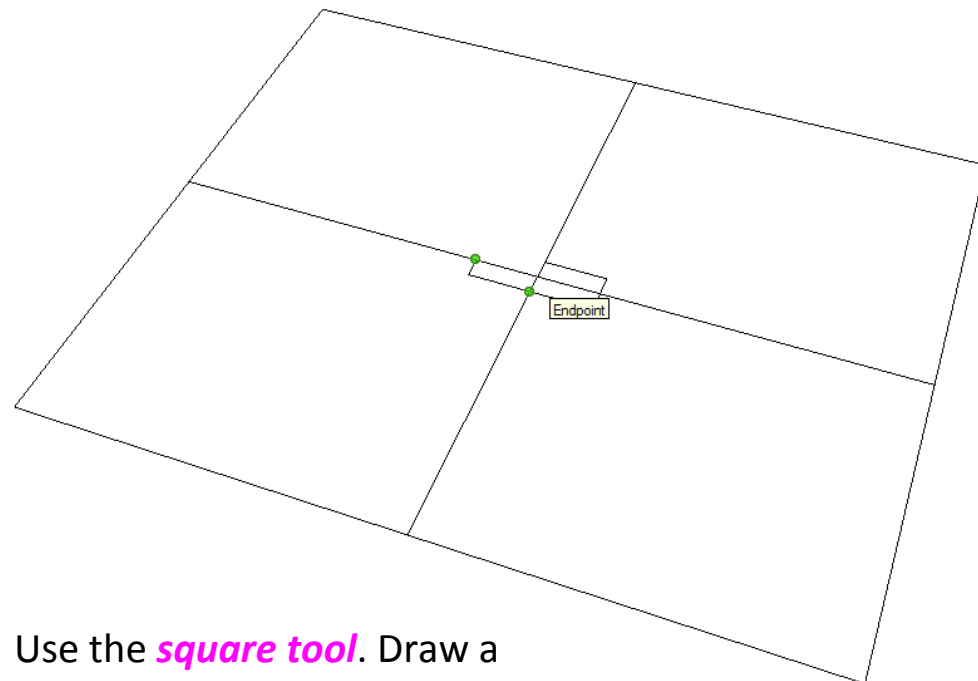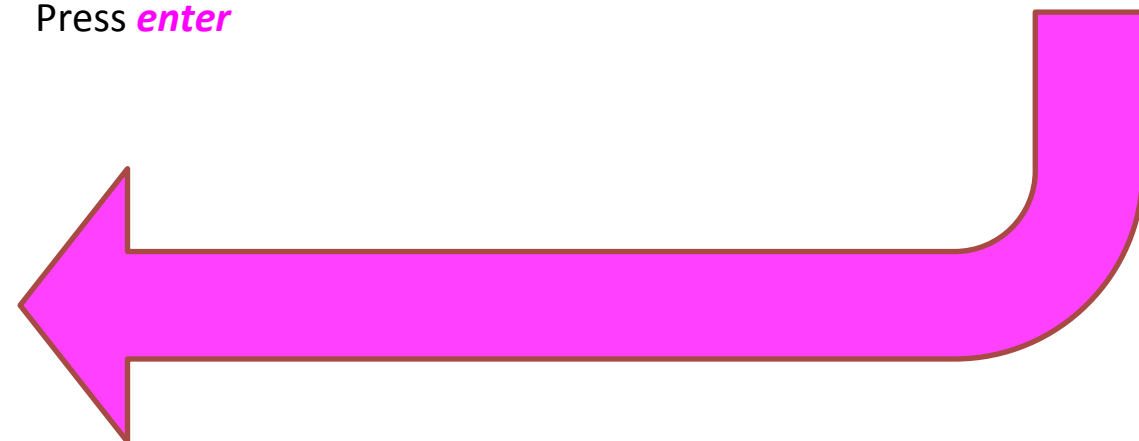
Use the *square tool*. Draw a square as shown above

Computer Aided Engineering: Step by Step Guide to Lamp Construction
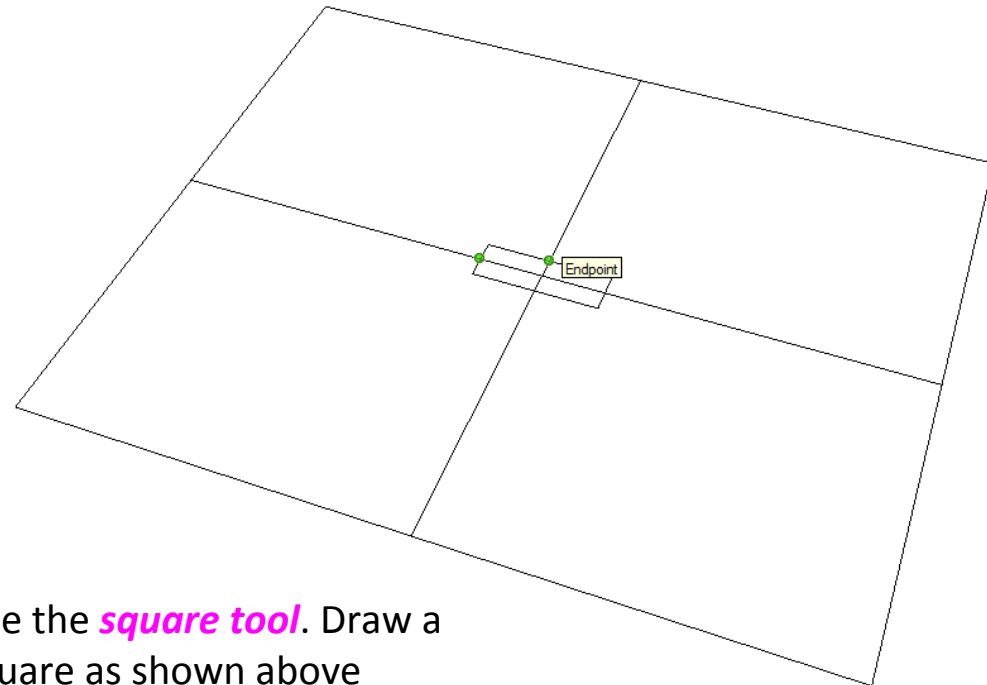
Use the *square tool*. Draw a square as shown above
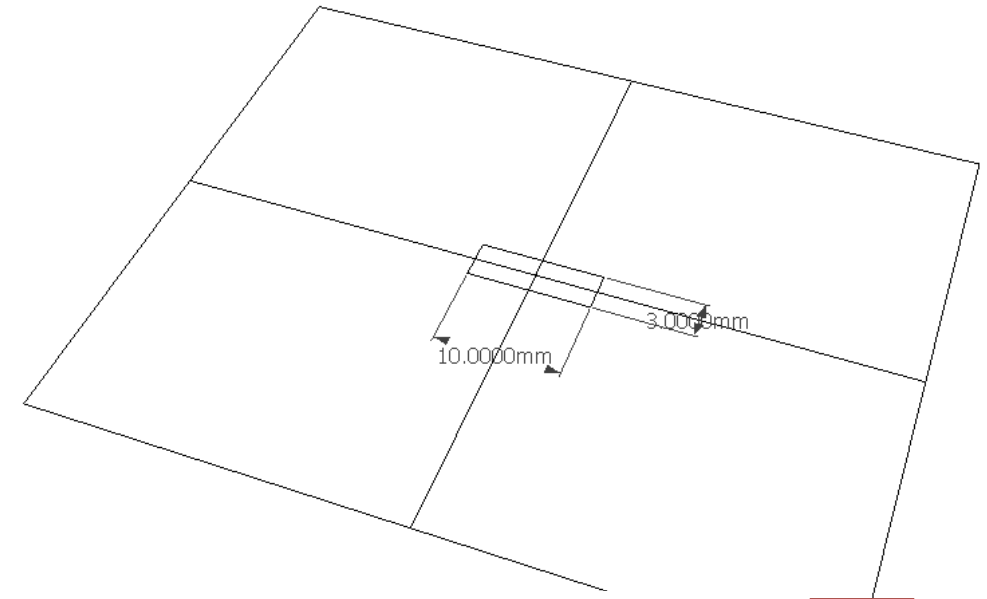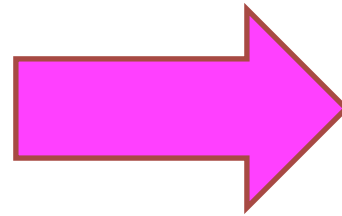
You should now have a center square that measures 10mm x 3mm

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.
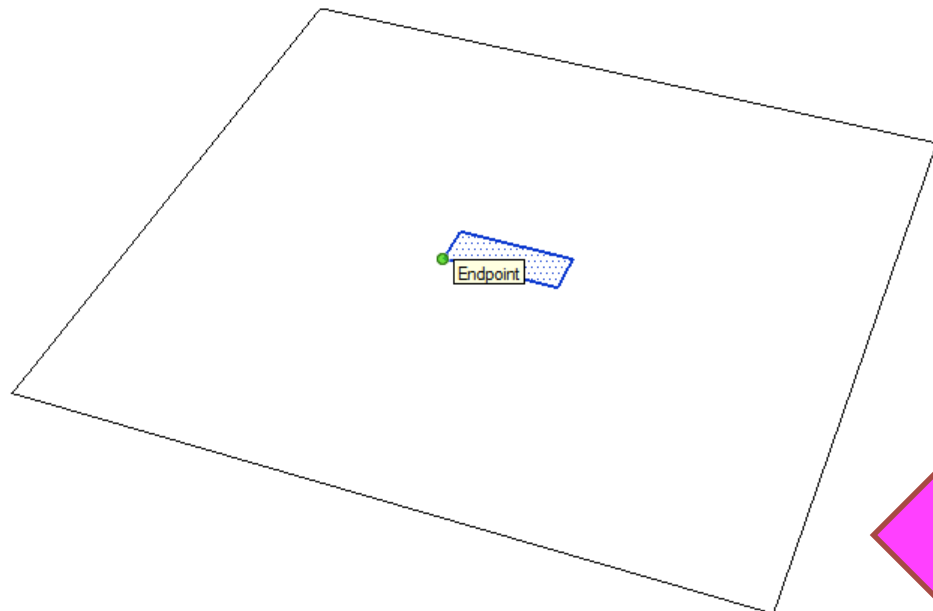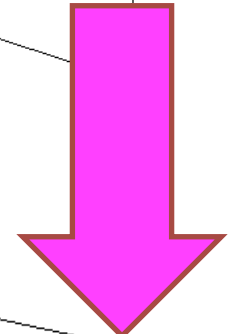
Click on the square three times to highlight it.
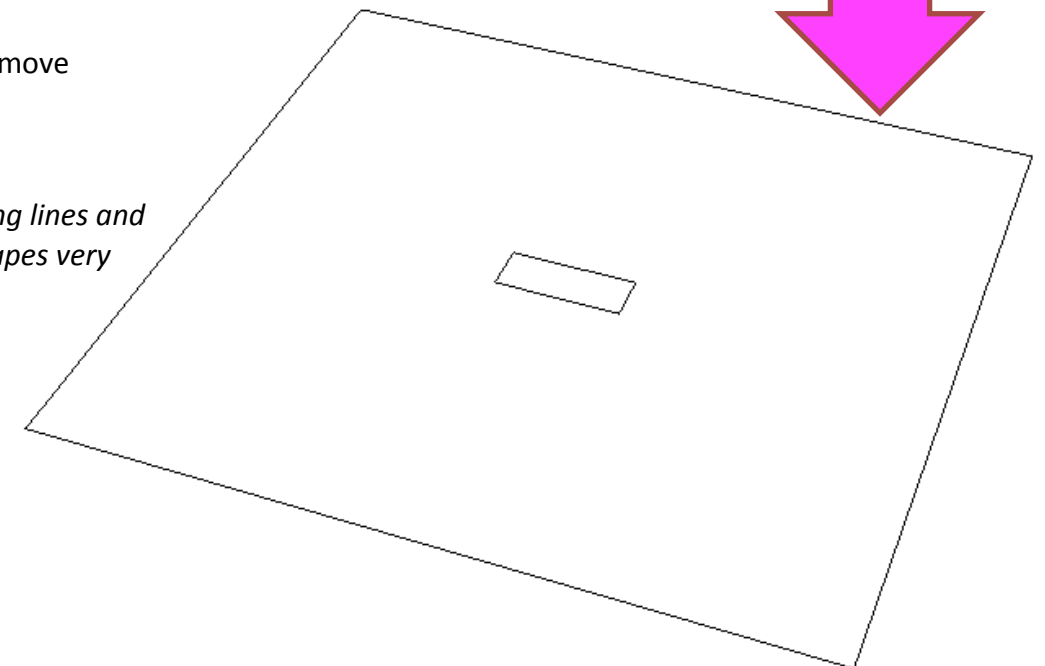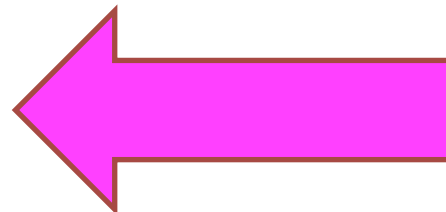
Use the *trim tool* to remove the guidelines no longer needed.

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction
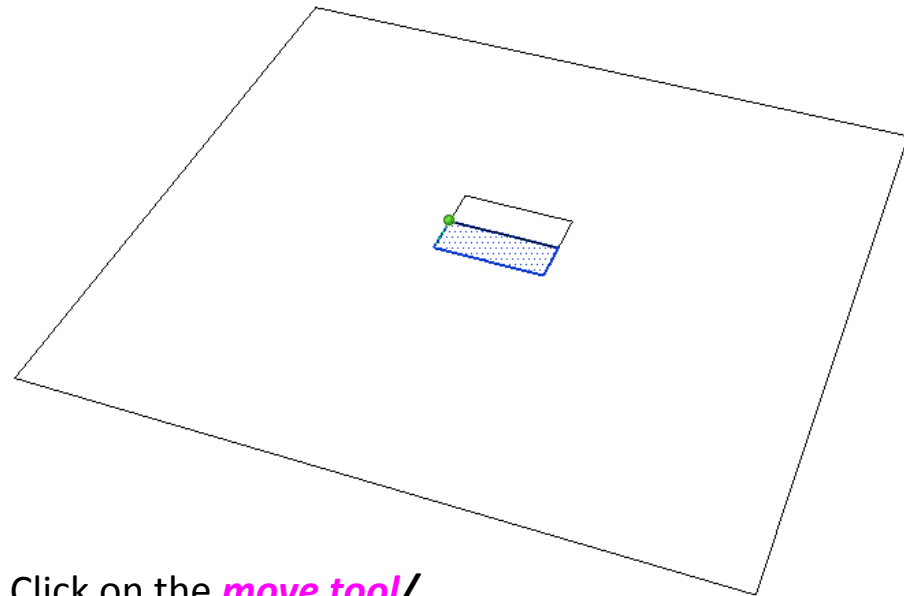
Click on the **move tool**/
Click on the bottom left hand corner of the square
Press Ctrl
Move on top of the last square.
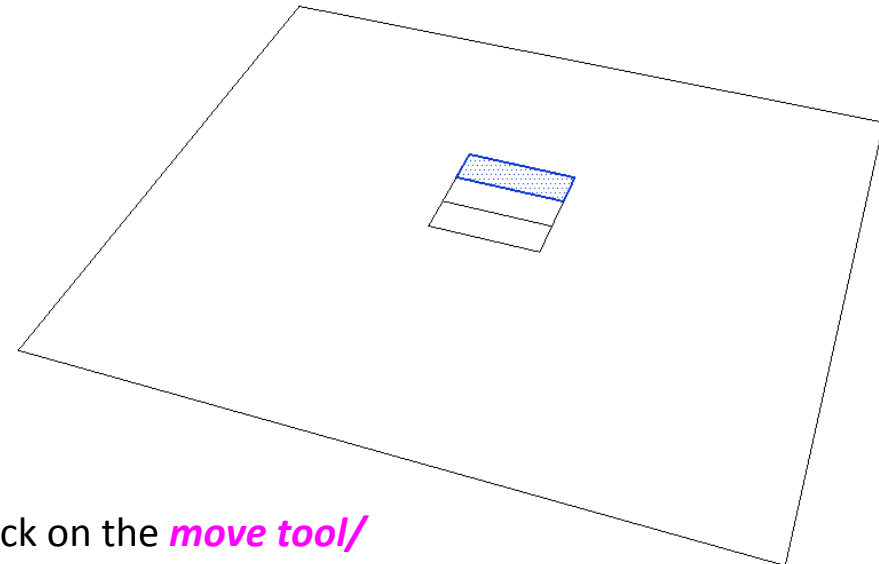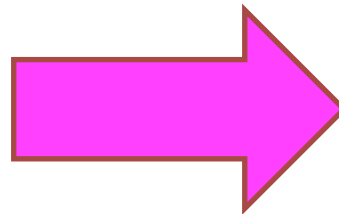
Click on the **move tool/**
Click on the bottom left hand corner of the square
Press Ctrl
Move on top of the last square.
Repeat process until you have four squares
Above the middle square
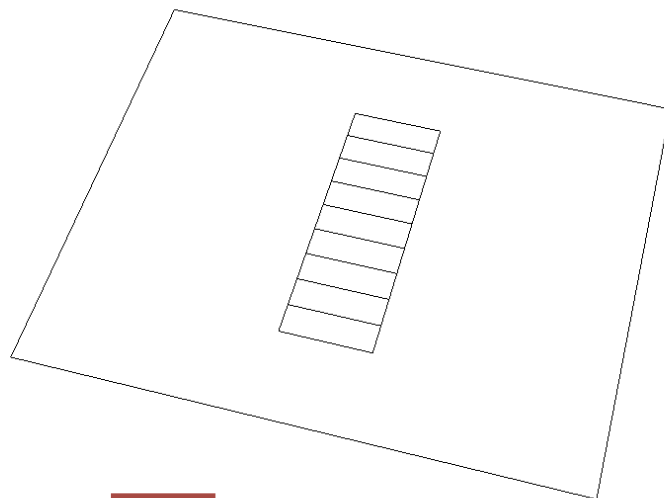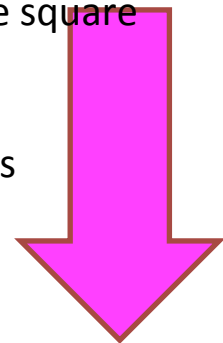
Click on the **move tool/**
Click on the bottom left hand corner of the square
Press Ctrl
Move below the center square
Repeat process until you have four squares
Above the middle square
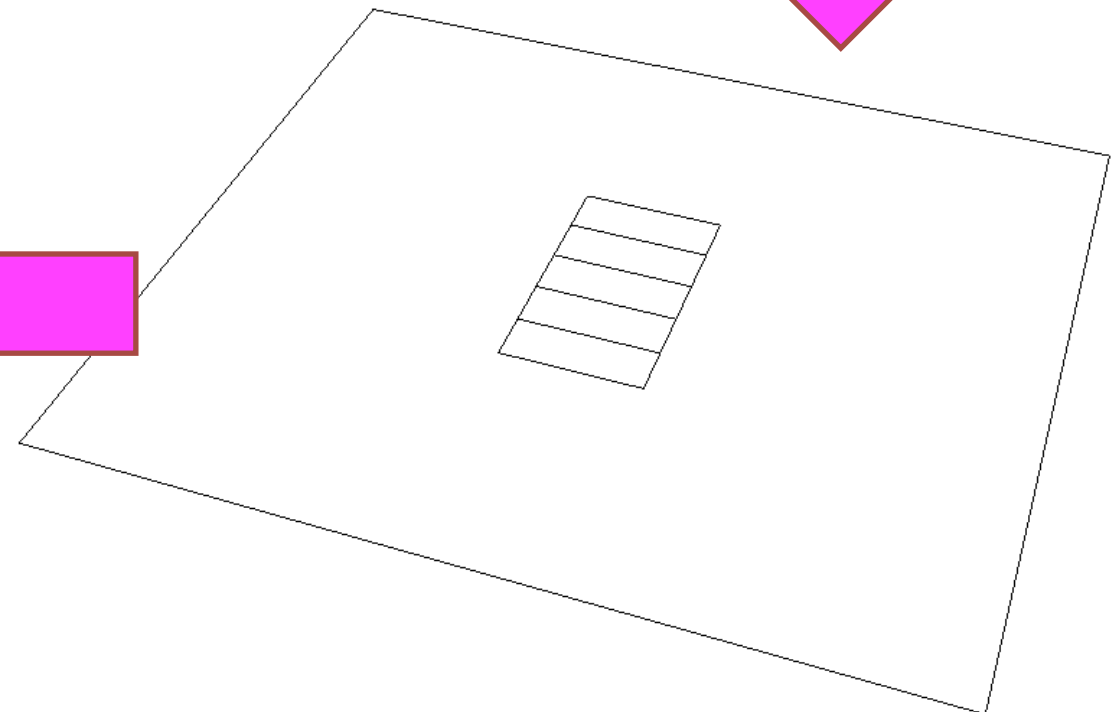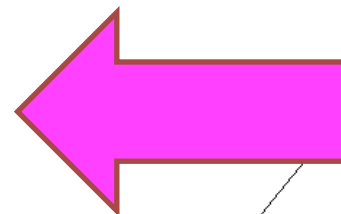
Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction
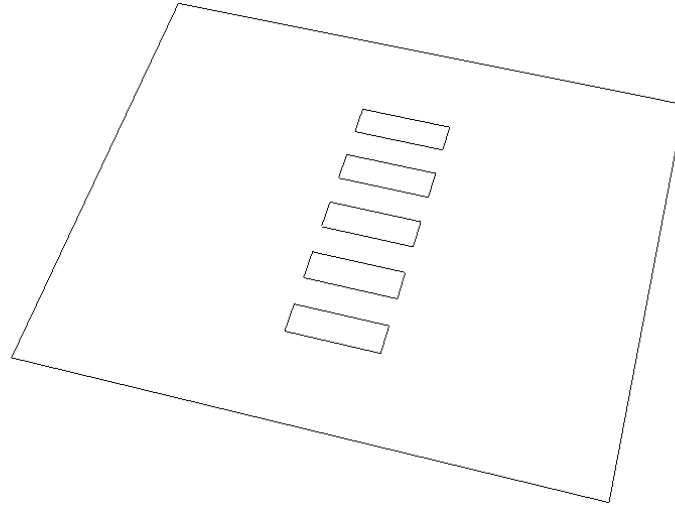
Use the *trim tool* to remove the alternative squares either side of the center square.
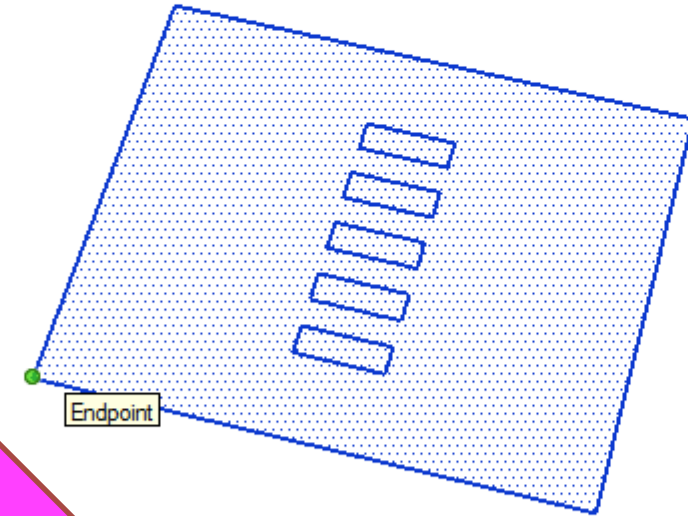
Click on the square **three times** to highlight as shown.
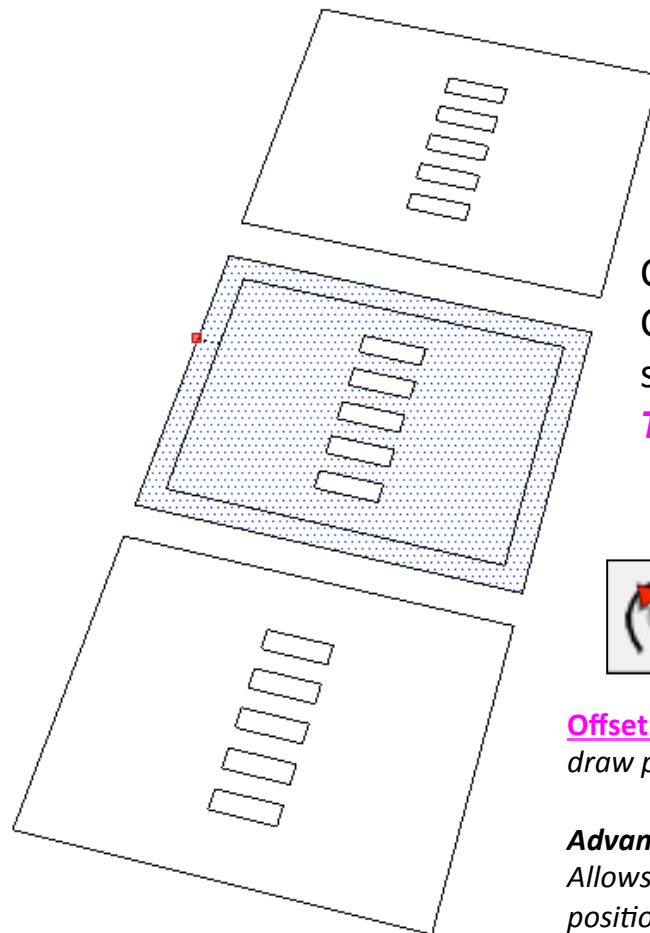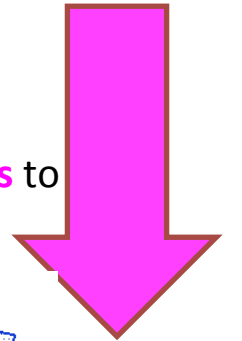
Click on the offset tool/
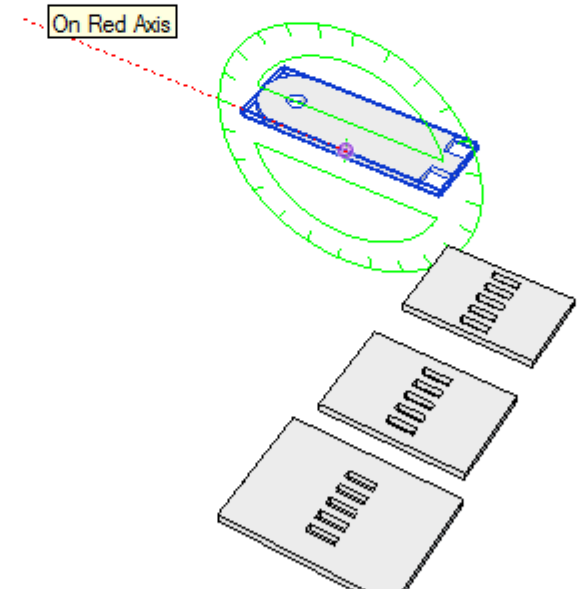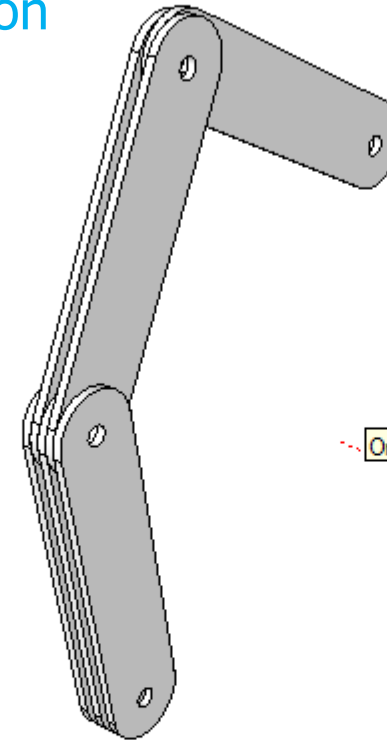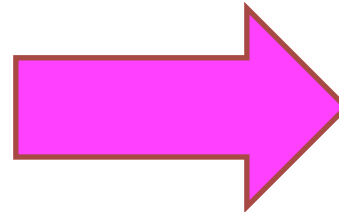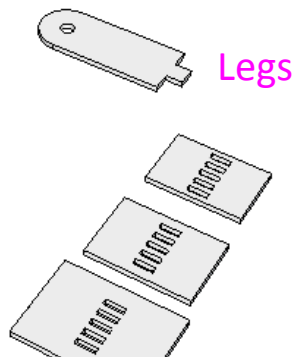Click on the outside edge of the middle square
Type in 2 and press *enter*

