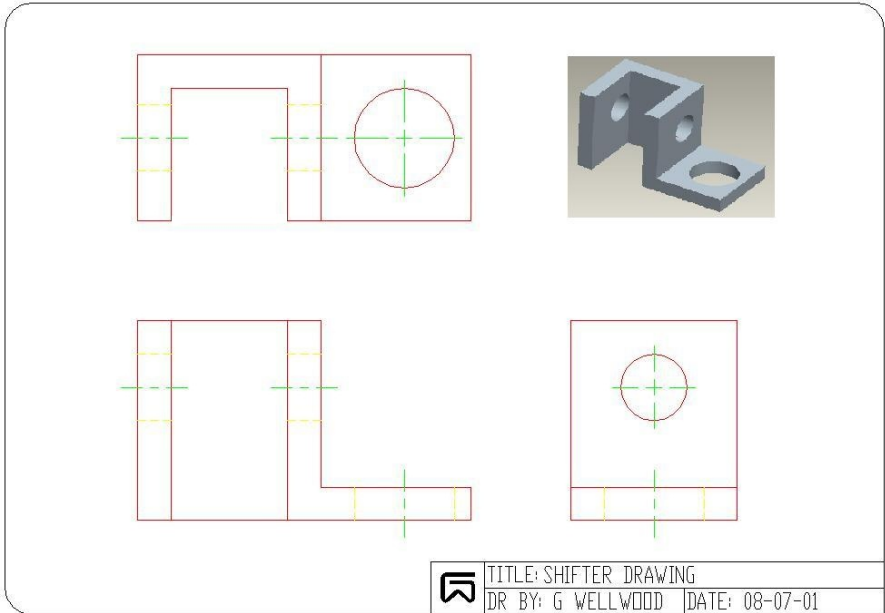


# TUTORIAL - Shifter

## Shape Description/Multi-View Projection

In this tutorial you will construct a three view drawing of the Shifter.

The use of construction lines makes three view drawings MUCH faster than drawing each view individually. Follow along with each step and see if you can get the hang of this technique.



The primary commands you will be using are **OFFSET** and **TRIM**.



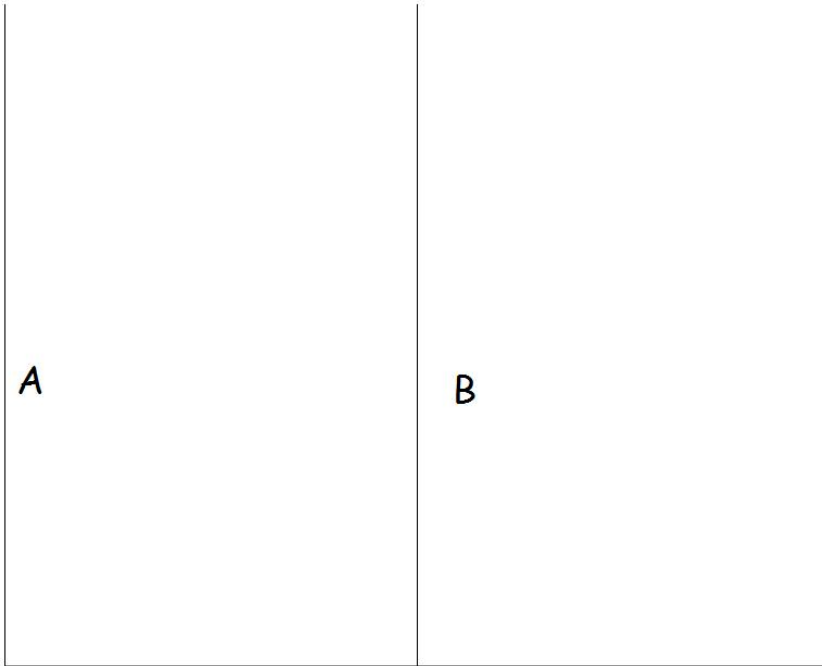
Commands you will need to type are in **RED**. For most commands, it is assumed you will hit enter. Follow what the program is asking for in the Command Window as well as the Pop Up window. There are text commands, drop down menus and icons. In time you will use what is fastest for you. Keyboard commands will ALWAYS be faster than mouse clicks alone.

1. **Laying out the basic shape**

- Type **LINE** (hit enter)
- <start of line>: **1,1**
- <end point>: **@11<0** (means “from where I just clicked, go 11 units at angle zero”)
- Hit **ESC** twice to exit
- Hit **SPACE** to restart LINE
- <start of line>: **1,1**
- <end point>: **@8<90**

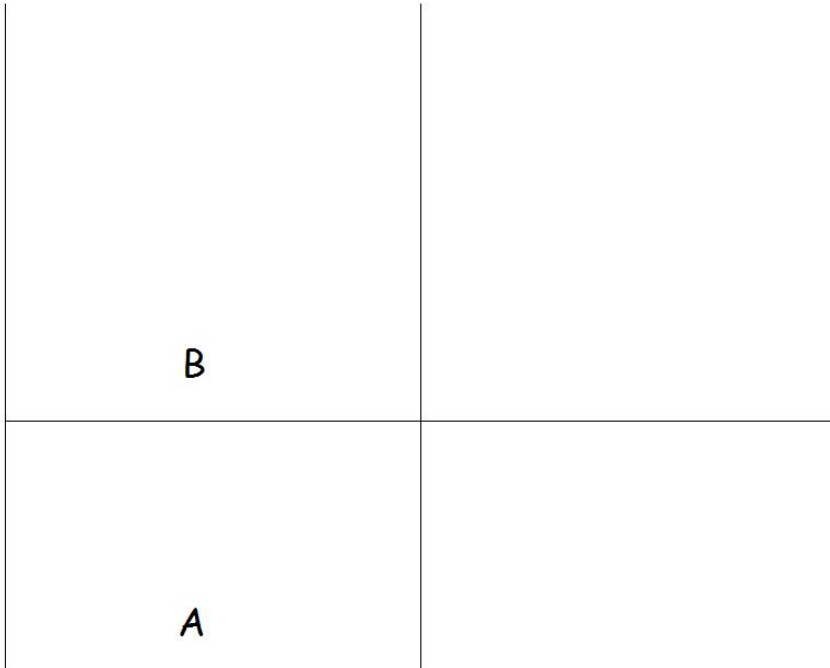
## 2. **Laying out the primary views**

- Type **OFFSET**
- <distance>: **5**
- Click line “A” to select it
- Now click somewhere near “B” below
- Right click to exit the command



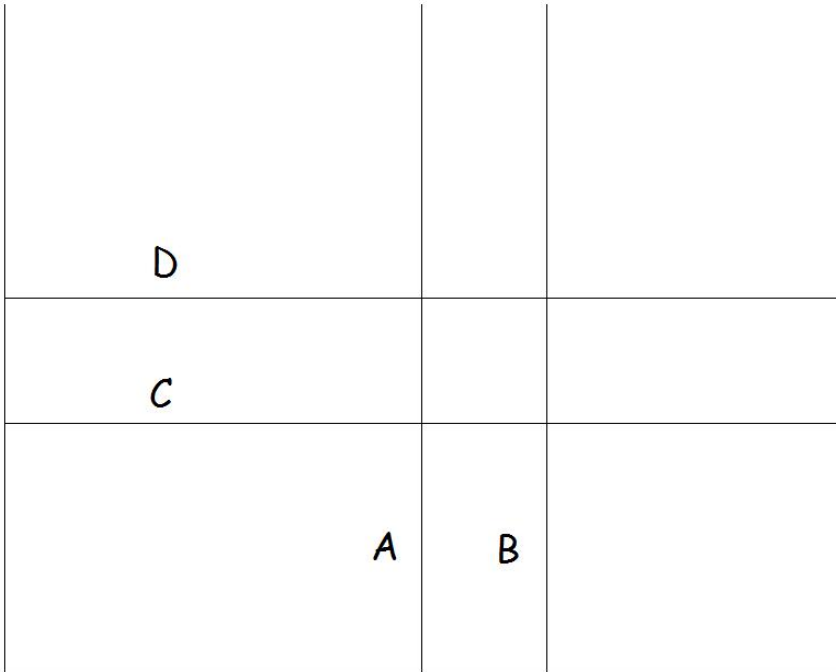
## 2. Laying out the height of the shifter

- Type **OFFSET** (you can also just type “O” for Offset, SPACE to restart it, or right-click to select it from a list)
- <Distance>: **3**
- Click line “A” below
- Click somewhere above it, near “B”
- ESC twice to exit the command



