

# DIGITAL MODELING *with* AUTOCAD

*from nothing to something*



■ DR. ISHAM SHAH HASSAN

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# FROM NOTHING TO SOMETHING

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## TABLE OF CONTENTS

### CHAPTER ONE

|                                                |    |
|------------------------------------------------|----|
| AutoCAD                                        | 1  |
| The Different Between 3D Model and 2D Drafting | 1  |
| Digital Model                                  | 2  |
| Wire Frame Model                               | 3  |
| Surface Model                                  | 4  |
| Solid Model                                    | 5  |
| Rendering                                      | 6  |
| Distant Light                                  | 7  |
| Point Light                                    | 8  |
| Spot Light                                     | 9  |
| Visual Style                                   | 10 |
| Conceptual Style                               | 11 |
| Realistic Style                                | 11 |
| Why Using 3D Model                             | 12 |
| 3D Capabilities of AutoCAD                     | 13 |
| The 3D Coordinate System                       | 14 |

### CHAPTER TWO

|                                                         |    |
|---------------------------------------------------------|----|
| Reflection for Wire Frame Model                         | 16 |
| Reflection 1 – Creating Wireframe Using Coordinate Only | 17 |
| Reflection 2 – Creating Wireframe Utilizing UCS         | 22 |

### CHAPTER THREE

|                                                                |    |
|----------------------------------------------------------------|----|
| Reflection for Surface Model                                   | 30 |
| Reflection 3 – Creating Surface Model Utilizing UCS and 3Dface | 31 |
| Reflection 4 – Creating Surface Model – Elevation & Thickness  | 41 |
| Reflection 5 – Creating Surface Model – Revsurf                | 50 |
| Reflection 6 – Creating Surface Model – Revsurf                | 58 |
| Reflection 7 – Creating Surface Model – Tabsurf                | 62 |
| Reflection 8 – Creating Surface Model – Tabsurf                | 68 |
| Reflection 9 – Creating Surface Model – Edgesurf               | 75 |
| Reflection 10 – Creating Surface Model – Edgesurf              | 85 |

# FROM NOTHING TO SOMETHING

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## CHAPTER FOUR

|                                                                 |     |
|-----------------------------------------------------------------|-----|
| Reflection for Solid Model                                      | 94  |
| Creating Solid Object                                           | 95  |
| Create a Composite Solid with Union                             | 96  |
| Create a Composite Solid with Subtract                          | 97  |
| Reflection 11 – Creating Solid Objects – Region                 | 98  |
| Reflection 12 – Creating Solid Object – Revolve Command         | 103 |
| Reflection 13 – Creating Solid Object – Paths                   | 106 |
| Reflection 14 – Creating Simple Solid Object – Boolean Commands | 110 |
| Reflection 15 – Creating Simple Solid Object – Boolean Commands | 128 |

## CHAPTER FIVE

|                                                |     |
|------------------------------------------------|-----|
| Reflection for Creating Simple Building        | 140 |
| Reflection 16 – Creating Simple Building       | 141 |
| Reflection 17 – Creating Medium Level Building | 163 |

## CHAPTER SIX

|                                                          |     |
|----------------------------------------------------------|-----|
| Reflection for Camera View                               | 199 |
| Reflection 18 – Creating view using camera in AutoCAD    | 200 |
| Reflection 19 – Utilizing camera for walk thru animation | 204 |
| Reflection 20 – Utilizing camera for bird eye animation  | 209 |

## CHAPTER SEVEN

|                                                                    |     |
|--------------------------------------------------------------------|-----|
| Reflection for Material Application                                | 213 |
| Reflection 21 – Material application with glass effect             | 214 |
| Reflection 22 – Material application with jpeg image from Internet | 217 |
| Reflection 23 – Material application with jpeg image as background | 221 |

## CHAPTER EIGHT

|                                            |     |
|--------------------------------------------|-----|
| Reflection for Lighting                    | 226 |
| Reflection 24 – Creating sunlight's effect | 227 |
| Reflection 25 – Creating spotlight         | 232 |
| Reflection 26 – Creating point light       | 235 |

## CHAPTER NINE

|                                                 |     |
|-------------------------------------------------|-----|
| Reflection 27 – Simple Project                  | 240 |
| Reflection 28 – Creating Stadium's Roof Project | 249 |



# FROM NOTHING TO SOMETHING

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## PREFACE

Architectural design process is a systematic process from abstract ideas to physical product. Utilizing digital tools in design process will enhance designer skill in producing creative design ideas. AutoCAD is one of the tools that can be used to produce three dimensional digital models. Digital models can help designer in different stages in the design process which synthesis and simulation. Designer should acquire ample skill to produce three dimensional digital models. By using AutoCAD it will enhance designer skill in producing digital models. Digital models represent a three dimensional object using a collection of points in three dimensional space, connected by various geometric entities such as triangles, lines and curved surfaces. Digital models are used in a wide variety of fields. In architecture three dimensional models can be a final product of the design ideas. There are three types of digital models which are wireframe model, surface model and solid model. There are many types of software available today that can be used to construct a digital model. This book gives some tips upon how AutoCAD can be used to construct a digital model.

This book will introduce the basic concepts of 3D and the capabilities of AutoCAD in constructing 3D models. When you have completed this book you will be able to understand the differences between 2D drafting and 3D modeling, to be able to differentiate between wireframe model, surface model and solid model, to understand what rendering means, to know some of the advantages that 3D models have over 2D drawings, to have some knowledges on the practical uses for 3D models and to get acquainted with some of the 3D capabilities and limitations of AutoCAD.



## CHAPTER ONE

### AutoCAD

AutoCAD is a software application for computer-aided design (CAD) and drafting. The software supports both 2D and 3D formats. The software is developed and sold by Autodesk, Inc. AutoCAD is the most ubiquitous microcomputer design program in the world, utilizing functions such as polylines and curve fitting. Prior to the introduction of AutoCAD, most other CAD programs ran on mainframe computers or minicomputers, with each user's unit connected to a graphics computer terminal. The native file format of AutoCAD is .dwg. This and, to a lesser extent, its interchange file format DXF have become de facto standards for CAD data interoperability. AutoCAD has included support for .dwg, a format developed and promoted by Autodesk, for publishing CAD data.

### The Different Between 3D Model and 2D Drafting

2D and 3D refer to the actual dimensions in a computer's workspace. 2D is 'flat', using the X & Y (horizontal and vertical) axis, the image has only two dimensions and if turned to the side becomes a line. 3D adds the 'Z' dimension. In addition to height and width, the 3D objects have depth. This extra dimension will be a change in our input methods. To create 3D objects we will probably use object snaps and typed in coordinates more often. Another different between 3D and 2D is the way we look the object that we create. For 2D work we will look straight down on the drawing plane whereas in 3D we will look at our object from an angle because it will often have objects directly over other objects.



While developing 3D object we are likely have several viewports on our computer screen so that we can see our model from different viewpoints. Another important different to recognize is that entities are more concentrated in 3D than they are in 2D. In order to control the densely drawn entities we will need to use more layers in 3D than in 2D. At the same time we will be freezing and thawing layers more frequently. The major difference between 2D and 3D is that there are over 80 AutoCAD commands related primarily to 3D for us to learn and use.

Lastly our approach and our thinking as we build 3D models will be craftly different than when constructing 2D drawings. In 3D we are actually building an object, not just drawing pictures of the object. In some point of views, 3D construction is more rigorous than 2D drawing. We must be very accurate in locating and positioning objects. This accuracy can be an advantage, as it pushes our ideas to be precise and accurate. In order to explore 3D features of AutoCAD, there are few terms that are unavoidable. Therefore we need to define few basic terms before going futher exploring 3D features of AutoCAD. Some of the frequently used 3D terms are as shown belows.

### **DIGITAL MODEL**

Models are basic term used to define 3D objects made in AutoCAD, representations of some real or planned object. AutoCAD models are fully 3D and relatively easy to build and modify. The major different from physicals models, we cannot directly touch them. The process involve in making a model is called modeling. In AutoCAD model and modeling usually reserved for 3D models. While 2D work being referred to as drafting or drawing.

## Wireframe Model

It represents an object by its edges only. A wireframe model is a skeletal description of a 3D object. There are no surfaces in a wireframe model; it consists only of points, lines, and curves that describe the edges of the object. With AutoCAD you can create wireframe models by positioning 2D (planar) objects anywhere in 3D space. AutoCAD also provides some 3D wireframe objects, such as 3D polylines (that can only have a CONTINUOUS linetype) and splines. Because each object that makes up a wireframe model must be independently drawn and positioned, this type of modeling can be the most time-consuming. Figure 1 shows a simple wireframe model.

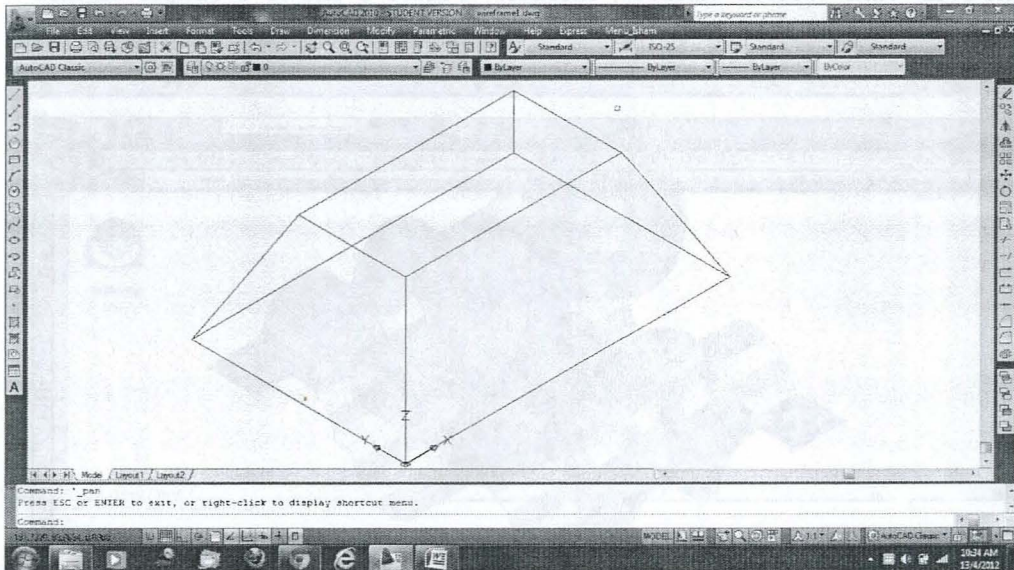


Figure 1



## Surface Model

Surface modeling is more sophisticated than wireframe modeling in that it defines not only the edges of a 3D object, but also its surfaces. It has an indefinitely thin computer-calculated surface between their edges. Surface models often use wireframe models as a frame for their surfaces; it is not unusual for models to be part wireframe and part surface. This is because surfaces are transparent unless a command for hidden line removal has been invoked. The AutoCAD surface modeler defines faceted surfaces using a polygonal mesh. Because the faces of the mesh are planar, the mesh can only approximate curved surfaces. To differentiate these two types of surfaces, AutoCAD calls faceted surfaces, meshes. Figure 2 shows a simple surface model.

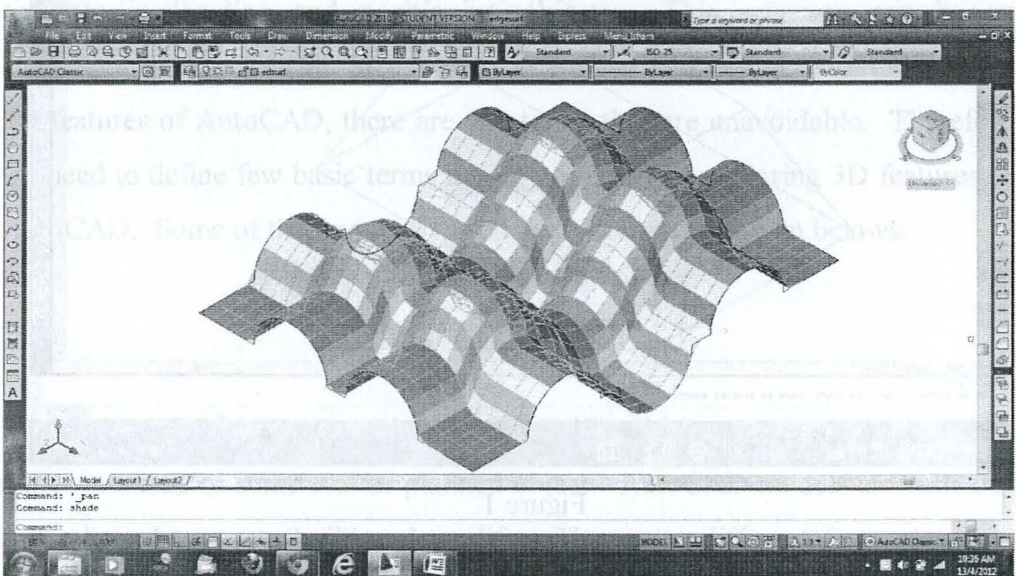


Figure 2



## Solid Model

Solid models have edges and surfaces, plus computer-calculated mass under their surfaces. Though it appears very similar to a surface model, it can be sliced in half to show that it is truly solid. Solid modeling is the easiest type of 3D modeling to use. With the AutoCAD solid modeler, you can make 3D objects by creating basic 3D shapes: boxes, cones, cylinders, spheres, wedges, and tori (donuts). You can then combine these shapes to create more complex solids by joining or subtracting them or finding their intersecting (overlapping) volume. You can also create solids by sweeping a 2D object along a path or revolving it about an axis. Figure 3 shows a simple solid model.

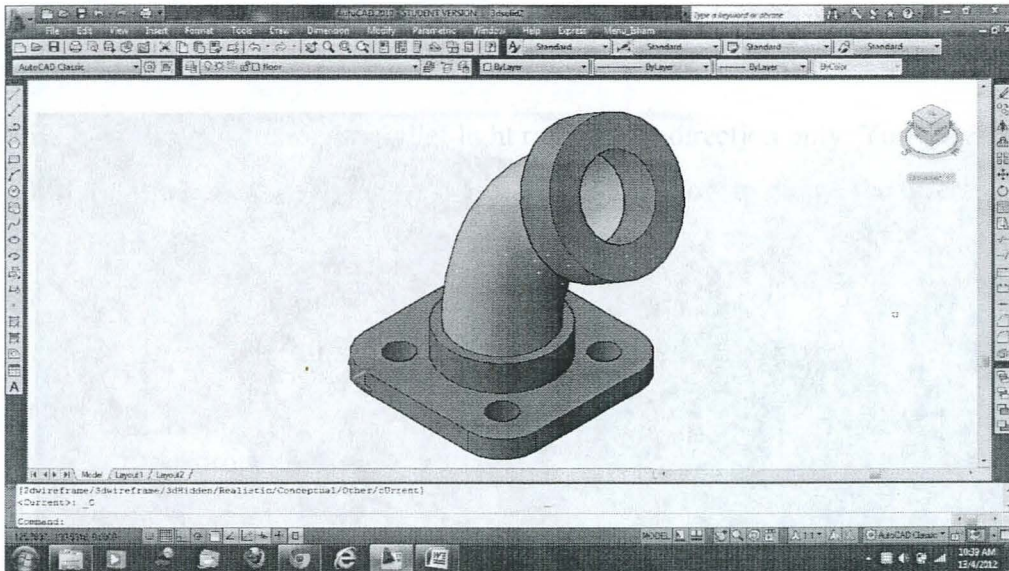


Figure 3

## Rendering

Realistic looking picture of a surface or solid model is called a rendering. AutoCAD has a full set of commands for making rendering object. AutoCAD is fully capable of color renderings or material effect renderings. It is a process of generating a shaded image of how geometry might look under a given set of lighting conditions and based on a given set of materials. Architects frequently provide rendered images of buildings as part of the design process. Mechanical designers often provide rendered images of components prior to producing them. The tools and techniques used to create rendered images vary from version to version of AutoCAD, as does the quality of the images rendered, but there are some general principles that always apply. Figure 4 shows a sample of rendered object.