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.
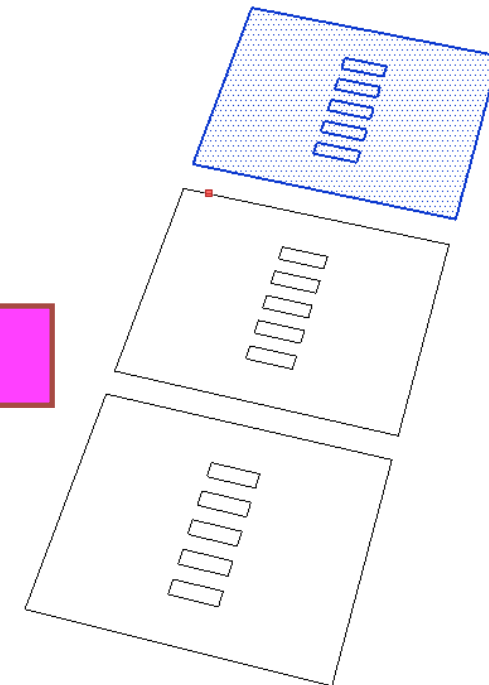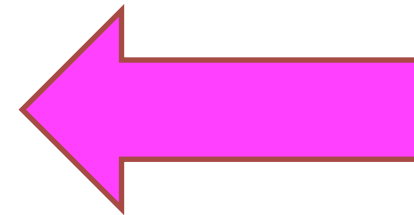
Click on the *move tool/*
Click on the bottom left hand corner of the square
Press Ctrl
Move below the square above the original
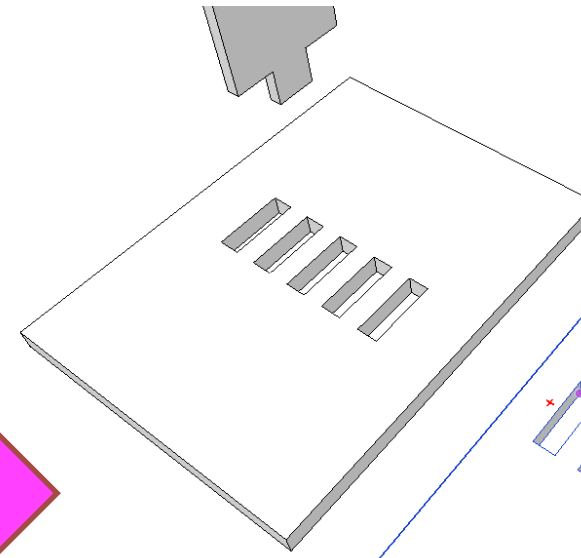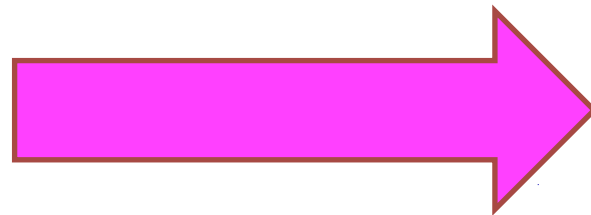Repeat process until you have three square base pieces

Endpoint

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

Click on the offset tool/
Click on the outside
edge of the top square
Type in 4 and press
enter

Use the push/
pull tool/
Raise each
base piece
3mm

Use the trim tool/
Delete the outside edges

Entity Info
Erase
Hide

Explode
Select
Area
Make Component
Make Group
Intersect Faces
Reverse Faces
Flip Along
Soften/Smooth Edges
Zoom Selection

Add Photo Texture

Click on the square
three times to highlight
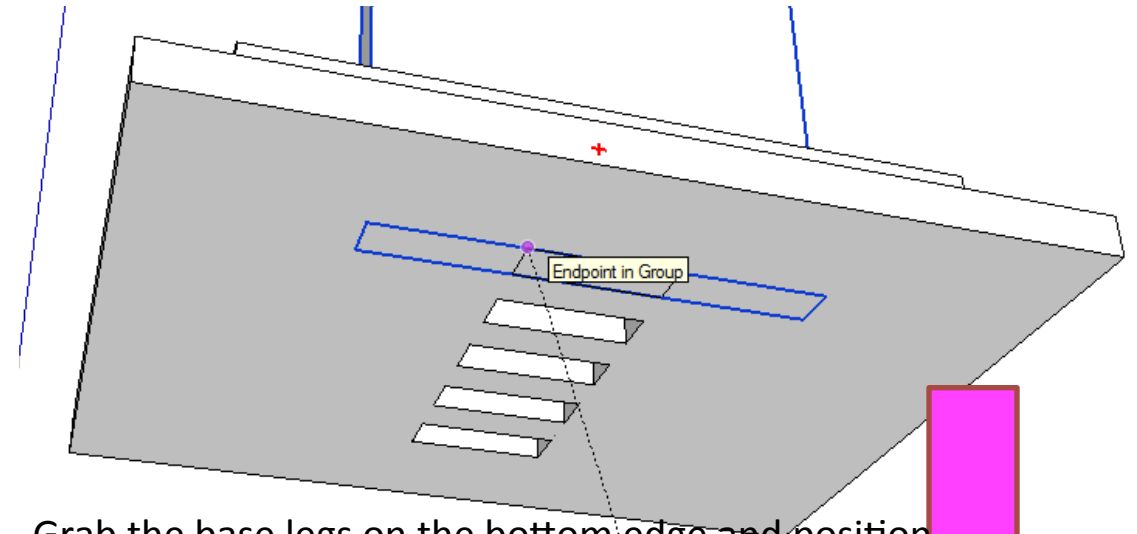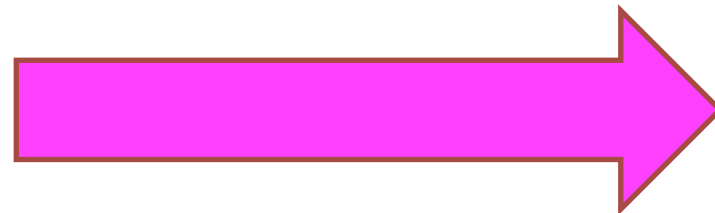as shown. Right click
and *make group*

Repeat process for
remaining base pieces

Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction

Using **square tool** draw a rectangle measuring *60 x 30mm*

30.0000mm

60.0000mm

Using **circle tool** snap to the **center point** on the top edge as shown

Midpoint

30.0000mm

60.0000mm

Endpoint

Pull the circle out and type in *15* and **press enter**

30.0000mm

60.0000mm

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.

On Face 3.6500mm

Using **circle tool** snap to the **center point** as shown.

Type in radius *3.675*.

Using **trim tool** delete all the lines no longer needed.

Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction

Pencil tool used to draw lines in X, Y and Z direction.

Advantages:
Allows user to draw or modify shapes very quickly and can be used to construct 3D objects faster than traditional hand drawings

On Green Axis 5.0000mm
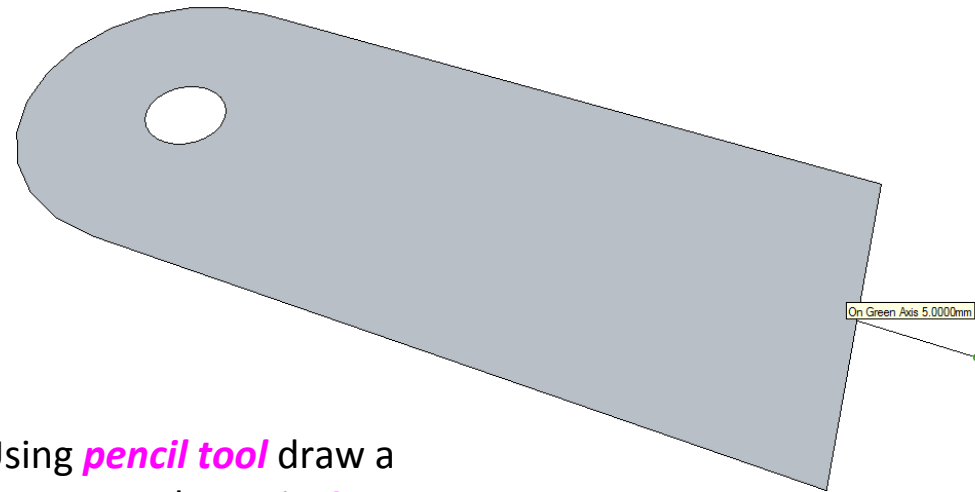
Using **pencil tool** draw a line out and type in **9**
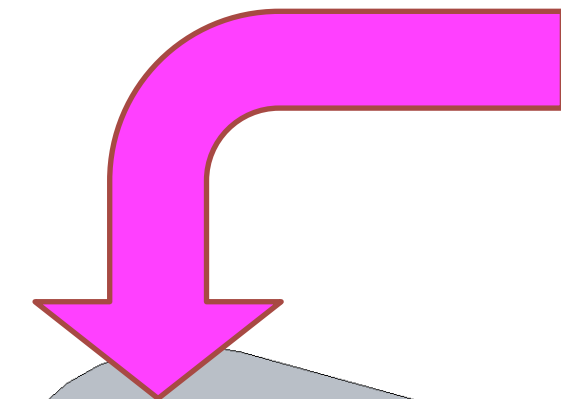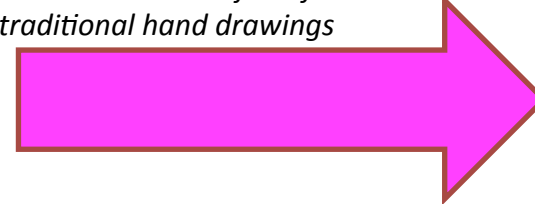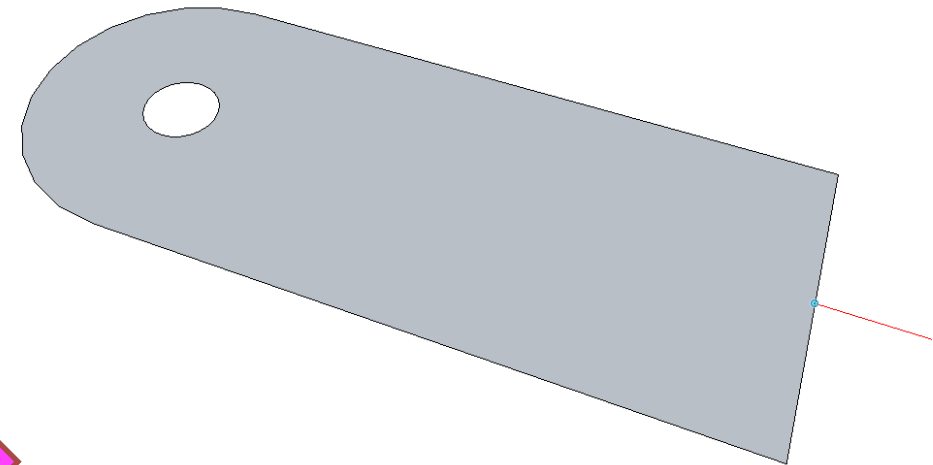
Using **pencil tool** draw a line up from the end and type in **5**

On Green Axis 5.0000mm

Endpoint
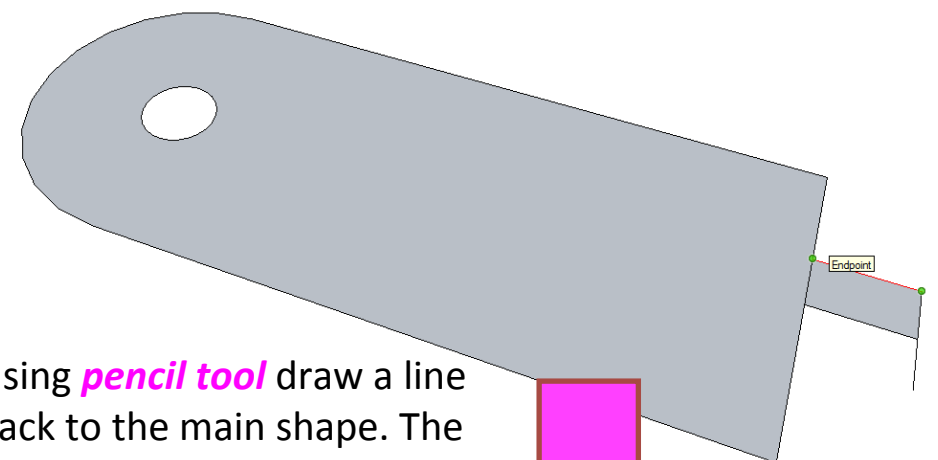
Using **pencil tool** draw a line back to the main shape. The rectangle should fill in grey

Using **pencil tool** draw a line from the center point down ***and type in 5***
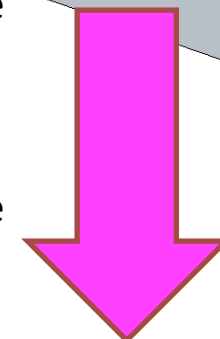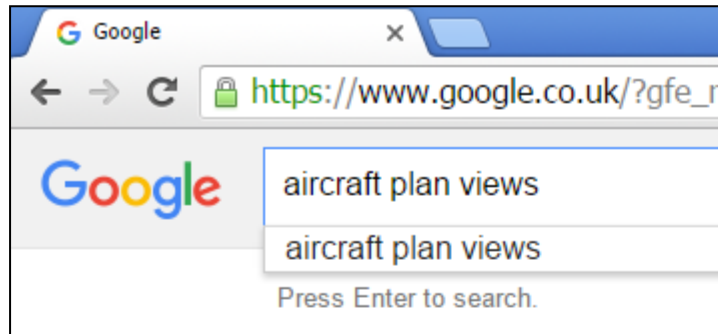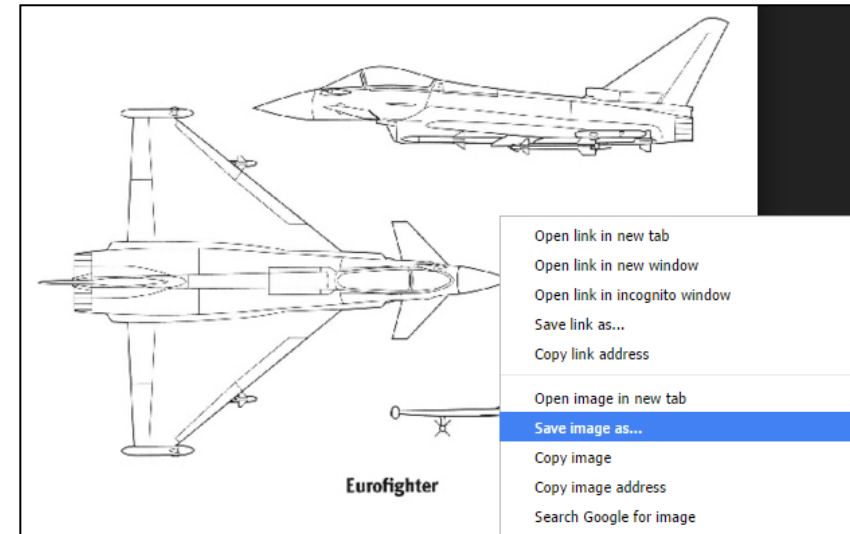
Computer Aided Engineering: Learning Aim A: Task 3

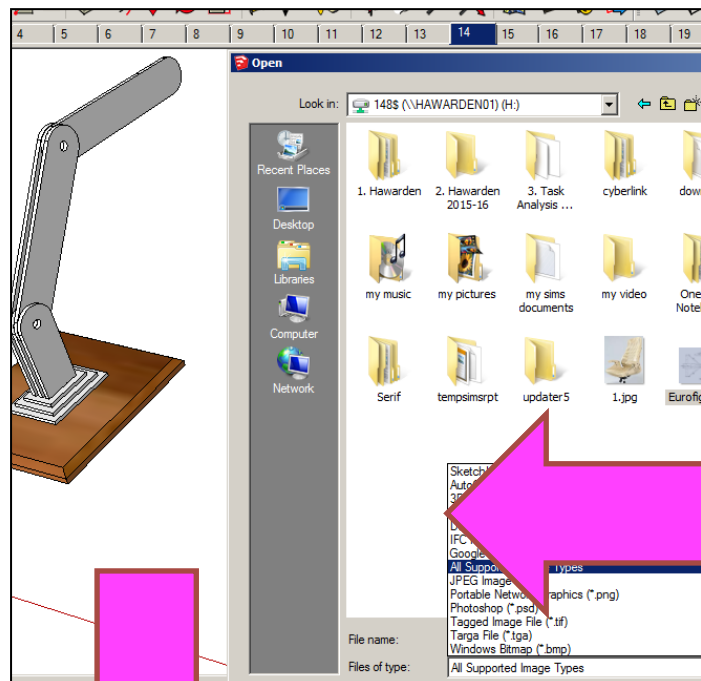## Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction

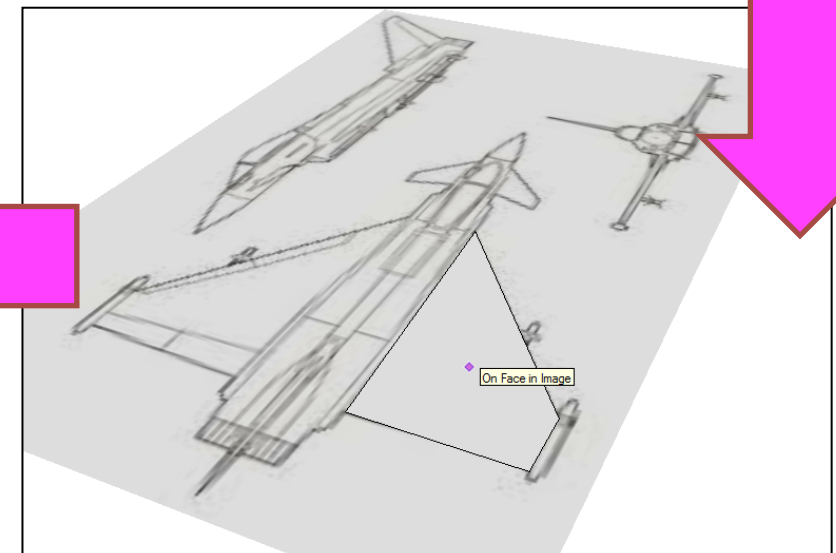Using *pencil tool* draw a line back to the main shape. The rectangle should fill in grey

From Point
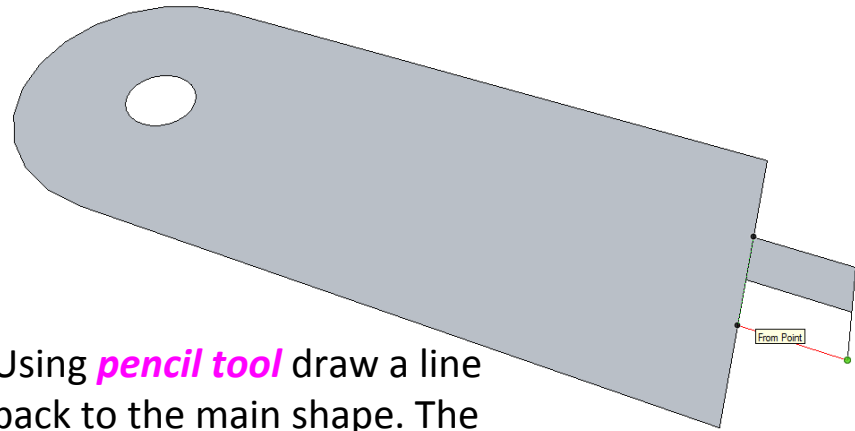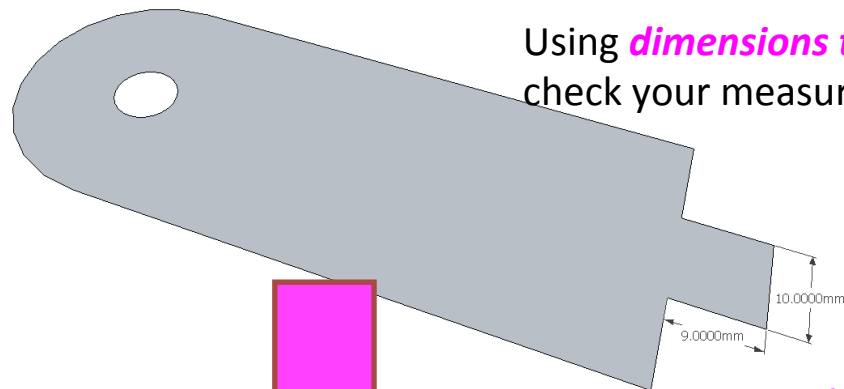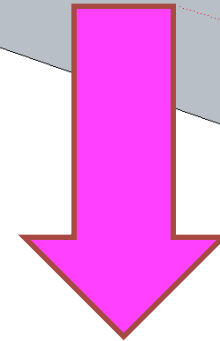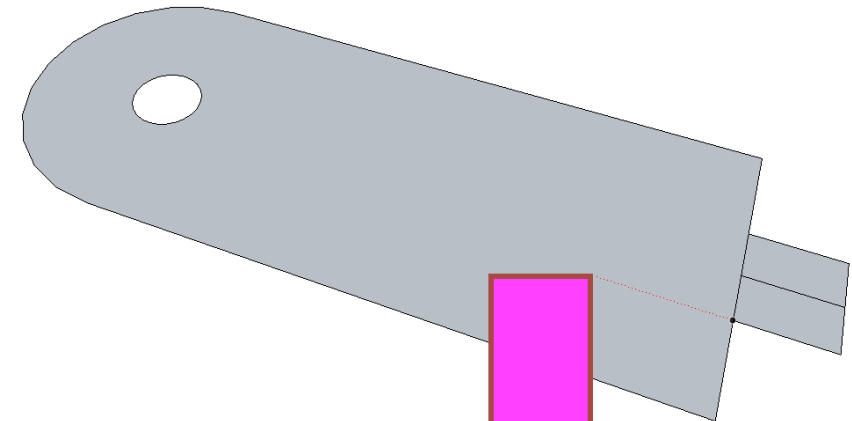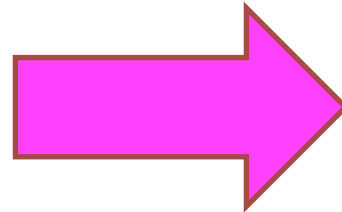
Using *dimensions tool* check your measurements

10.0000mm
9.0000mm

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
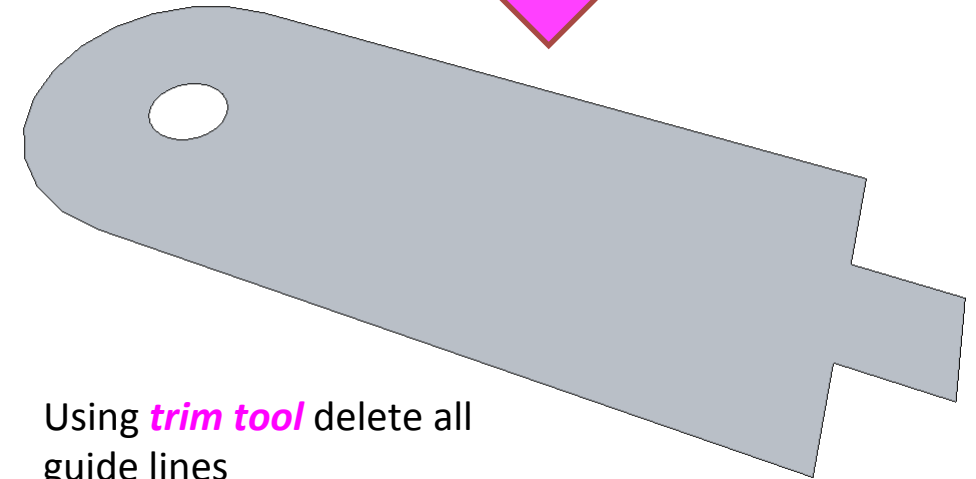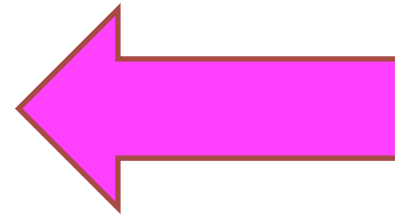
Using *trim tool* delete all guide lines
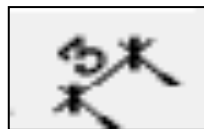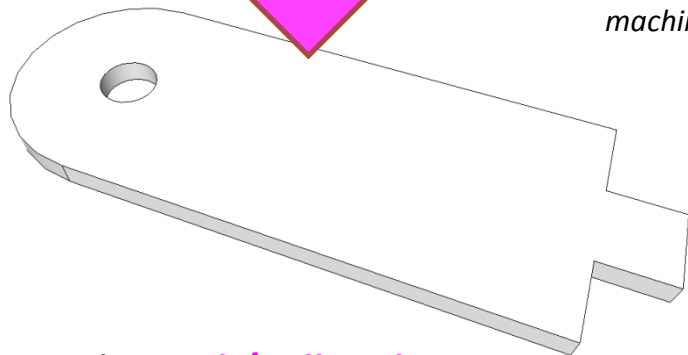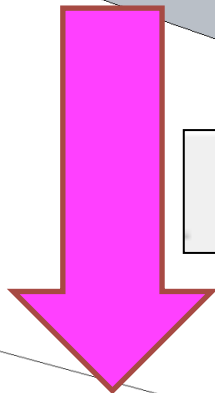
Using the *push/pull tool* pull the object up by *3*

Entity Info
Erase
Hide
Explode
Select
Area
Make Component
Make Group
Intersect Faces
Reverse Faces
Flip Along
Convert to Polygon
Explode Curve
Soften/Smooth Edges
Zoom Selection
Add Photo Texture
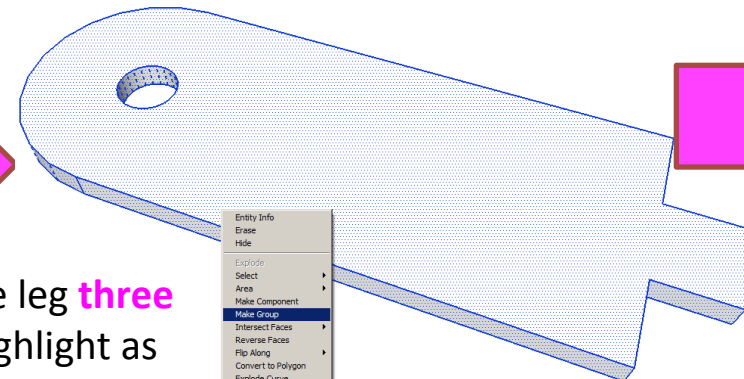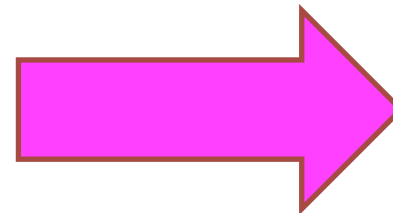
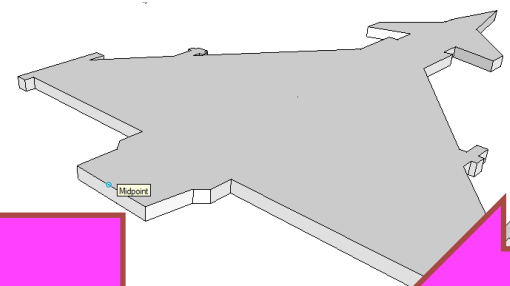Click on the leg **three times** to highlight as shown. Right click and *make group*