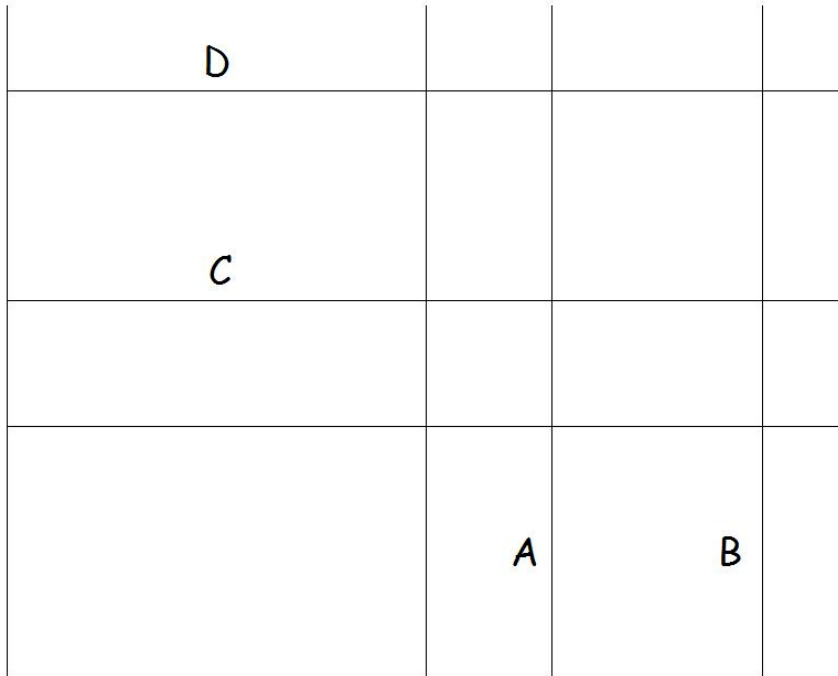
#### 4. Laying out the view separators

- Type **OFFSET**
- <Distance>: **1.5**
- Click line "A"
- Click somewhere near line "B":
- Click line "C"
- Click somewhere near line "D"
- ESC to exit



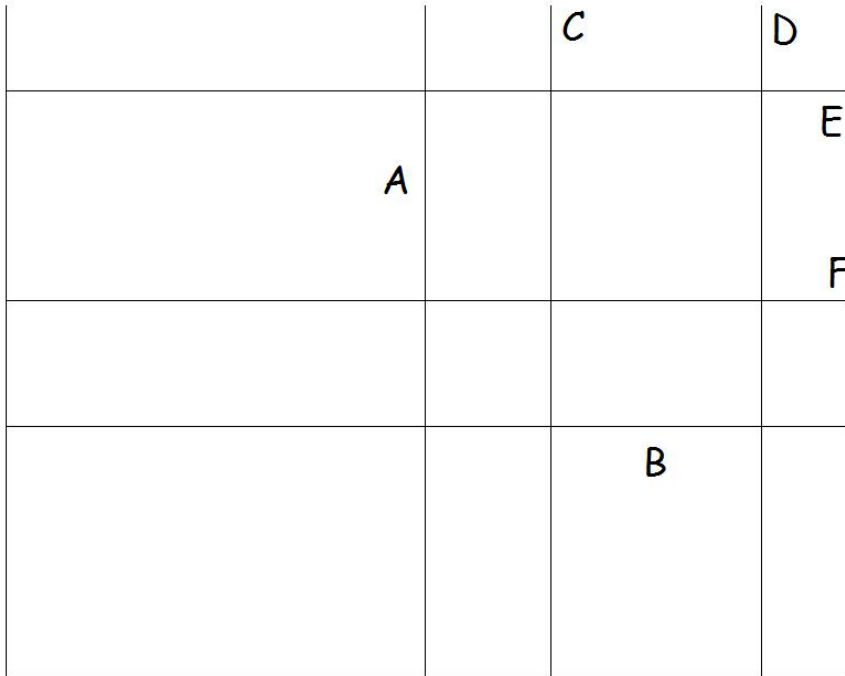
5. **Laying out the depth of the shifter**

- Type **OFFSET**
- <Distance>: **2.5**
- Click line "A"
- Click somewhere near line "B":
- Click line "C"
- Click somewhere near line "D"
- ESC to exit



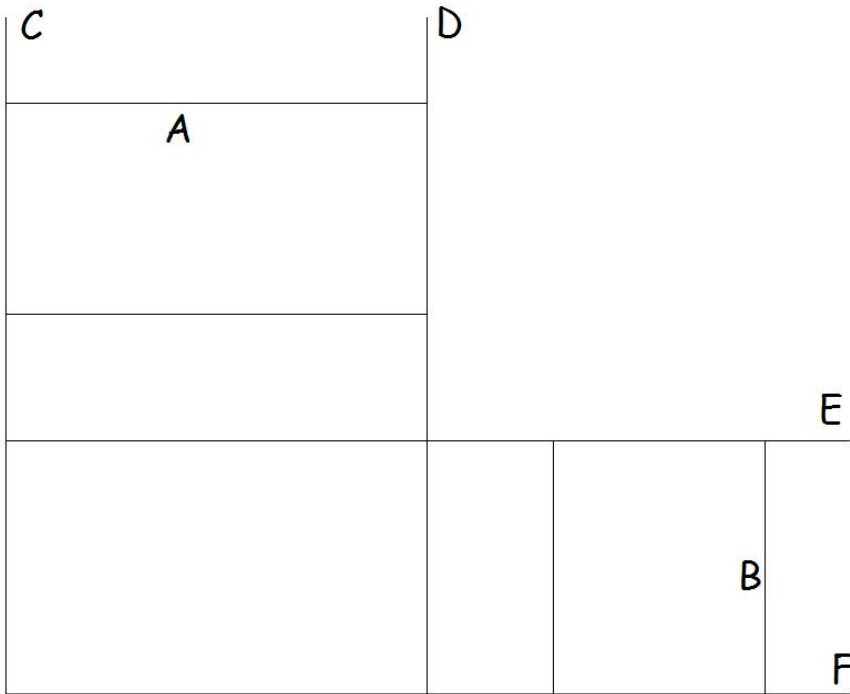
6. **Trimming away excess construction lines**

- Type **TRIM**
- Click lines "A" and "B" as cutting edges (what you want to cut TO)
- Right click to finish selecting
- Click line segments "C", "D", "E" and "F" on the side you want trimmed OFF
- ESC to exit



**7. Trimming away excess construction lines**

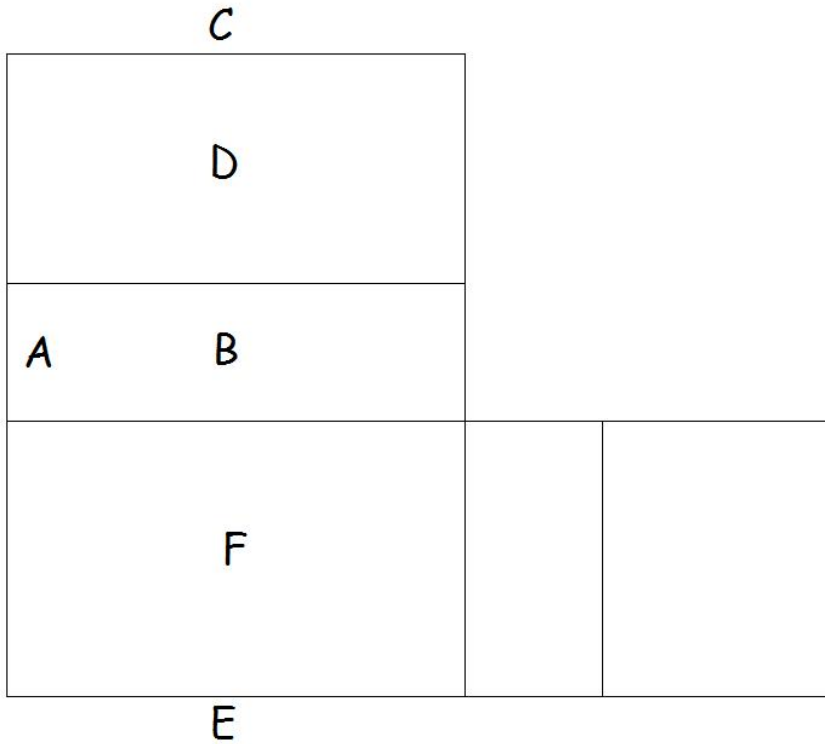
- Type **TRIM** (or type TR, or right click to restart the TRIM command)
- Click lines “A” and “B” as cutting edges
- Right click to finish selecting
- Click line segments “C”, “D”, “E” and “F” on the side to trim OFF
- ESC to exit



8. **Adding details to the views**

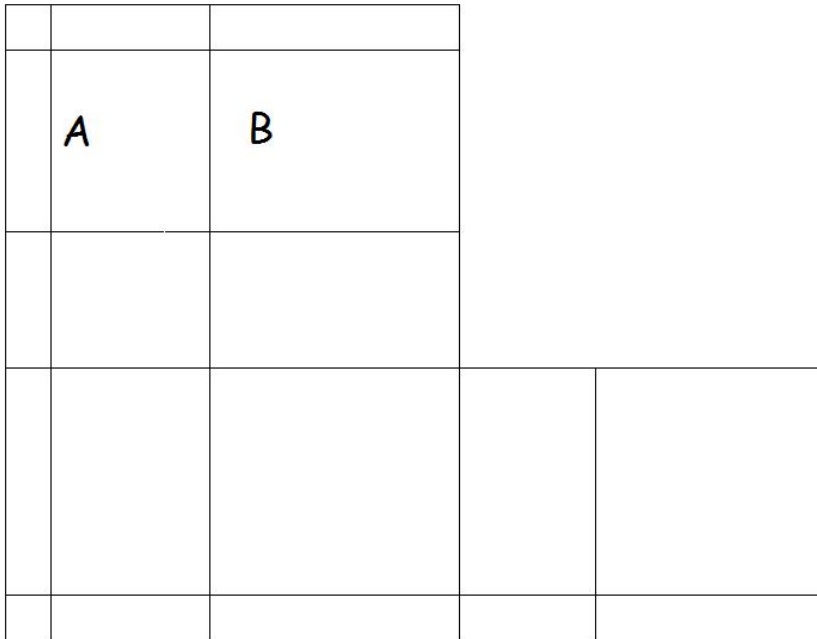
- Type **OFFSET**
- <Distance>: **0.5**
- Click line "A"
- Click somewhere near "B":
- Click line "C"
- Click somewhere near "D"
- Click line "E"
- Click somewhere near "F"
- ESC to exit