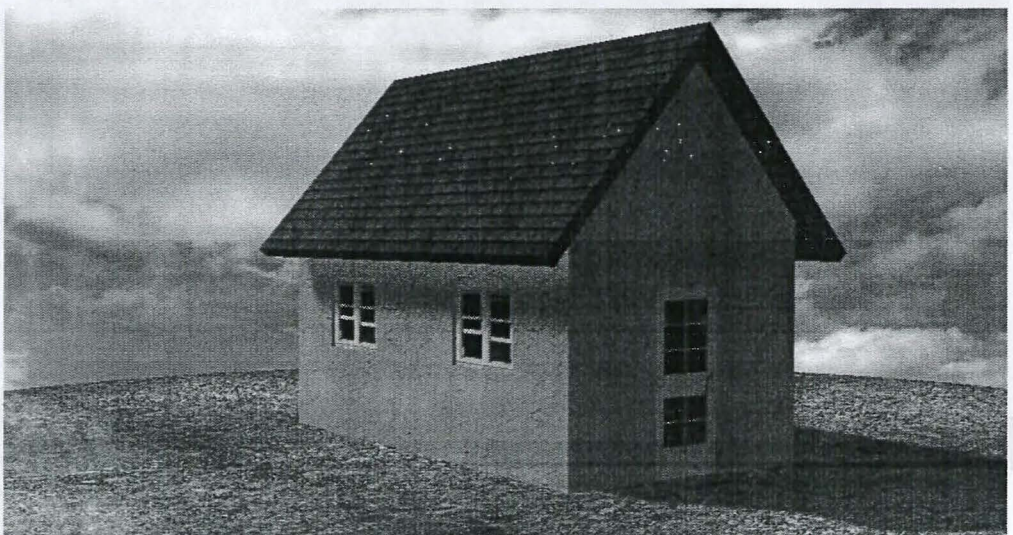


Figure 4



## LIGHTING

To illuminate 3D objects we need illumination options. AutoCAD provides several illumination options that are called lighting. Early versions of the application offer users omni and spotlights. Omni lights cast light in every direction. Spotlights can be aimed like flashlights. Later versions of AutoCAD let users select a date, latitude and longitude to create a sun system in the drawing. This allowed designers to render an architectural environment based on a given day and time during the year. Most recently, Autodesk has added the ability to create indirect, diffuse lighting in drawings. This, when rendered, looks most photorealistic in most cases. Basically in AutoCAD there are three types of lighting which are distant light, point light and spot light.

### Distant Lights

Distant light emits uniform parallel light rays in one direction only. You specify a FROM point and a TO point anywhere in the viewport to define the direction of the light. Distant lights are not represented by glyphs in the drawing because they do not have a discrete position and affect the entire scene. The intensity of a distant light does not diminish over distance; it is as bright at each face it strikes as it is at the source. Distant lights are useful for lighting objects or for lighting a backdrop uniformly. The symbol for distant light in AutoCAD is as shown in figure 5



Figure 5

## Pointlight

A point light radiates light rays equally in all directions. It generates a similar effect to a light bulb. Point lights can generate shadows. You may use several point lights in a scene. However, it is better to limit the number of point lights to have more control over the parameters. The following tutorial shows you how to install and change parameters of point lights. It also demonstrates the effect of point lights on some 3D models. Figure 6 shows a sample of rendered object with pointlight effect

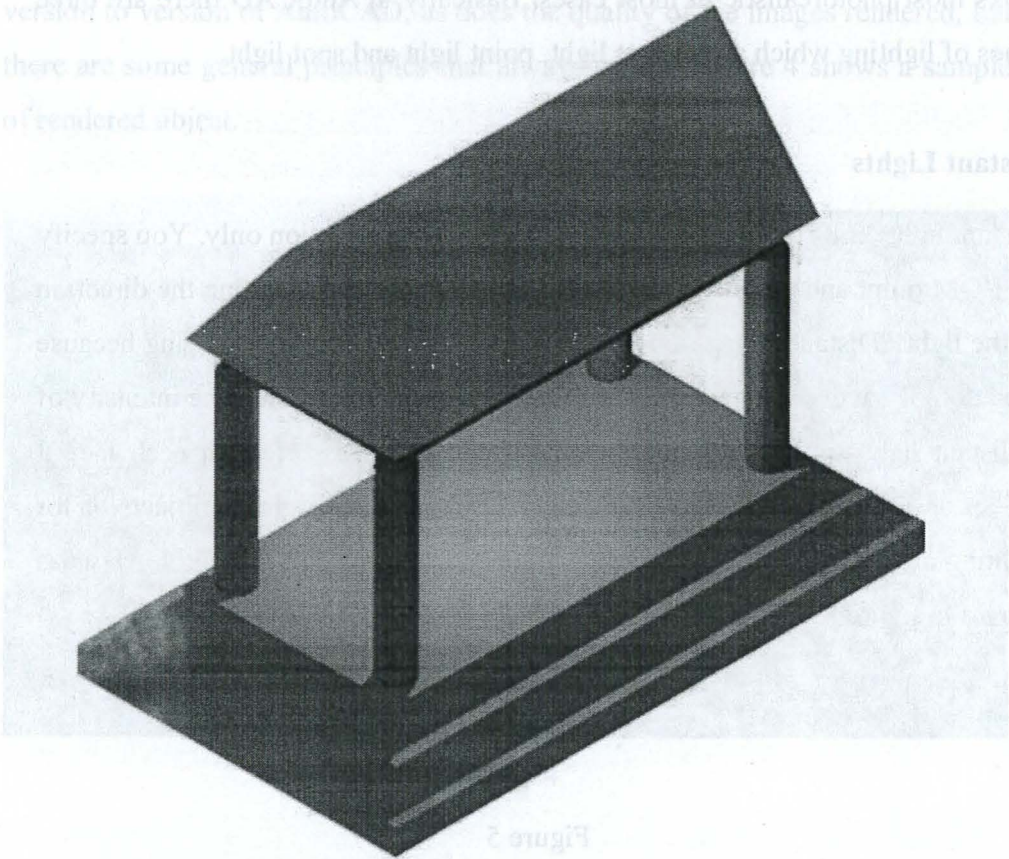


Figure 6



## Spotlight

Spotlights are conical lights that can simulate headlights of cars, shade lamps, and so on. Every spotlight consists of two major angles called Hotspot and Falloff. The Hotspot angle defines that portion of light cross-section that retains a fix light intensity. The light intensity drops to zero within the Falloff angle. The Falloff angle is always greater than Hotspot.

The spotlight can cast shadow. You need to define a target point along with a location point to define direction and location of the spotlight. Hotspot cone angle defines the brightest part of an object. This is also known as the beam angle. Falloff cone angle defines the full cone of light. This is also known as the field angle. Graphic image to explain about spotlight is shown in Figure 7. Sample of spotlight on rendered model shown in Figure 8.

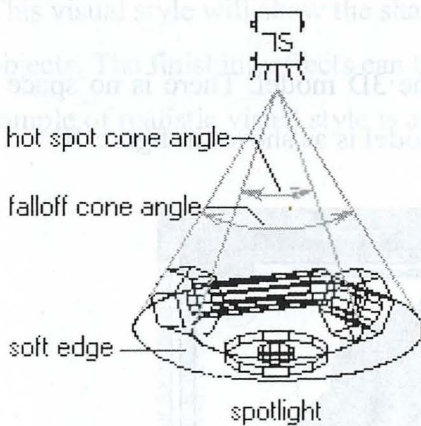


Figure 7

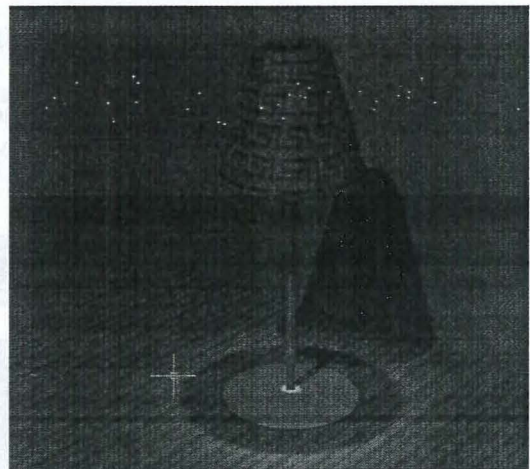


Figure 8

## VISUAL STYLE

It represents the 3d look of the model in AutocAD 2010. There are three type of visual style. Visual style can be choosed from the dialog given in AutoCAD 2010. The dialog box is as shown in figure 9

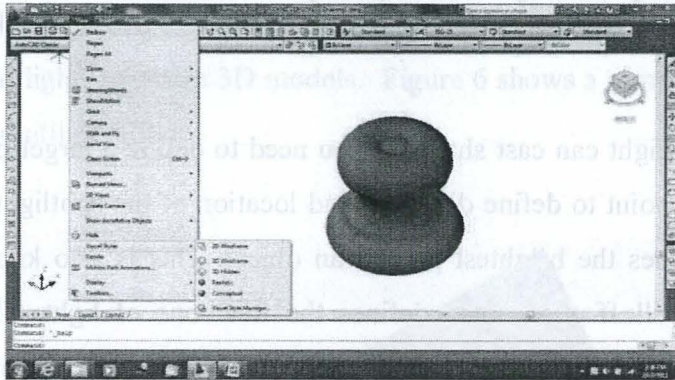


Figure 9

### Wireframe Style

This visual style only showed the outline of the 3D model. There is no space and volume for this style. The sample of this model is as shown in figure 10

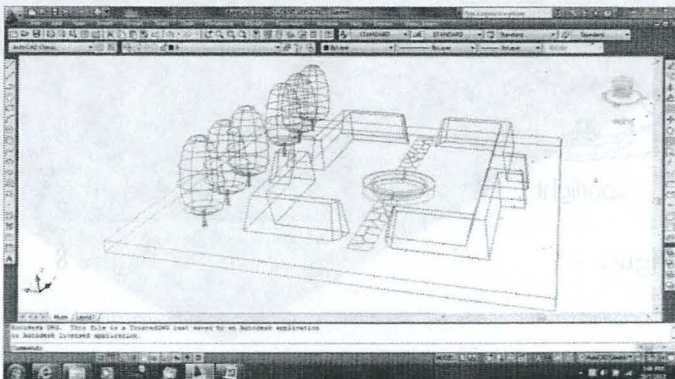


Figure 10



## Conceptual Style

This visual style will show the shape of the object but does not show the finishing of the objects such as material and sunlight as shown in figure 11

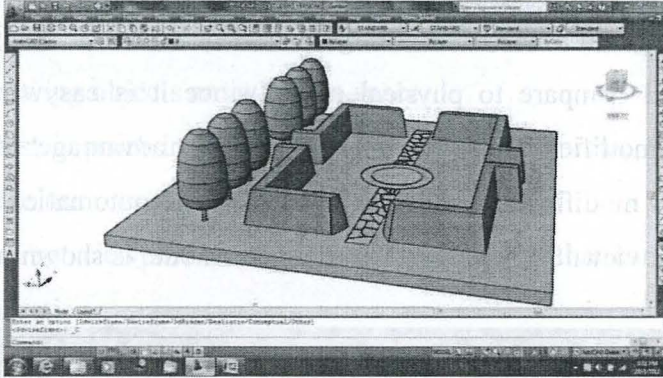


Figure 11

## Realistic Style

This visual style will show the shape of the object and the finishing effect of the objects. The finishing effects can be seen when the object being rendered. The sample of realistic visual style is as shown in figure 12.

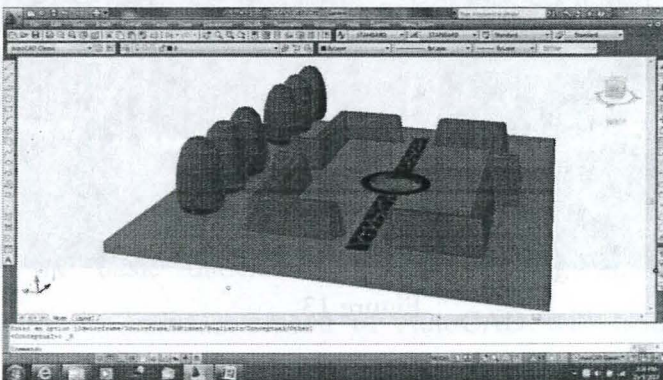


Figure 12

### WHY USING 3D MODEL

The real reason people making 3D model in architectural design process since it resembles closer to represent the real building than a 2D drawing. Even in some cases quite difficult for 3D model to become reality but it is closer to reality than a 2D drawing. In architectural design process the real advantage of using 3D digital model compare to physical model since it is easy to make any adjustment and modification to the model. Another advantage of using 3D model is that any modifications made to the model will automatically show up in the appropriate view. Sample of rendered digital model is shown in figure 13.

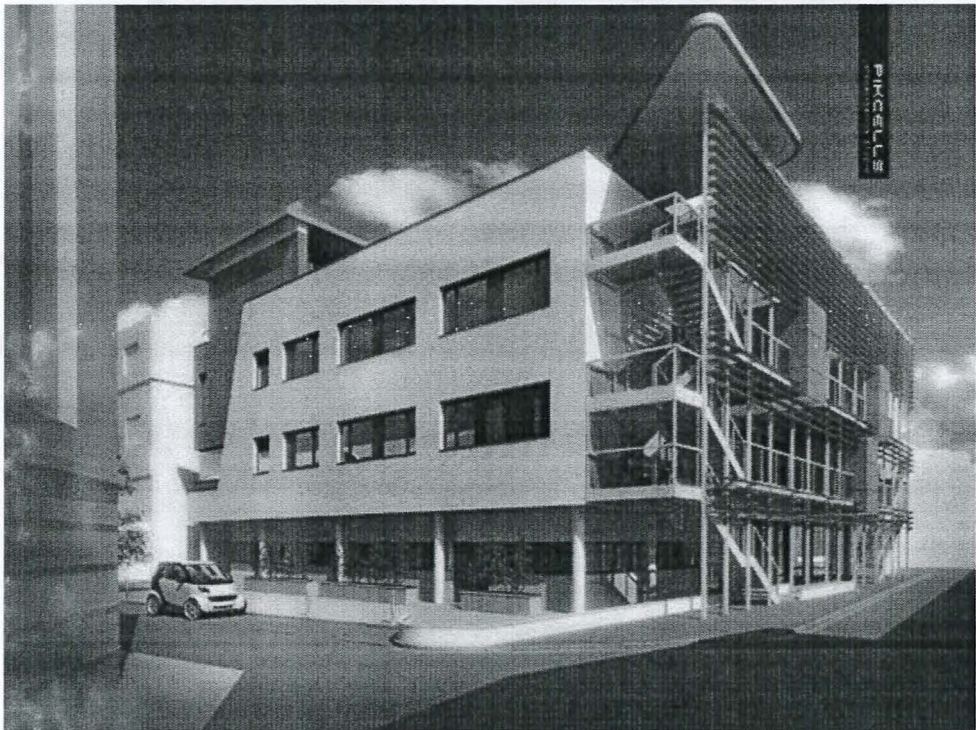


Figure 13



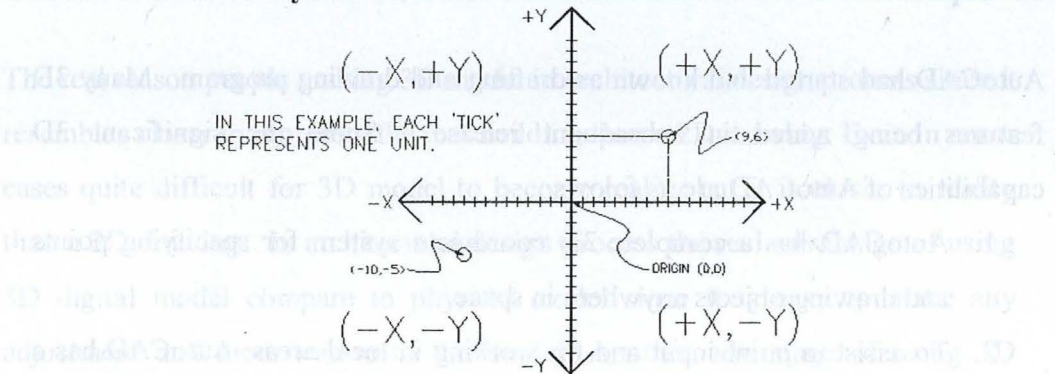
### 3D Capabilities of AutoCAD

AutoCAD had started and known as drafting and drawing program. Many 3D features being added in subsequent release. Some the significant 3D capabilities of AutoCAD are as follows.