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

Arms
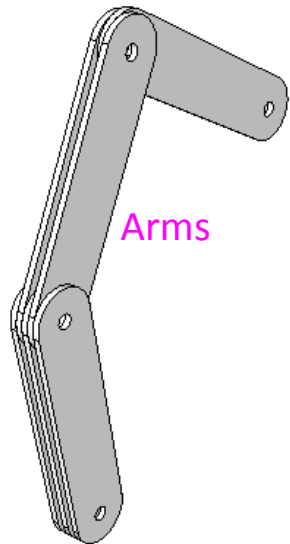
Legs

Base

You should have now drawn your lamp legs and your base pieces. Time to arrange and assemble your lamp.
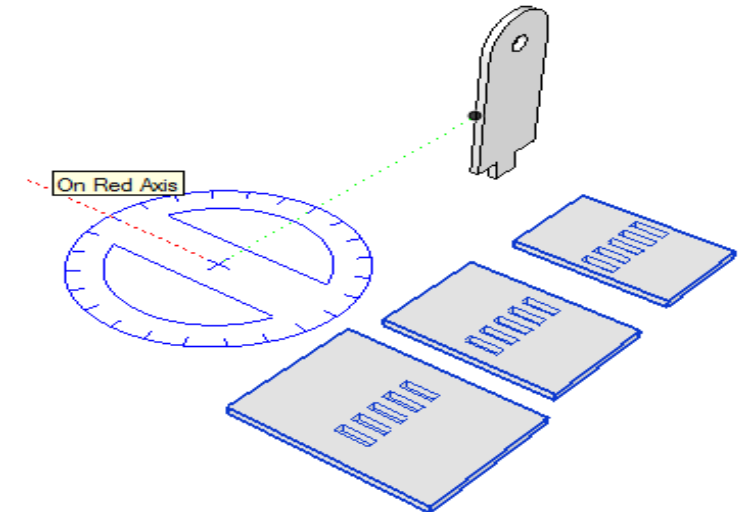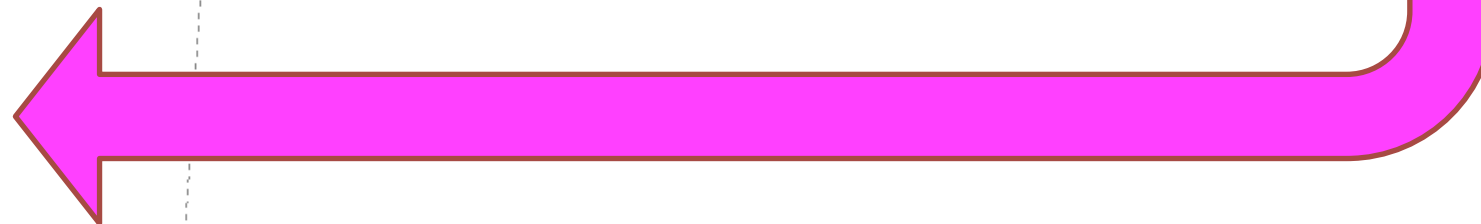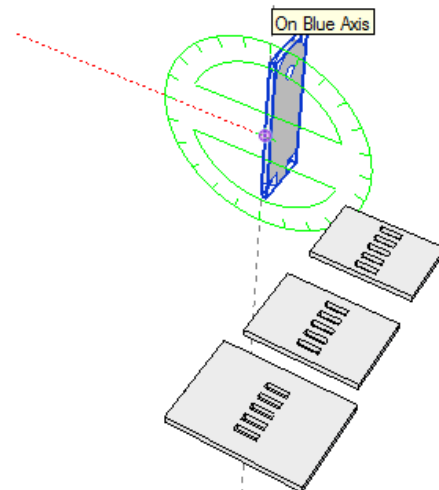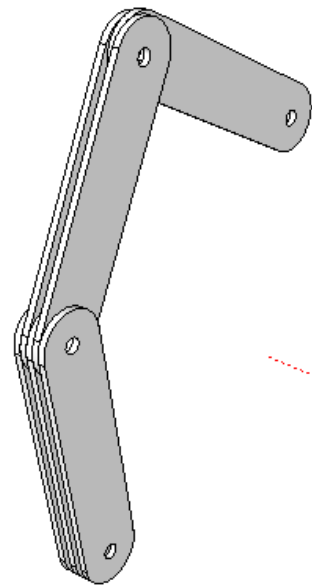
Each individual part should be grouped.

Highlight the leg. Click on the ***rotate tool.*** When it is either **green** or red click to set it.

On Red Axis

On Blue Axis

On Red Axis

Pull the line out on either the **green** or red axis. Click on the ***rotate tool.*** Type in *90* to rotate the lamp *90 degrees.*

Click on the ***rotate tool.*** Type in *90* to rotate the base *90 degrees if needed so the slots line up with the leg.*

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction
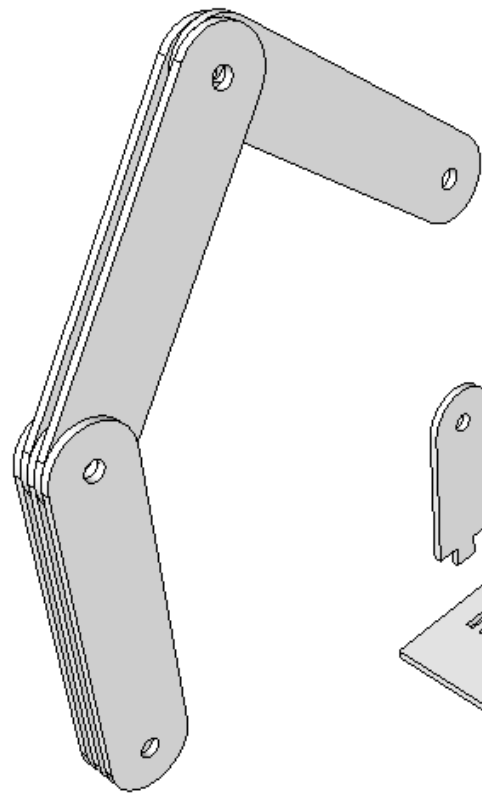
You should have your lamp legs and your base pieces in the correct alignment. Time to arrange and assemble your lamp.

Each individual part should be grouped.

Select the middle base piece
Click on the *move tool*
Grab the base on the corner shown. You will need to *zoom* in using the mouse wheel at the same time

Endpoint in Group

Endpoint in

Endpoint in Group
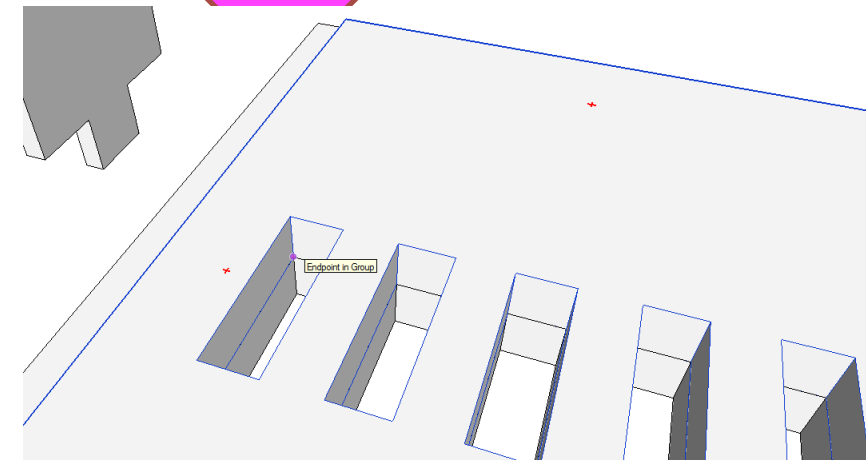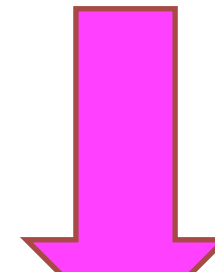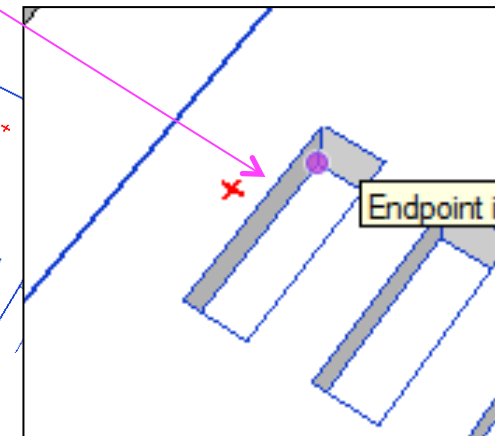
Align the middle base piece with bottom piece
Using the *move tool sit on top*

Repeat the process with the top base piece
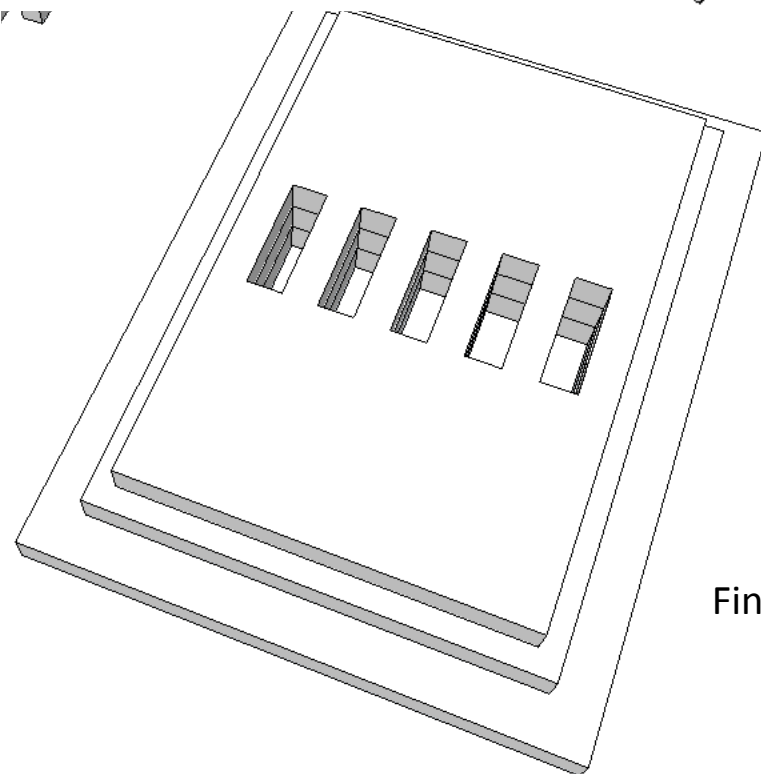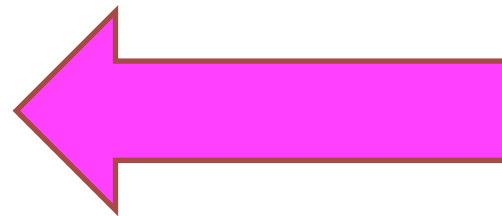
Final stepped base piece

Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction

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*

Grab the base legs on the bottom edge and position underneath the base as shown

Use the *move tool* to position the base legs in place
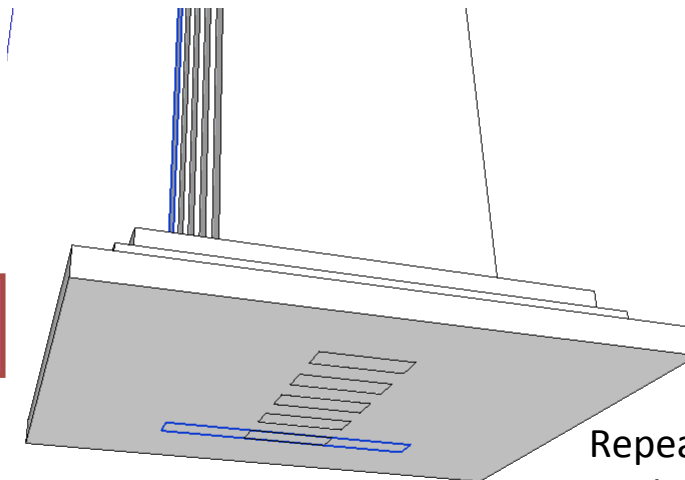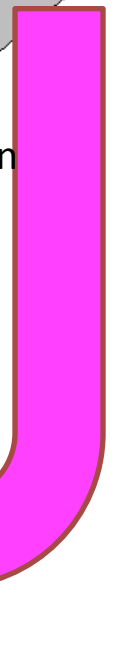
Repeat this for the other five base legs as shown.
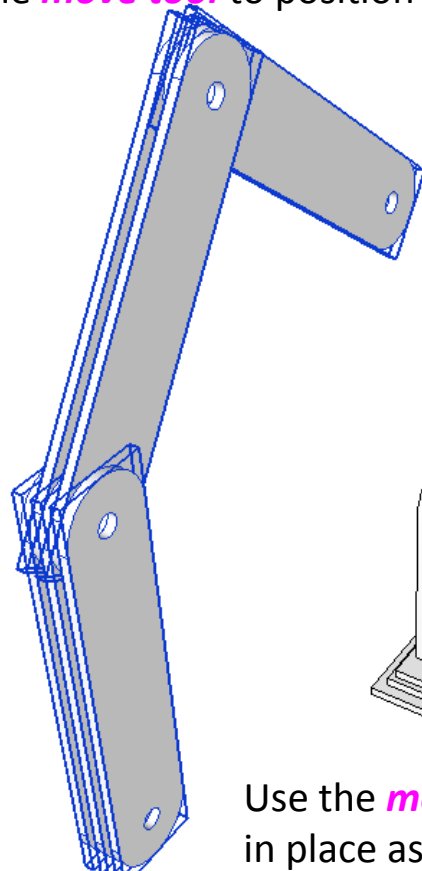
Use the *move tool* to position the lamp in place as shown.
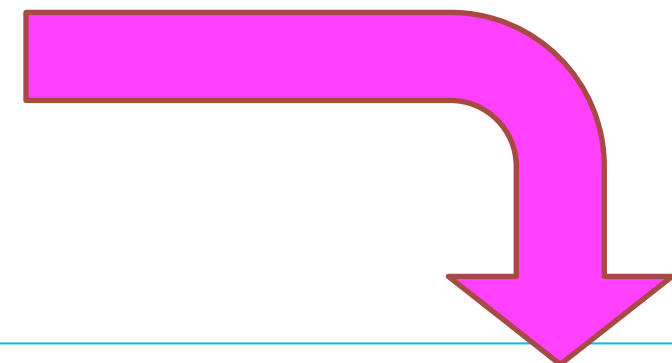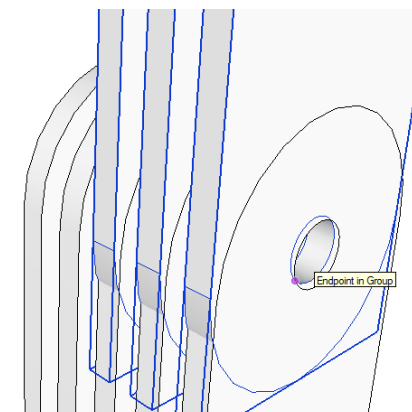
Computer Aided Design: Aircraft Lamp

Computer Aided Engineering: Step by Step Guide to Lamp Construction
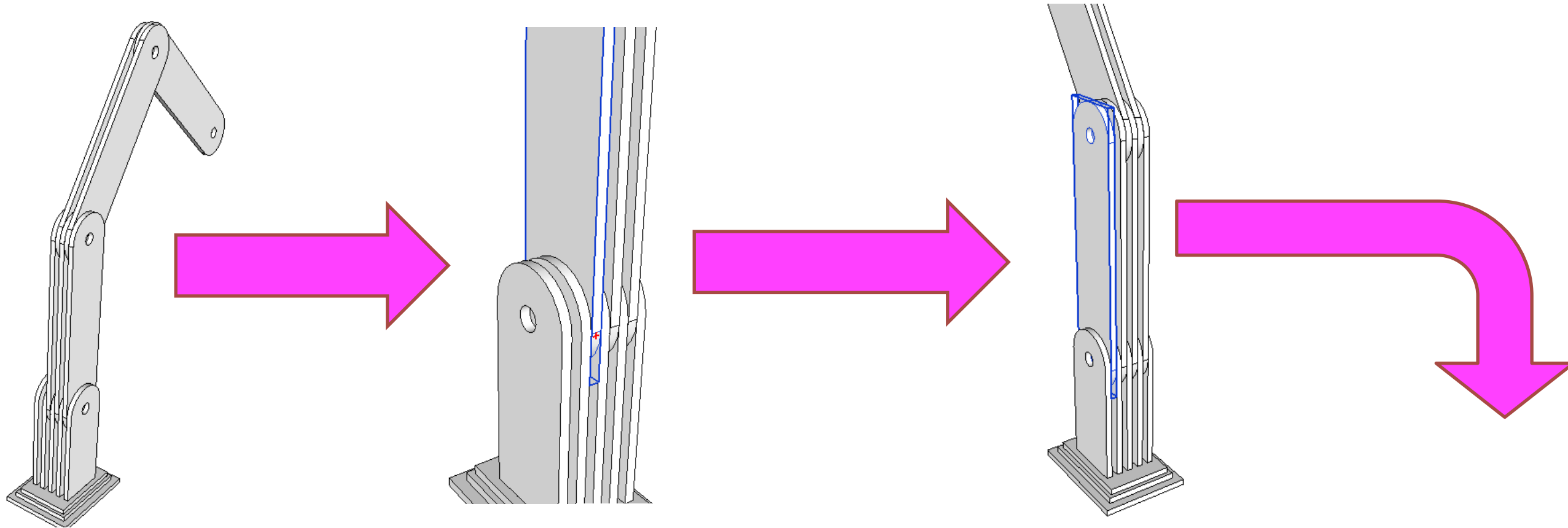
Use the copy and paste tool and the **_move tool_** to position the more lamp legs in place
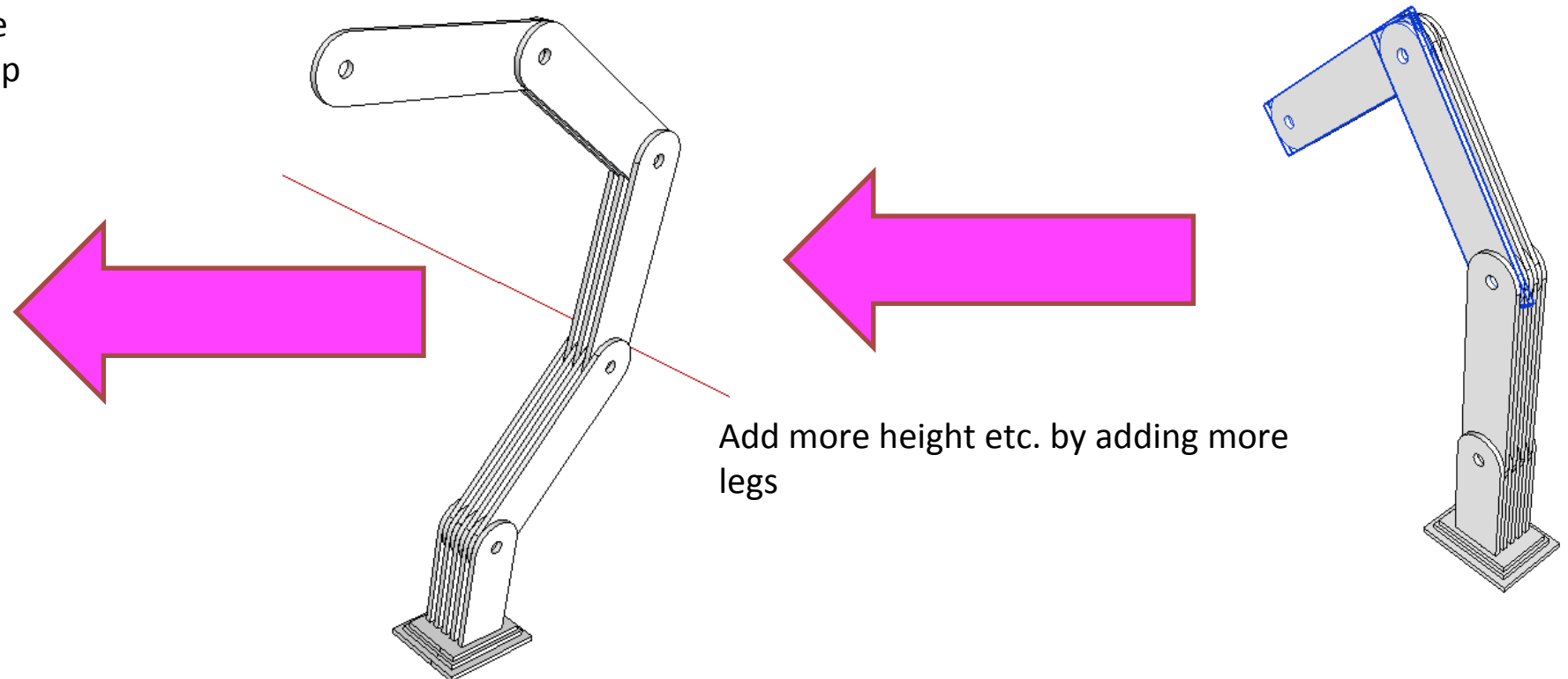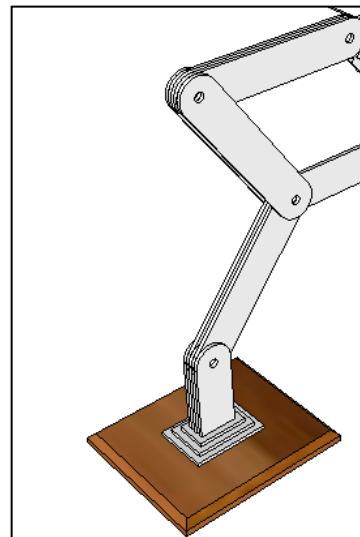
Add more height etc. by adding more legs

Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction

We now need to add the design to the lamp legs

Search Google for *aircraft plan* drawings or 2D drawings

Save image as *JPEG or Bitmap* drawings

Change the file type to all *supported images*
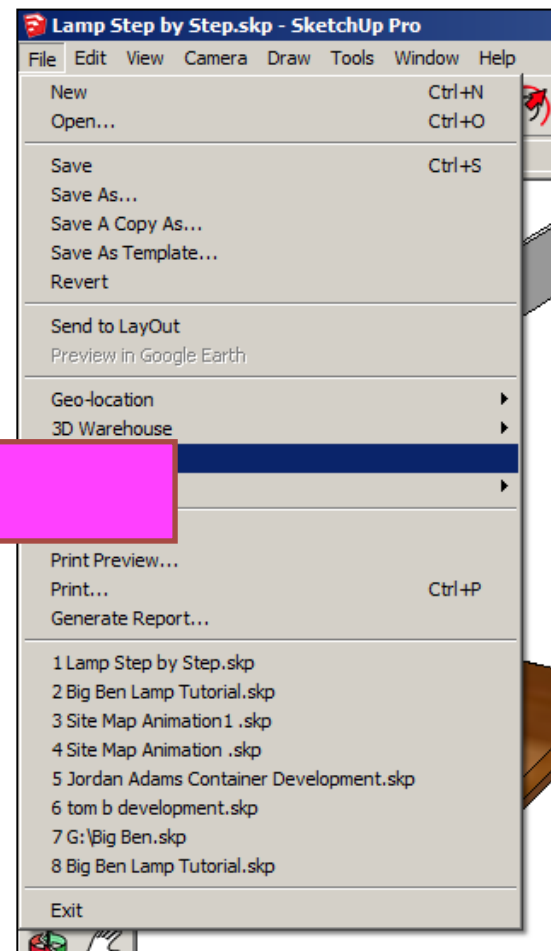
In Sketchup click on *file import*
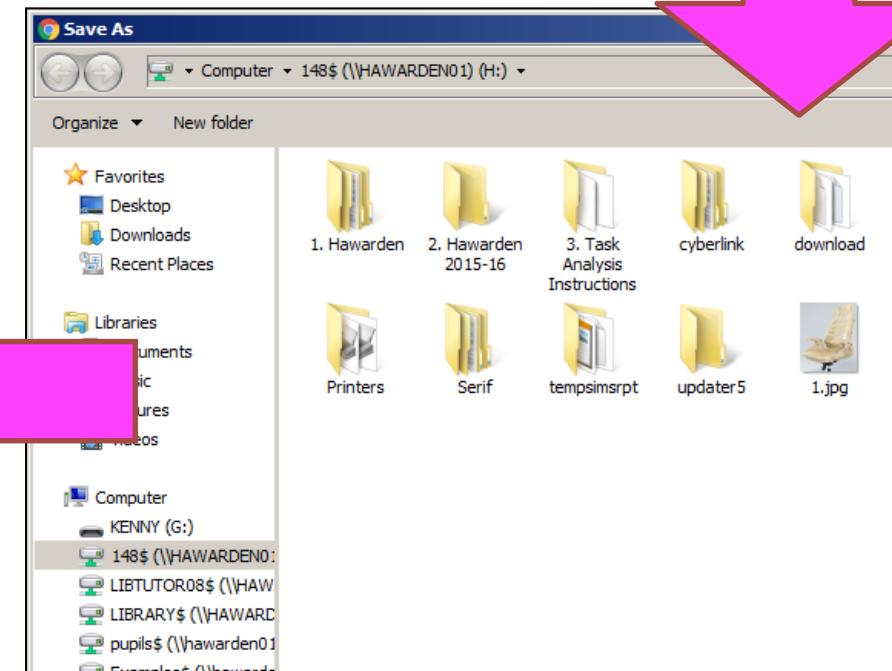
Make a not of where the file is saved in your area

Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction
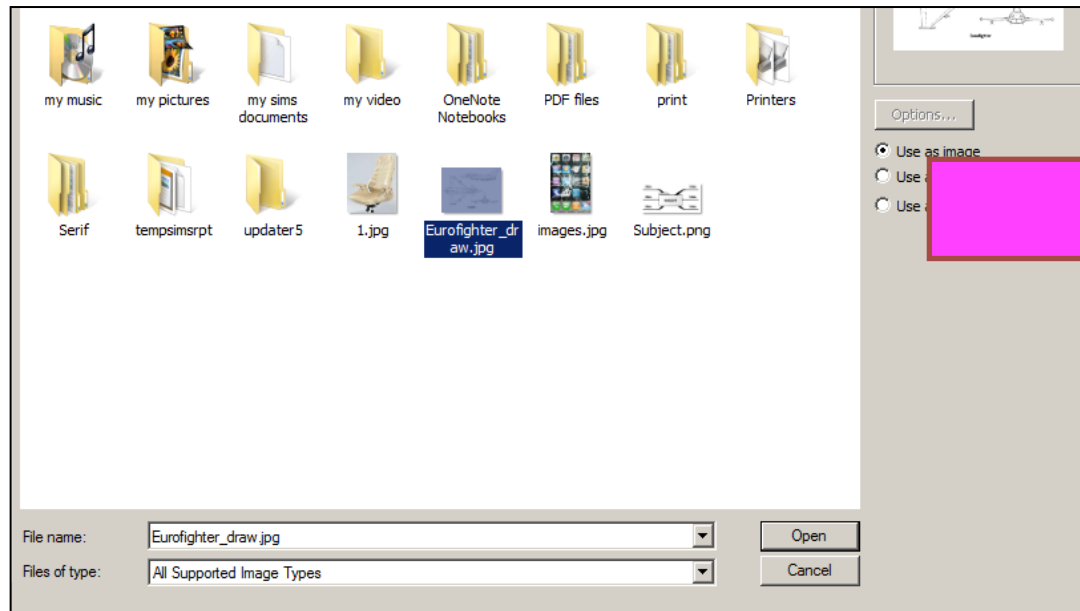
Search for where you saved your file and click *import*
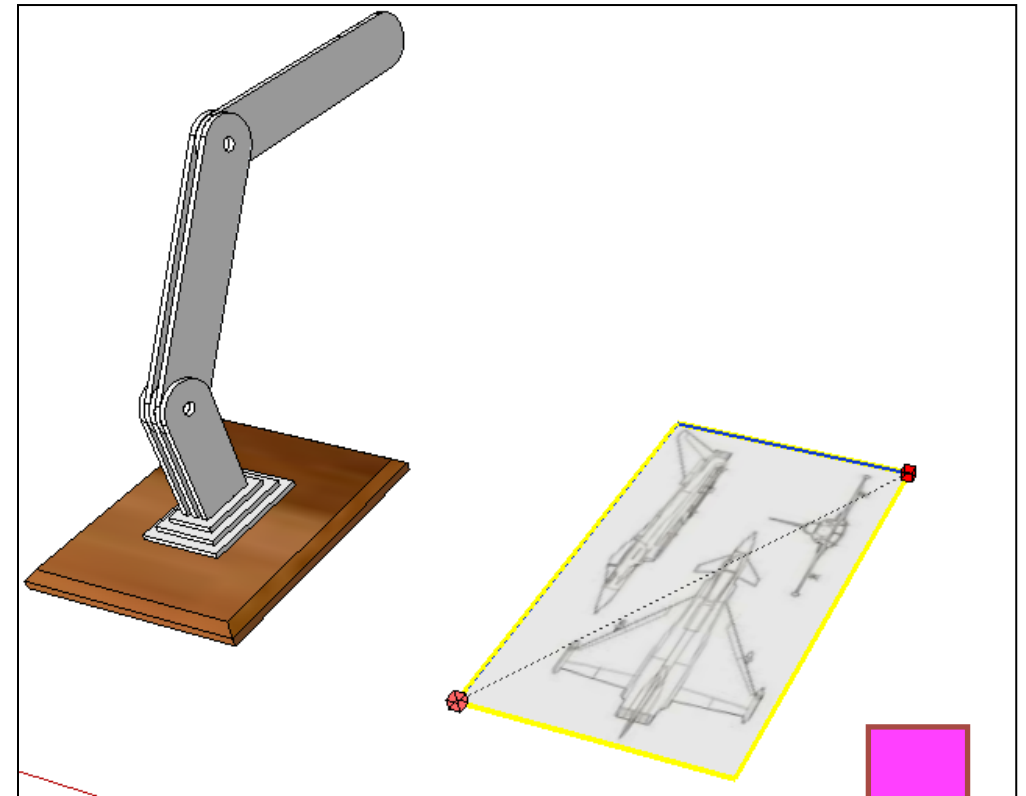
Using the move tool and scale tool, size your image next to your lamp

Using the *pencil tool* and the *arc tool* trace the top and side view of the aircraft
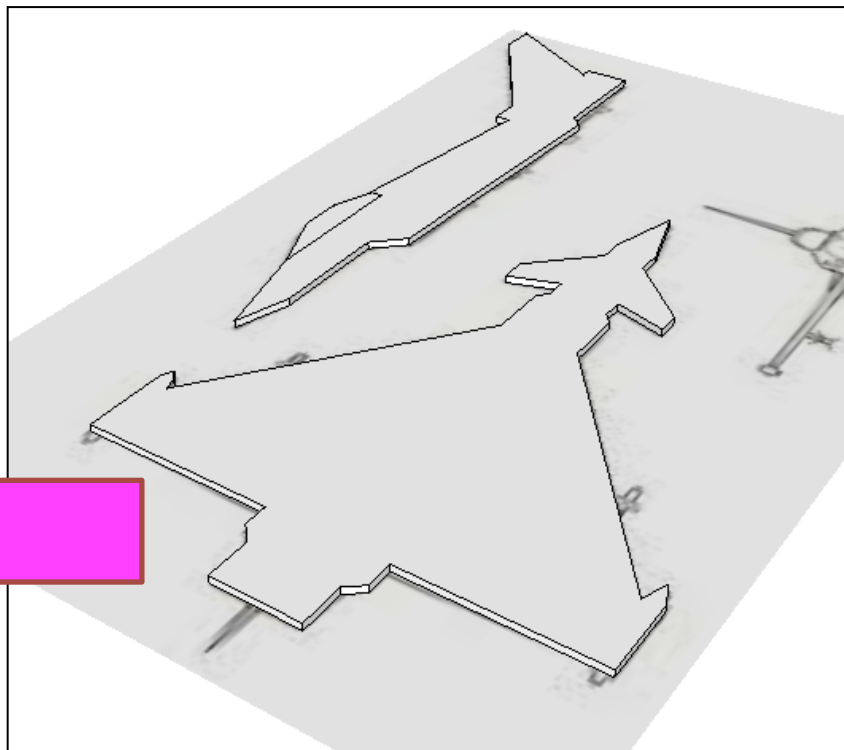
Using the *push pull tool* give the aircraft 4mm thickness

Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction

Highlight the base, right click and make group.
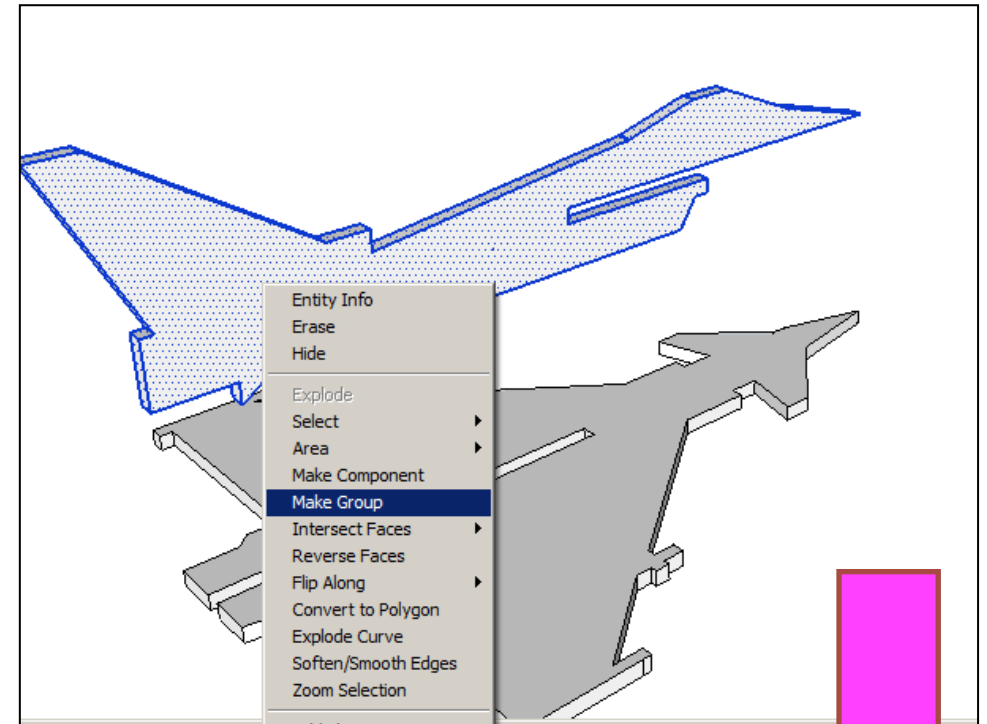
Highlight the side, right click and make group.

Separate the two parts for now.

Using the *pencil tool* to locate the center point at the end of the aircraft

Using the *pencil tool* draw a line straight down the middle of the aircraft
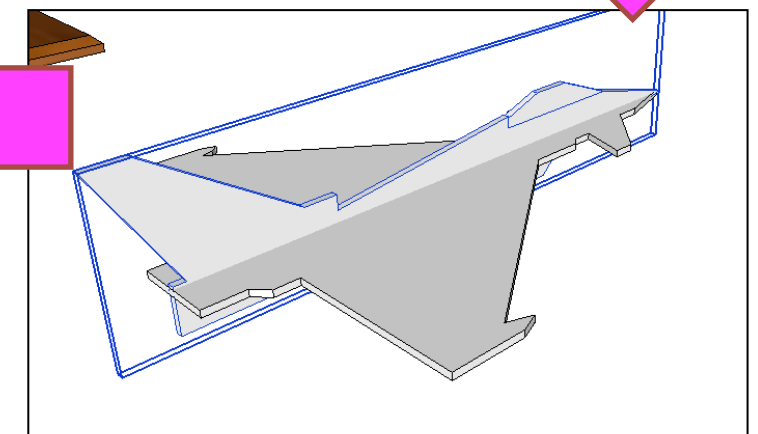
Using the *rotate tool* and rotate the side piece 90 degrees through the green or red axis

Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction

Using the *pencil tool* to locate the center point on the line you have just drawn.
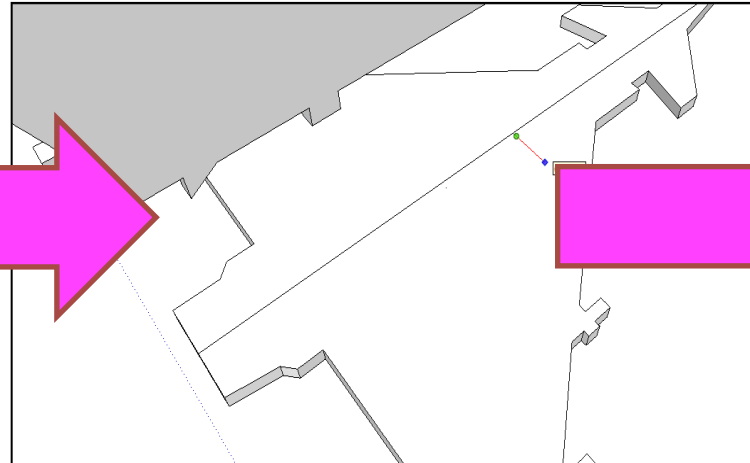
Using the *pencil tool* draw a line out on the red axis and type in 2 and press enter
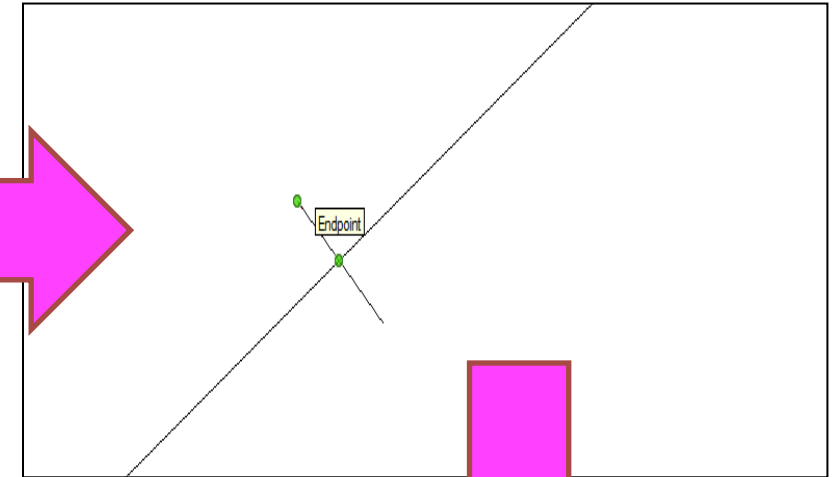
Repeat the process on the other side of the center line
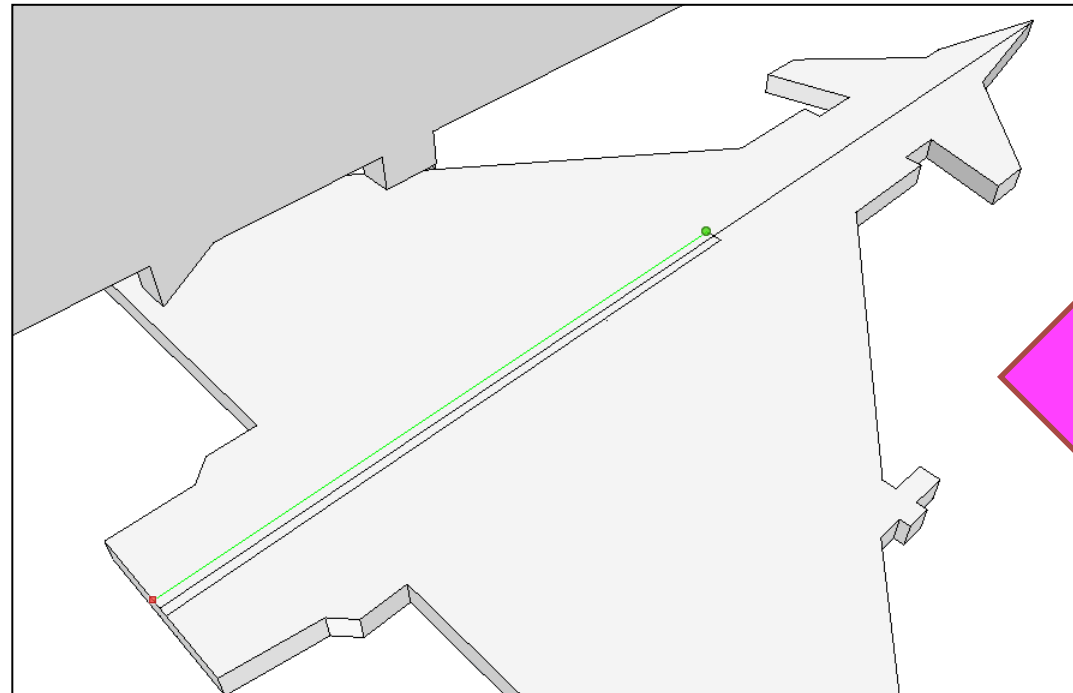
Repeat the process on the other side of the center line
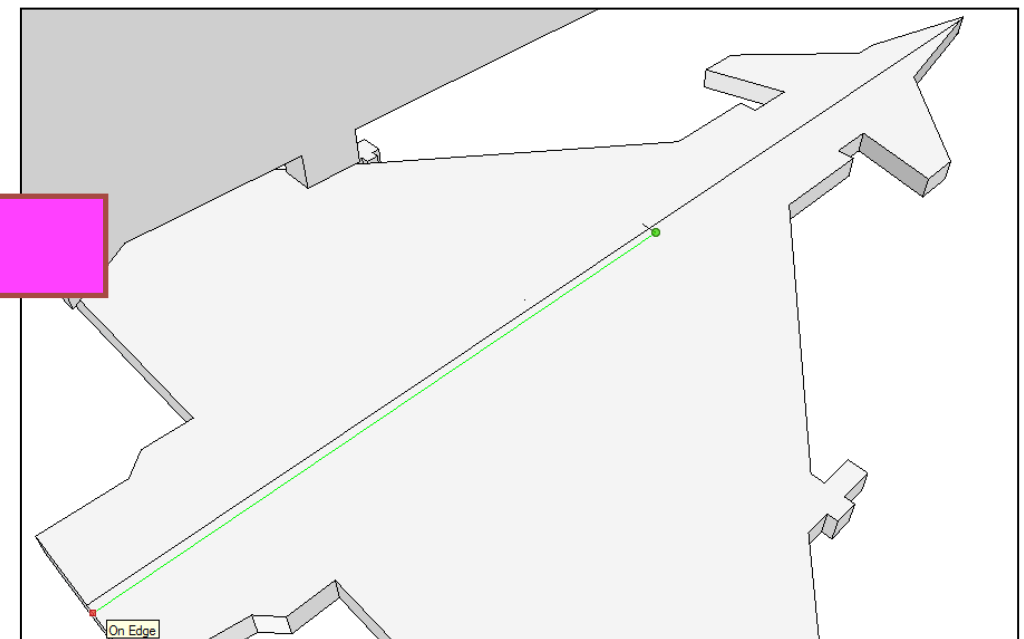
Using the *pencil tool* draw a line from the end of the last mark you made on the green axis to the end of the aircraft

Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction
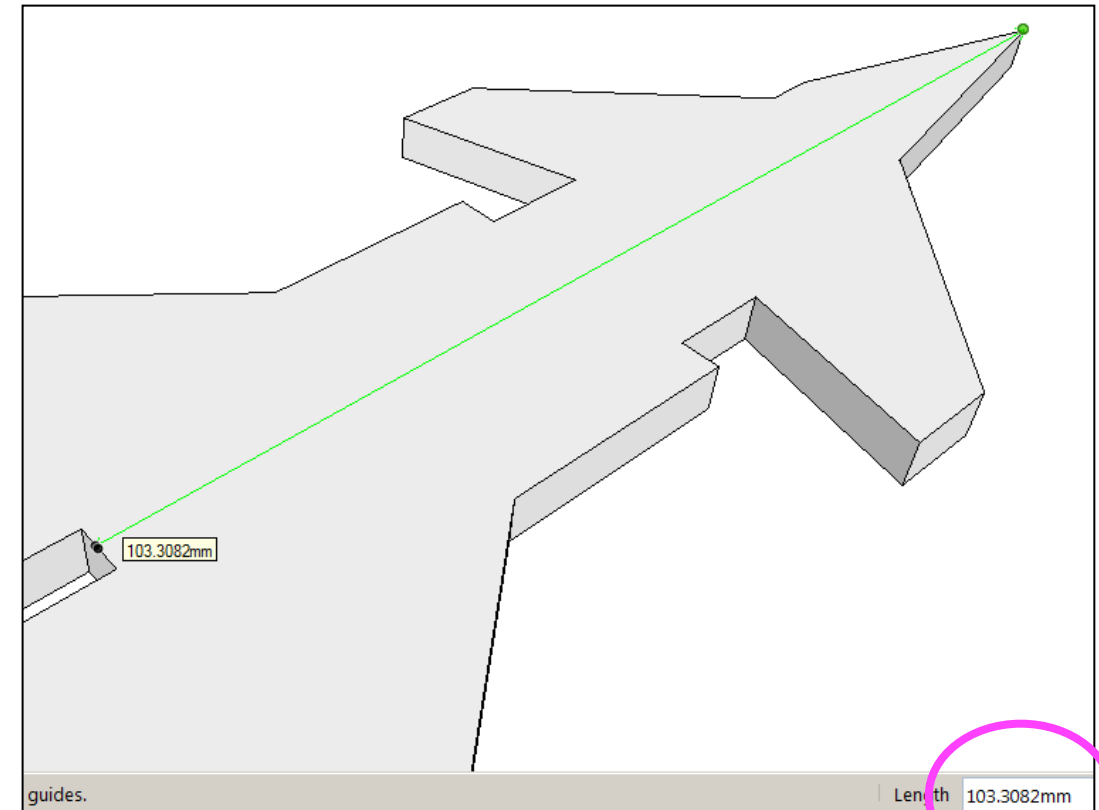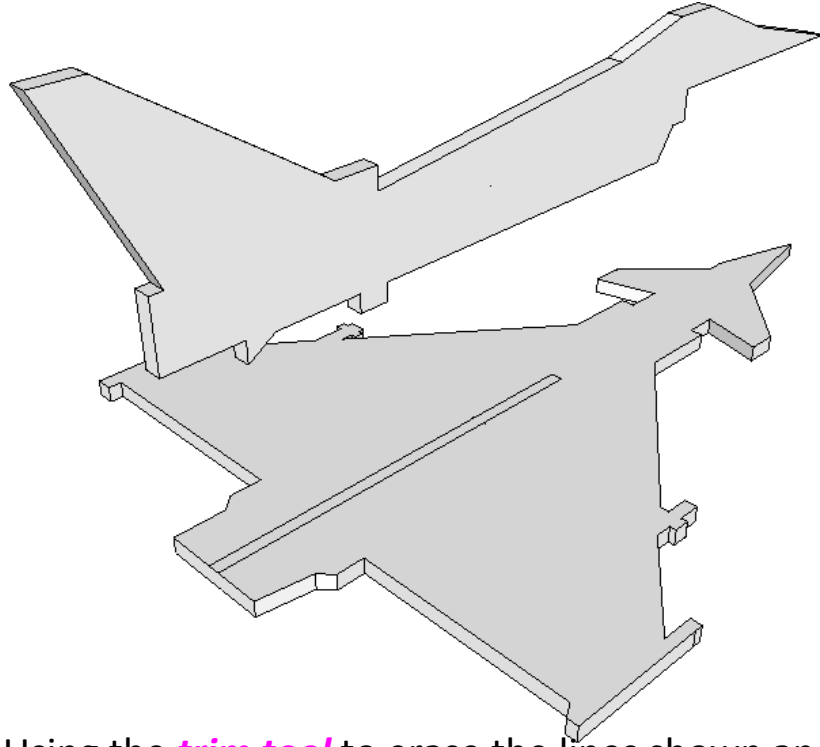
Using the *trim tool* to erase the lines shown and use the push pull tool to add the slot shown

103.3082mm

guides.   Length 103.3082mm

Using the *tape measure tool* to measure from the center of the slot to the front of the aircraft. Note the size circled

103.0000mm

From the front of the aircraft use *the pencil tool* to draw a line back on the green axis and type in the length identified above.

Using the *pencil tool* to draw a line down. Type in 4 and press enter

Computer Aided Engineering: Learning Aim A: Task 3

Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction
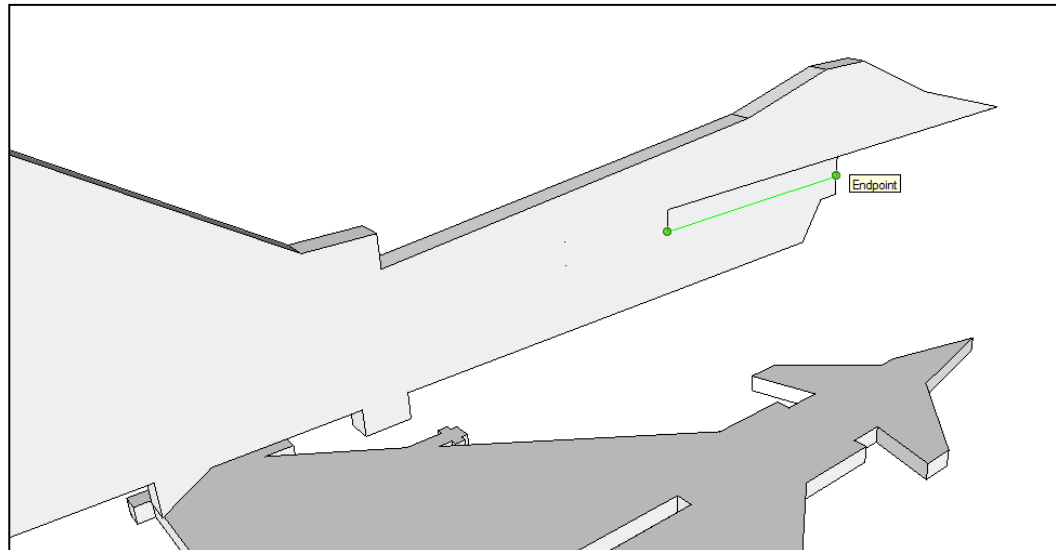
Using the *pencil tool* to complete the slot as shown

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

Using the *move tool* to grab the aircraft base in the corner of the slot identified
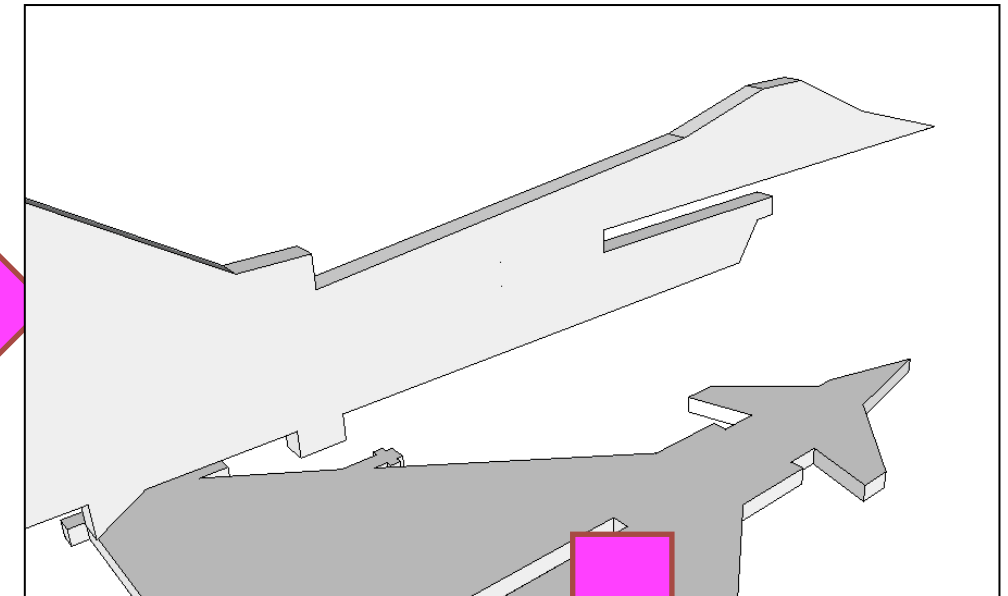
Using the *push/pull tool* to remove the material as shown
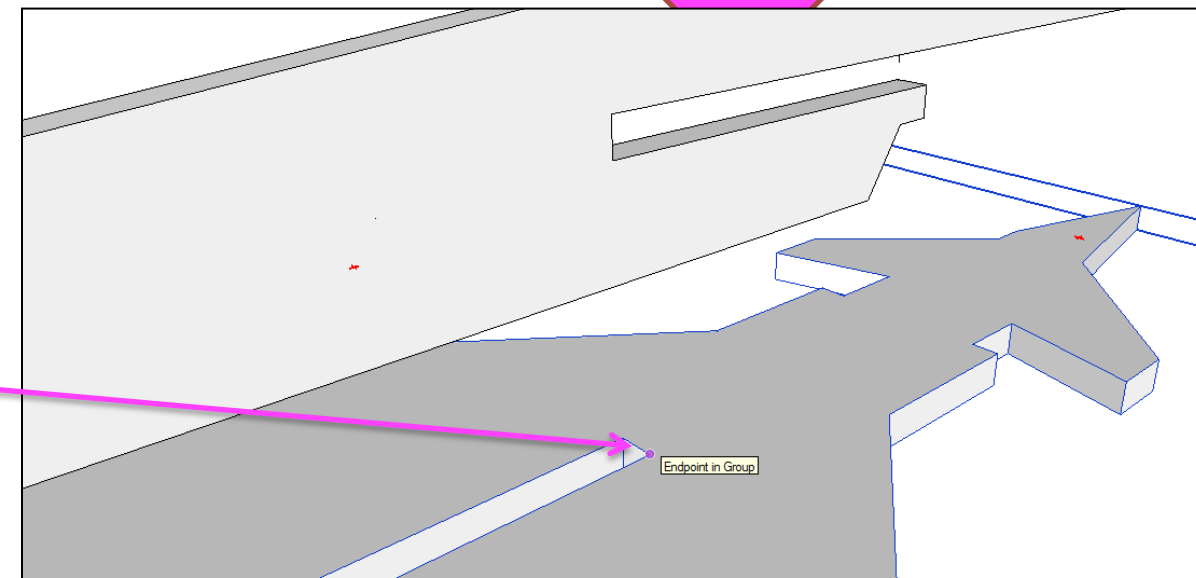
Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction
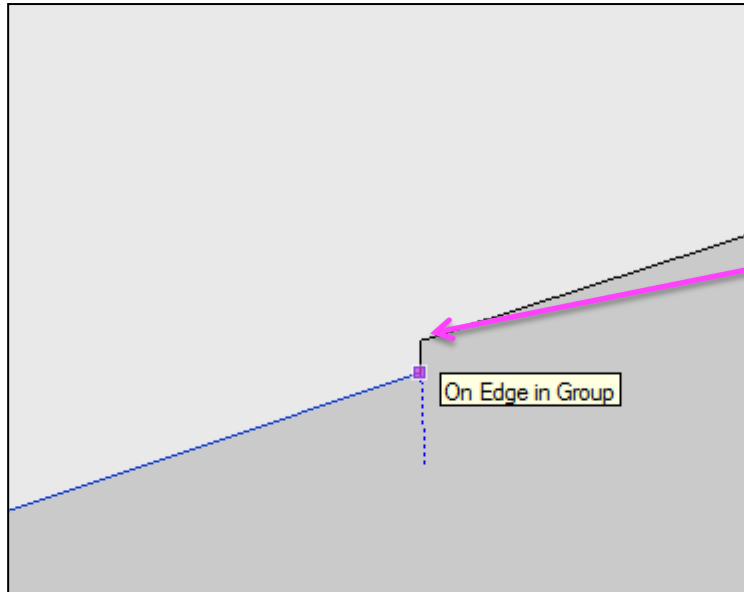
Using the **move tool** to move the aircraft base in the corner of the slot to the corresponding corner on the side piece.