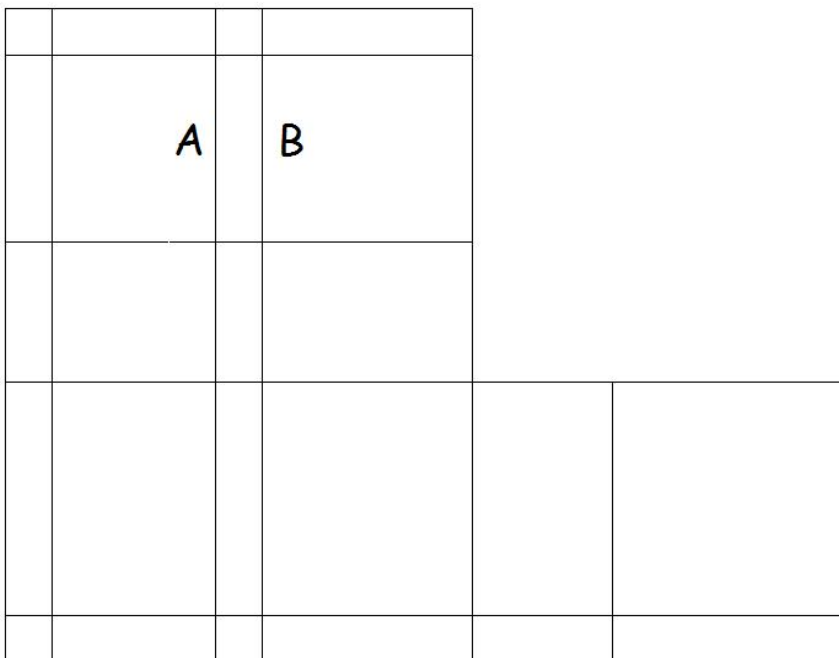
9. **Adding more details to the views**

- Type **OFFSET**
- <Distance>: **1.75**
- Click line "A"
- Click somewhere near "B"
- ESC to exit



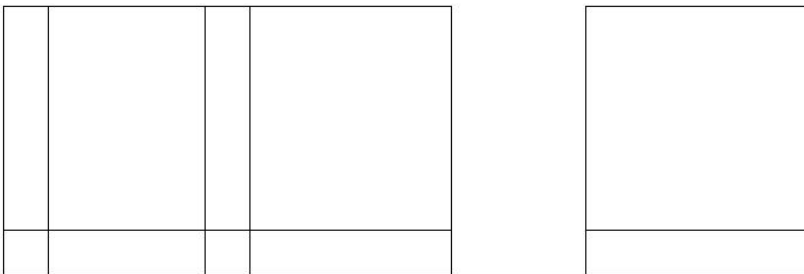
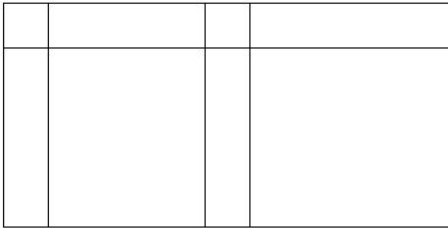
10. Adding more details to the views

- Type **OFFSET**
- <Distance>: **0.5**
- Click line "A"
- Click somewhere near "B"
- ESC to exit



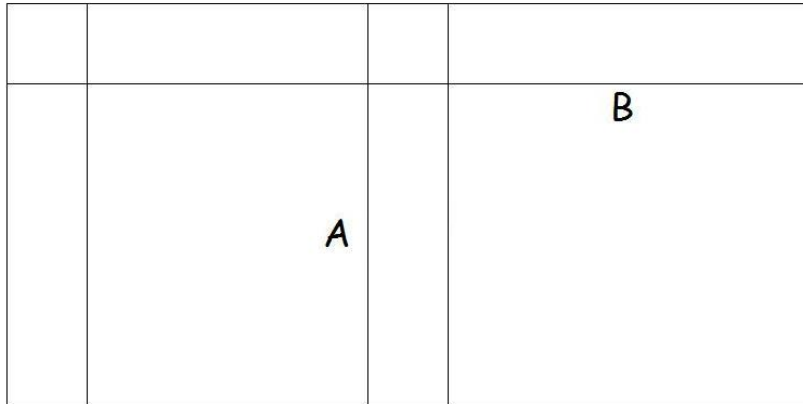
### 11. Trimming the line segments between views

- Type **TRIM**
- Right click to select ALL objects (selects every line as a cutting edge)
- Click on each line (you want removed) between all three views
- ESC to exit



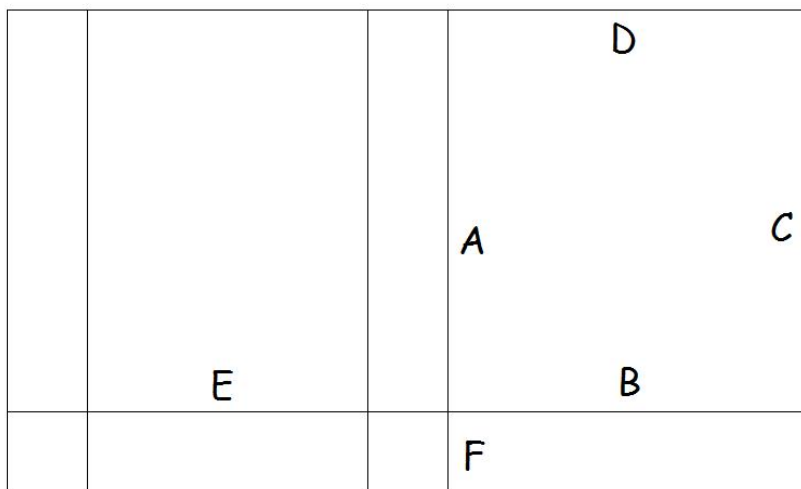
### 12. Trimming away excess lines

- Type **ZOOM** (or just “Z”)
- Draw a crossing box around the top view
- Type **TRIM**
- Click line “A” as the cutting edge
- Right click to finish selecting
- Click line at “B” to trim
- ESC to exit



### 13. Trimming away excess lines

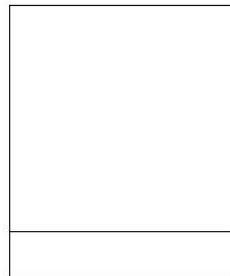
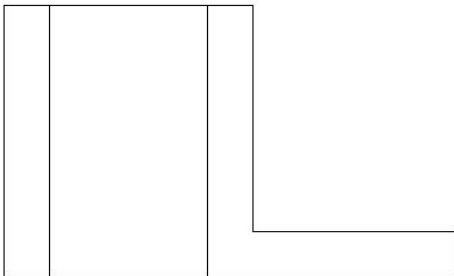
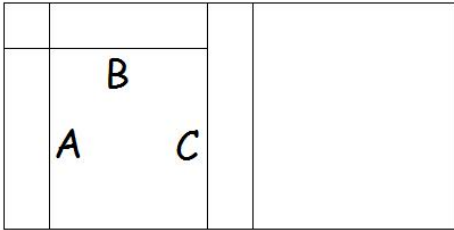
- Move the cursor to the bottom of the screen
- Hold the mouse wheel down and PAN the page up until you can see the front view
- Type **TRIM** (or right click to restart TRIM)
- Click lines "A" and "B" as cutting edges
- Right click to finish selecting
- Click lines "C", "D", "E" and "F" for trimming
- ESC to exit



### 14. Filleting to 90° corners

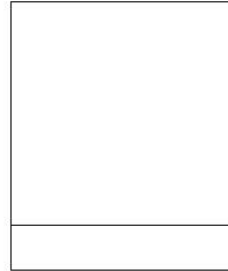
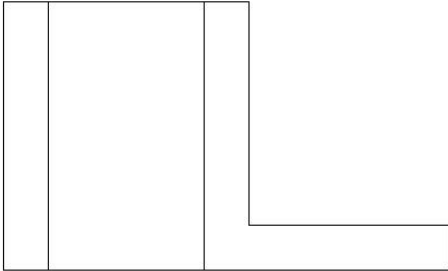
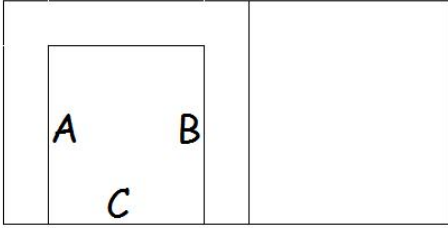
- Type **ZOOM**, then type **ALL** (or just double click the mouse wheel)
- Type **FILLET**
- Type **RADIUS** (or just "R")

- Change the radius to 0 (zero)
- Type **FILLET** again
- Click line “A” and then line “B”
- Type **FILLET** again
- Click line “B” then line “C”