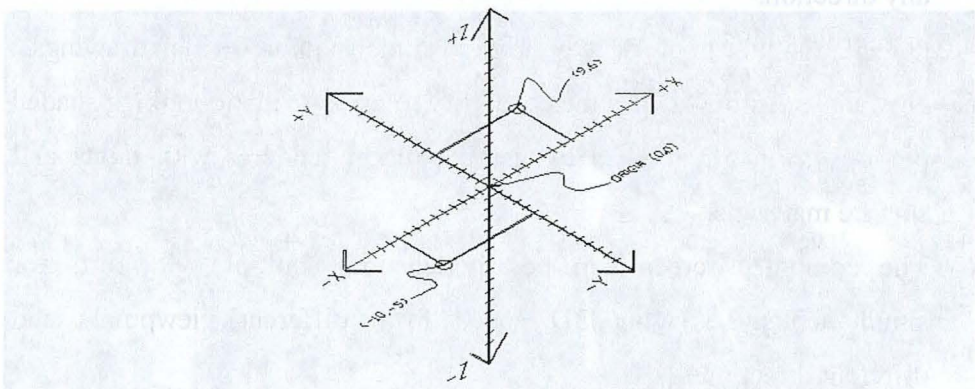
1. AutoCAD has a complete 3D coordinate system for specifying points and drawing objects anywhere in space.
2. To assist in point input and for working in local areas, AutoCAD has a movable user coordinate system.
3. We can set viewport from any location in space that can get view from any direction.
4. One 3D model can produce multiview, dimension production drawings.
5. Nowadays AutoCAD has the capability to make realistic-looking shaded pictures from 3D models by using built in renderer with lights and surface materials.
6. The computer screen can be divided into multiple viewports for simultaneously viewing 3D space from different viewpoints and different directions.

After introducing what is the function of AutoCAD in producing 3D models, this book going to show some steps upon how to develop simple digital models. Students will be guided step by step until the 3D model can be constructed. By taking time to follow the step being shown students will understand upon how to use AutoCAD in producing 3D models. This book is meant for those who already have the basic understanding in producing 2D drawing. The understanding to the basic command of AutoCAD will help the students generates the basic skills in producing 3D model.

## The 3D Coordinate System

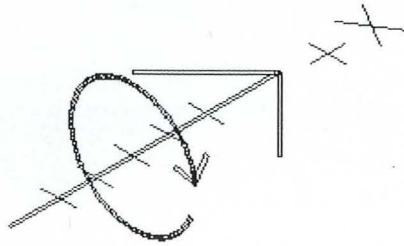


Looking from the plan (top) view, this is what you see to figure out where is positive X and positive Y.

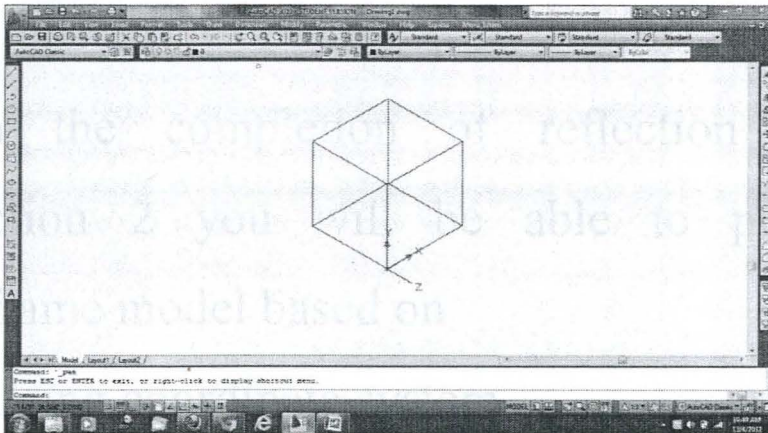


This new axis is called the Z-axis. Imagine that the positive Z-axis is coming towards you out of the monitor. When you entered points previously, you would enter them in the format: **X,Y**. By doing this, you let AutoCAD know that in these cases, Z was equal to zero. If we are using polar coordinates we will use this command @100<0 to show that you are constructing a line with the length of 100 and with the direction to the right. But in 3d coordinate if we are going to draw a line with the height of 100 the coordinate will be @0, 0,100. Similarly we are going to draw line with the width of 100 to left the coordinate will be @-100,0,0.





Now for the confusing part. You also have to know how AutoCAD measures angles of rotation in 3-D. There is a somewhat simple rule for this called "The Right Hand Rule". To figure out which is the positive rotation angle, imagine that you are wrapping your right hand around the axis with your thumb pointing towards the positive end. The direction that your fingers are wrapped is the positive direction. This applies to all three axes.



The **3point (3p)** option prompts us to pick 3 points in space. This will define the position of the new *XY plane*. The three points represent three positions in the new *XY plane*. The first point becomes the first point for new UCS. The second point is on the positive portion of the X axis. The third point is on the positive portion of the Y axis. The illustration above shows the three points we could pick to define a UCS with an *XY plane* which is coplanar with the front face of the box.





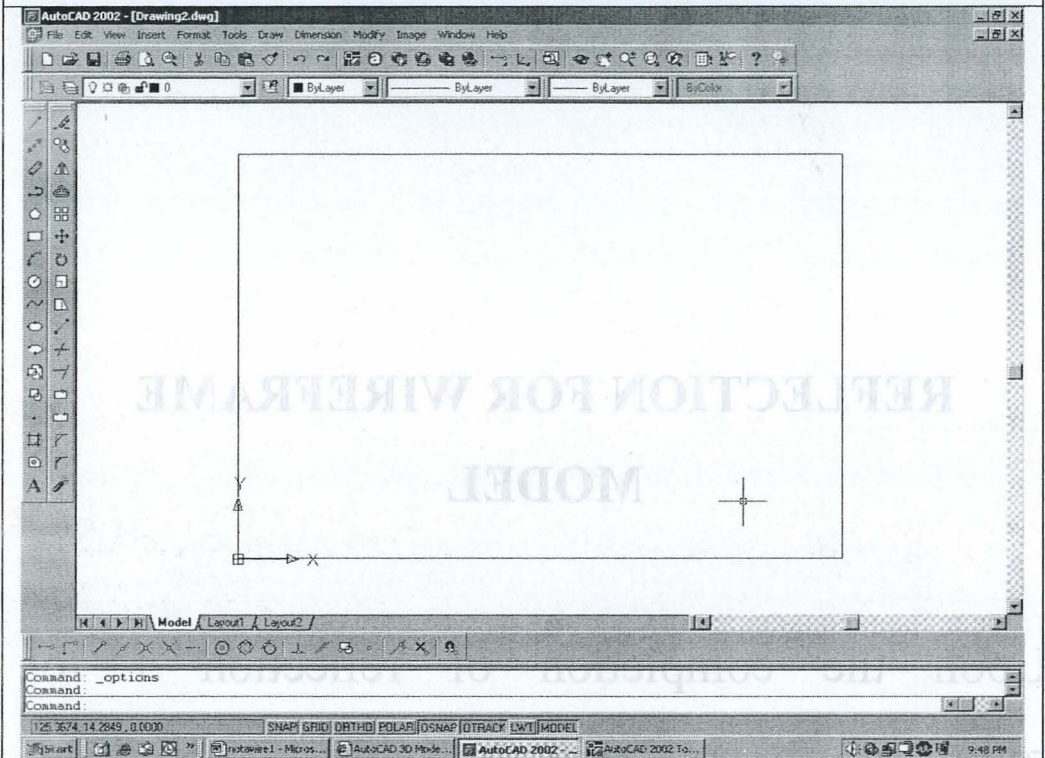
## CHAPTER TWO

# REFLECTION FOR WIREFRAME MODEL

Upon the completion of reflection 1 to reflection 2 you will be able to produce wireframe model based on

1. Using coordinate system
2. Utilizing UCS system

## Reflection 1 – Creating Wireframe Using Coordinate Only



Command: l

LINE Specify first point: 0,0

Specify next point or [Undo]: @100<90

Specify next point or [Undo]: @150<0

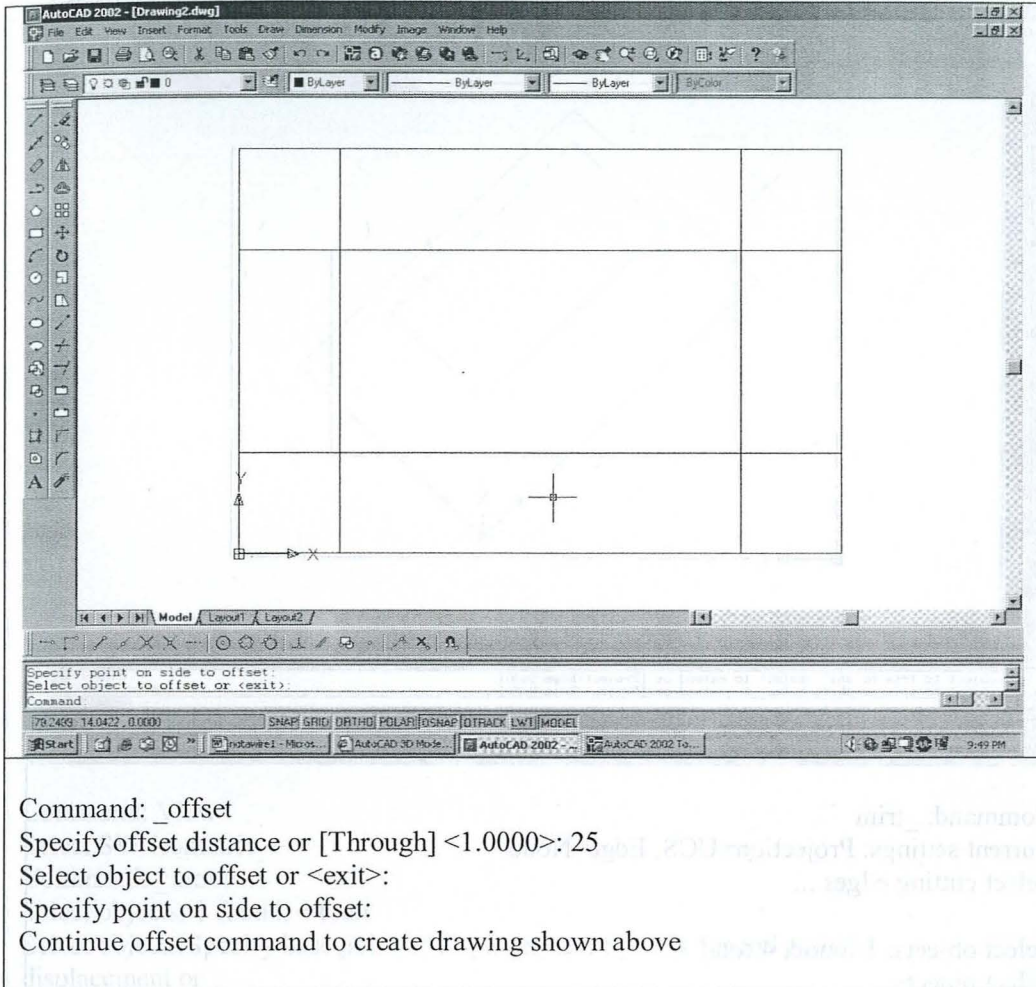
Specify next point or [Close/Undo]: @100<-90

Specify next point or [Close/Undo]: cl

Command: zoom window

Specify first corner: Specify opposite corner:





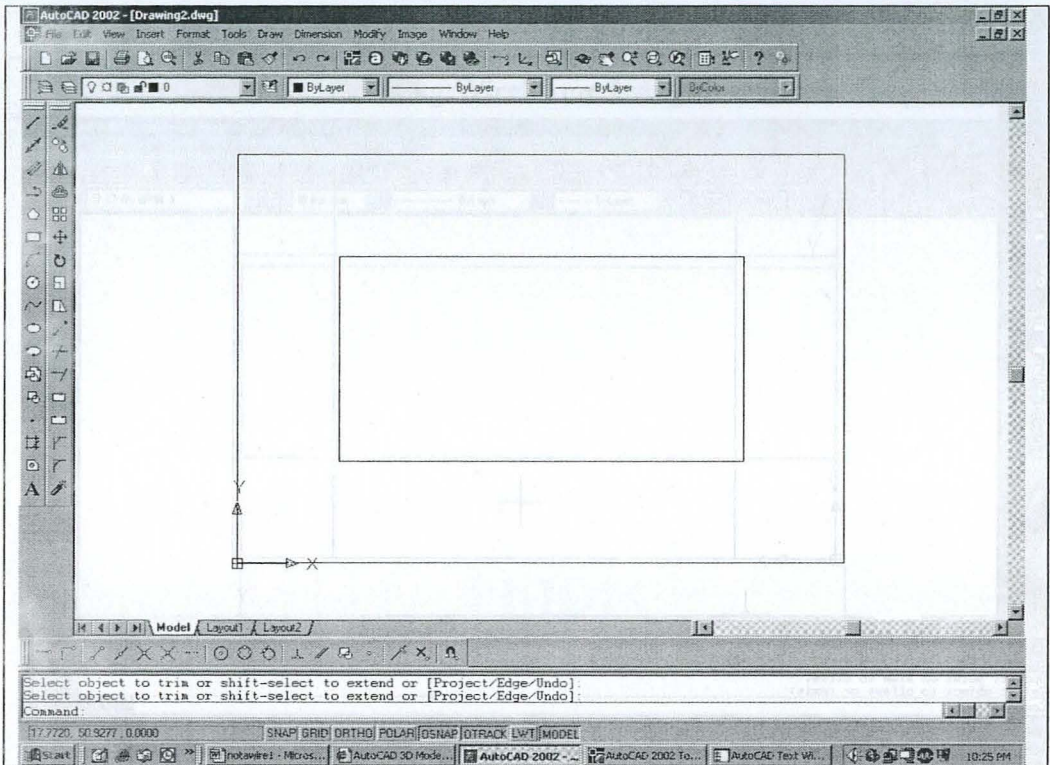
Command: `_offset`

Specify offset distance or [Through] <1.0000>: 25

Select object to offset or <exit>:

Specify point on side to offset:

Continue offset command to create drawing shown above



Command: `_trim`

Current settings: Projection=UCS, Edge=None

Select cutting edges ...