On Edge in Group
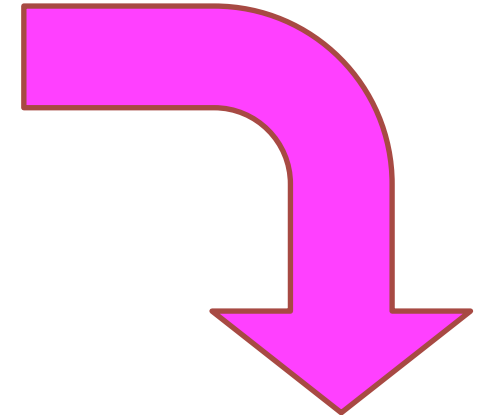
Using the **aircraft should slot together as shown below**. Move onto the top arm of your lamp so the tail of the aircraft sits next to the arm or bracket.
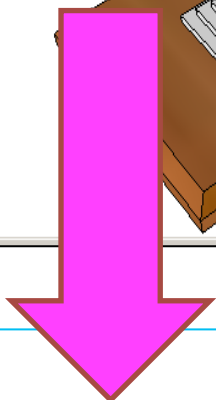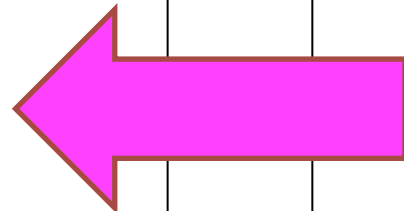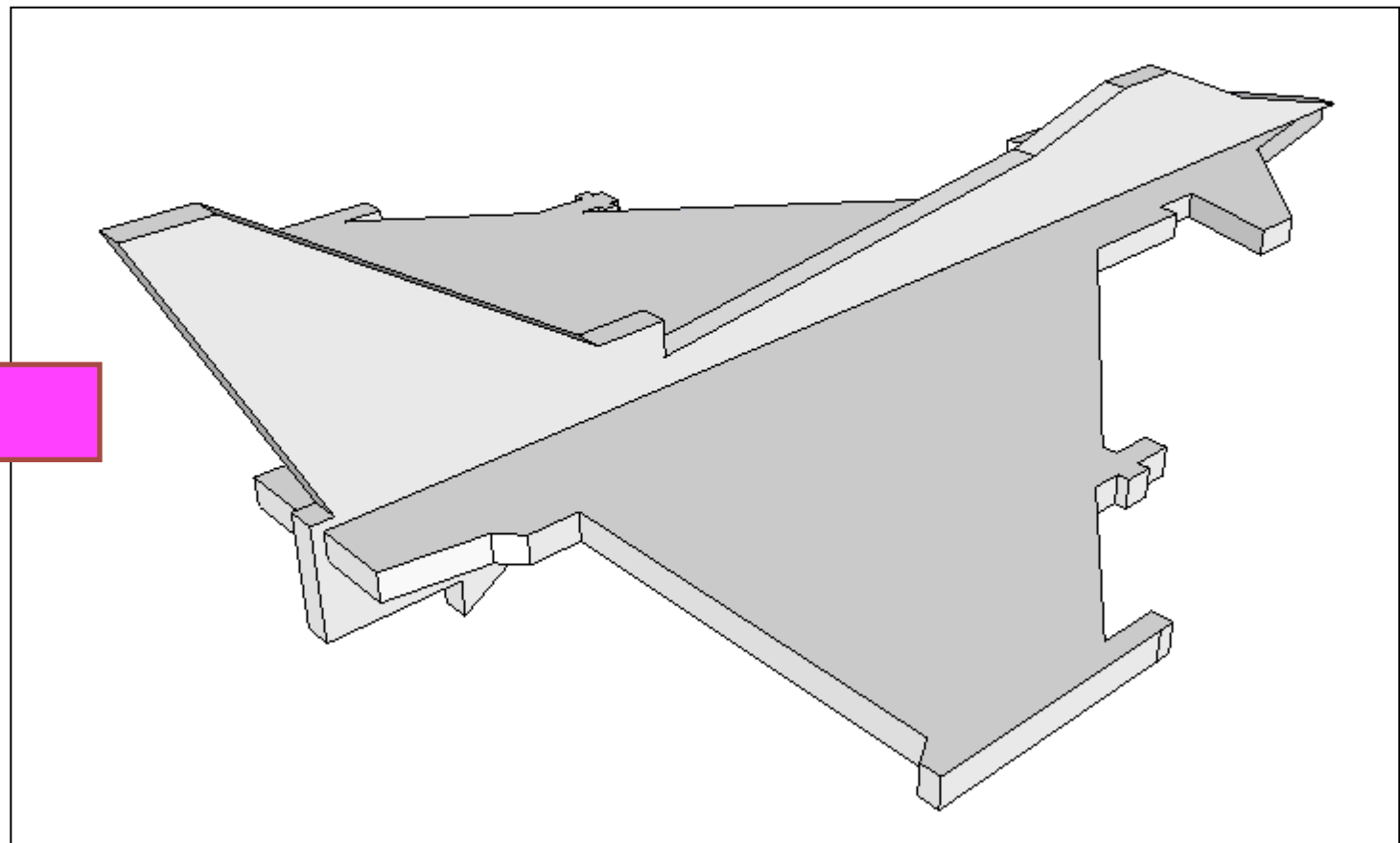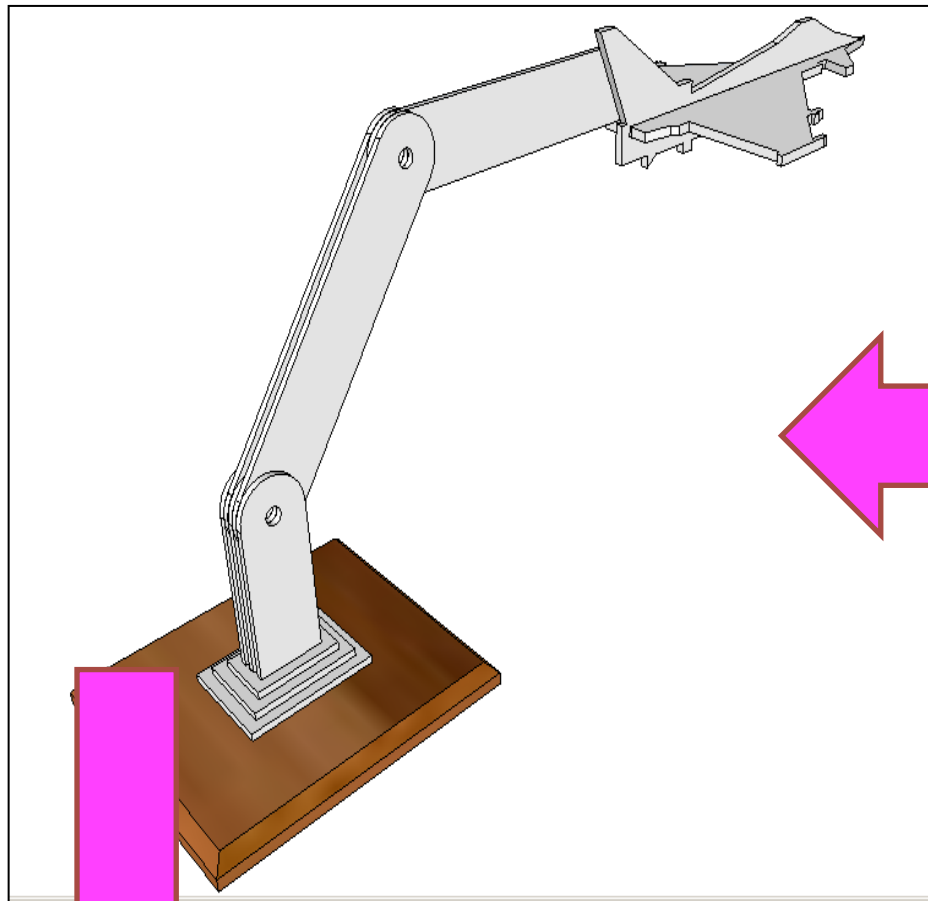
Computer Aided Engineering: 14. Step by Step Guide to Lamp Construction
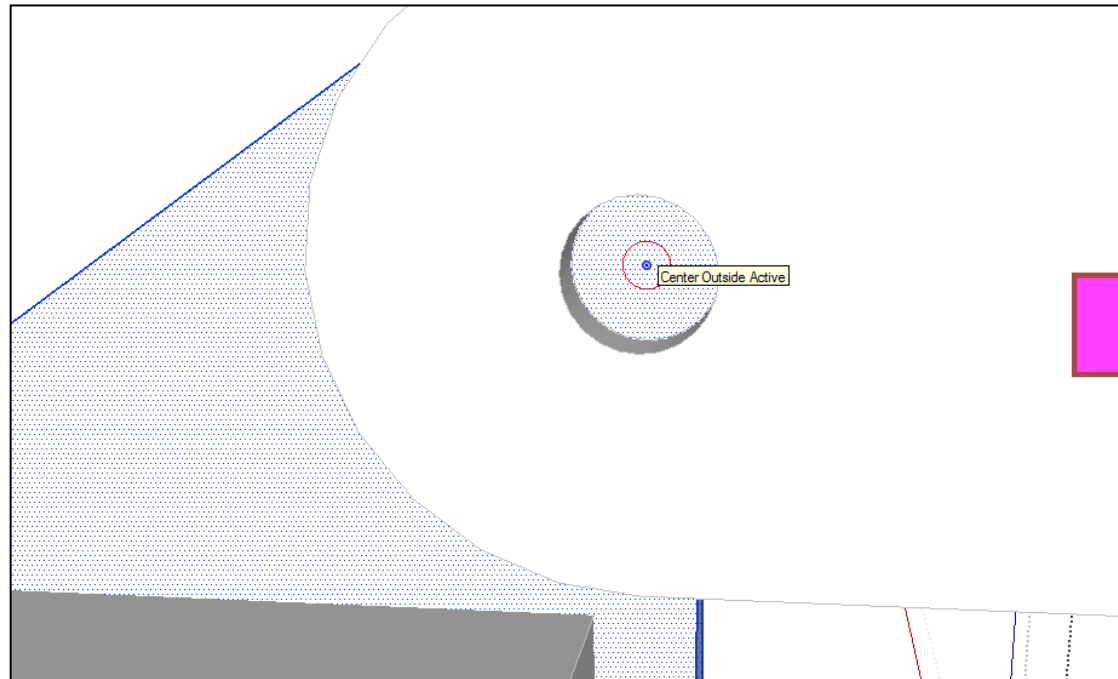
Position so that you are looking through the circle cut out of the arm. **Double click** the aircraft tail. Use the **circle tool**, run it around the inside circle of the lamp arm and it should snap to the center on the aircraft.
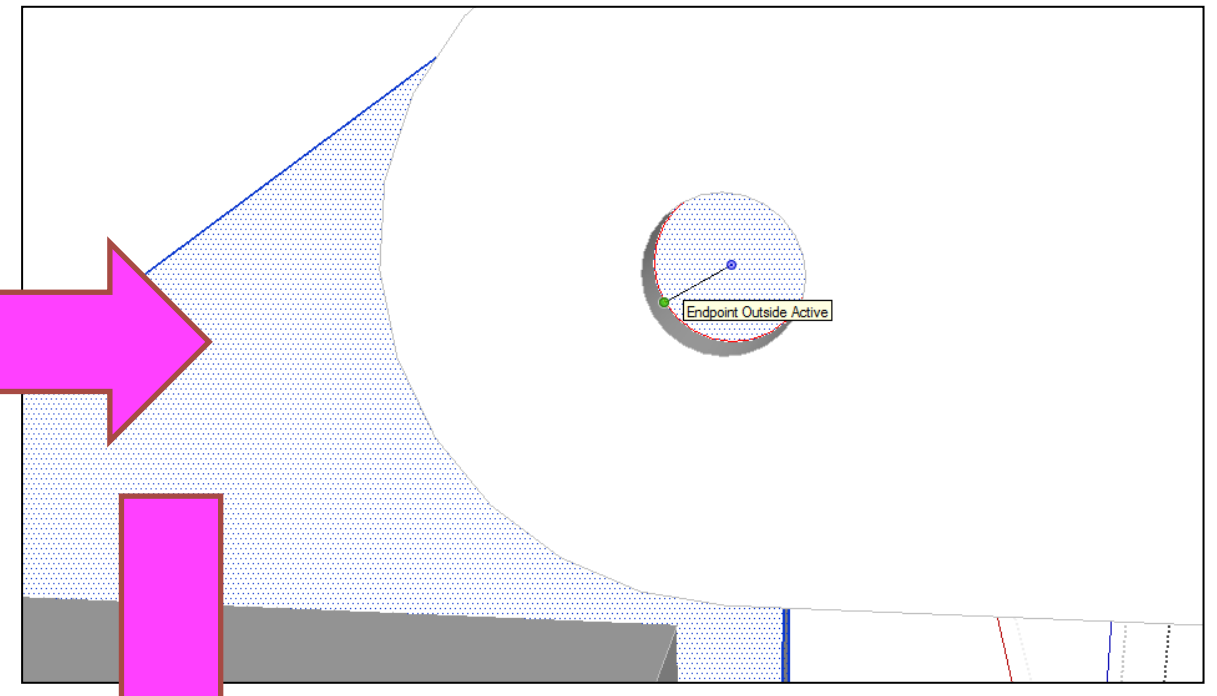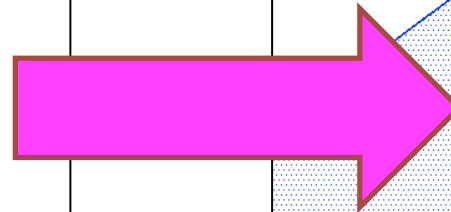
Increase the circle size so it matches the lamp arm. It will snap into place
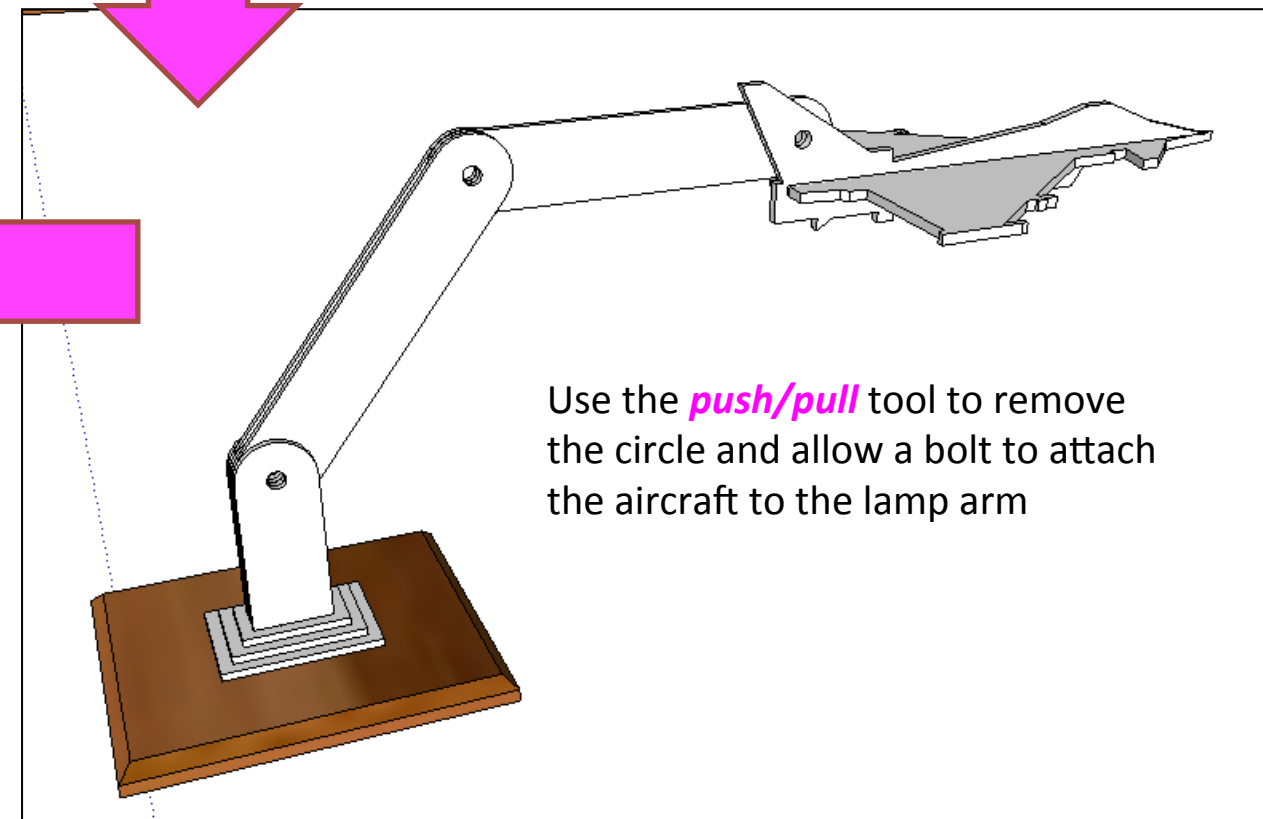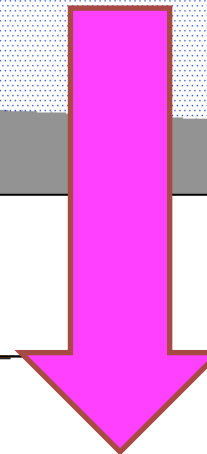
Use the **push/pull** tool to remove the circle and allow a bolt to attach the aircraft to the lamp arm

Add more arms and aircraft to the lamp design

Computer Aided Design: Aircraft Lamp Working Drawing

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: Aircraft Lamp Working Drawing

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: Aircraft Lamp Working Drawing

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

Highlight the entire lamp and right click **make group**
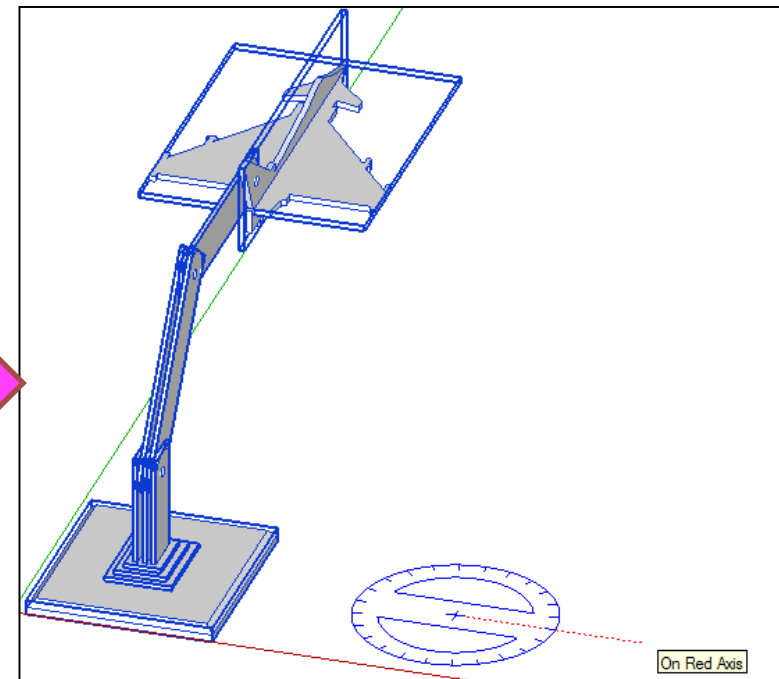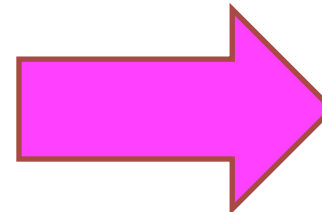
Click on the rotate tool and turn the lamp **around as shown below**
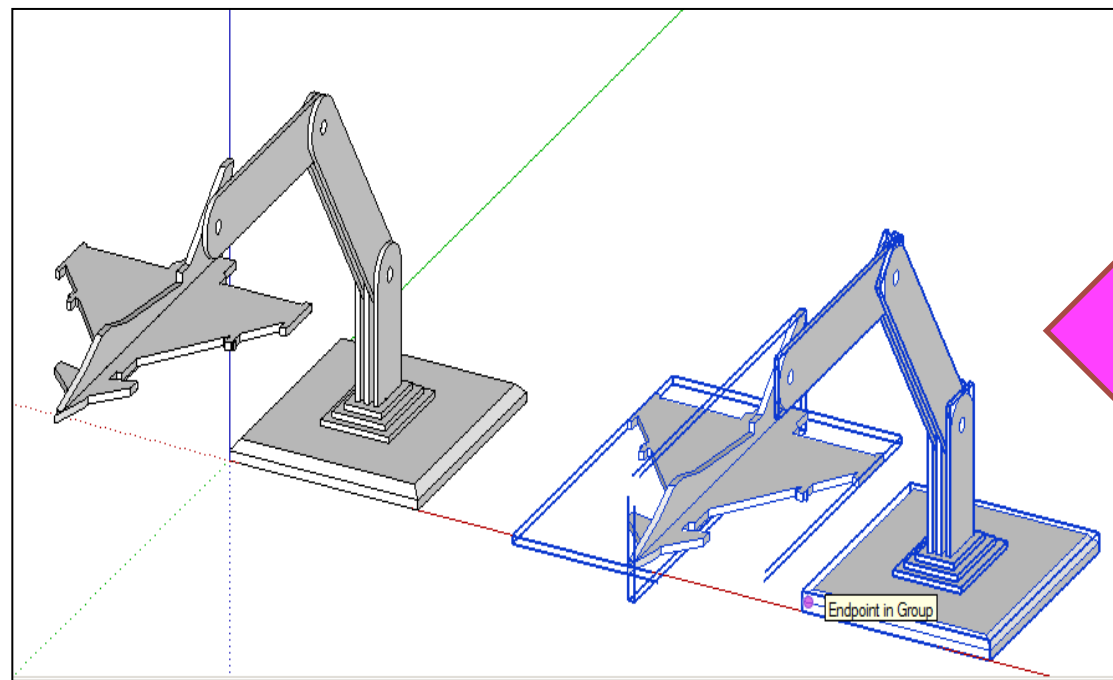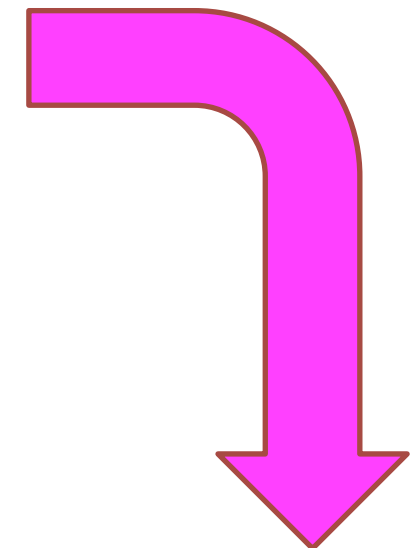
Copy and move a second lamp along the **red axis**
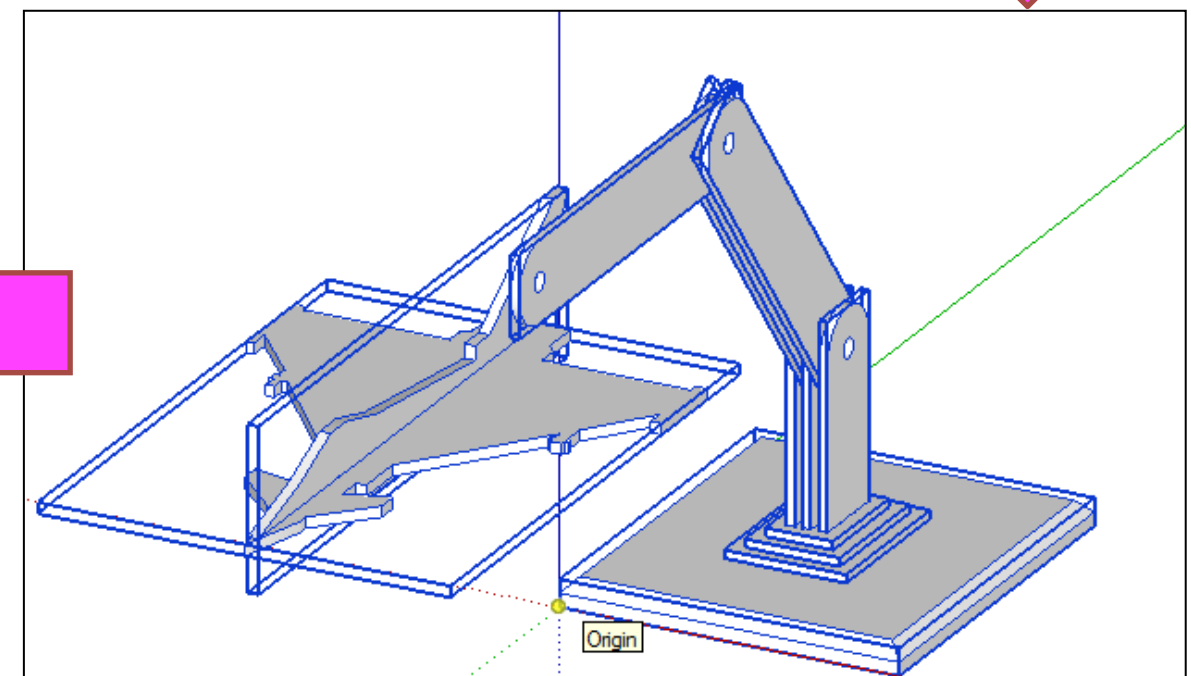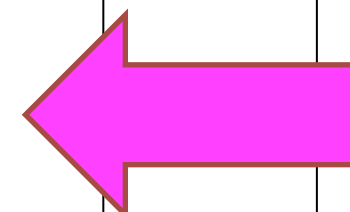
Click on the **move tool** and move the lamp so the corner is on the origin

Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)
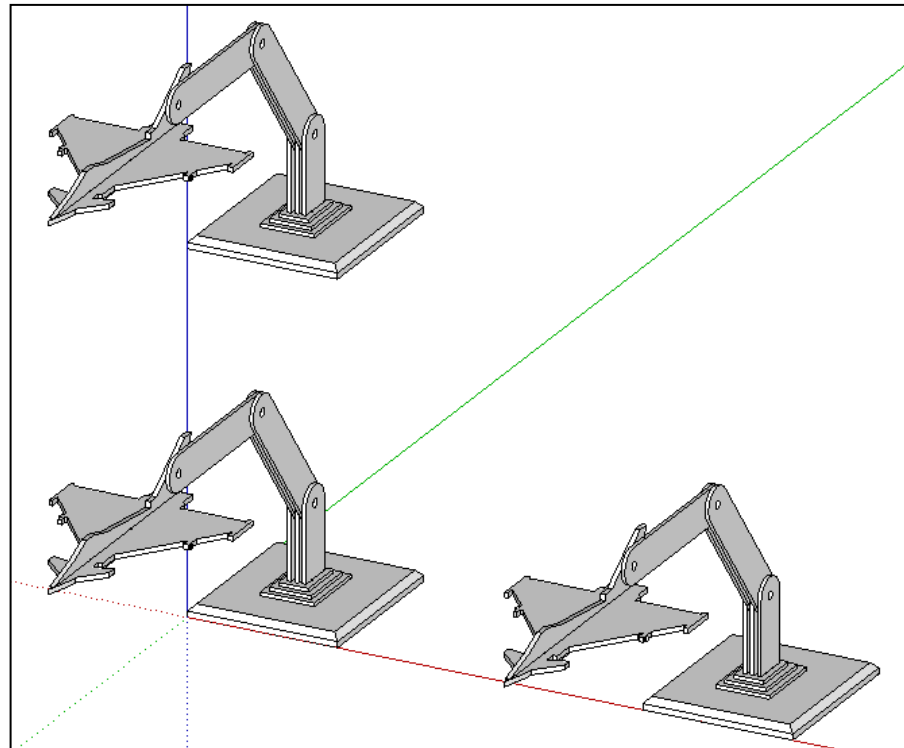
Copy and move a second lamp along the **blue axis**

Click on the rotate tool and turn the lamp
around 90 degrees as shown below
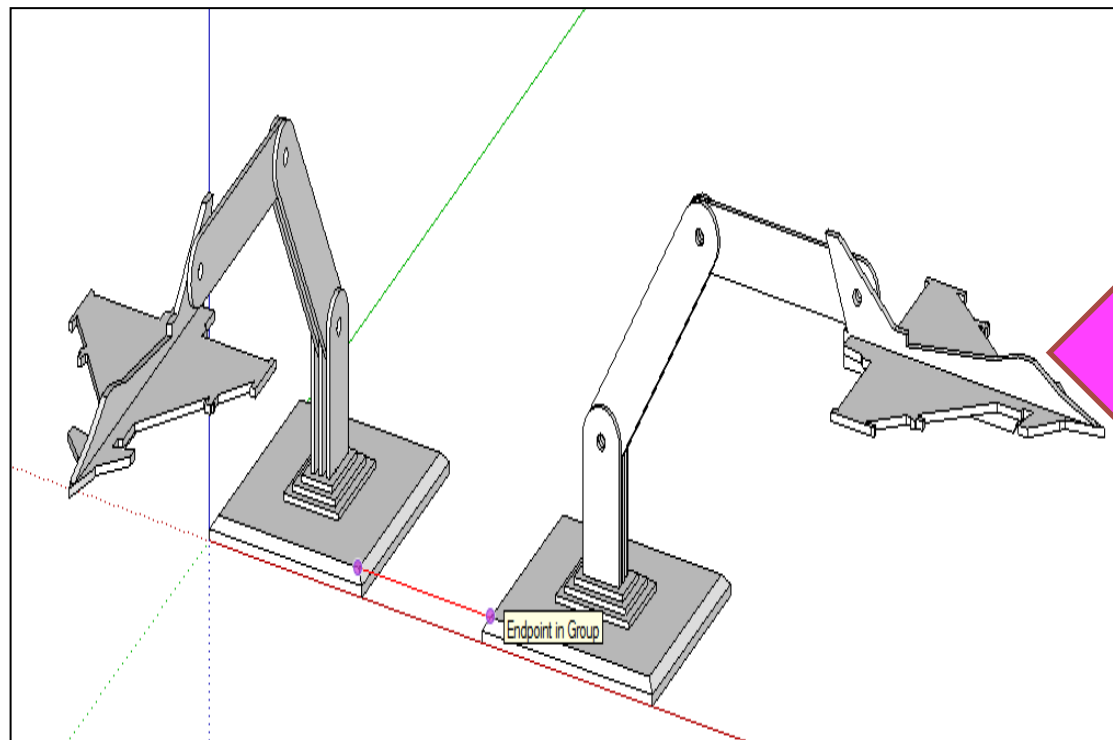
Click on the **move tool** along the red axis. You should be able
to draw a line that turns red from corner to corner to indicate
it lines up exactly
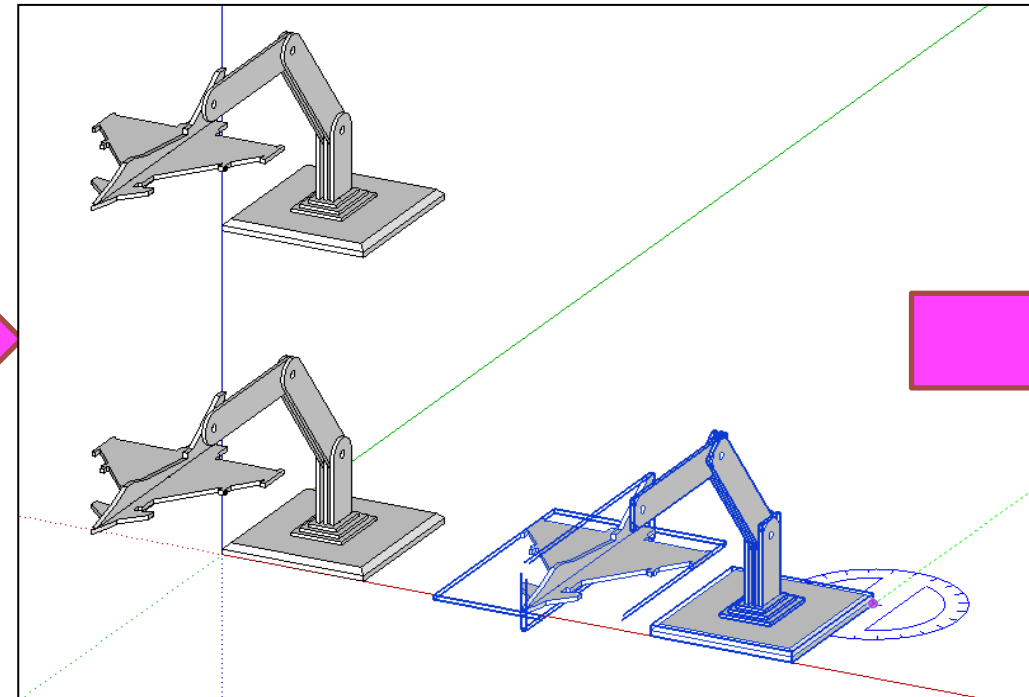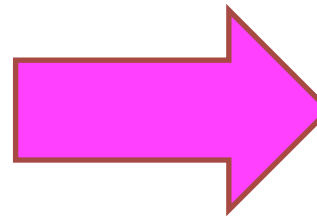
Click on the **move tool** and move the lamp so the corners of the base
meet
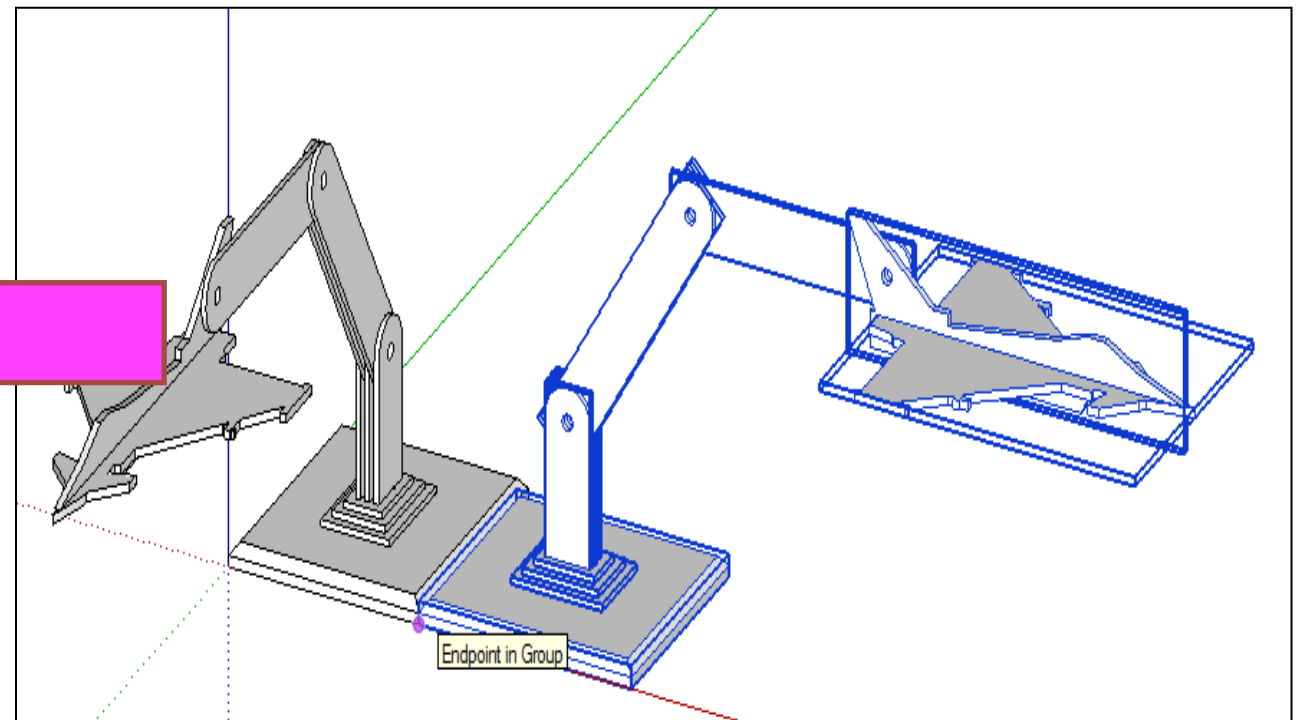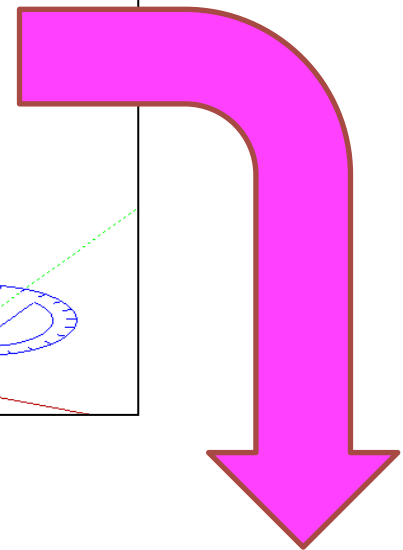
Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)
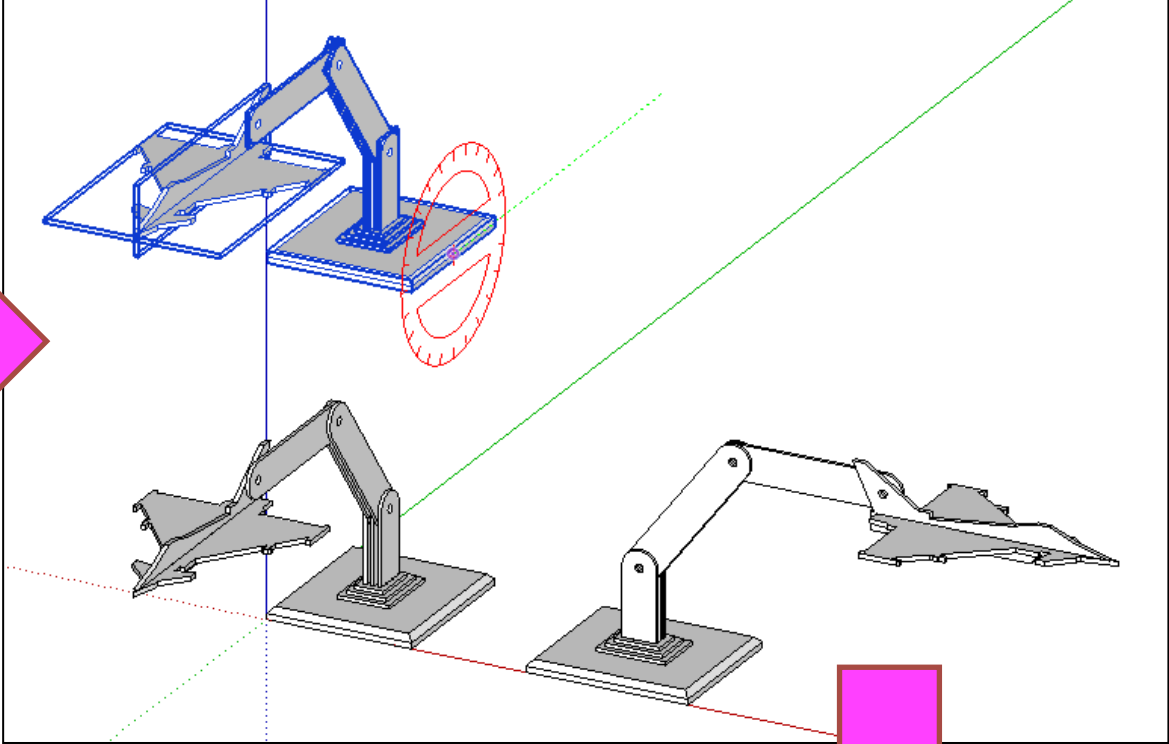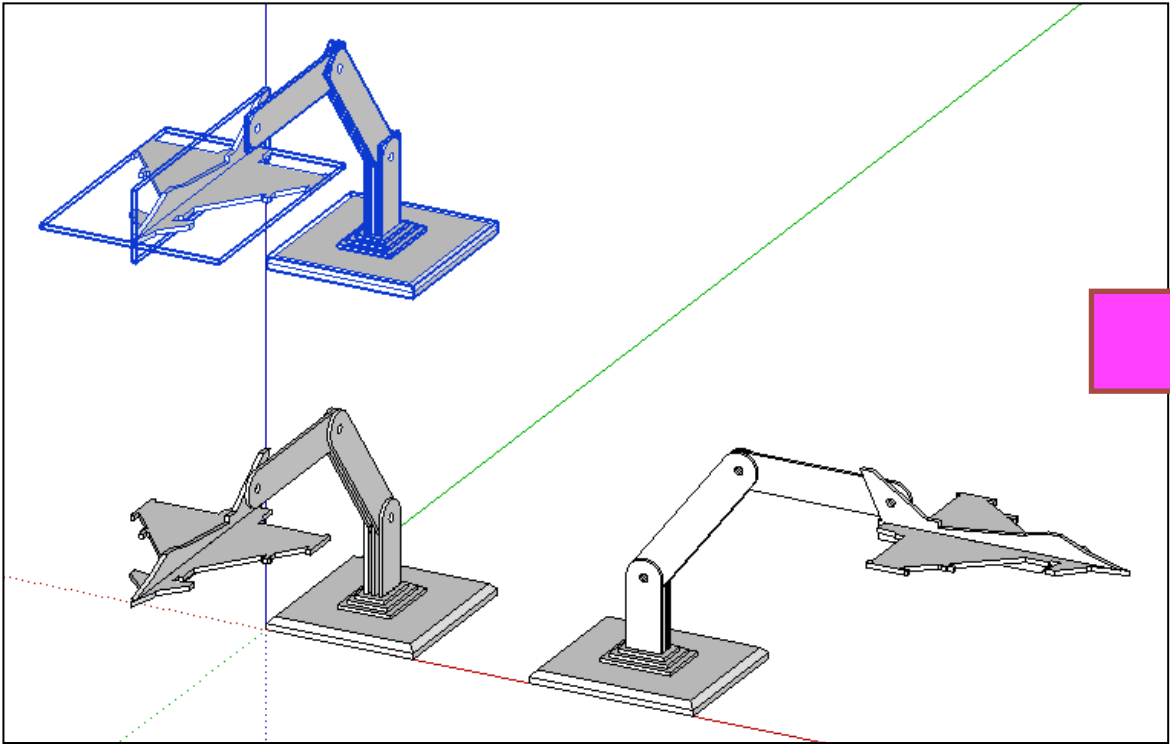
Click on the top lamp

Click on the rotate tool and turn the lamp **around 90 degrees as shown below**
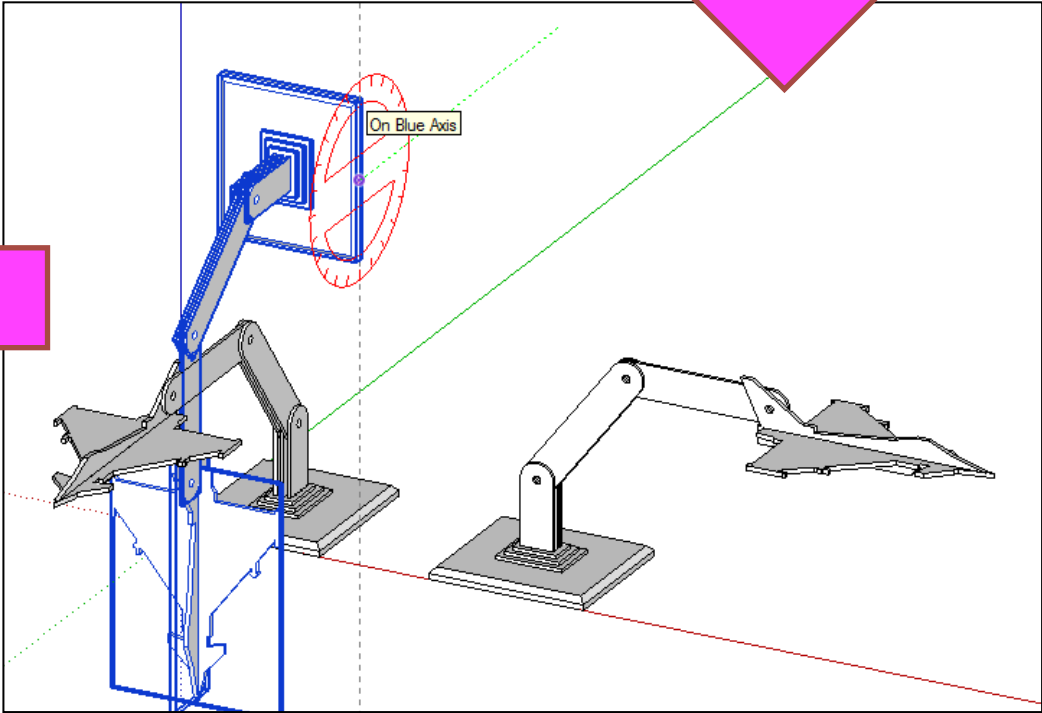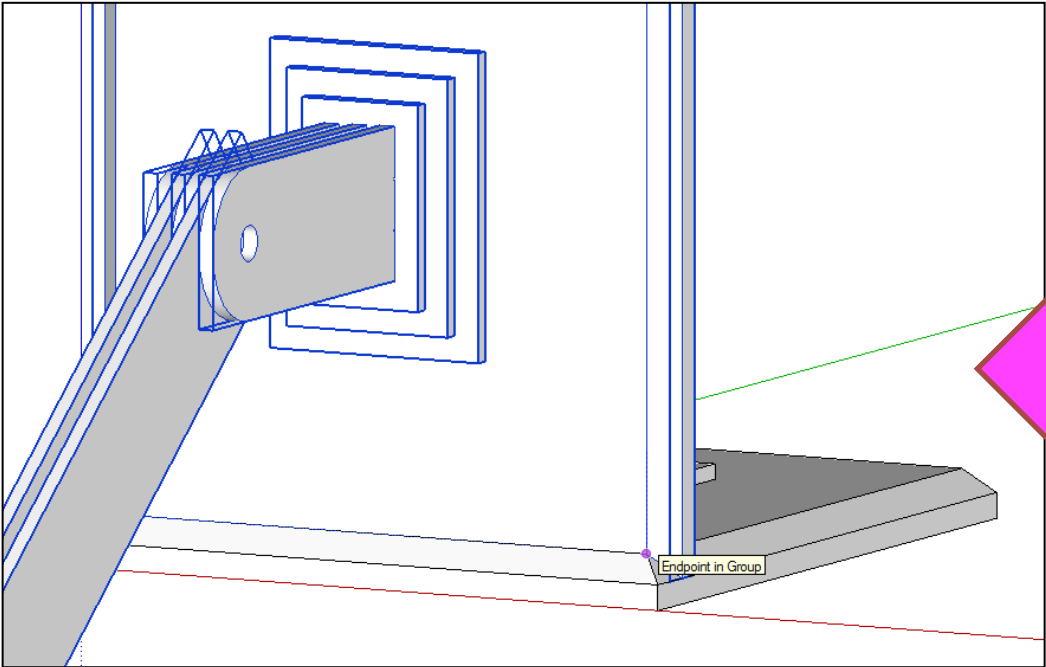
Click on the **move tool** and move the lamp so the corners of the base meet

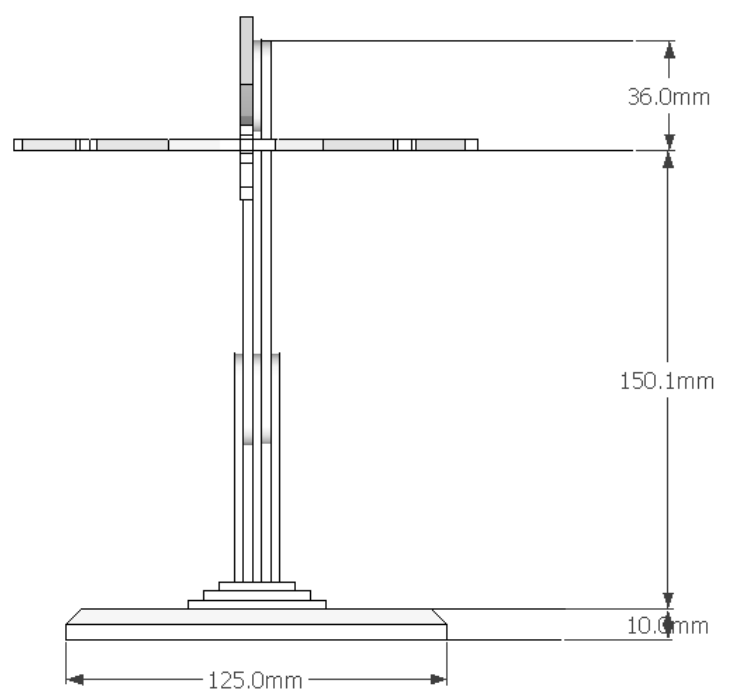# Computer Aided Design: Aircraft Lamp Working Drawing

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

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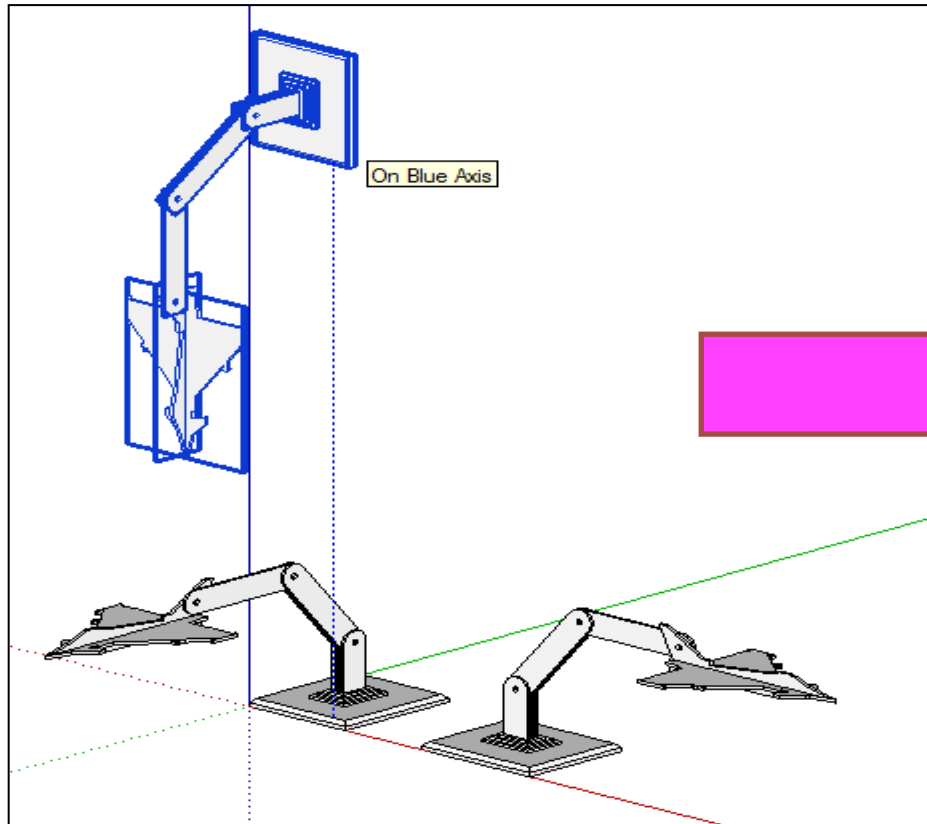
Click on the **move tool** and move the lamp so the corners of the base meet and then separate again

Click on the **front view using the view toolbar**

Views

From Point

125.0mm

Certain points are difficult to add sizes using the pencil tool to line up edges as shown above.
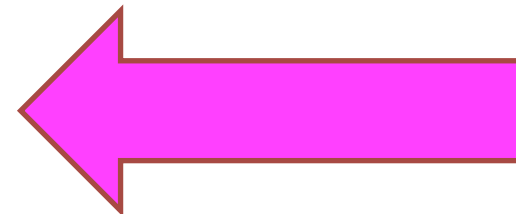
Click on the **dimensions tool bar** and add sizes. All sizes should be below and to the right. Never on the left hand side or on the top
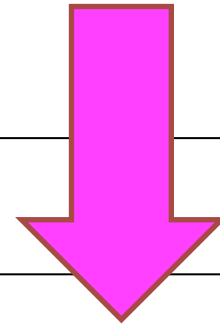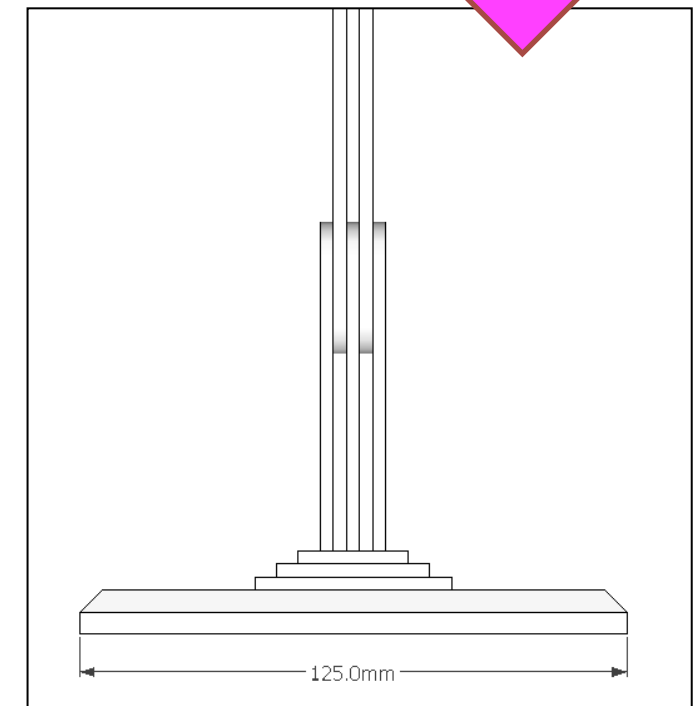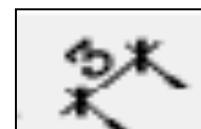
125.0mm