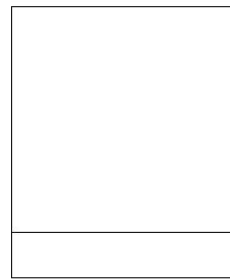
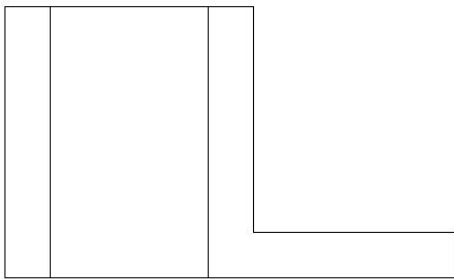
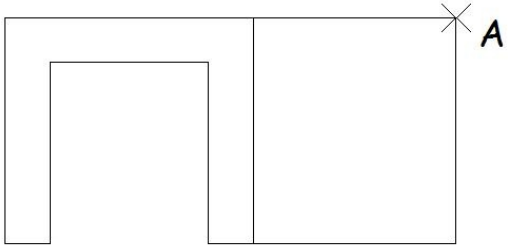
#### 15. **Trimming extra lines**

- Type **TRIM**
- Click lines “A” and “B”
- Right click to finish selecting
- Click line “C”
- ESC to exit



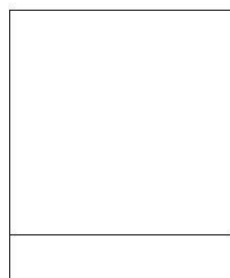
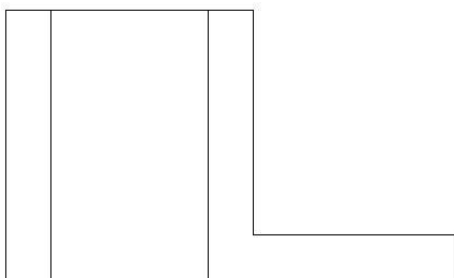
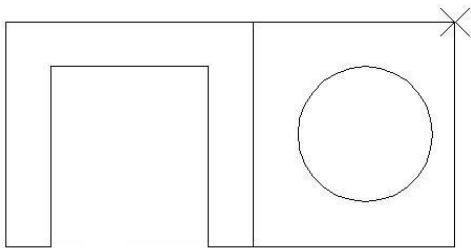
#### 16. Placing a Reference Point

- Type **PDMODE**
- New value for PDMODE <0>: **3**
- Type **POINT**
- <Location of point>: **INT** (for intersection attach)
- Click the intersection at "A" - notice a green "X" appears indicating that it will grab the exact intersection of the two lines
- ONCE THE POINT APPEARS DO NOT CLICK ANYWHERE – GO DIRECTLY TO STEP 17



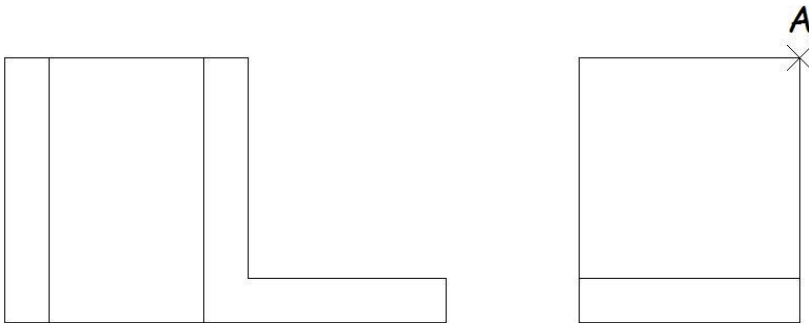
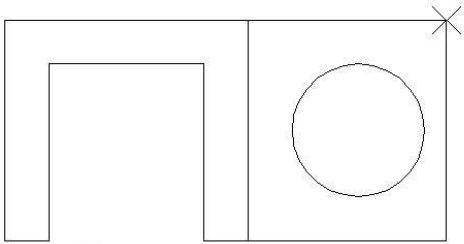
### 17. Placing a circle

- Type **CIRCLE**
- <Center of circle>: **@-1,-1.25**
- Diameter/<Radius>: **D**
- Diameter of circle: **1.5**



### 18. Placing a Reference Point

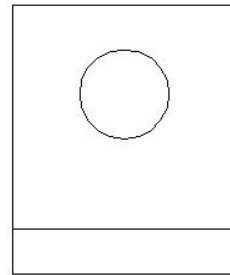
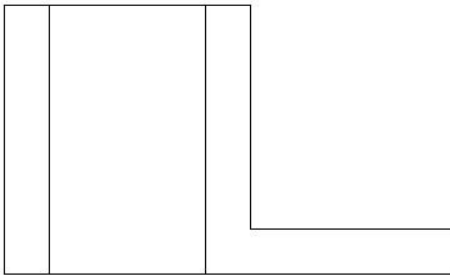
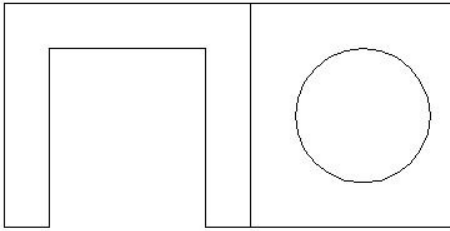
- Type **POINT**
- <Location of point>: **INT**
- Click the intersection at "A"
- ONCE THE POINT APPEARS DO NOT CLICK ANYWHERE – GO DIRECTLY TO STEP 19



#### 19. Placing a circle and deleting reference points

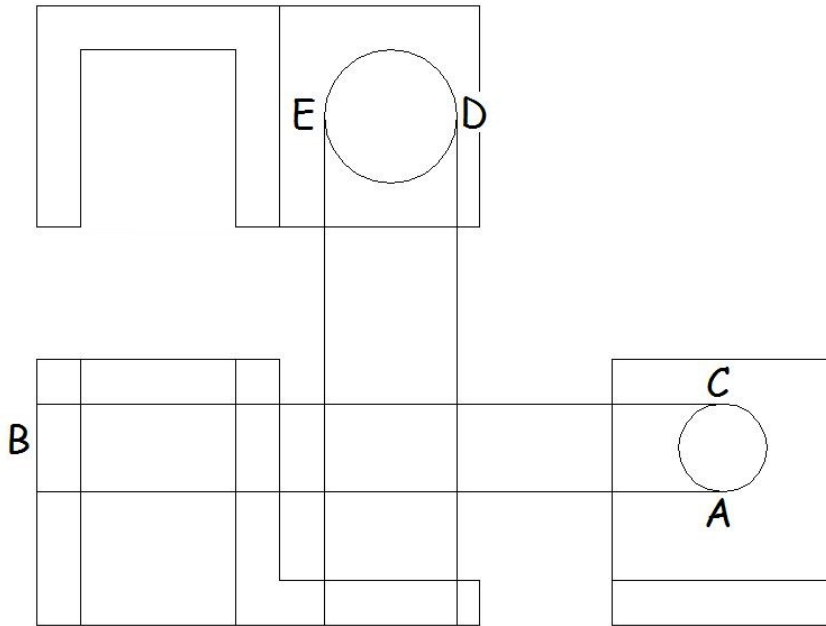
- Type **CIRCLE**
- <Center of circle>: **@-1.25,-1**
- Diameter/<Radius>: **D**
- Diameter of circle: **1**
- Type **DELETE**
- Click on the reference points
- ESC to exit





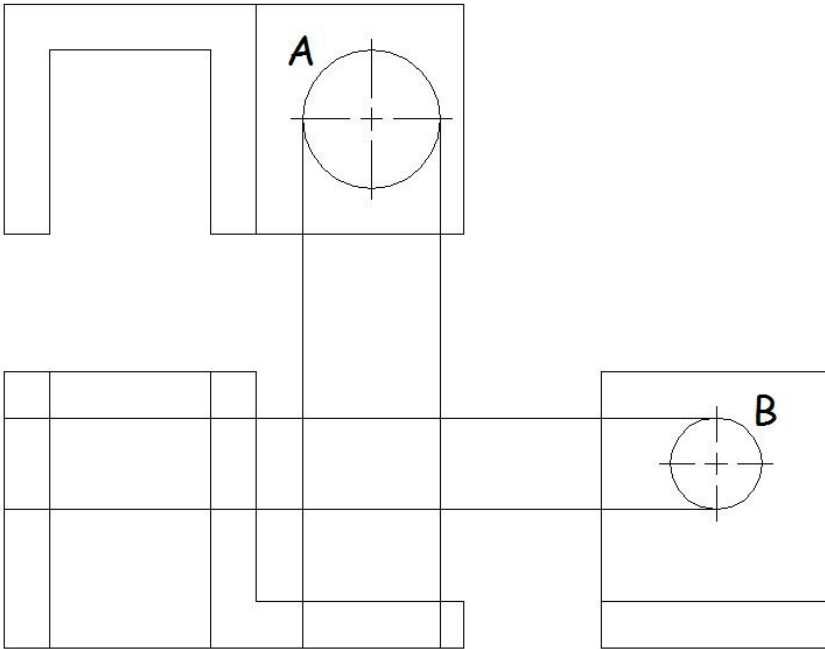
#### 20. Adding projection lines

- Type **LINE** (or just "L")
- <start of line>: **QUA** (to attach to the quadrant of a circle)
- Click the circle at point "A"
- <end point>: **PER** (to attach perpendicularly to a line)
- Click line "B" (notice a green "square" symbol appears)
- ESC to exit
- Repeat for quadrant "C", "D" and "E"