Command: `1`

Select objects: 1 found, 4 total

Select objects:

Select object to trim or shift-select to extend or [Project/Edge/Undo]:

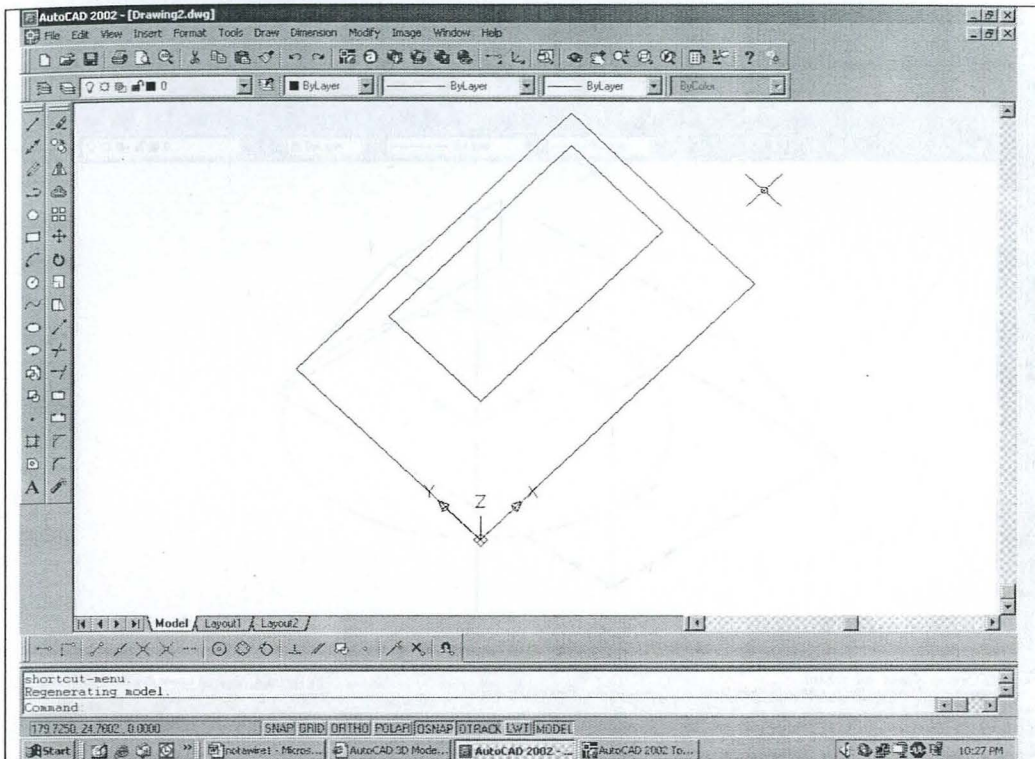
Select object to trim or shift-select to extend or [Project/Edge/Undo]:

Specify start point or [Close/Undo]: `1`

Command: `zoom window`

Specify first corner. Specify opposite corner





Command: View

Select SW Isometric

Command: \_move

Select objects: 1 found, 4 total

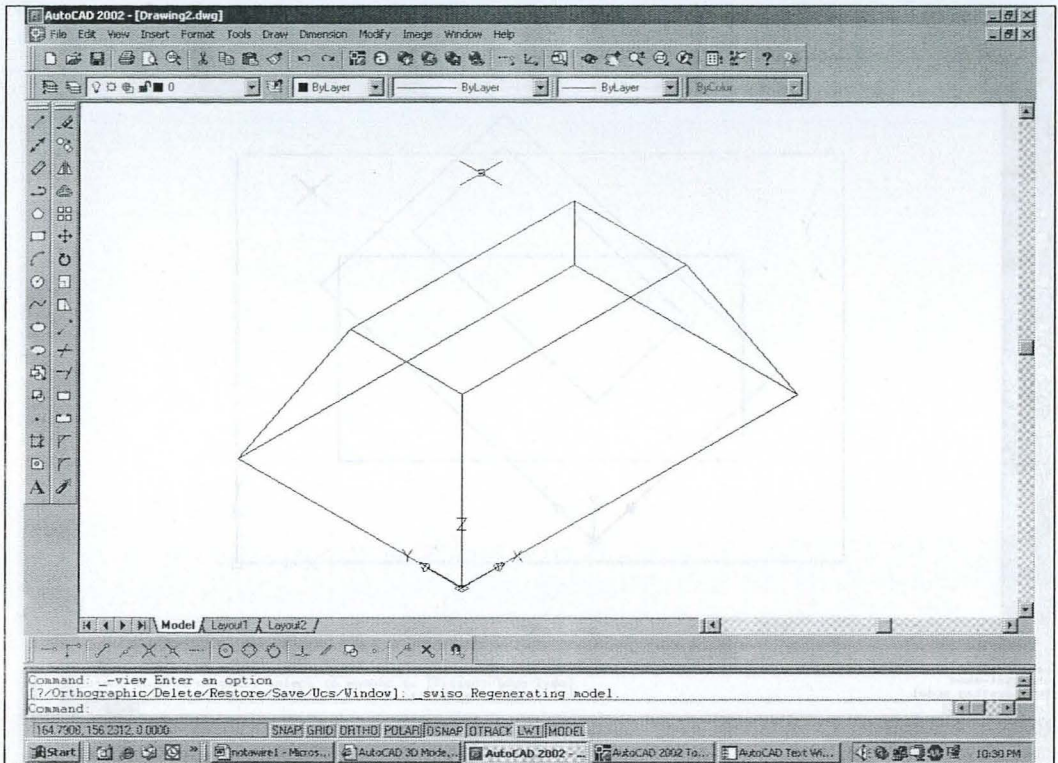
Select objects: Specify base point or displacement: Specify second point of displacement or

<use first point as displacement>: @0,0,50

Command: 3d orbit

To adjust the view

Regenerating model.



Joint all the edges by using line command

Command: l

LINE Specify first point:

Specify next point or [Undo]:

Specify next point or [Undo]:

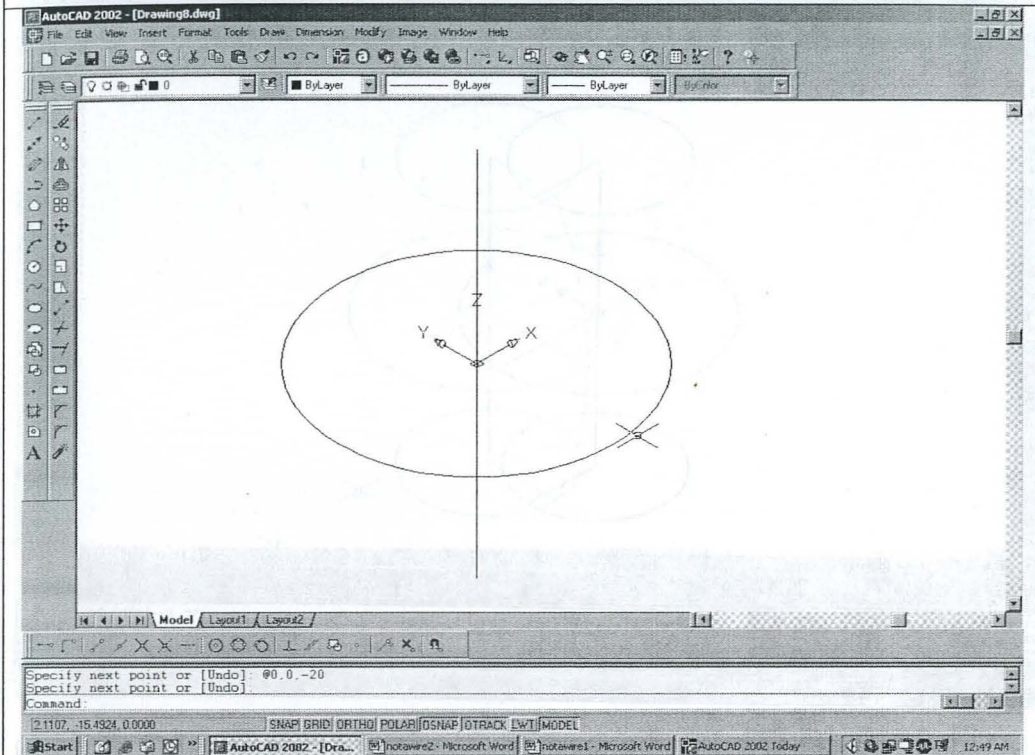
Command: View

Select SW Isometric

Regenerating model.



## Reflection 2 – Creating Wireframe Utilizing UCS



Command: circle

Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: 0,0

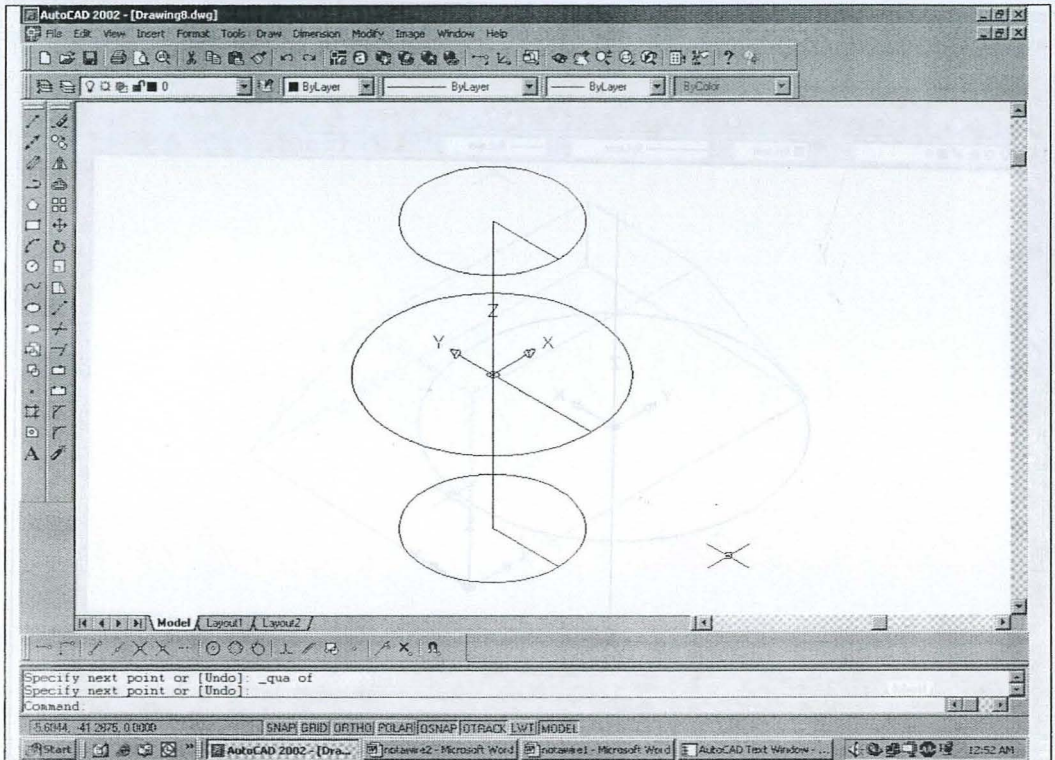
Specify radius of circle or [Diameter]: 15

Command: \_line Specify first point: 0,0

Specify next point or [Undo]: @0,0,20

Command: \_line Specify first point: 0,0

Specify next point or [Undo]: @0,0,-20



Command: `_circle` Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: **(Top endpoint of the vertical line)**

Specify radius of circle or [Diameter] <15.0000>: 10

Command: `_circle` Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: **(Bottom endpoint of the vertical line)**

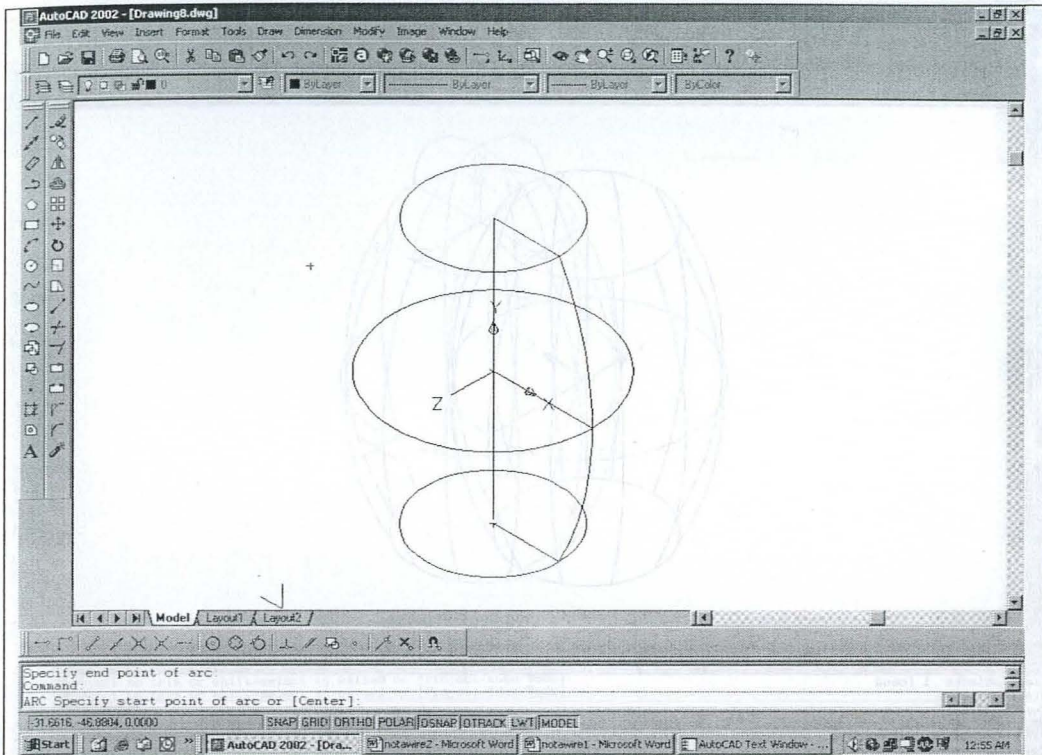
Specify radius of circle or [Diameter] <10.0000>: 10

**(CREATING HORIZONTAL LINE ON EACH CIRCLE) – Use object snap for accuracy**

Command: `_line`

Use command line to construct line from the center of each circle to quadrant of each circle.





## (CREATING CURVING VERTICAL LINE JOINING EACH CIRCLE) –

**Use object snap for accuracy**

Set UCS plane by rotating WCS at X and Y axis

Command: ucs

Current ucs name: \*WORLD\*

Enter an option [New/Move/orthoGraphic/Prev  
/Restore/Save/Del/Apply/?/World]

<World>: x

Specify rotation angle about X axis <90>:

Current ucs name: \*NO NAME\*

Enter an option [New/Move/orthoGraphic/Prev  
/Restore/Save/Del/Apply/?/World]

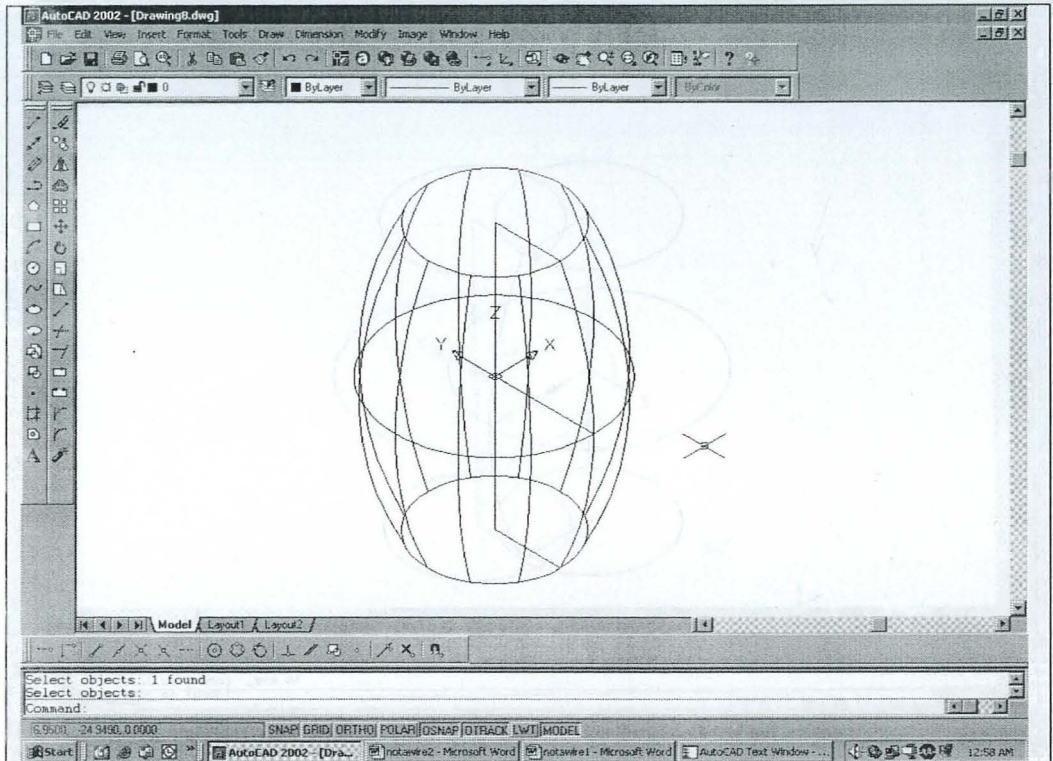
<World>: y

Specify rotation angle about Y axis <90>: -90

Command: \_arc Specify start point of arc or [Center]:

Specify second point of arc or [Center/End]:

Specify end point of arc:



## (ARRAYING THE VERTICAL CURVING LINE)

Command: ucs

Current ucs name: \*NO NAME\*

Enter an option [New/Move/orthoGraphic/Prev  
/Restore/Save/Del/Apply/?/World]

<World>: w

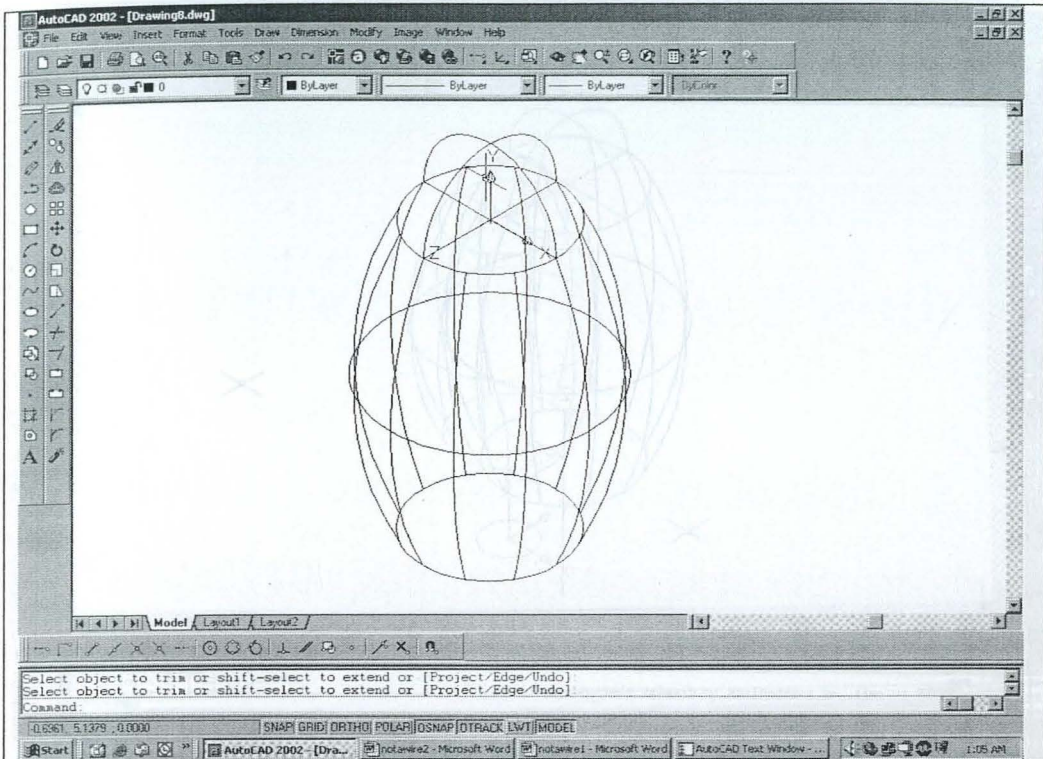
Command: array(polar)

Specify center point of array: *(Center of the horizontal circle)*

Select objects: 1 found

Number of array : 12





## (CREATING TWO SEMI CIRCLE)

Command: ucs (Rotate UCS)

Current ucs name: \*NO NAME\*

Enter an option [New/Move/orthoGraphic/Prev  
/Restore/Save/Del/Apply/?/World]

<World>: x

Specify rotation angle about X axis <90>:

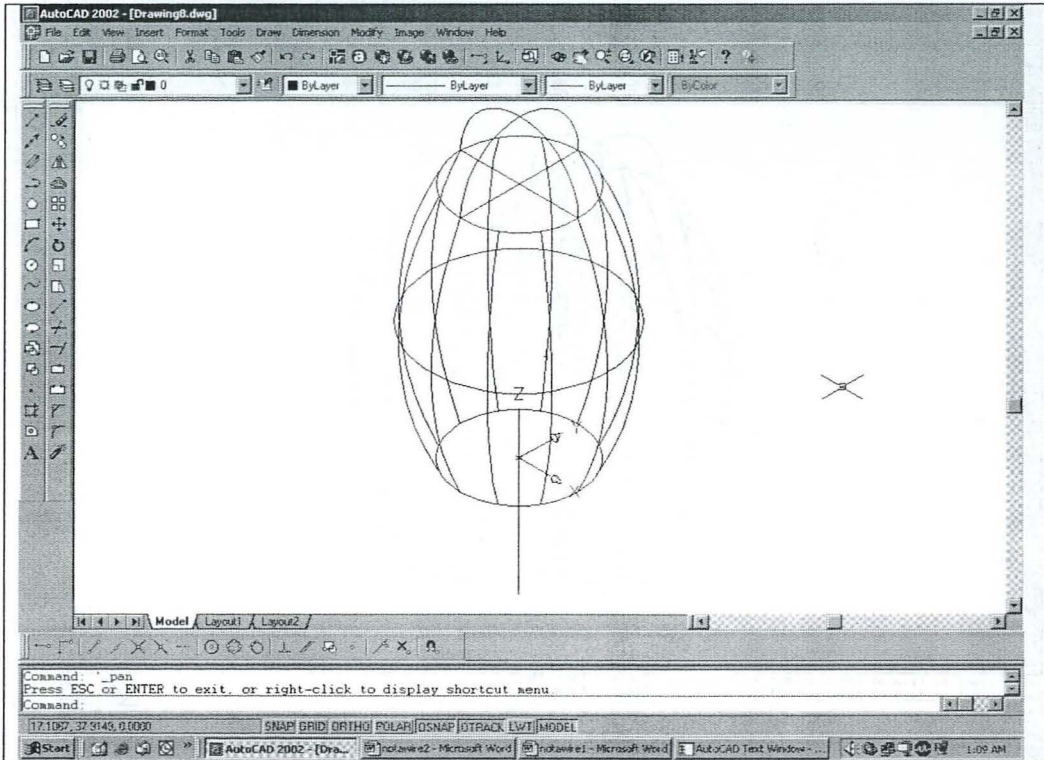
Command: circle (Creating circle using 2p technic)

Specify center point for circle or [3P/2P/Tr (tan tan radius)]: 2p

Command: \_line Specify first point: (Drawing line on horizontal plane)

Specify next point or [Undo]:

Command: \_trim (Trim the bottom part of the two circle created)



Rotate UCS at X axis by -90

Then move the UCS to bottom circle as shown

Command: ucs

Current ucs name: \*NO NAME\*

Enter an option [New/Move/orthoGraphic/Prev  
/Restore/Save/Del/Apply/?/World]

<World>: or

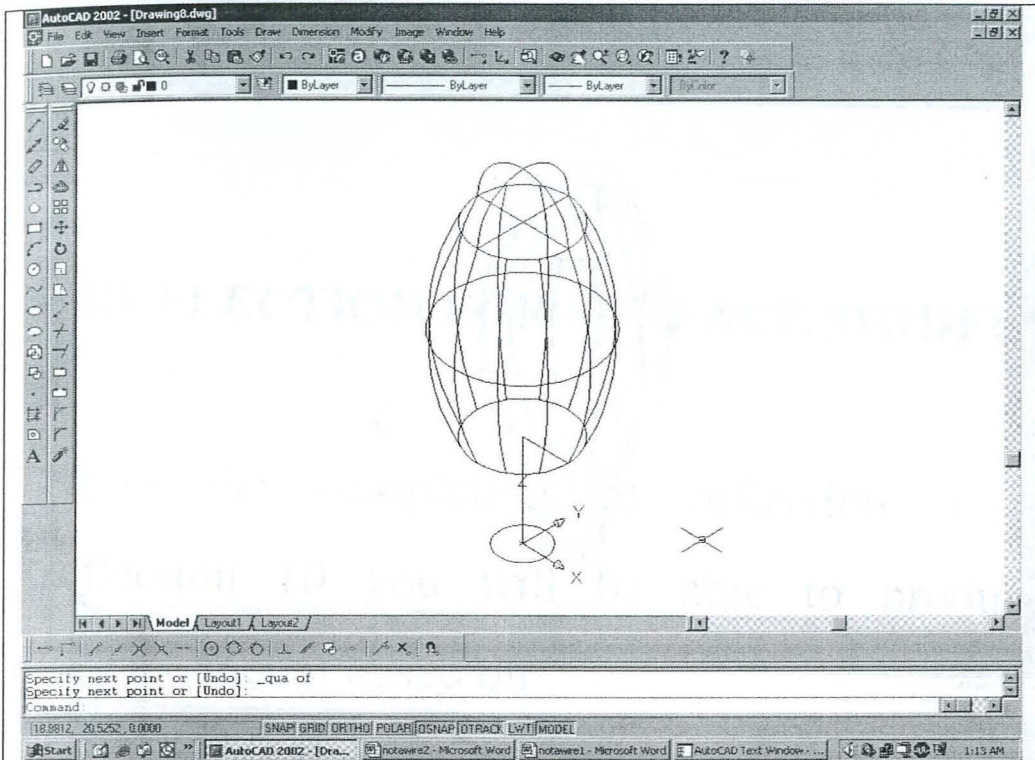
Specify new origin point <0,0,0>:

**(CREATING VERTICAL LINE FROM THE BOTTOM CIRCLE)**

Command: \_line Specify first point:

Specify next point or [Undo]: @0,0,-20





Move UCS to the bottom of vertical line

Command: ucs

Then type or then select the end of vertical line, UCS will move to new position.

### (CREATING HORIZONTAL SMALL CIRCLE FROM THE BOTTOM OF THE VERTICAL LINE)

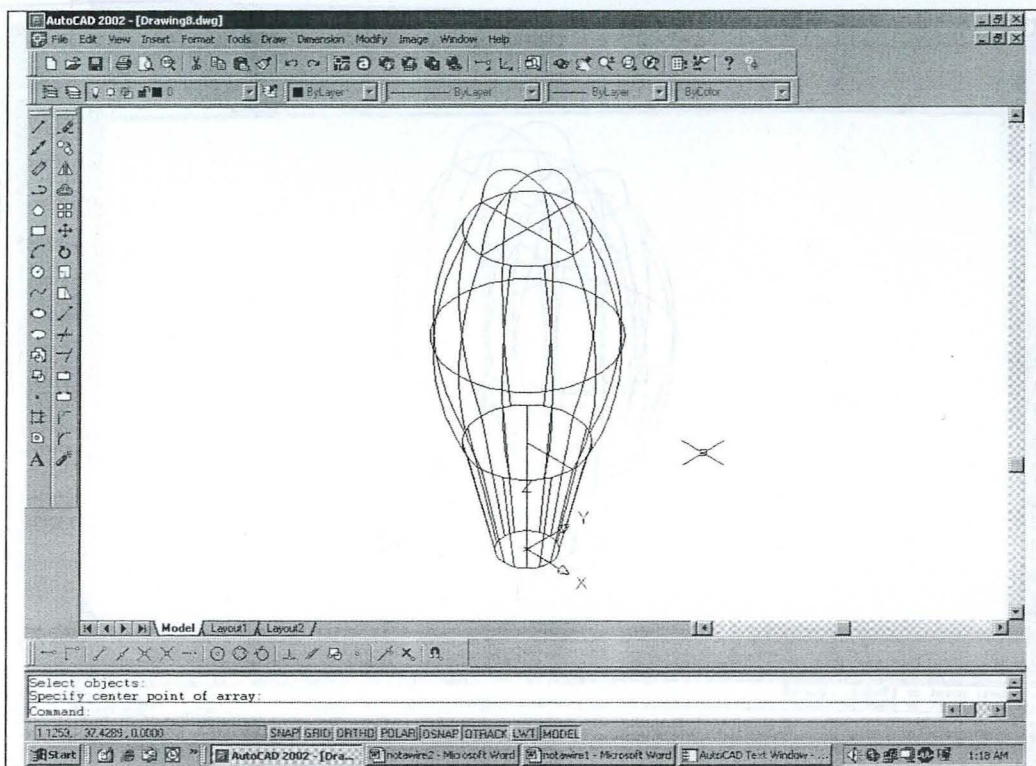
Specify new origin point <0,0,0>:

Command: \_circle Specify center point for circle or [3P/2P/Ttr (tan tan radius)]:

Specify radius of circle or [Diameter] <10.0000>: 5

Command: \_line Specify first point:

Specify next point or [Undo]: \_qua of



Rotate UCS by X axis

Rotation angle 90

Draw vertical line from quadrant of the big circle to quadrant of small circle

Command: `_line` Specify first point:

Specify next point or [Undo]:

Specify next point or [Undo]:

Rotate UCS by X axis

Rotation angle -90

### (ARRAYING THE VERTICAL LINE)

Command: `array`

Select objects: 1 found

Select objects:

Specify center point of array:

Number of array : 16

After the array command the object is done as shown



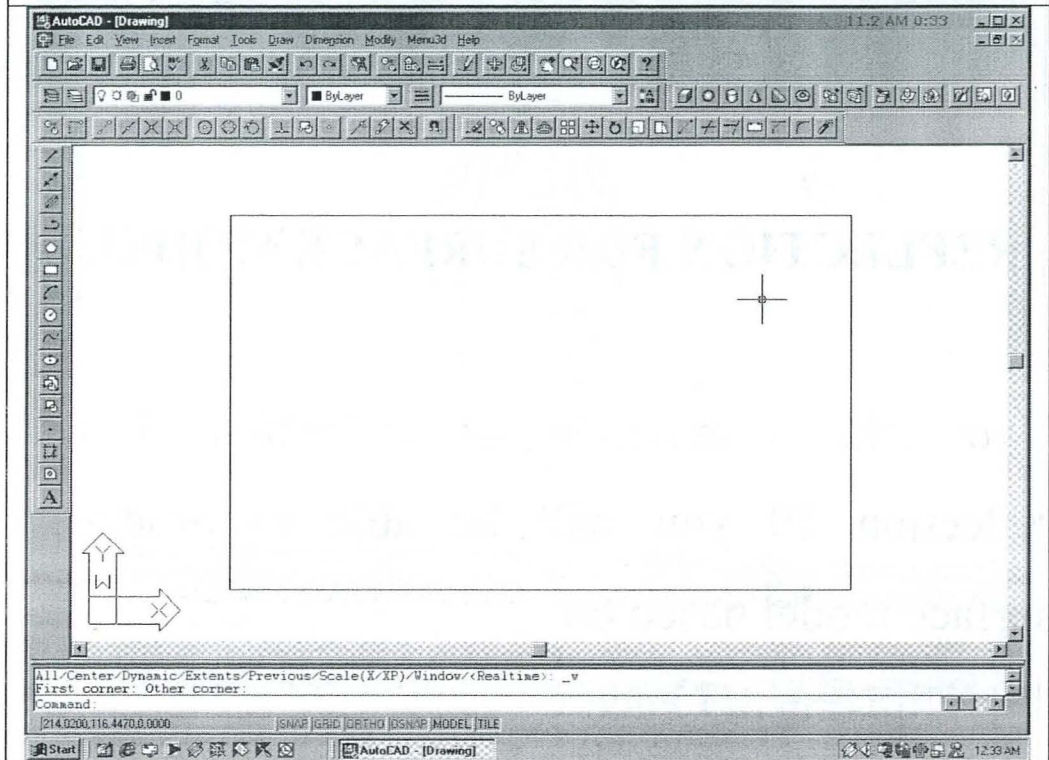
## CHAPTER THREE

### REFLECTION FOR SURFACE MODEL

Upon the completion of reflection 3 to reflection 10 you will be able to produce surface model based on