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

10.0mm

125.0mm
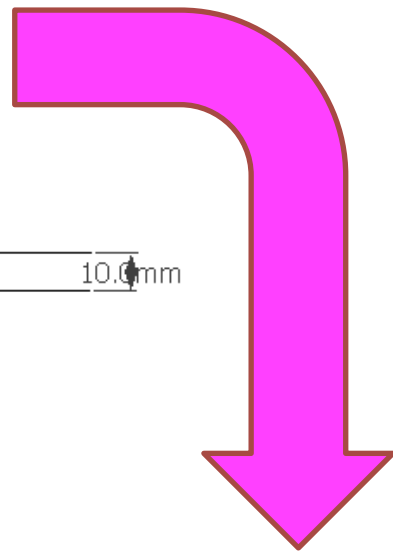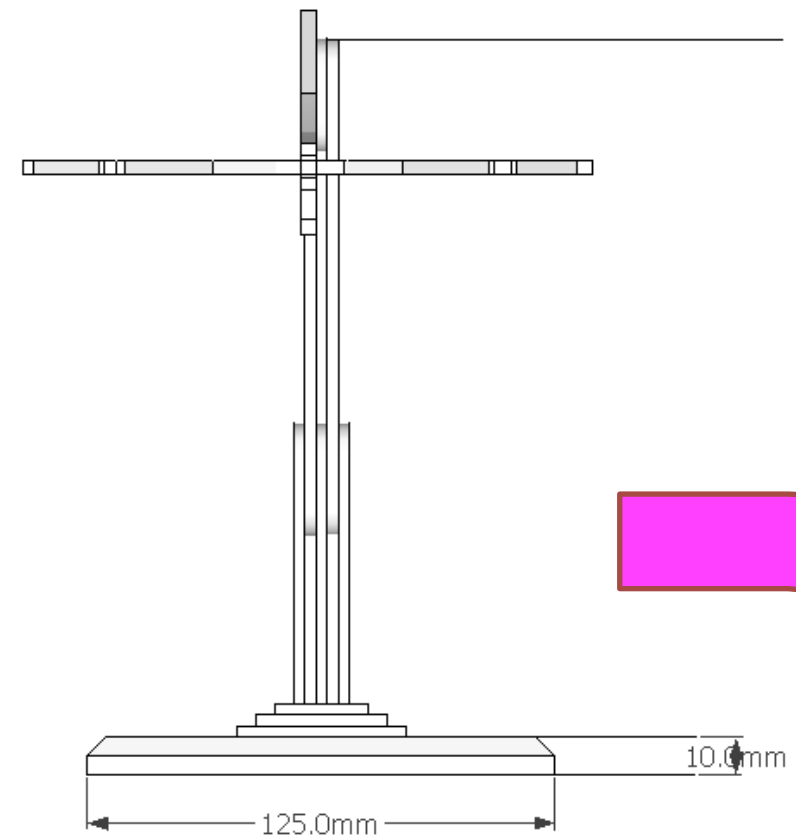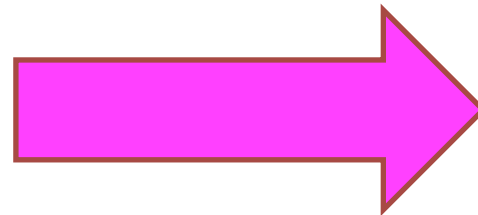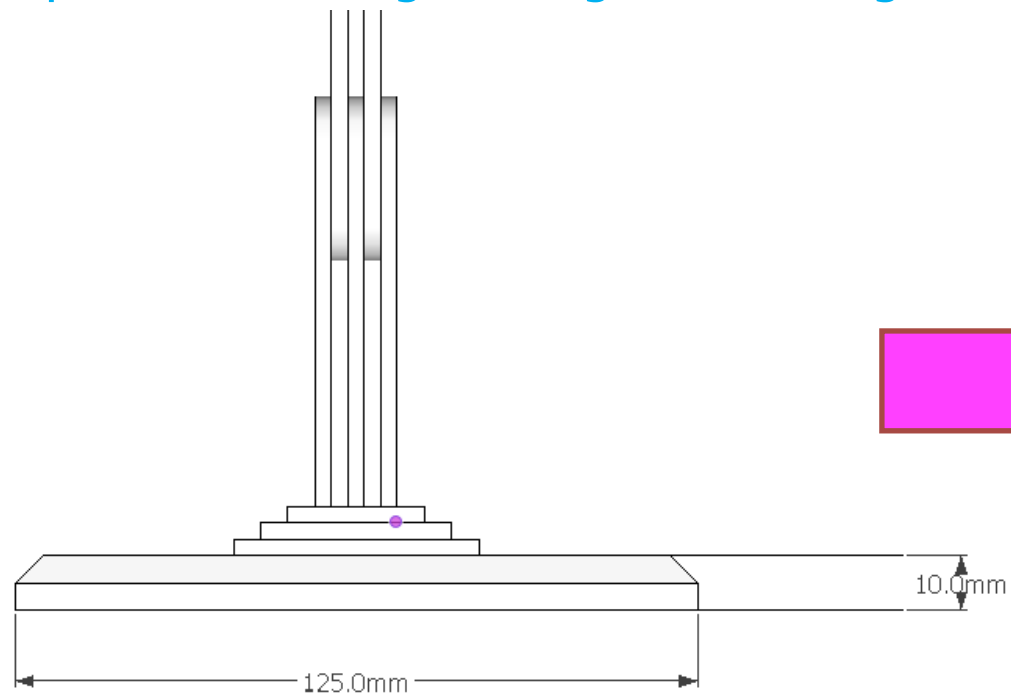
Add sizes to show height, width and any other important sizes. You will compare these to the lamp later on
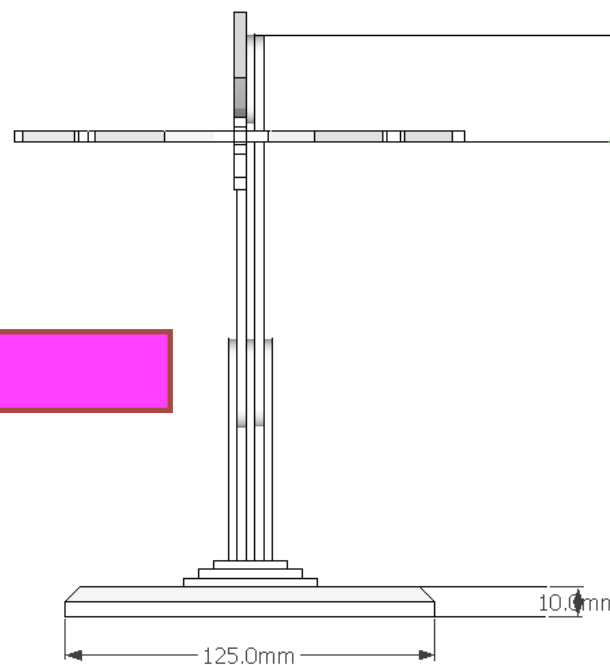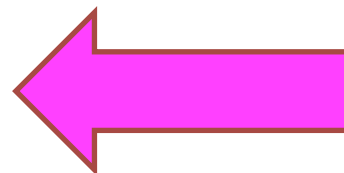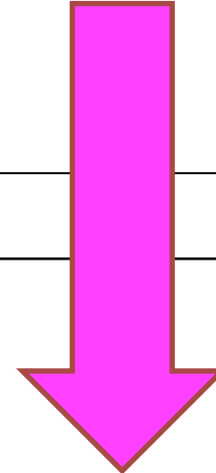
10.0mm

125.0mm

36.0mm

150.1mm

10.0mm

125.0mm

10.0mm

125.0mm

Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)
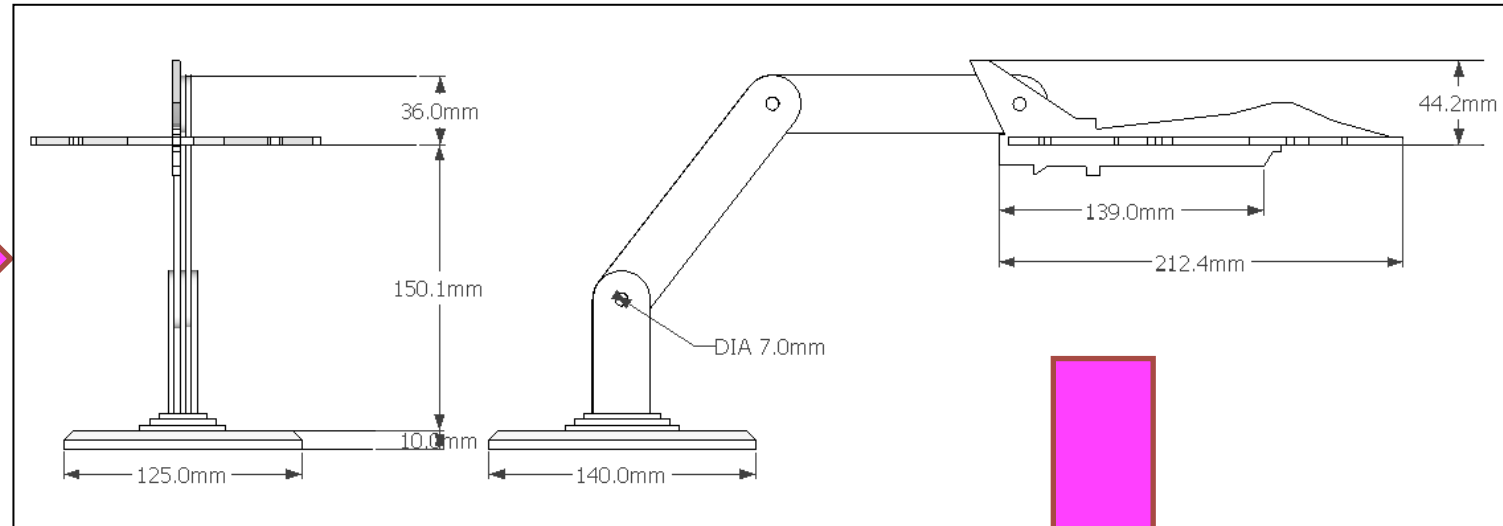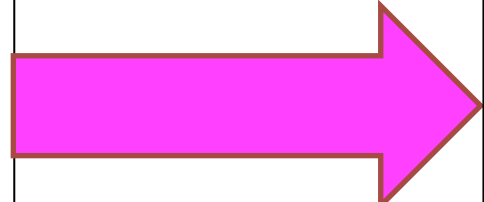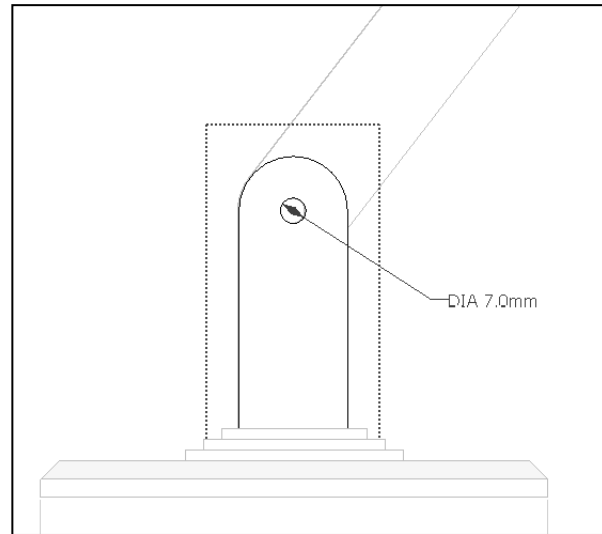
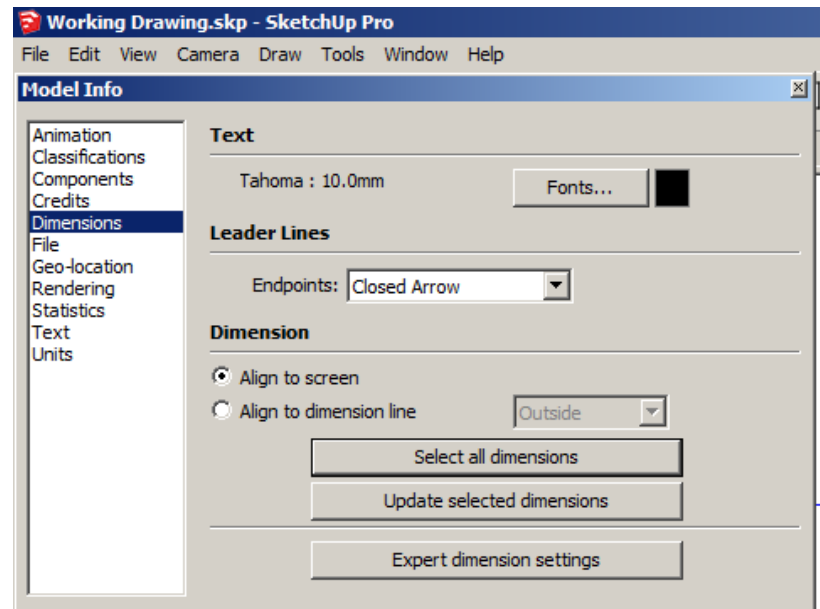If the object is grouped you may need to double click to add some sizes and radius
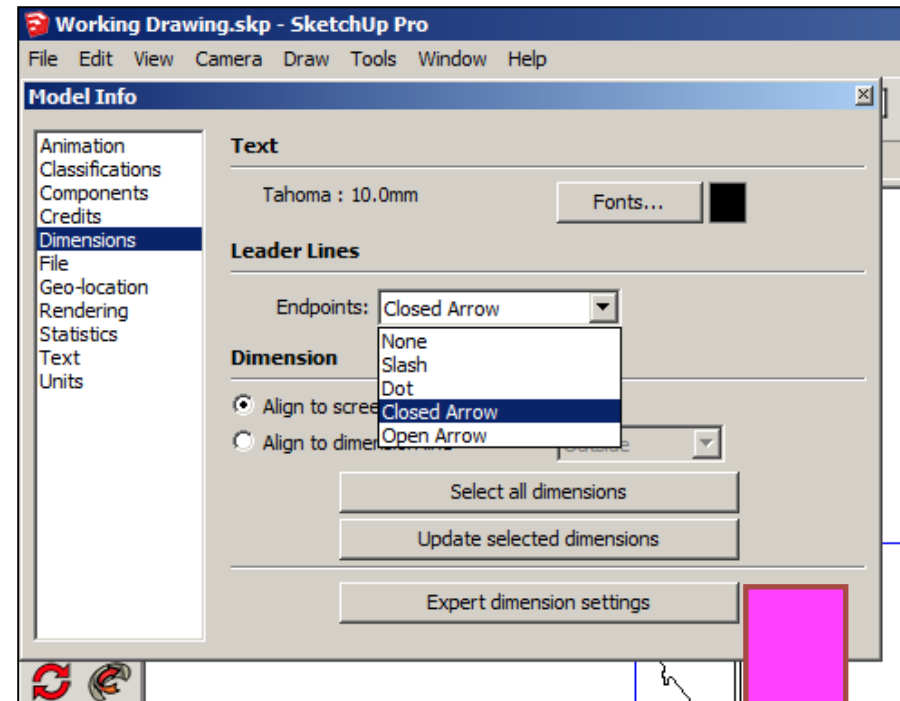

Add sizes to the three drawings Front, Side and Plan
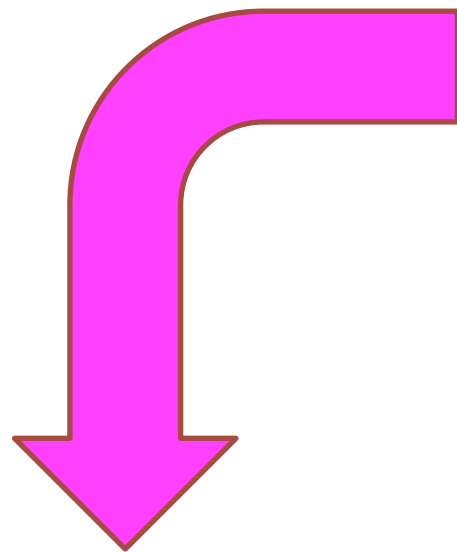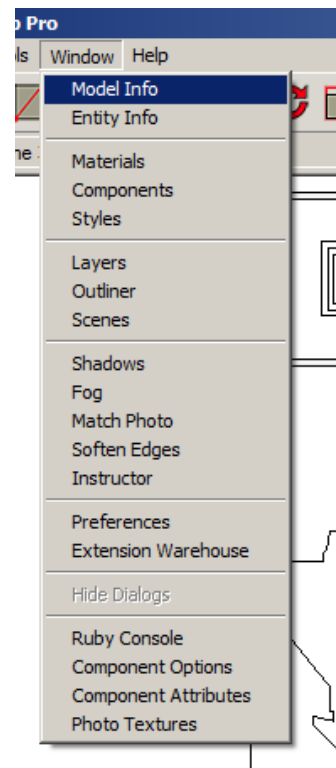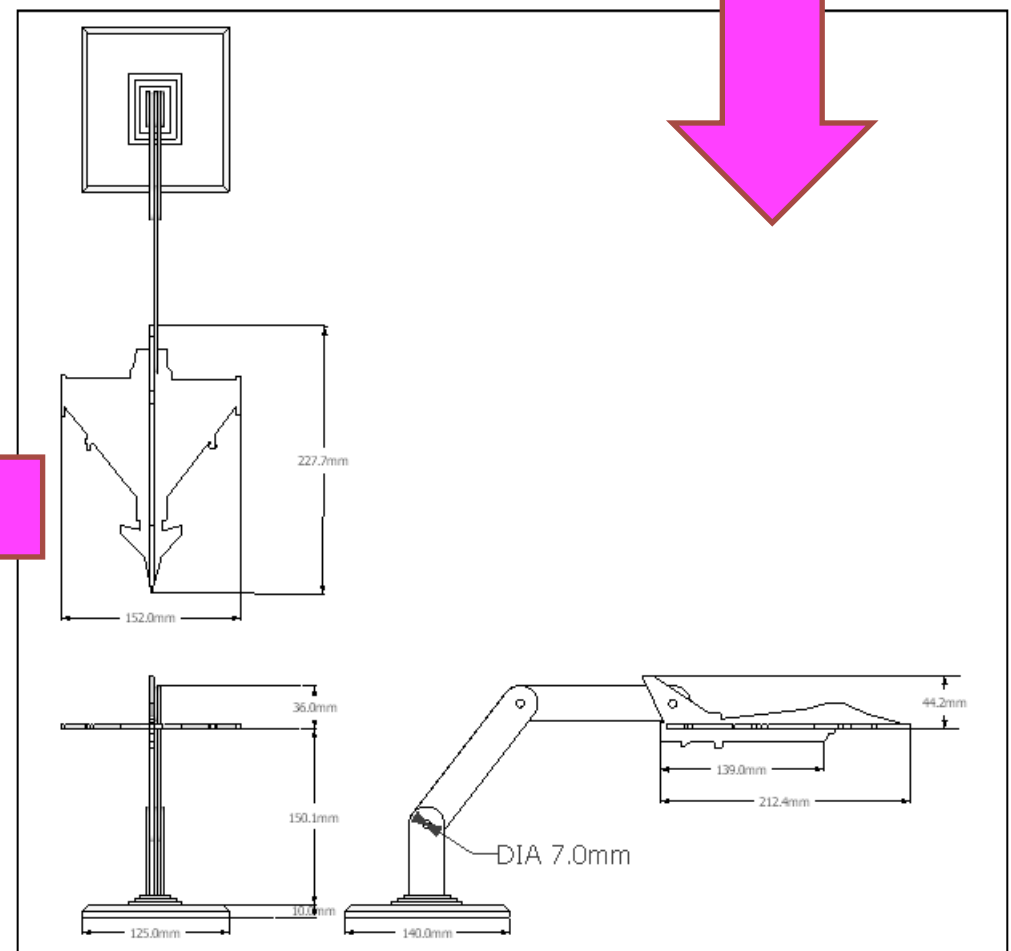
Click on *Window / Model Info*

Computer Aided Design: Aircraft Lamp Working Drawing

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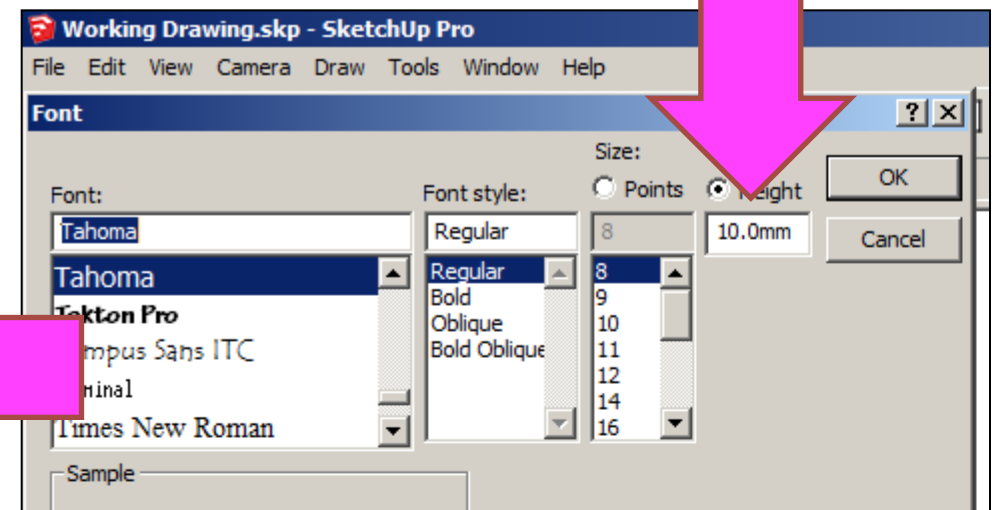

Click on *Dimension* and select all dimensions

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

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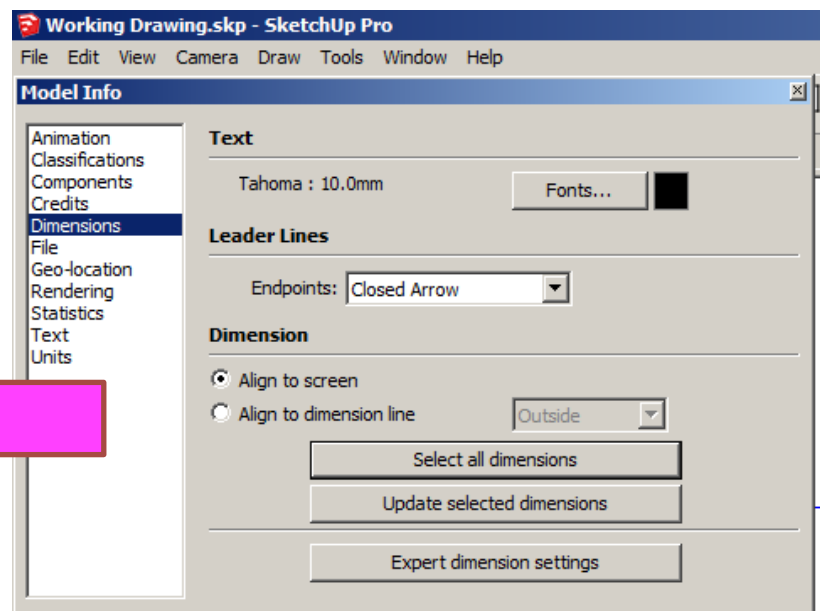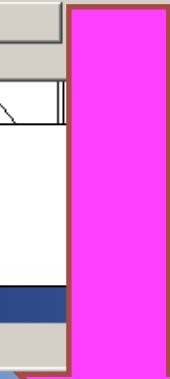
Click on *Update all dimensions.* The dimensions should change on the screen. When your happy close window down.