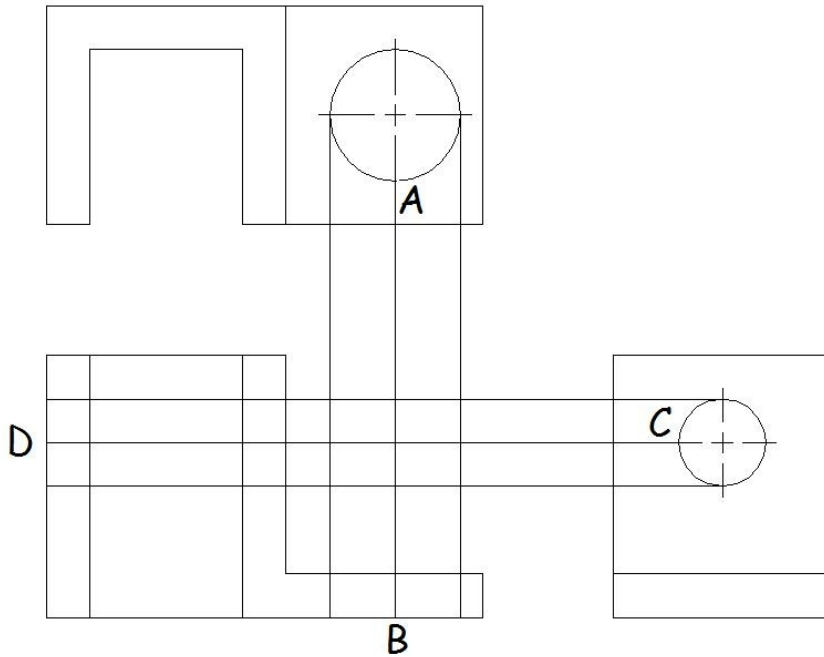
#### 21. Placing center marks

- Type **DIMCEN**
- New current value for DIMCEN (0): **-0.12**
- Type **CENTERMARK**
- Click circle "A"
- Click circle "B"
- Hit ESC to exit



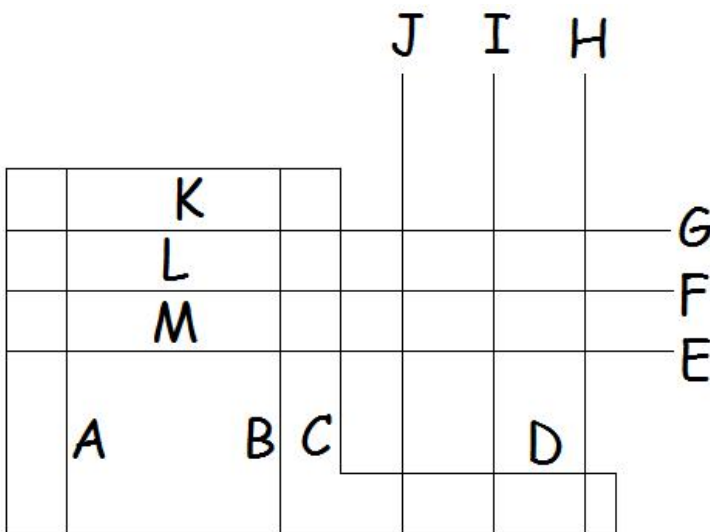
## 22. Adding projection lines

- Type **LINE**
- <Start of line>: **END**
- Click the end of center mark line at "A"
- <End point>: **PER**
- Click line "B"
- ESC to exit
- Repeat for line "C" and "D"



### 23. Trimming excess lines

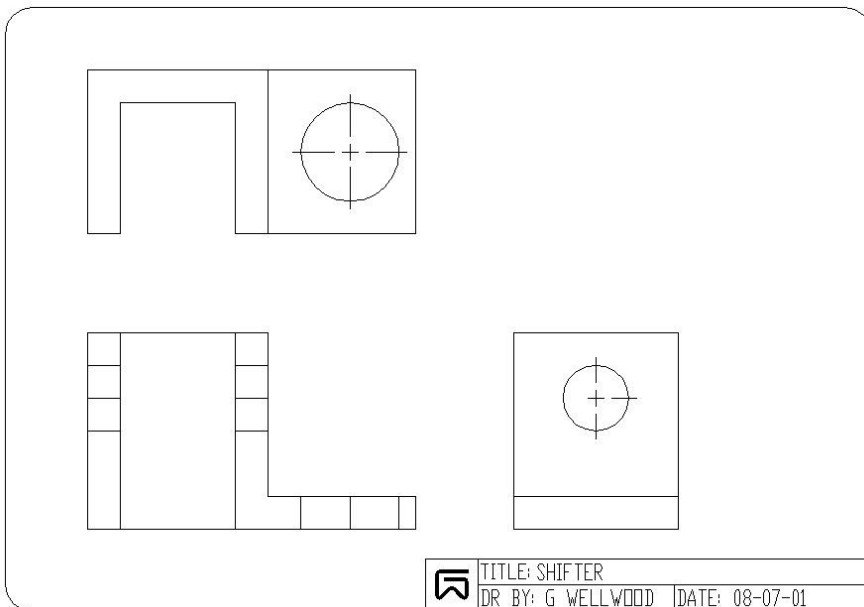
- Type **TRIM**
- Click lines "A", "B", "C" and "D" as cutting edges
- ESC to exit
- Click line segments "E", "F", "G", "H", "I", "J", "K", "L" and "M" to trim off
- ESC to exit



### 24. Inserting a title block with layers

- Type **INSERT**

- Type **BROWSE**
- Locate and select your title block that has the layers already installed
- <Insertion point for block>: **0,0**
- Scale factor: **Hit Enter**
- Rotation angle: **Hit Enter**
- Click on your title block
- Right click and select SCALE
- Base point: **0,0**
- Move the mouse or try different scale factors (0.5 = 50%, 1.5 = 150%) until the title block fits the drawing nicely
- Type **MOVE**
- Click the title block and move it so the drawing is centered inside the border



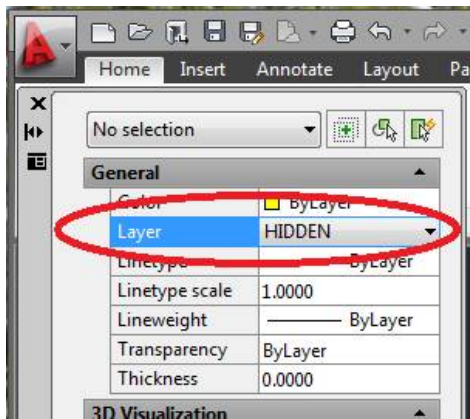
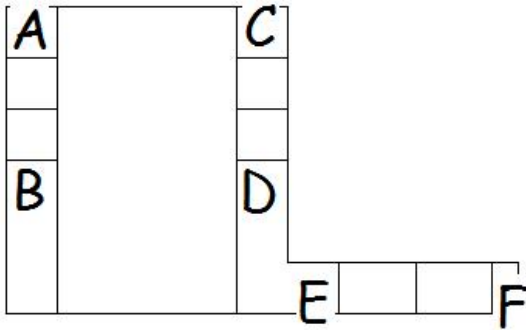
#### 25. Changing layers and linetypes

- Click all the lines of the actual object (not center lines or hidden lines)
- Right click and select PROPERTIES
- Change LAYER (top left) from "O" to "OBJECT"

#### 26. Changing layers and linetypes

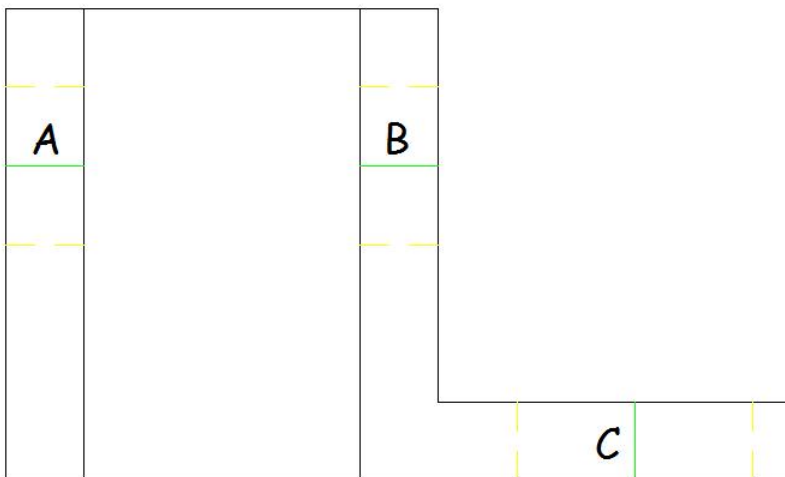
- Click lines "A", "B", "C", "D", "E" and "F"
- Right click and select PROPERTIES
- Change LAYER from "O" to "HIDDEN"

- If the lines do not look dashed (with at least three segments visible), you may have to go into properties again, but change LINETYPE SCALE to something appropriate



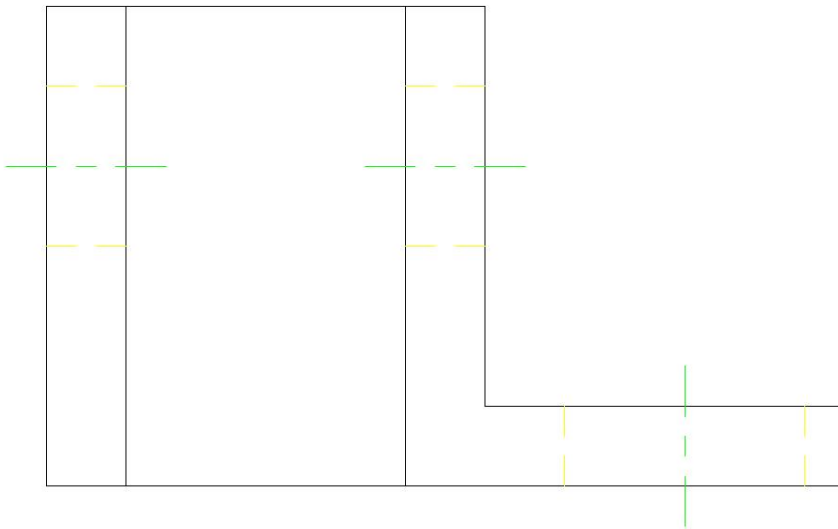
## 26. Changing layers and linetypes

- Click lines “A”, “B” and “C”
- Right click and select PROPERTIES
- Change LAYER from “O” to “CENTER”