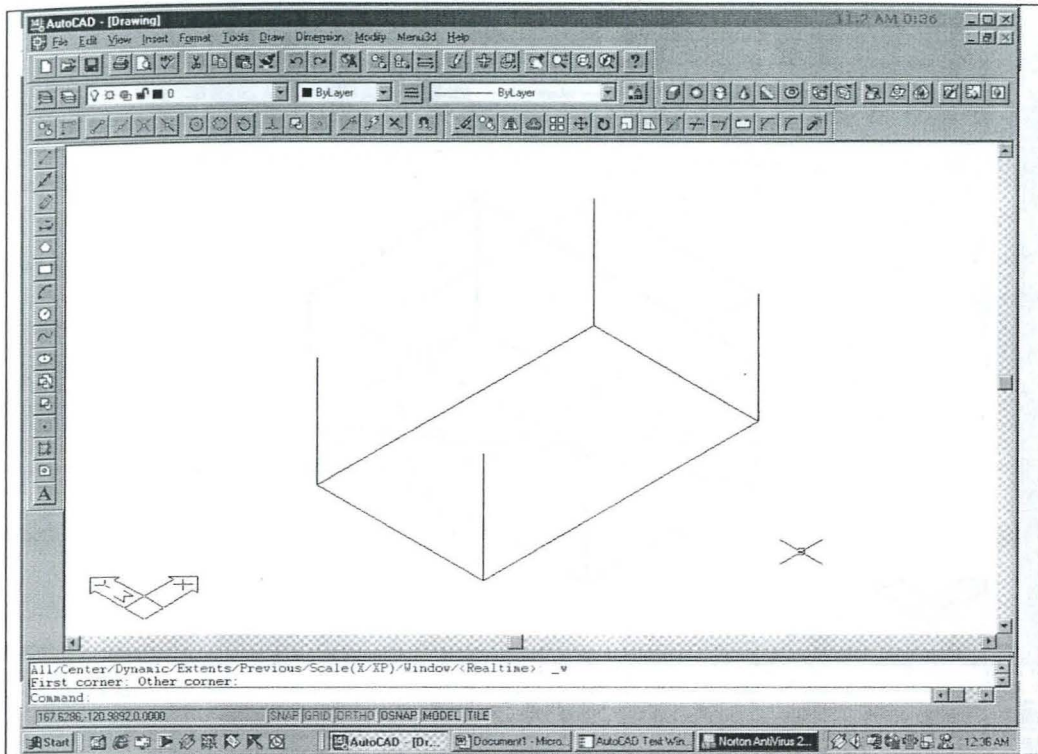
1. Utilizing 3D Face
2. Utilizing Elevation and Line Thickness
3. Revsurf
4. Tabsurf
5. Edgesurf

### Reflection 3 – Creating Surface Model Utilizing UCS and 3DFace



Command: \_line From point: 0,0  
 To point: @150<90  
 To point: @250<0  
 To point: @150<-90  
 To point: cl





Construct one vertical line with height of 100

Command: `_line` From point: `_endp` of

To point: `@0,0,100`

Copy the vertical line and make it multiple copy to put line on each corner

Command: `copy`

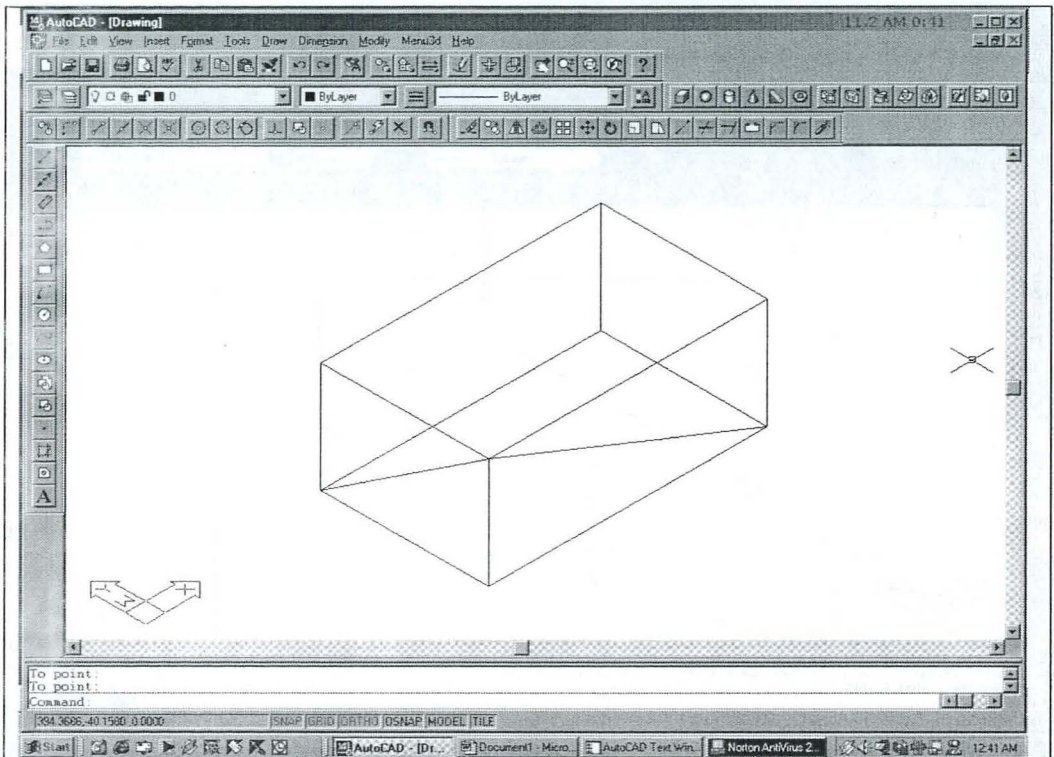
Select objects: 1 found

Select objects:

<Base point or displacement>/Multiple: `m`

Base point: `'_osnap`

## FROM NOTHING TO SOMETHING



Copy the bottom horizontal line to the top of the box.

Use the copy Command  
and select the objects

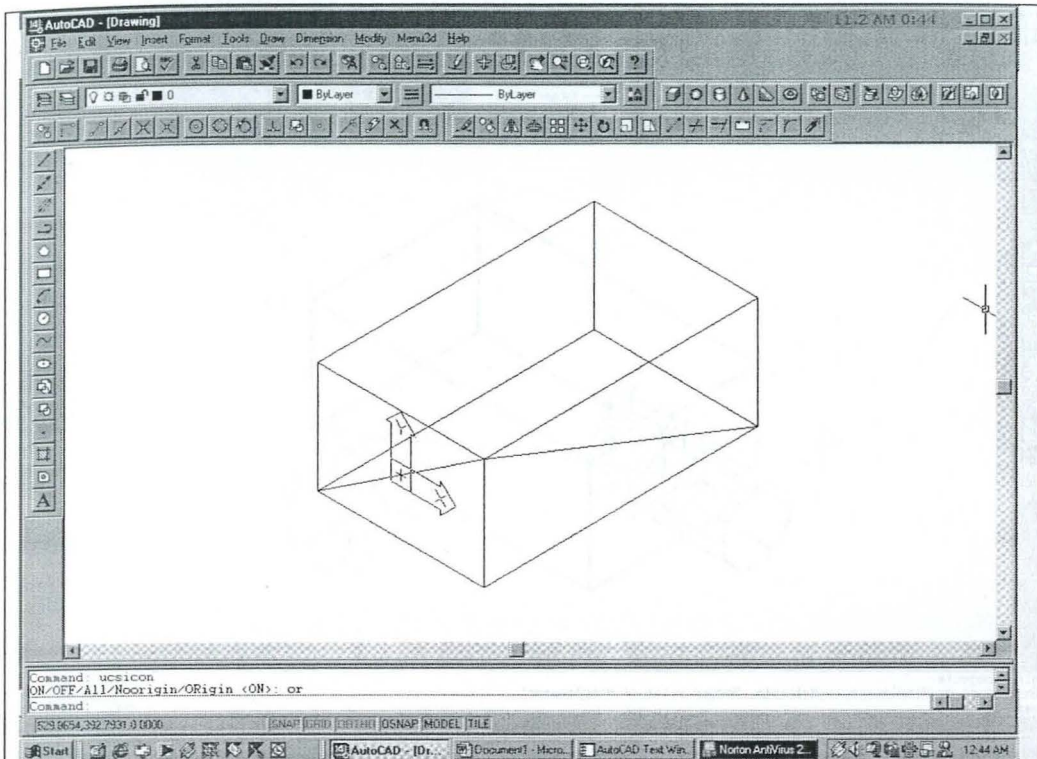
<Base point or displacement>/Multiple: Second point of displacement:

Draw two lines from the corner of top box to the bottom of the box as shown.

Command: l

LINE From point:

To point:



Rotate the UCS by X axis at the angle of 90

Command: ucs

Origin/ZAxis/3point/Object/View/X/Y/Z/Prev/

Restore/Save/Del/?/<World>: x

Rotation angle about X axis <0>: 90

Rotate the UCS by Y axis at the angle of 90

Command: ucs

Origin/ZAxis/3point/Object/View/X/Y/Z/Prev/

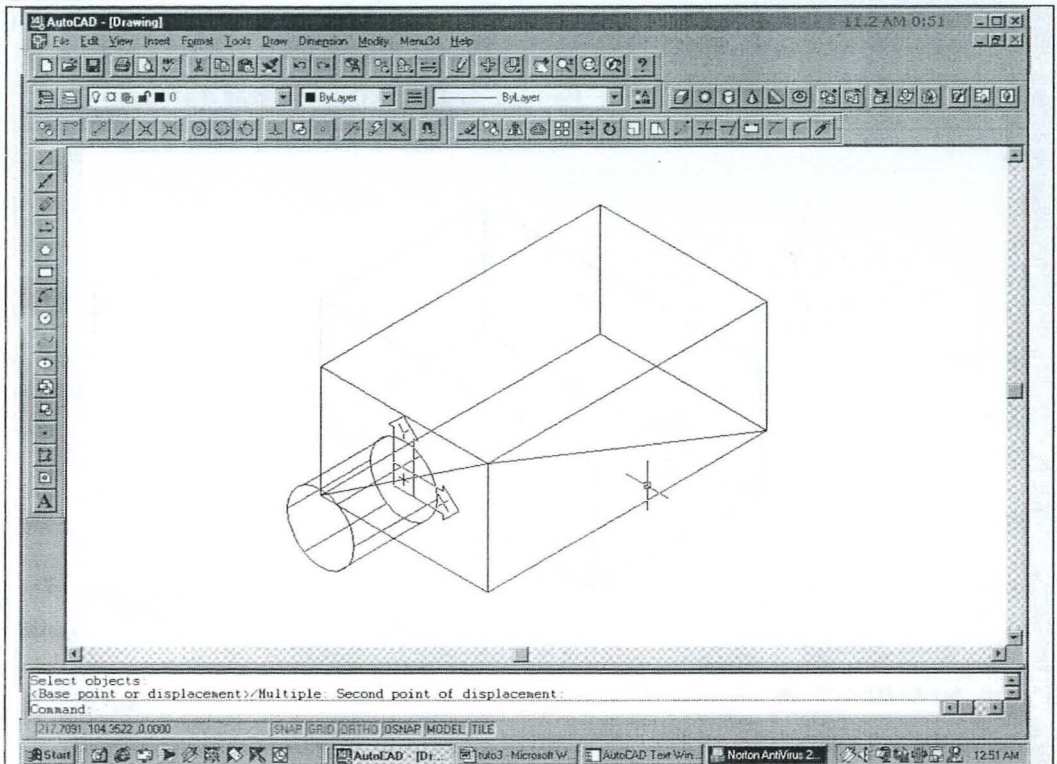
Restore/Save/Del/?/<World>: y

Rotation angle about Y axis <0>: -90

Set the position of the UCS as shown

Use UCS Command and type or and set the origin at the position shown.





Draw a circle to the wall as shown

The size of the radius is 30

Command: `_line` From point: `_qua` of

To point: `@0,0,75`

Command: `array`

Select objects: 1 found

Select objects:

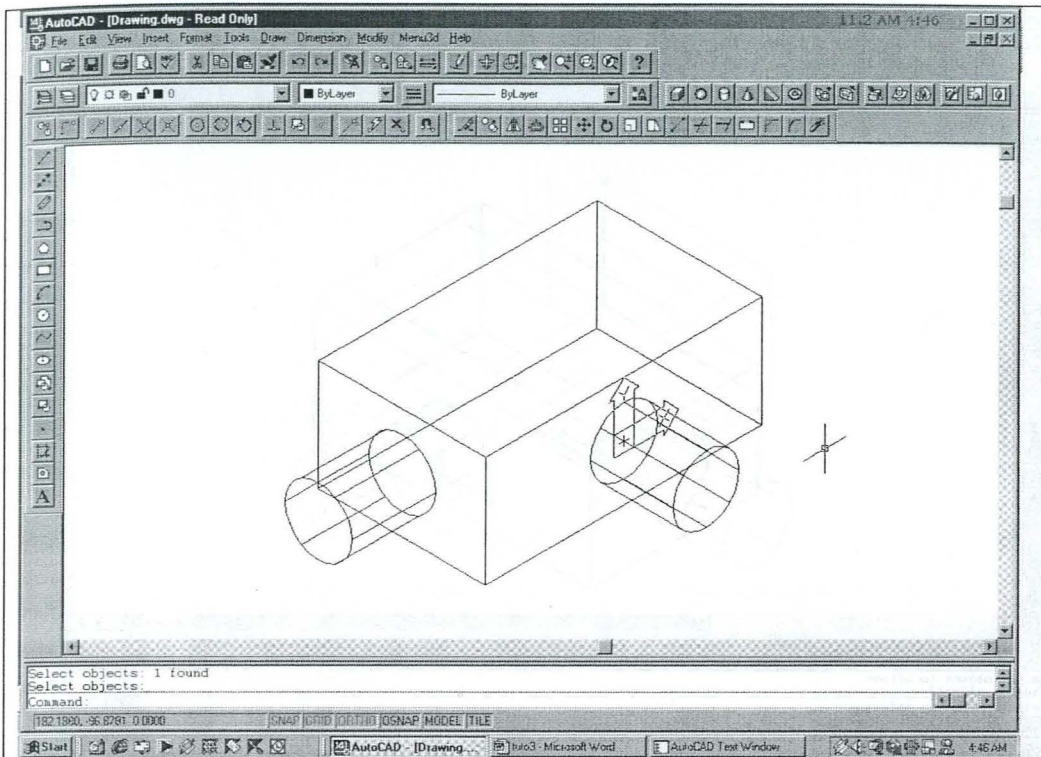
Rectangular or Polar array (`<R>/P`): `p`

Base/`<Specify center point of array>`:

Number of items: 6

Angle to fill (`+ = ccw`, `- = cw`) `<360>`:

## FROM NOTHING TO SOMETHING



Rotate the UCS at Y axis with the angle equal to 90

Command: ucs

Set the origin of the UCS as shown

Draw the circle with the radius is equal to 30

Draw line from the quadrant of the circle

Command: \_line From point: \_qua of

To point: @0,0,75

Copy the bottom circle to the top of the cylinder

Command: array

Select objects: 1 found

Select objects:

Rectangular or Polar array (R/<P>): p

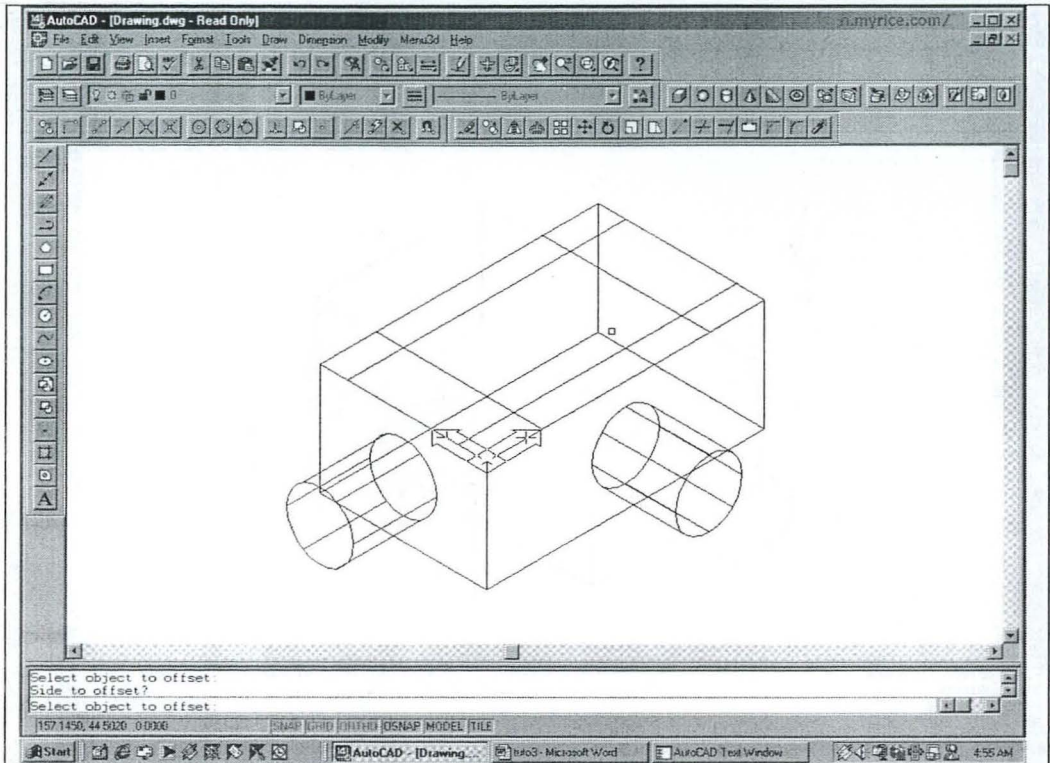
Base/<Specify center point of array>:

Number of items: 8

Angle to fill (+=ccw, -=cw) <360>:

Rotate objects as they are copied? <Y>

Erase the unused lines or entities



Rotate the UCS at X axis with the angle equal to -90  
Set the origin of the UCS as shown

Offset the shortest part of the rectangle with the distance of 50

Command: `_offset`

Offset distance or Through <1.0000>: 50

Select object to offset:

Side to offset?