Computer Aided Design: Aircraft Lamp Working Drawing

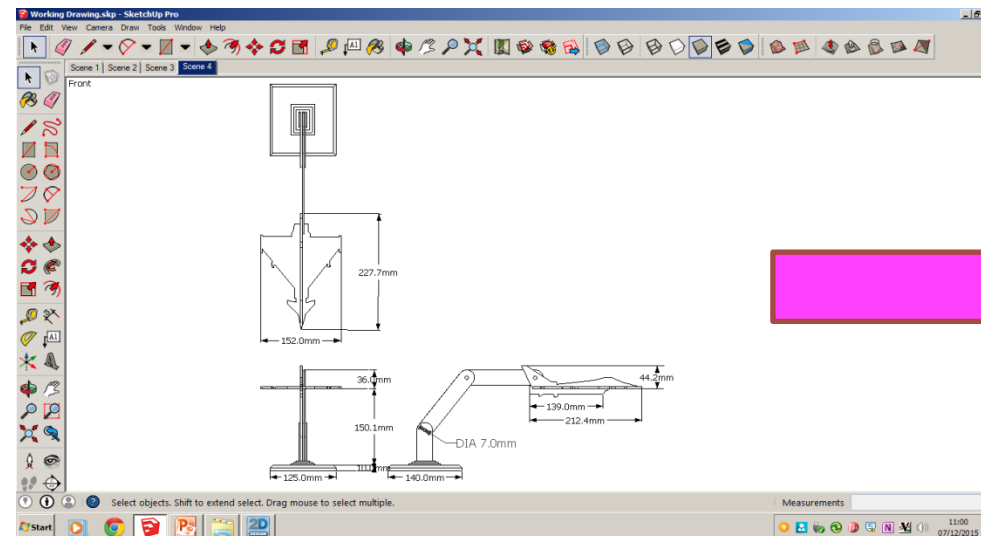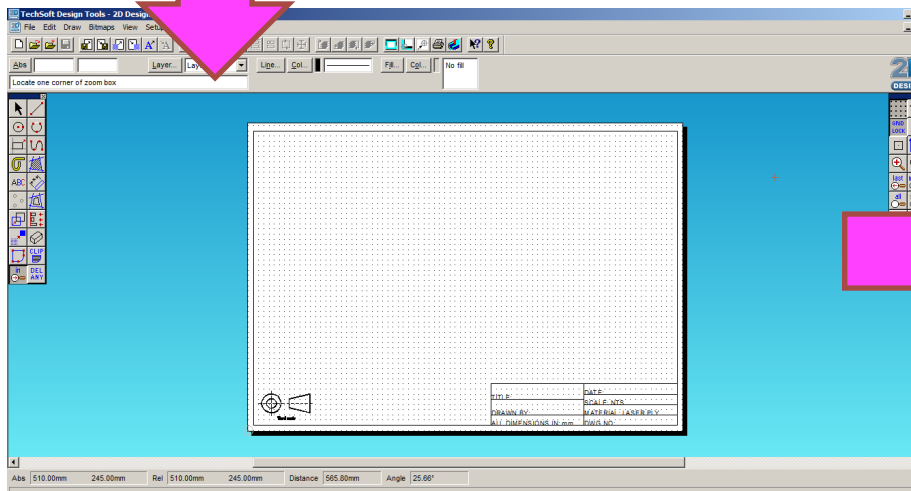Computer Aided Engineering: 2. Working Drawing (Setting up Correct Format)
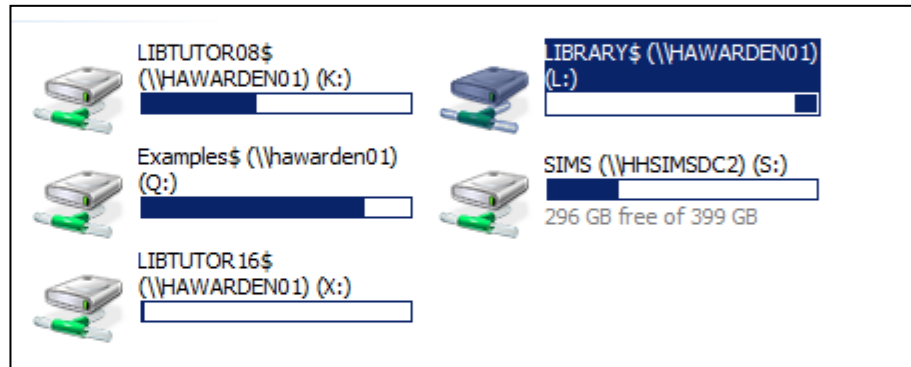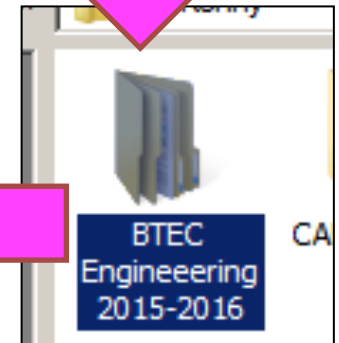
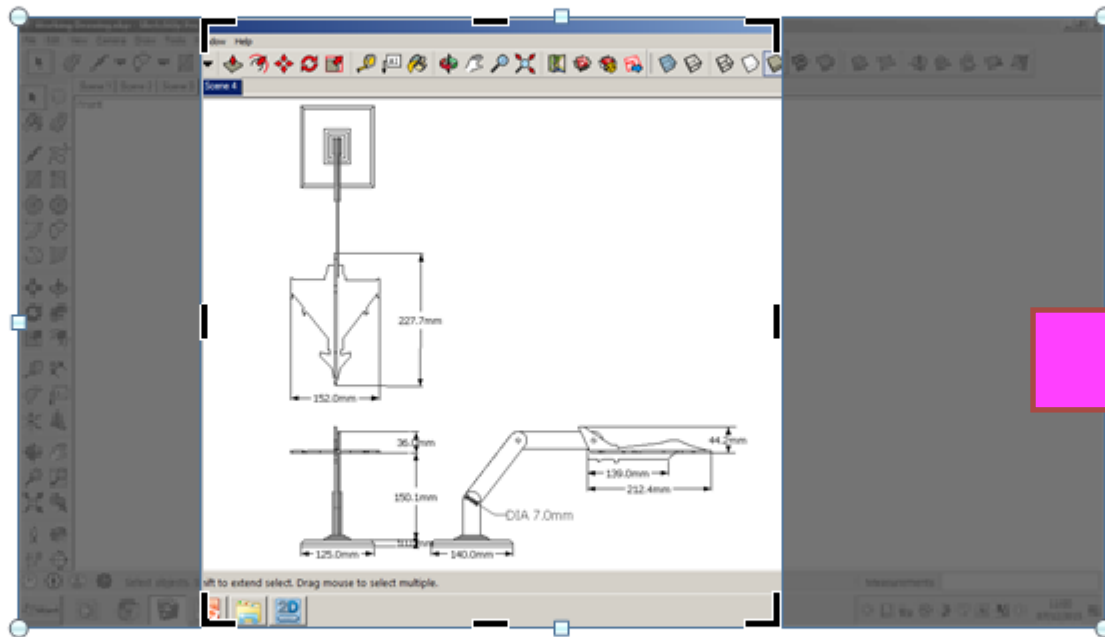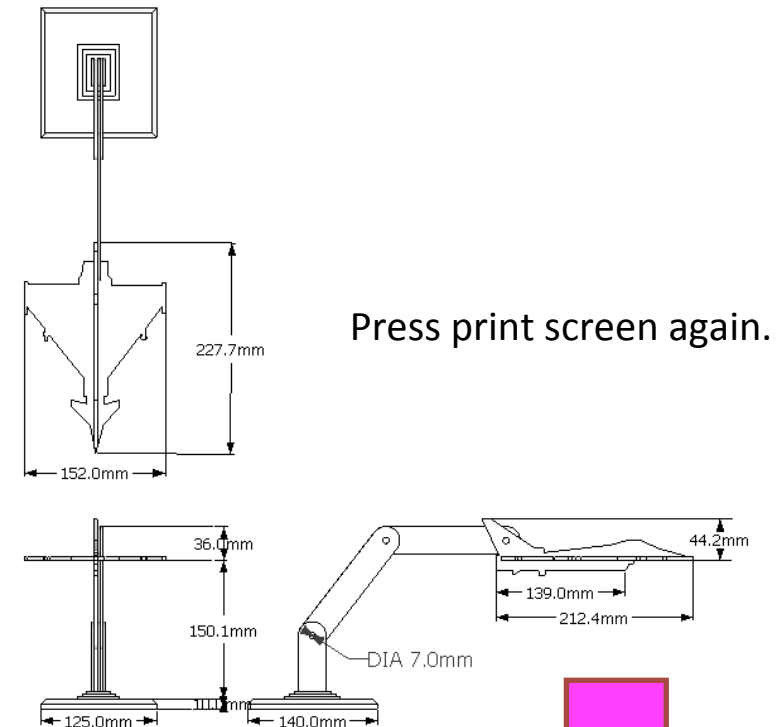Click on *Library.*
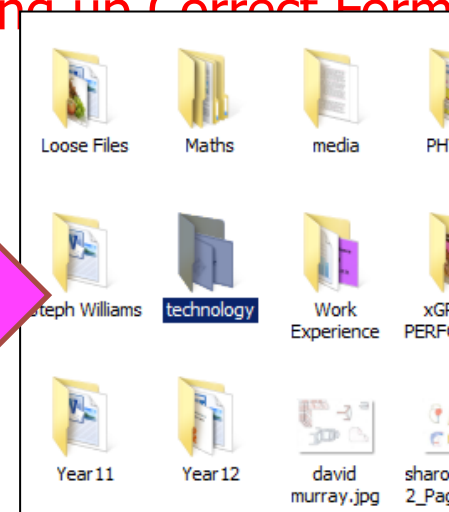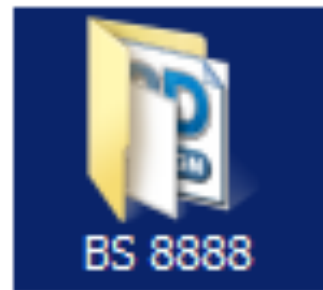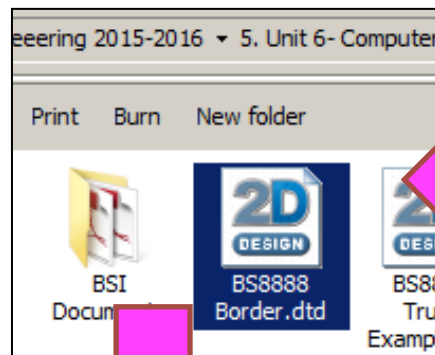
Click on *Technology.*
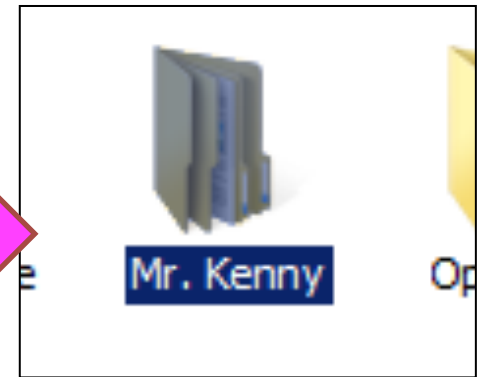
Click on *Mr Kenny.*

Go back to your working drawing. *Click on camera / Parallel projection and then press print screen*

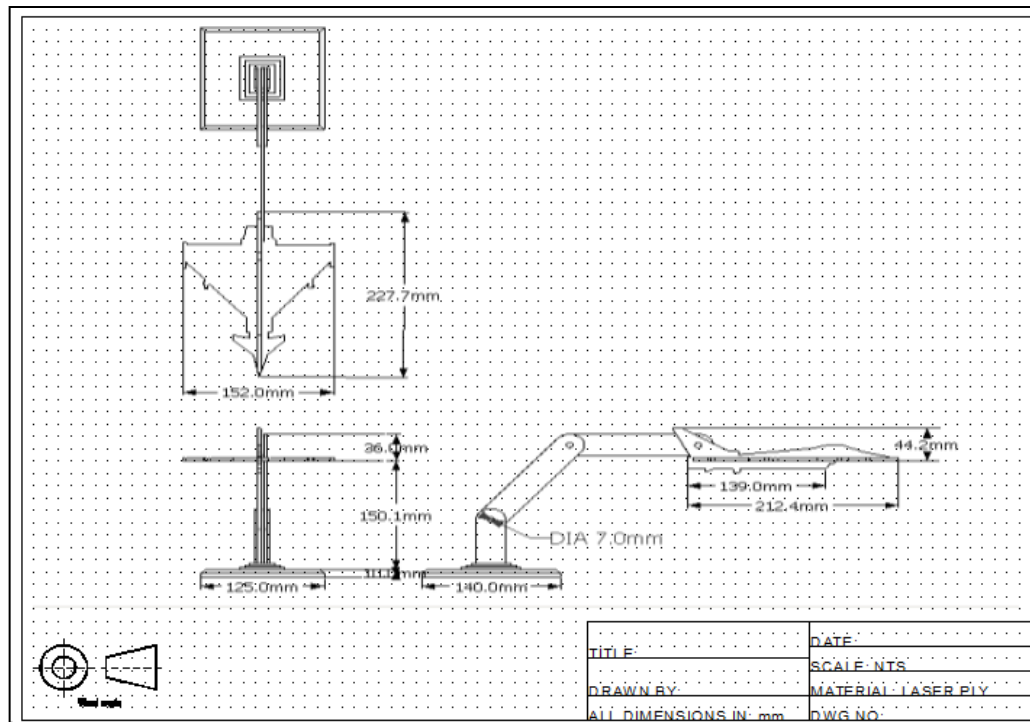# Computer Aided Design: Aircraft Lamp Working Drawing

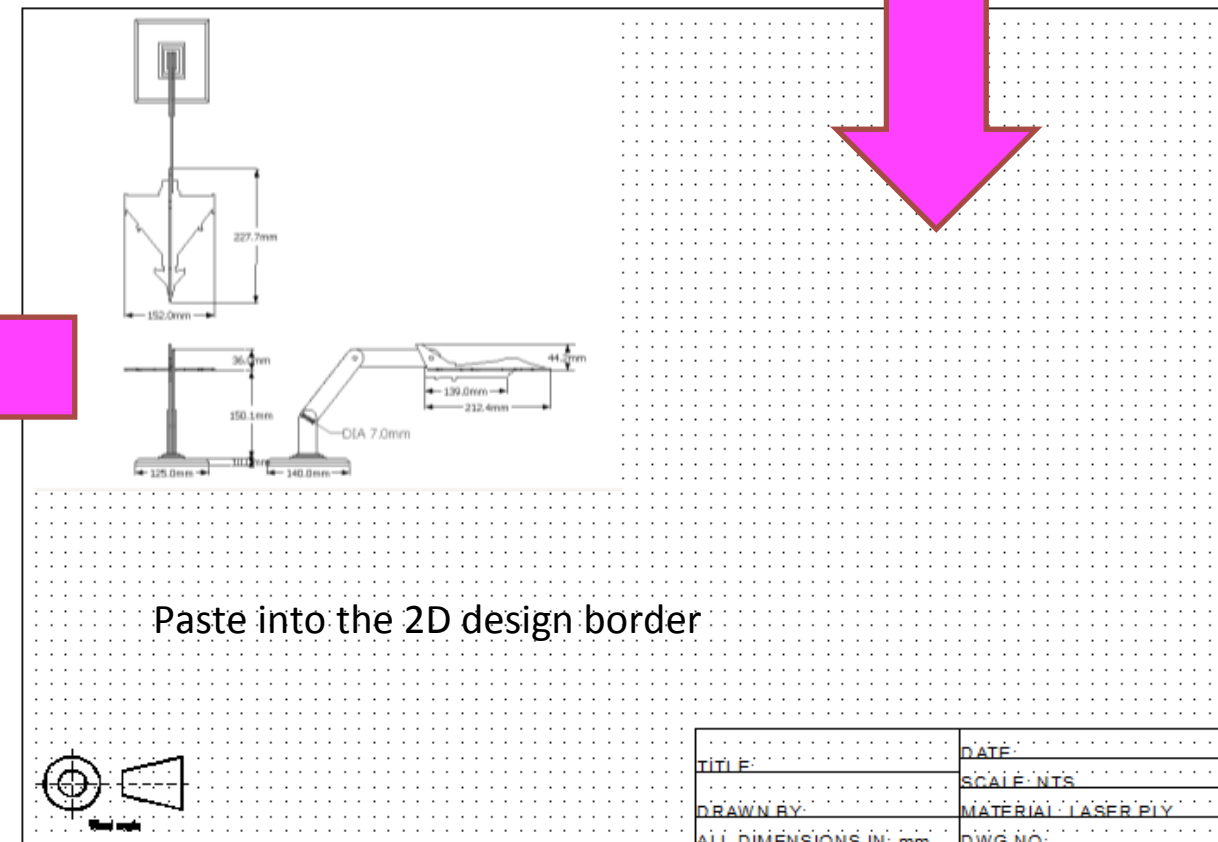## Computer Aided Engineering: 2. Working Drawing (Importing DXF into 2D Design)

Paste into Power point first and then crop.

Press print screen again.

Paste into the 2D design border
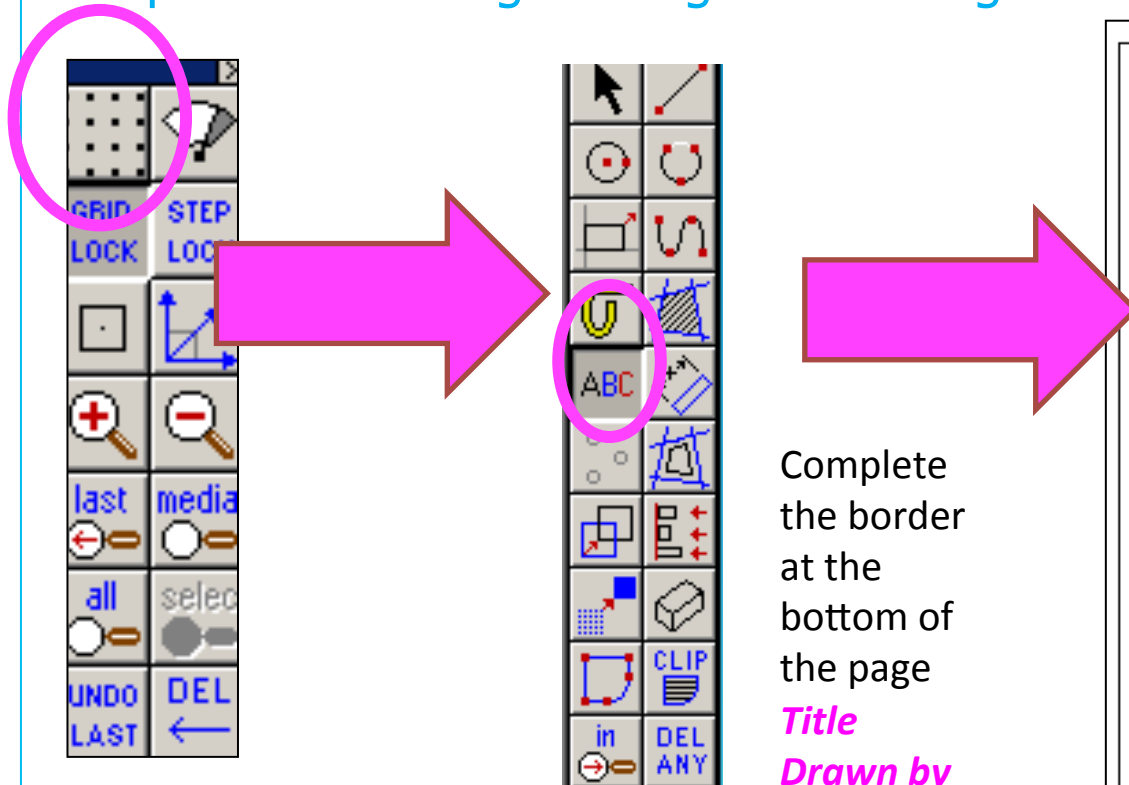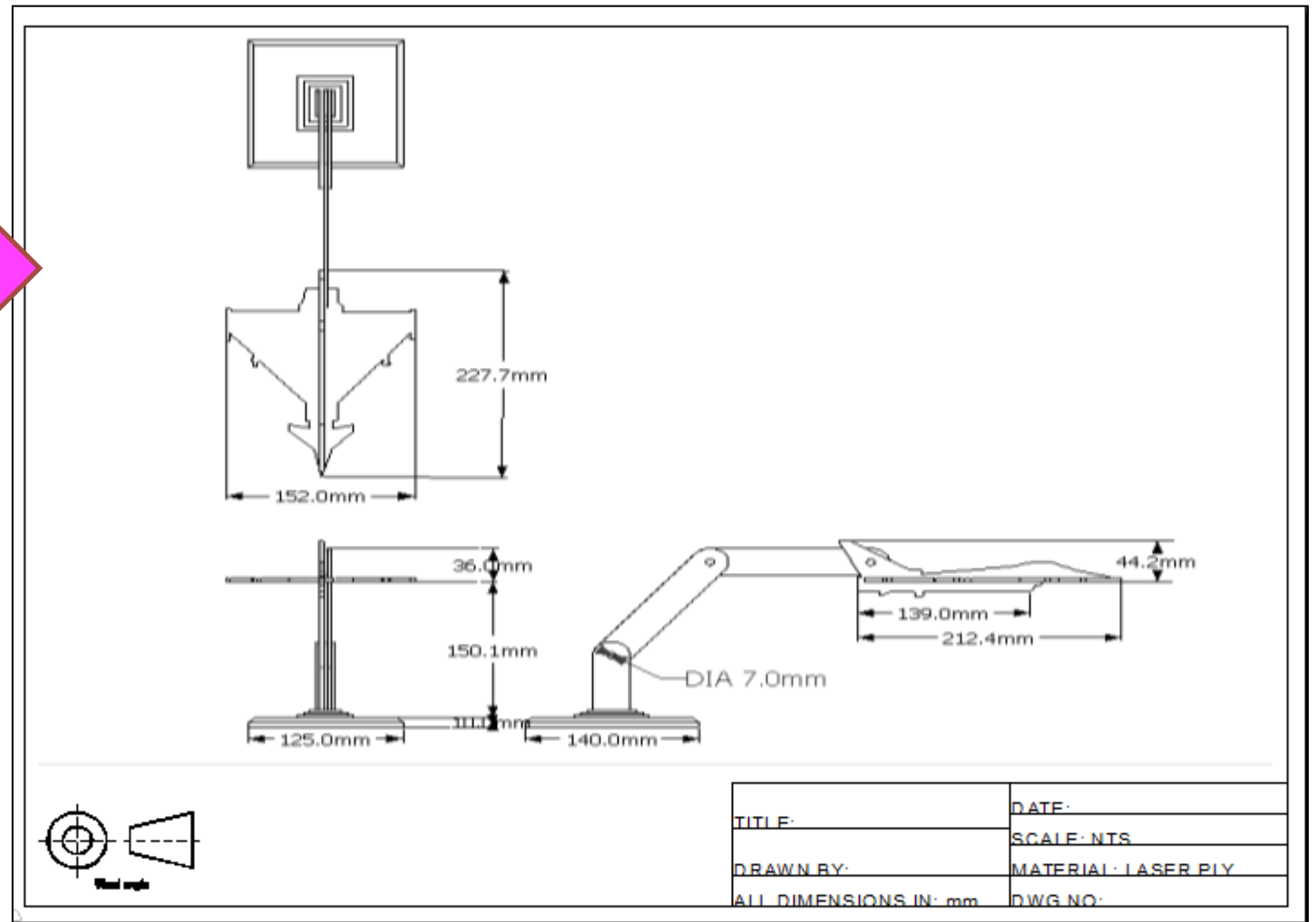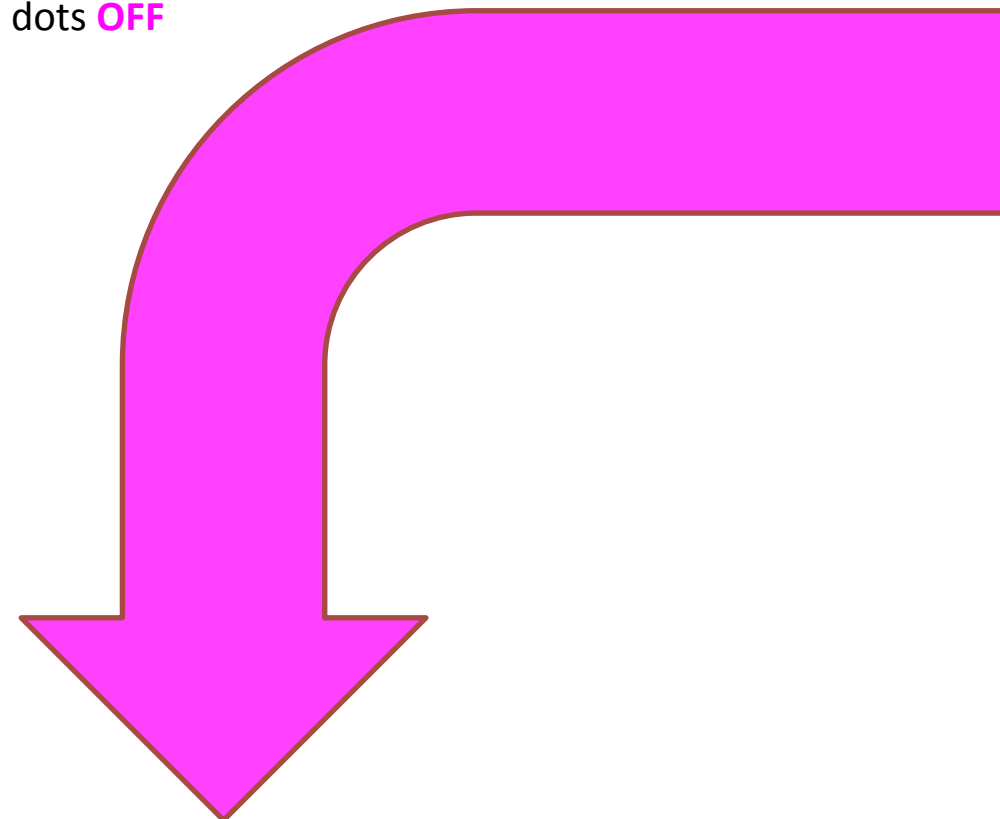
Resize appropriately

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

Complete the border at the bottom of the page
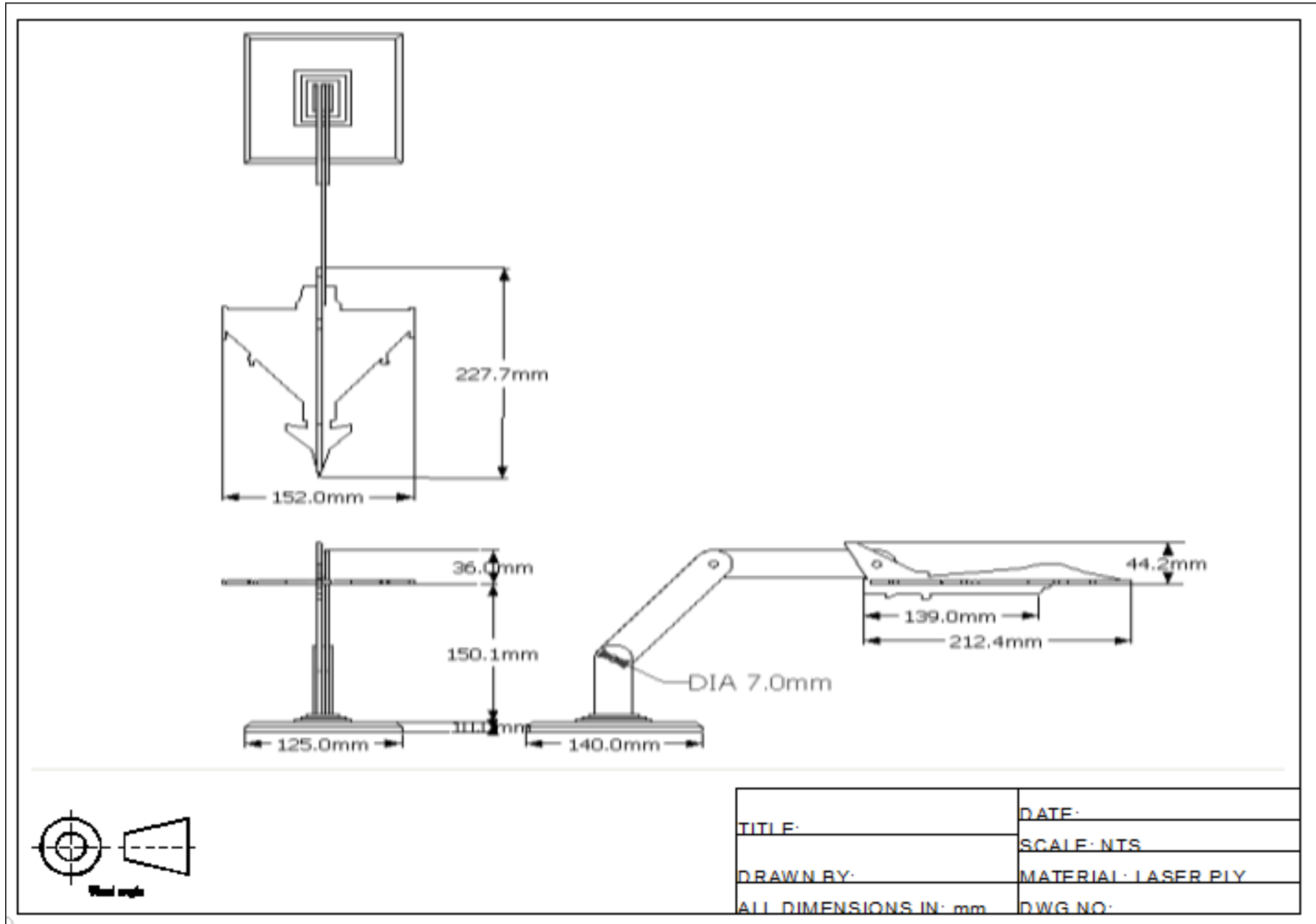*Title*
Drawn by
Date

Click the dots **OFF**

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: Aircraft Lamp Working Drawing

Extension

- Design a wooden lamp based around a culture...........