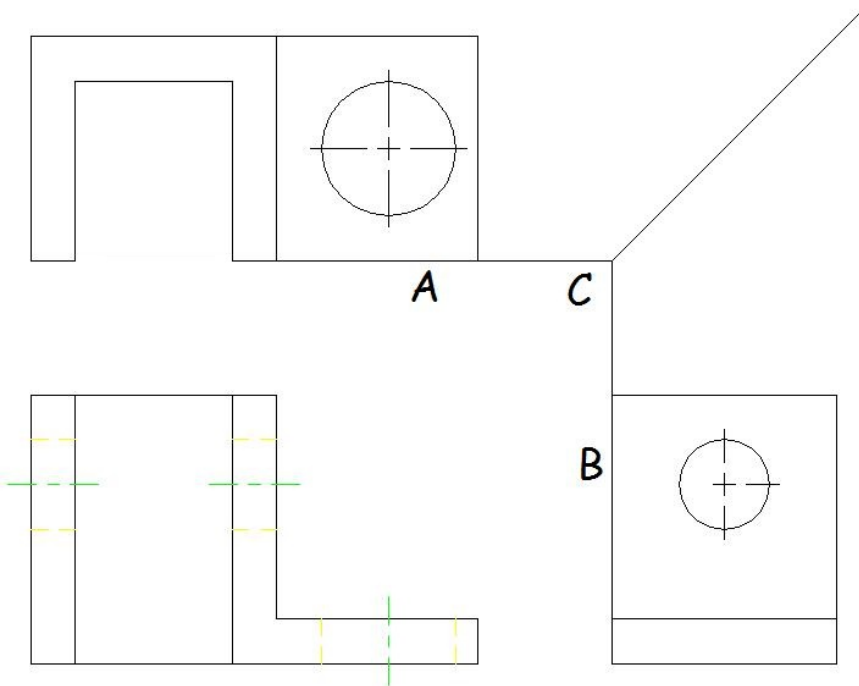
## 27. Scaling lines

- Click one of the three centerlines
- Right click and select SCALE
- Base point: **MID** (to attach to the MIDPOINT of the line)
- Click the line (notice a green triangle appears)
- **<Scale factor>: 2**
- Repeat for the other two center lines
- If the lines do not look dashed (with at least three segments visible), you may have to go into properties again, but change LINETYPE SCALE to something appropriate



## 28. Adding projection lines

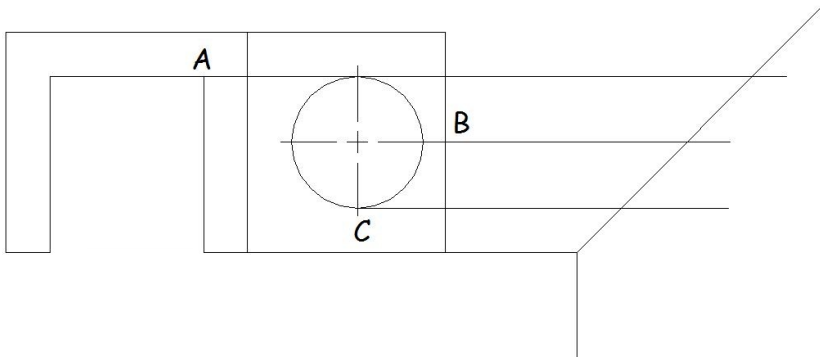
- Type **FILLET** (Radius should still be zero)
- Click lines "A" and "B"
- Type **LINE**
- **<Start of line>: INT**
- Click the intersection at point "C"
- **<End point>: @4<45**
- ESC to exit



### 29. Adding projection lines

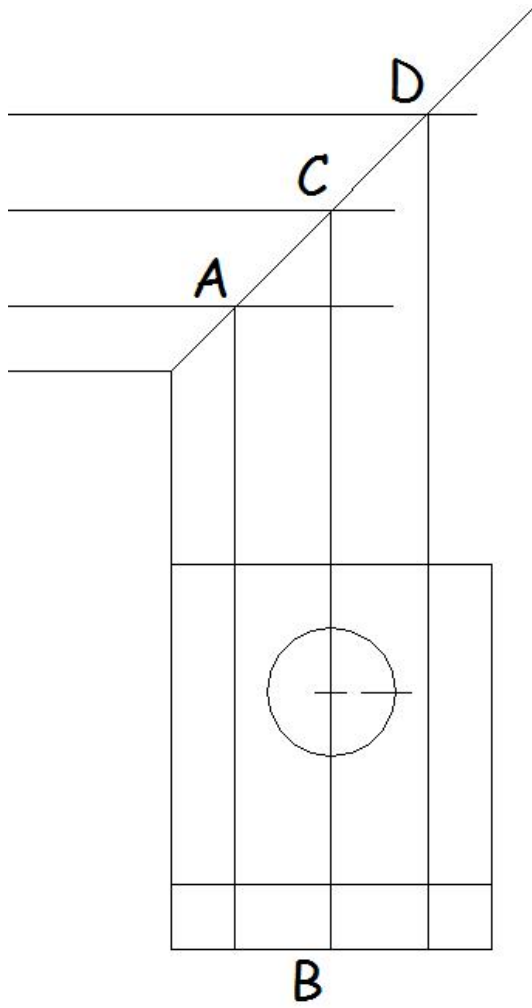
- Type **LINE**
- <Start of line>: **INT**
- Click intersection at point "A"
- Hold SHIFT down and draw a line to the right, past the 45° line
- ESC to exit
- SPACE to restart LINE
- <Start of line>: **END**
- Click the end of the center mark line at "B"
- Hold SHIFT down and draw a line as before
- ESC to exit
- SPACE to restart
- <Start of line>: **QUA**
- Click circle quadrant at "C"
- Draw the line as before
- ESC to exit





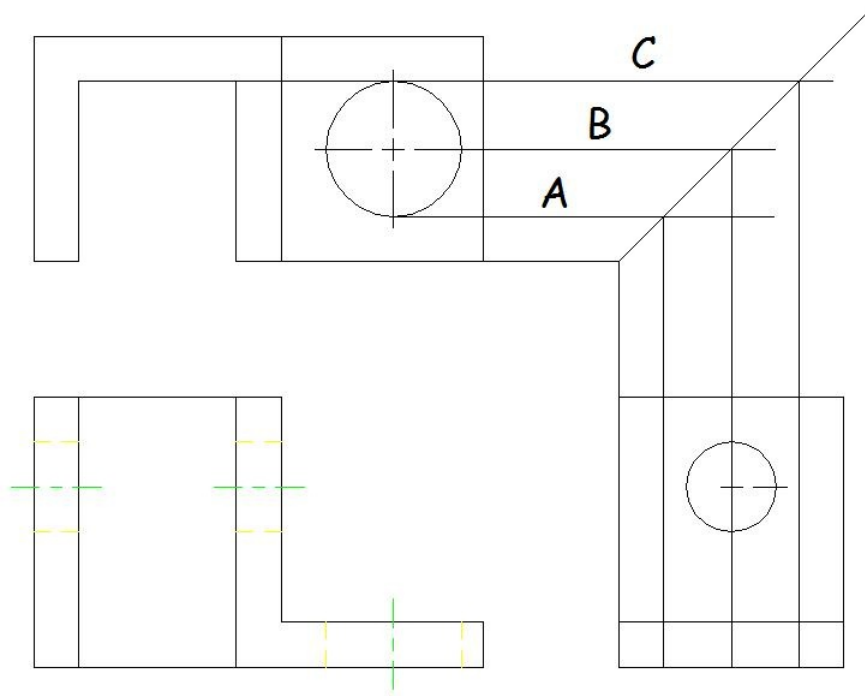
### 30. Adding projection lines

- Type **LINE**
- <Start of line>: **INT**
- Click intersection at "A"
- <End point>: **PER**
- Click line "B"
- ESC to exit
- Repeat for lines "C" and "D"



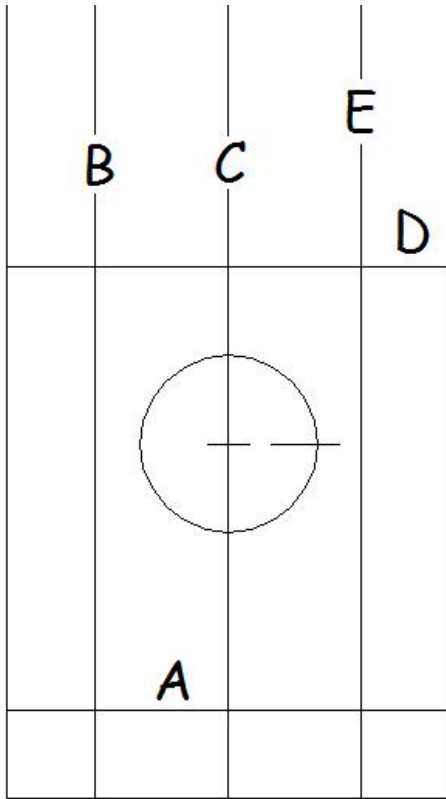
31. **Deleting extra lines**

- Type **DELETE**
- Click lines "A", "B" and "C"
- Right click to exit



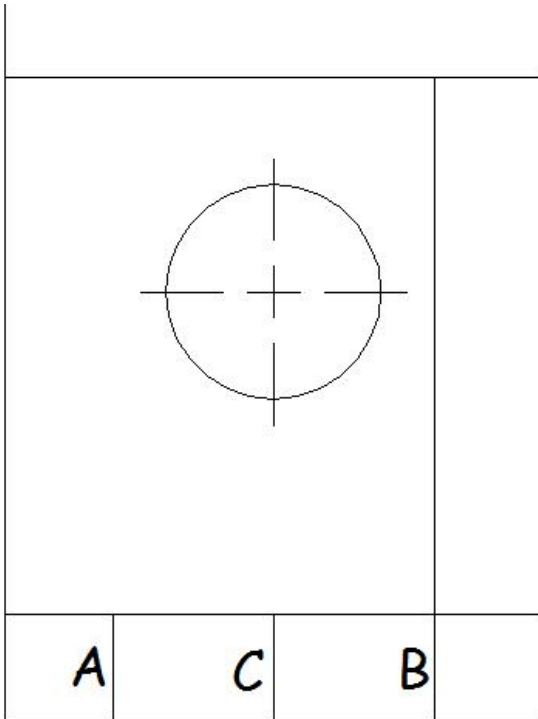
### 32. Trimming extra lines

- Type **TRIM**
- Click line "A" as a cutting edge
- Right click to finish selecting
- Click lines "B" and "C"
- ESC to exit
- SPACE to restart
- Click line "D" as a cutting edge
- Right click to finish selecting
- Click line "E"
- ESC to exit



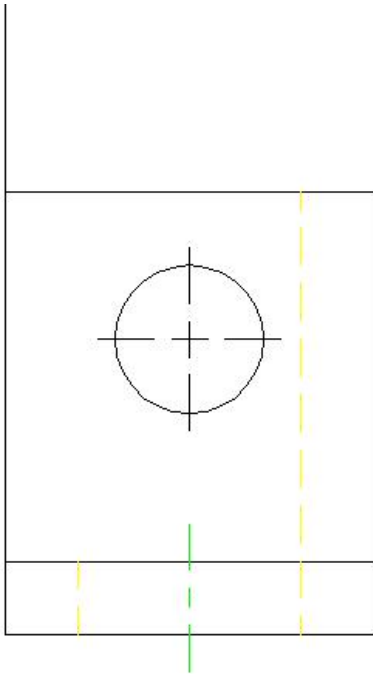
### 33. Changing layers and linetypes

- Click lines "A" and "B"
- Right click and select PROPERITES
- Change LAYER (top left) from "O" to "HIDDEN"
- Click line "C"
- Right click and select PROPERITES
- Change LAYER (top left) from "O" to "CENTER"



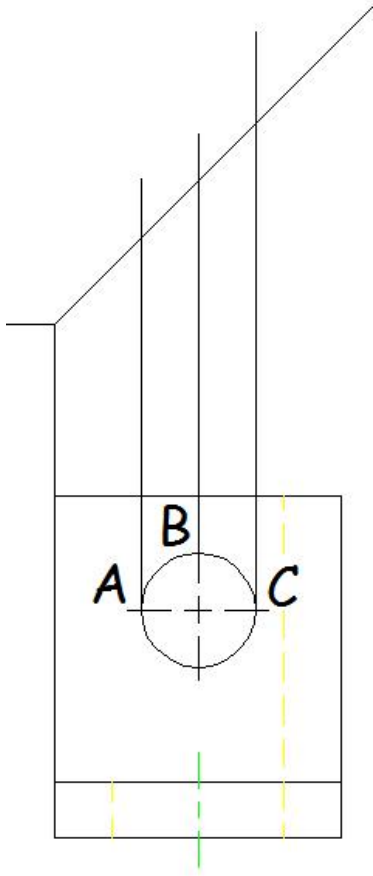
#### 34. Scaling lines

- Click the centerline
- Right click and select SCALE
- Base point: MID (to attach to the MIDPOINT of the line)
- Click the line (notice a green triangle appears)
- <Scale factor>: 2



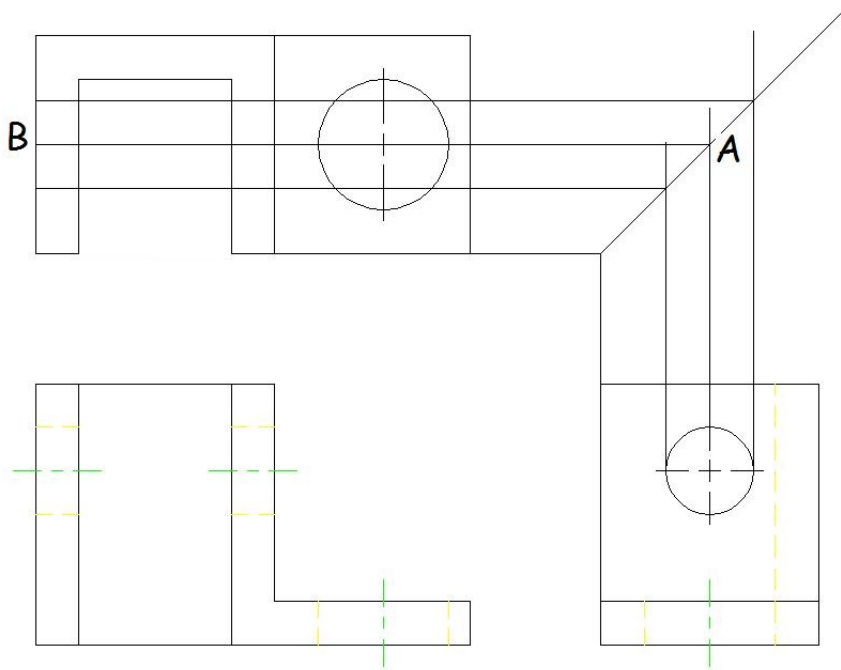
### 35. Adding projection lines

- Type **LINE**
- <Start of line>: **QUA**
- Click intersection at point "A"
- Hold SHIFT down and draw a line up, past the 45° line
- ESC to exit
- SPACE to restart LINE
- Repeat for quadrants "B" and "C"



### 36. Adding projection lines

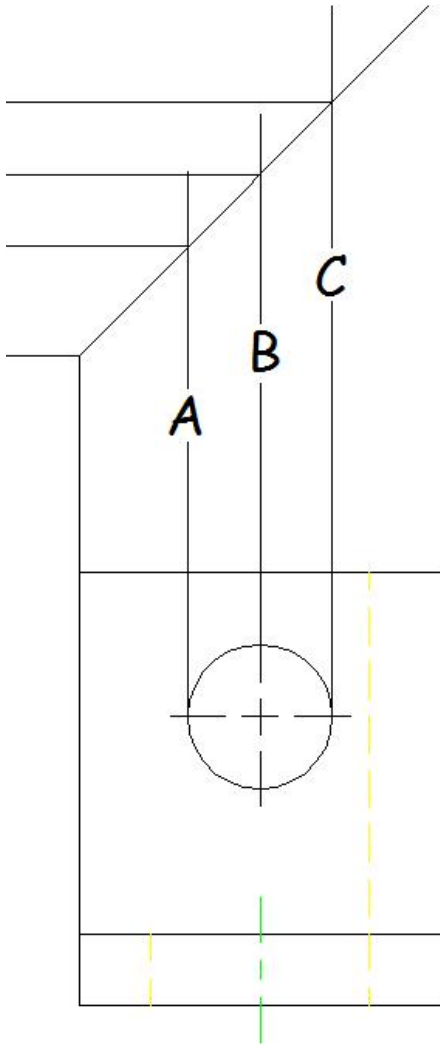
- Type **LINE**
- <Start of line>: **INT**
- Click the intersection at "A"
- <End point>: **PER**
- Click line "B"
- ESC to exit
- Repeat for the other two lines



### 37. Deleting extra lines

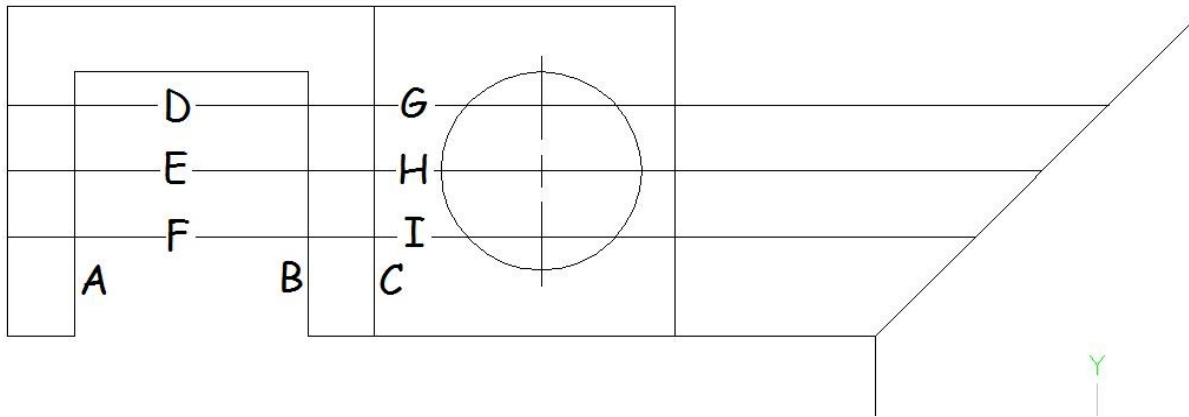
- Type **DELETE**
- Click lines "A", "B" and "C"
- ESC to exit





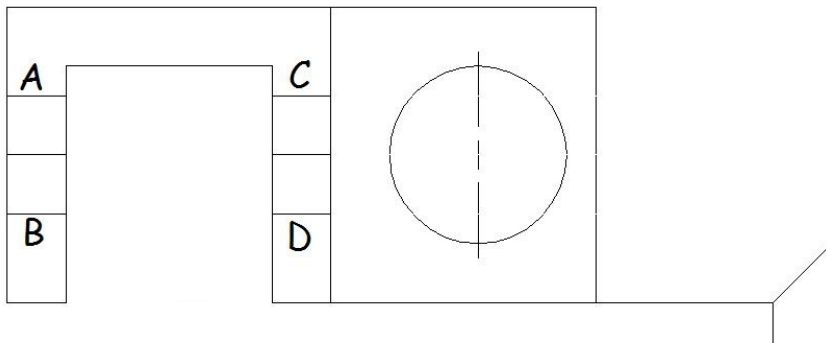
### 38. Trimming extra lines

- Type **TRIM**
- Click lines "A", "B" and "C" as cutting edges
- Right click to finish selecting
- Click line segments "D", "E", "F", "G", "H" and "I"
- ESC to exit



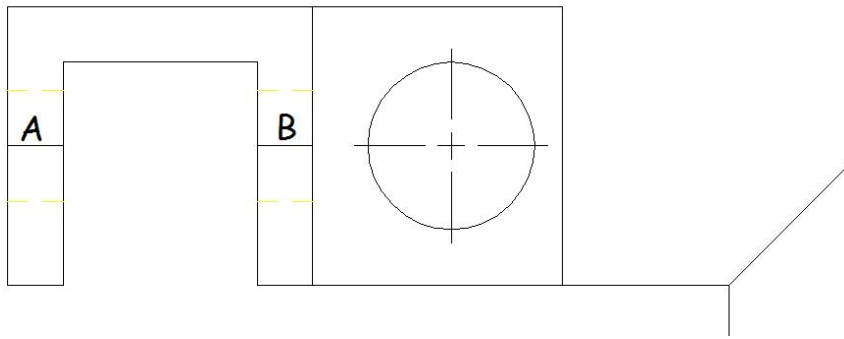
#### 39. Changing layers and linetypes

- Click lines “A”, “B”, “C” and “D”
- Right click and select PROPERTIES
- Change LAYER (top left) from “O” to “HIDDEN”



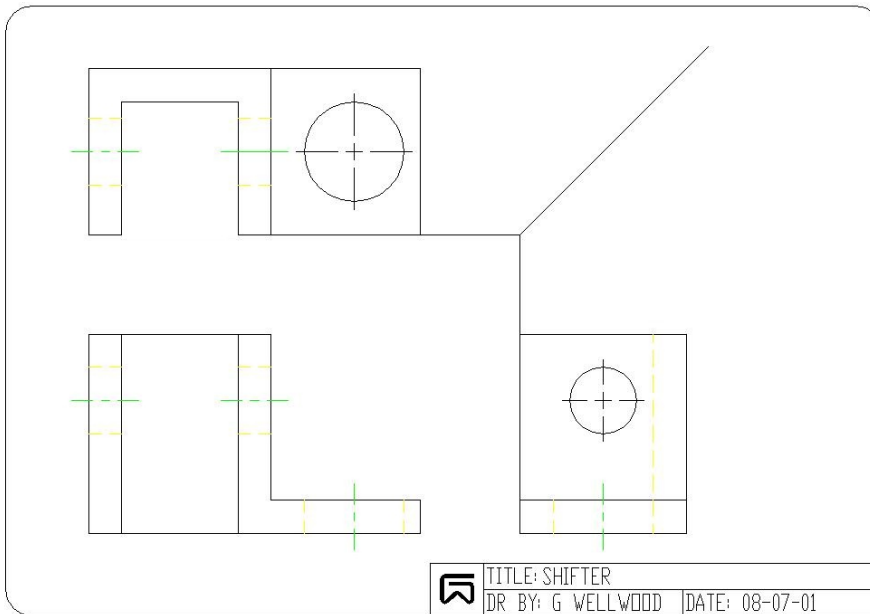
#### 40. Changing layers, linetypes and scaling lines

- Click lines “A” and “B”
- Right click and select PROPERTIES
- Change LAYER (top left) from “O” to “CENTER”



#### 41. Scaling lines

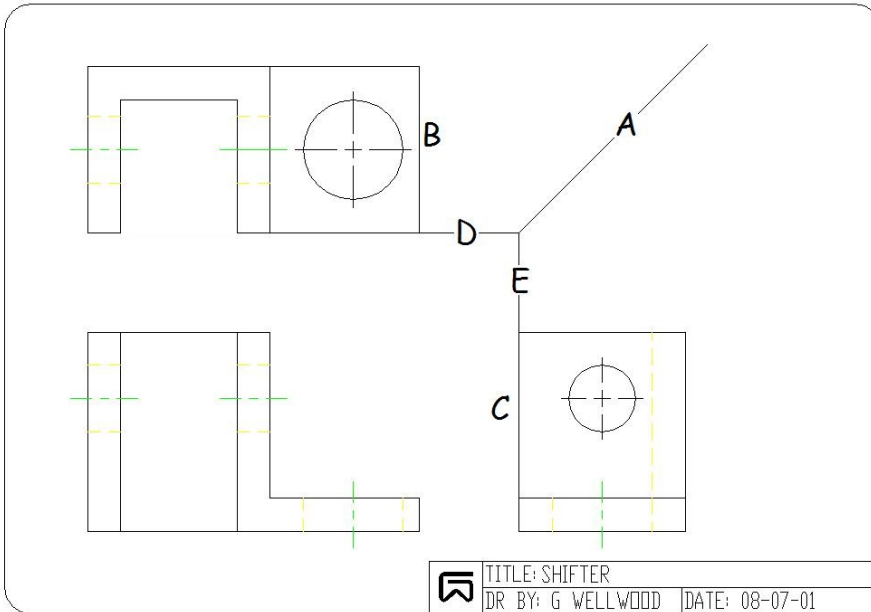
- Click one centerline
- Right click and select SCALE
- Base point: **MID** (to attach to the MIDPOINT of the line)
- Click the line (notice a green triangle appears)
- <Scale factor>: **2**
- Repeat for the other centerline



#### 42. Trimming and deleting

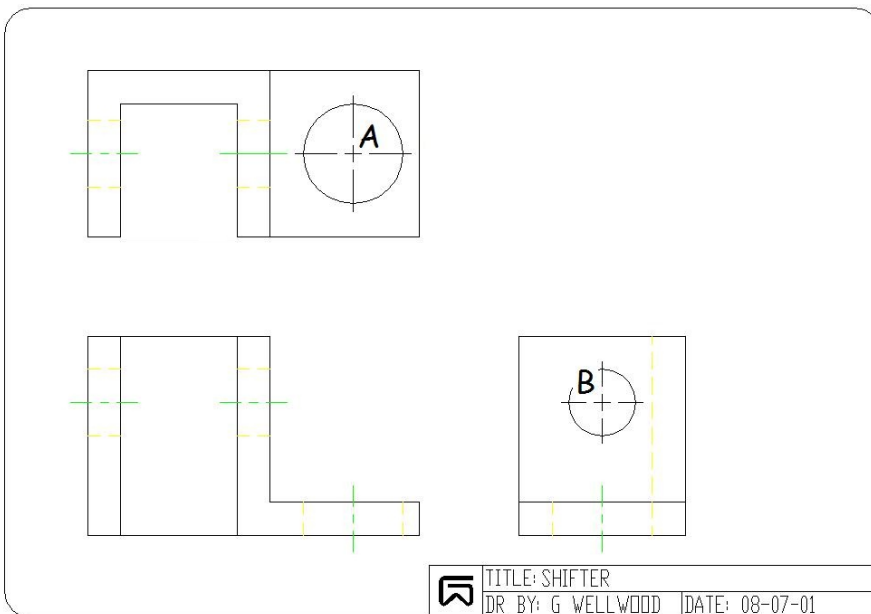
- Type **DELETE**
- Click line "A"
- ESC to exit
- Type **TRIM**
- Click lines "B" and "C" as cutting edges

- Right click to finish selecting
- Click lines “D” and “E” to trim
- ESC to exit



#### 43. Changing layers

- Click center marks “A” and “B”
- Right click and select PROPERTIES
- Change LAYER (top left) from “0” to “CENTER” and change COLOR from “BY BLOCK” to “BY LAYER”



#### 44. You're done!

- While this tutorial is rather detailed and lengthy, as you practice this method (lots of OFFSET and TRIM) of laying out a drawing, you will get faster and faster
- I can do this drawing in less than 10 minutes, start to finish (GRIN)
- Can you do it faster?