Select object to offset:

Side to offset?

Offset the other part of the rectangle with the distance of 25

Command: `_offset`

Offset distance or Through <50.0000>: 25

Select object to offset:

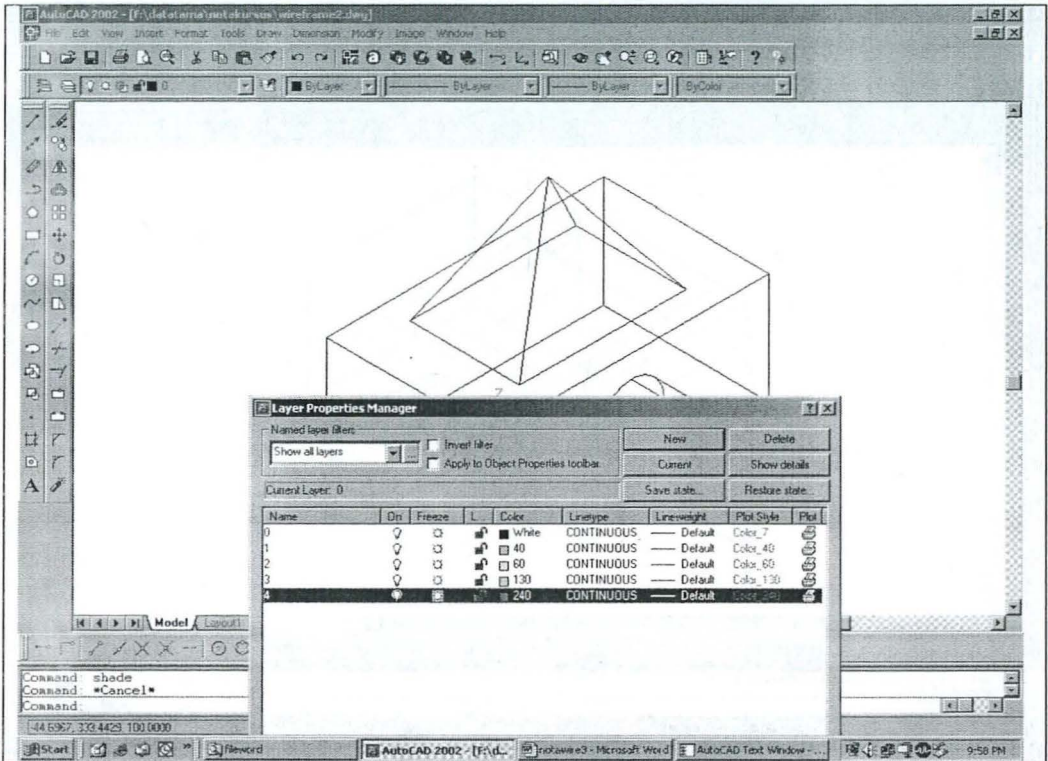
Side to offset?

Select object to offset:

Side to offset?







Draw line from the bottom of the rectangle to the top of the vertical line

Command: `_line` Specify first point:

Specify next point or [Undo]:

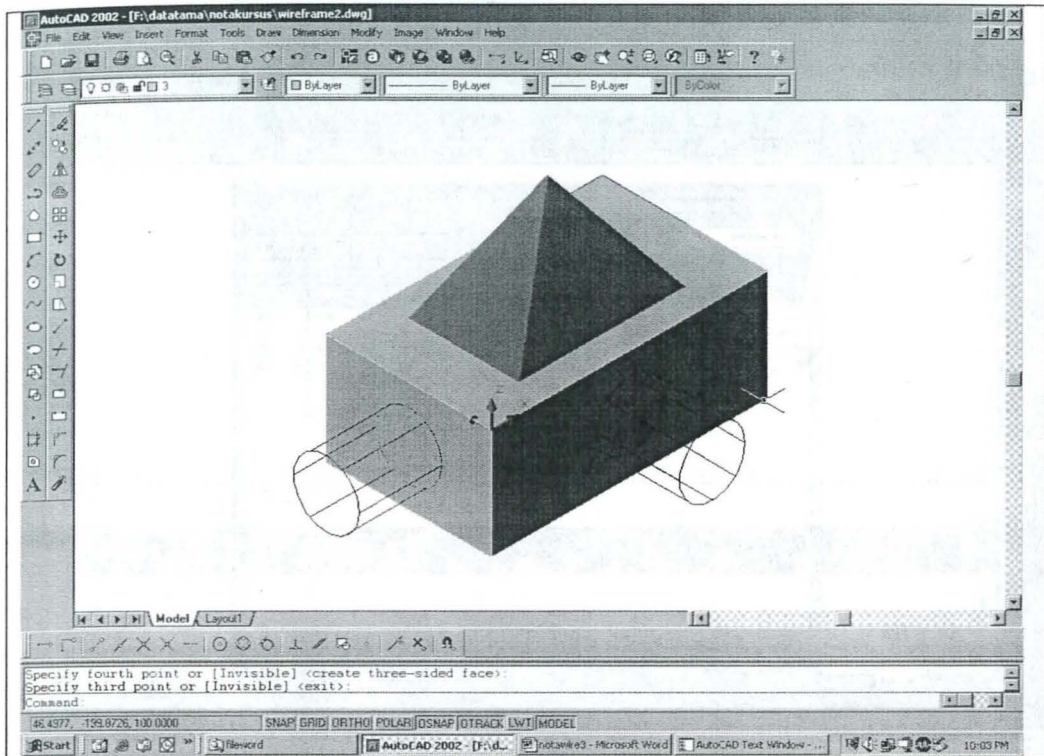
Specify next point or [Undo]:

Command: `_erase`

Select objects: 2 founds

Insert 4 layers and name it (1, 2, 3, 4) and use 4 different colours.

## FROM NOTHING TO SOMETHING



Command: 3dface (Use for 4 different layers)

Specify first point or [Invisible]:

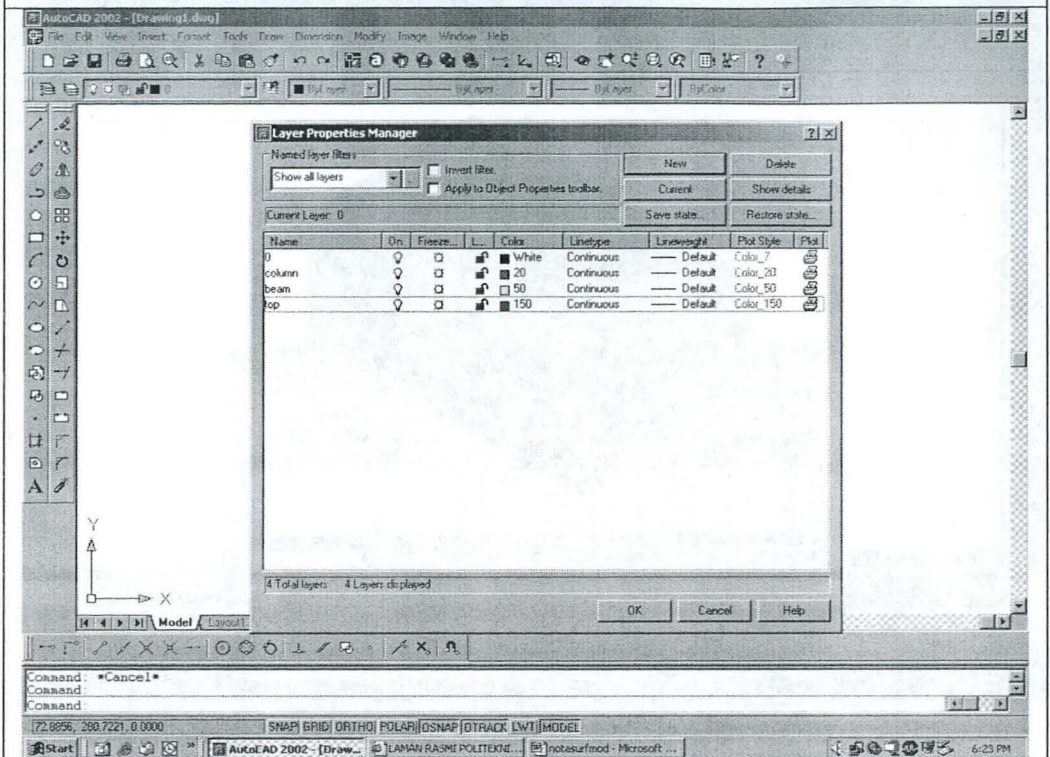
Specify second point or [Invisible]:

Specify third point or [Invisible] <exit>:

Specify fourth point or [Invisible] <create three-sided face>:



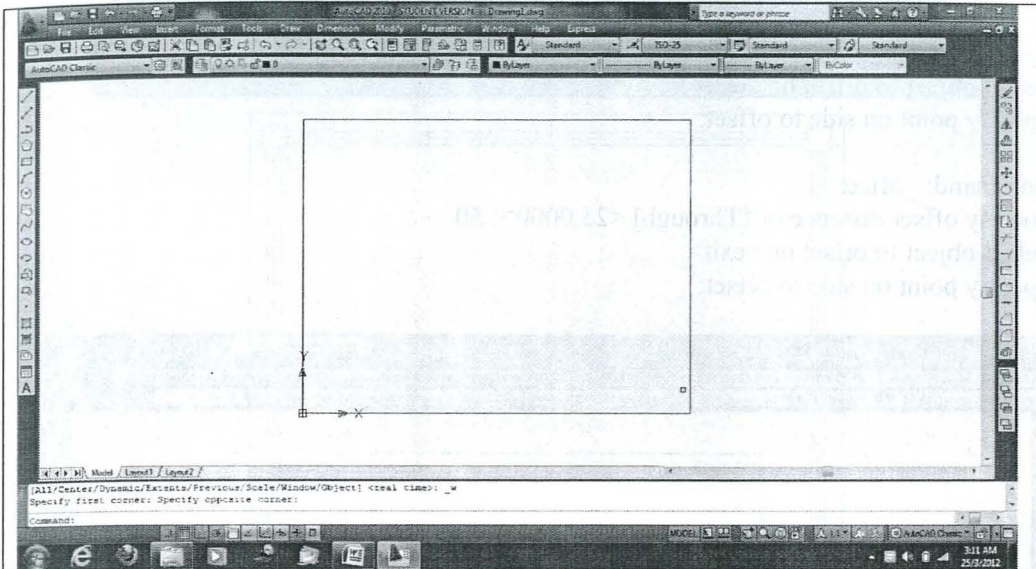
## Reflection 4 – Creating Surface Model – Elevation & Thickness



Command: '\_layer

Create three layers which are beam, column and top

## FROM NOTHING TO SOMETHING



Draw rectangle with the size of 900 x 1200

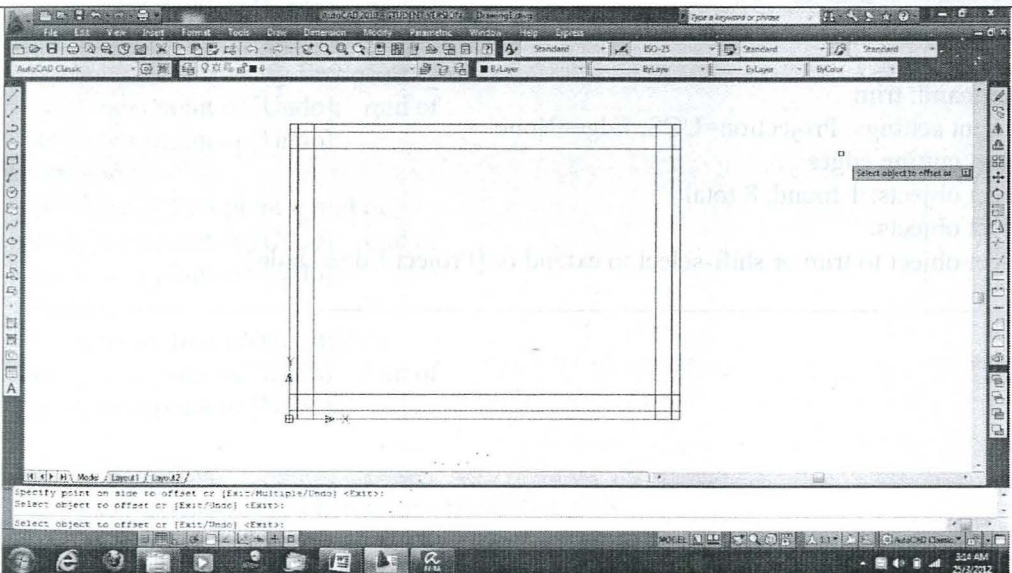
Command: line Specify first point: 0,0

Specify next point or [Undo]: @900<90

Specify next point or [Undo]: @1200<0

Specify next point or [Close/Undo]: @900<-90

Specify next point or [Close/Undo]: cl



Command: offset

Specify offset distance or [Through] <1.0000>: 25

Select object to offset or <exit>:

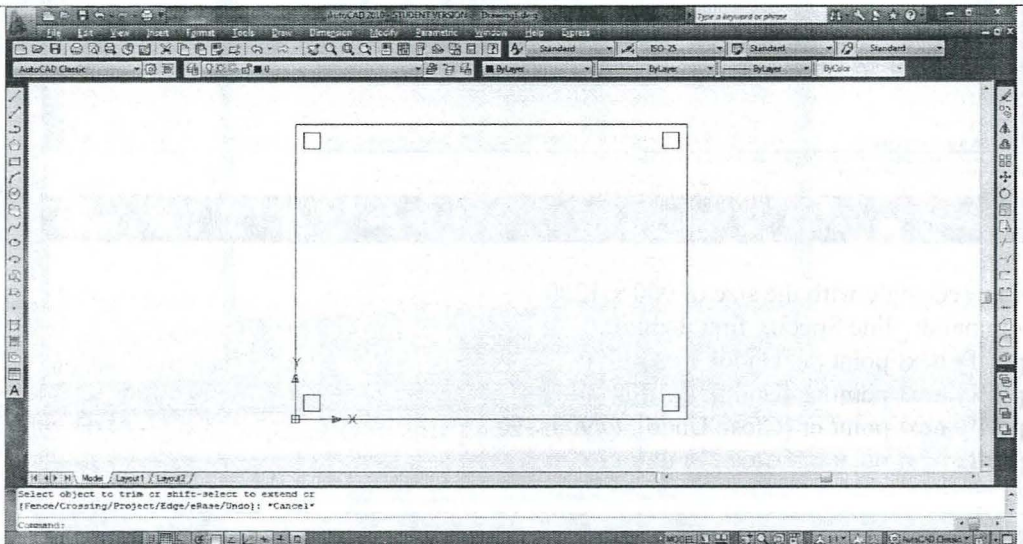
Specify point on side to offset:

Command: \_offset

Specify offset distance or [Through] <25.0000>: 50

Select object to offset or <exit>:

Specify point on side to offset:



Command: trim

Current settings: Projection=UCS, Edge=None

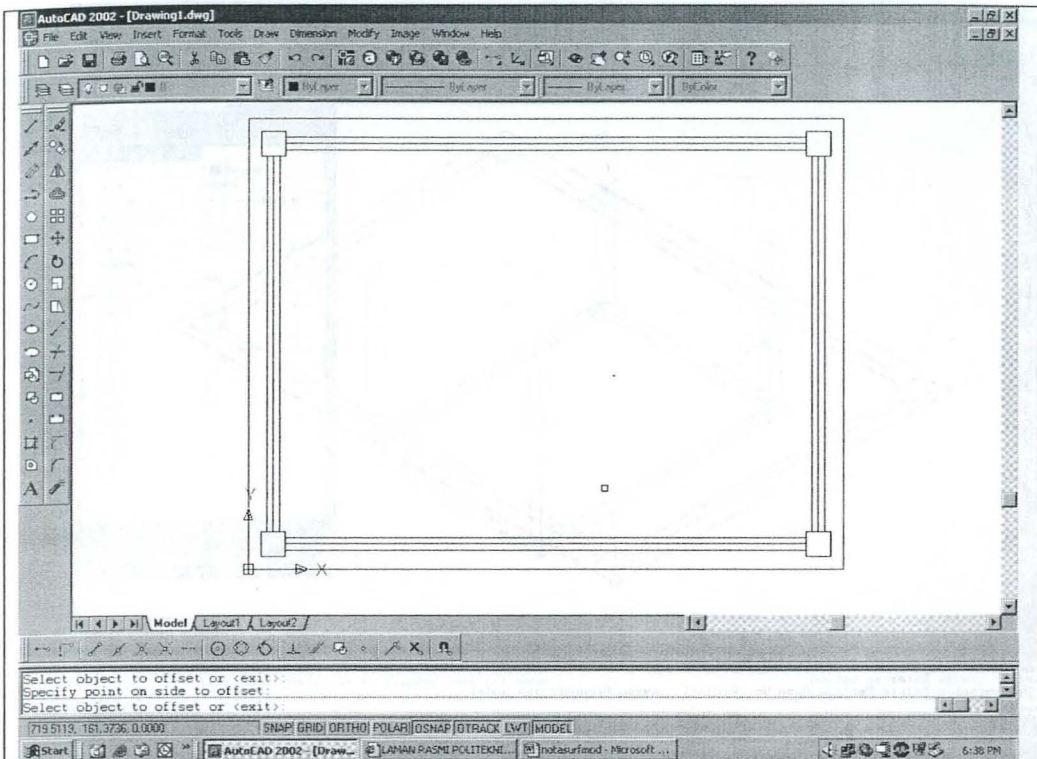
Select cutting edges ...

Select objects: 1 found, 8 total

Select objects:

Select object to trim or shift-select to extend or [Project/Edge/Undo]:





Command: \_line Specify first point: \_mid of

Specify next point or [Undo]: \_mid of

Specify next point or [Undo]:

Command: \_line Specify first point: \_mid of

Specify next point or [Undo]: \_mid of

Specify next point or [Undo]:

Command:

LINE Specify first point: \_mid of

Specify next point or [Undo]: \_mid of

Specify next point or [Undo]:

Command:

LINE Specify first point: \_mid of

Specify next point or [Undo]: \_mid of

Specify next point or [Undo]:

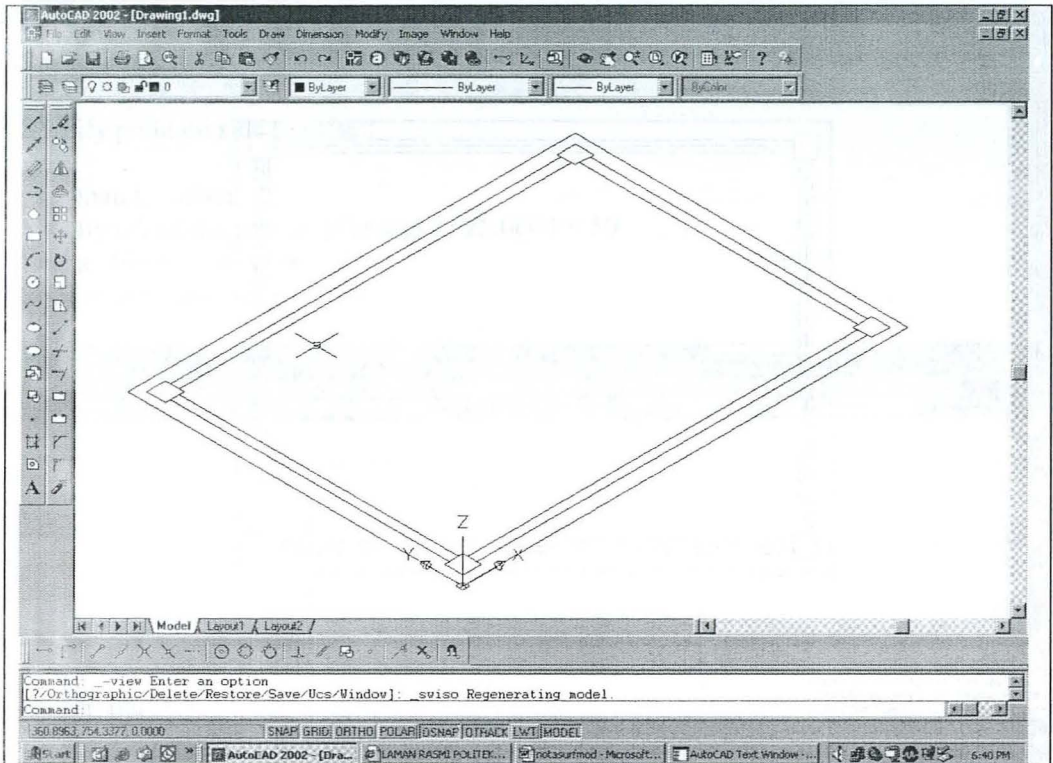
Command: \_offset

Specify offset distance or [Through] <50.0000>: 12.5

Select object to offset or <exit>:

Specify point on side to offset:

## FROM NOTHING TO SOMETHING



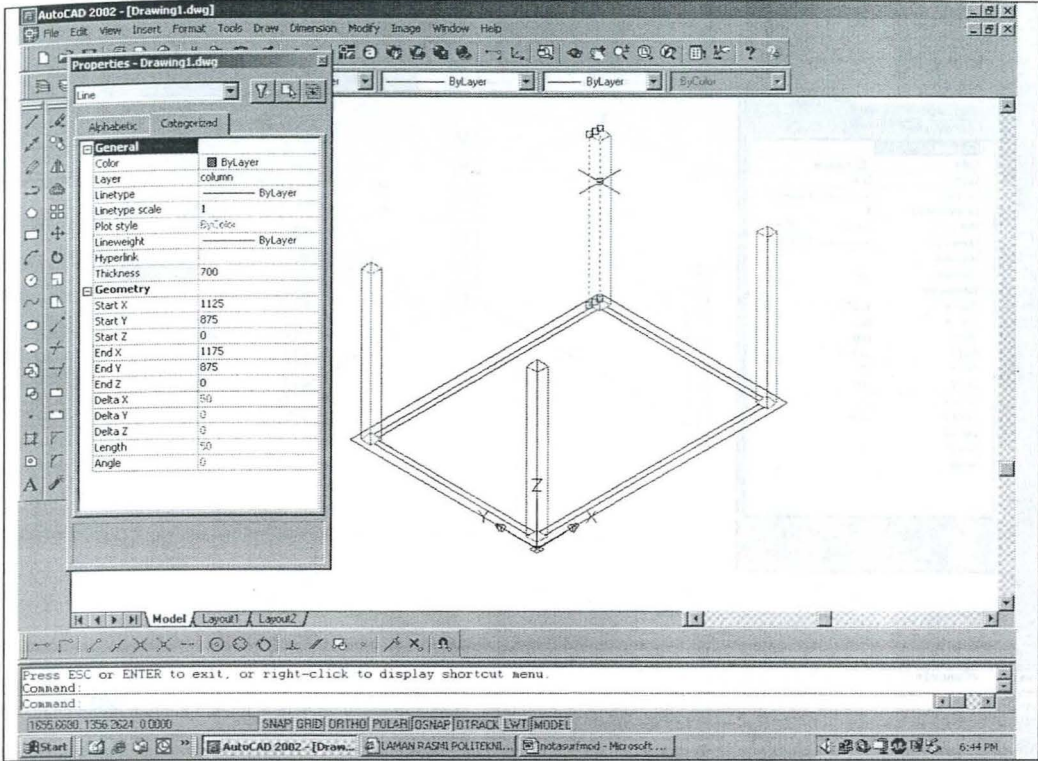
Command: \_erase

Select objects: 1 found, 4 total

Select objects:

Command: \_view Enter an option

[?/Orthographic/Delete/Restore/Save/Ucs/Window]: \_swiso Regenerating model.



Command: `_properties`

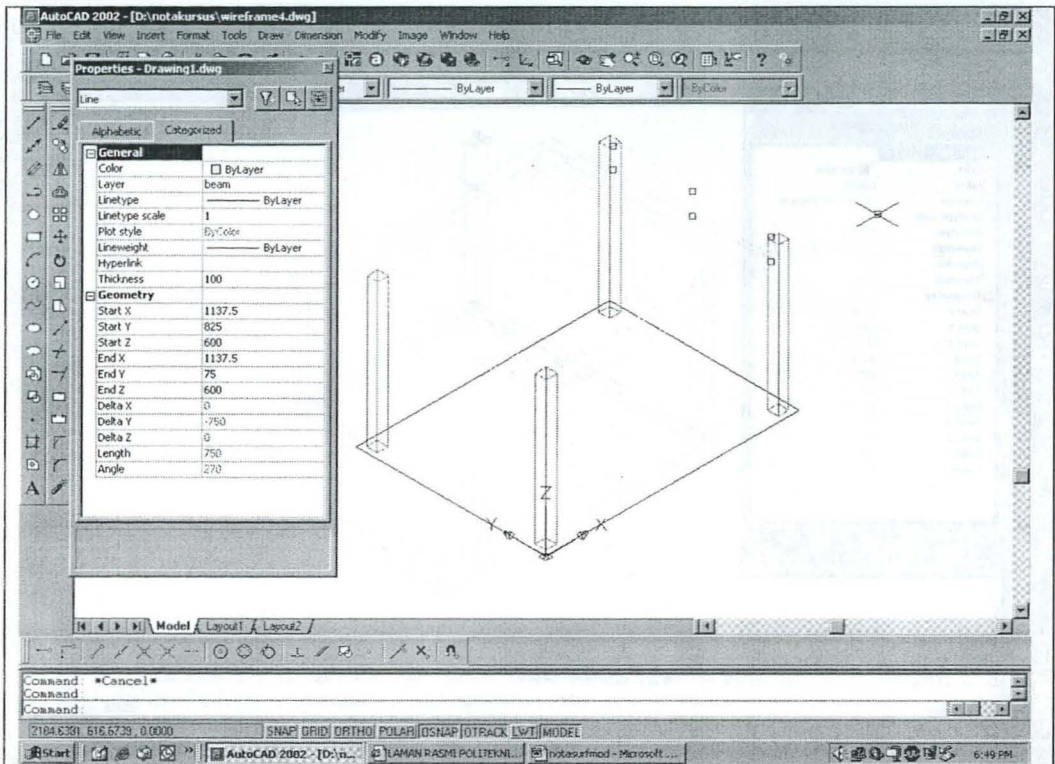
Command: `'pan`

Press ESC or ENTER to exit, or right-click to display shortcut menu.

(Change layer to column and thickness to 700)



## FROM NOTHING TO SOMETHING



Move the beam line upward 600 units

Command: `_move`

Select objects: 1 found, 8 total

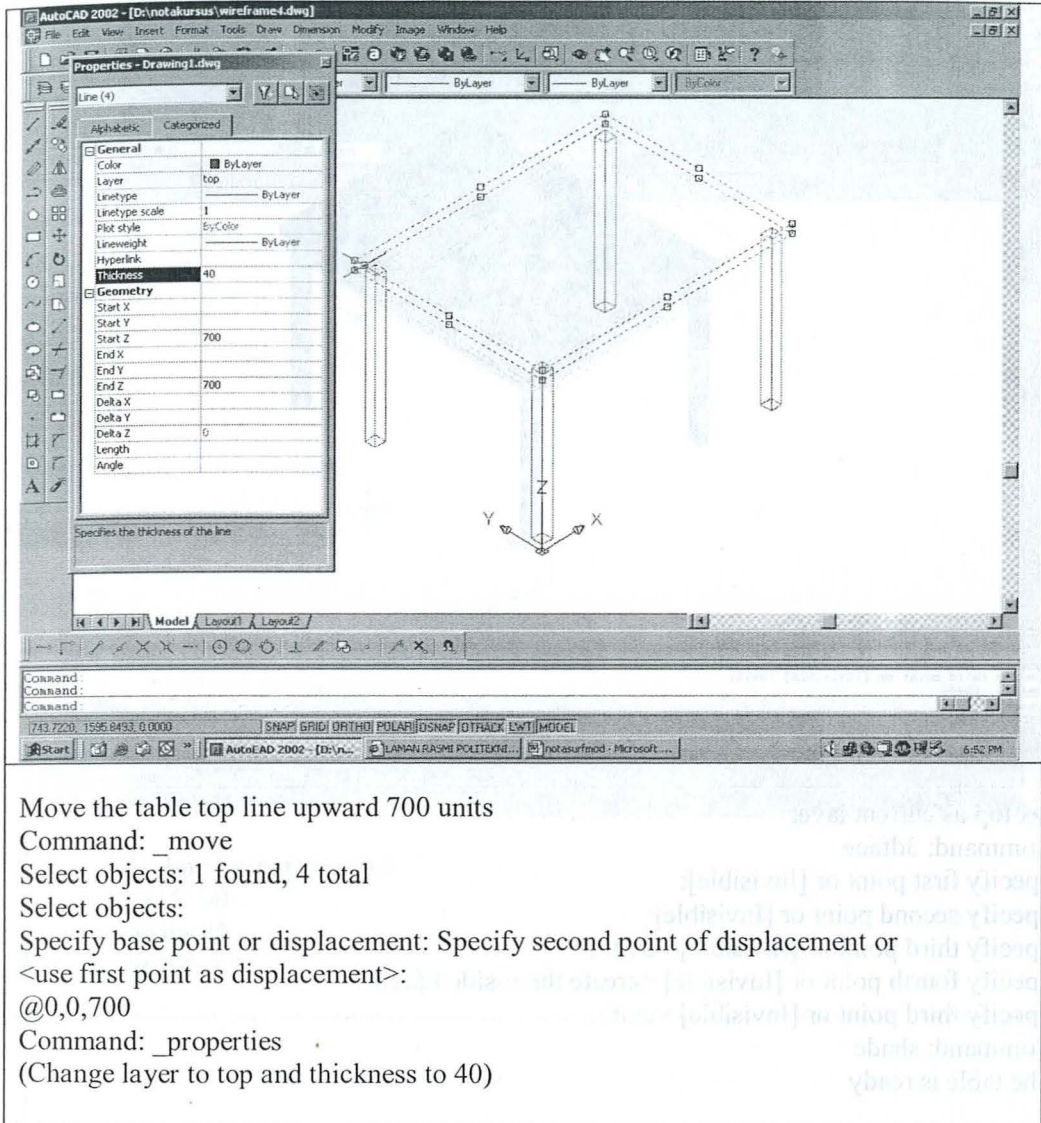
Select objects:

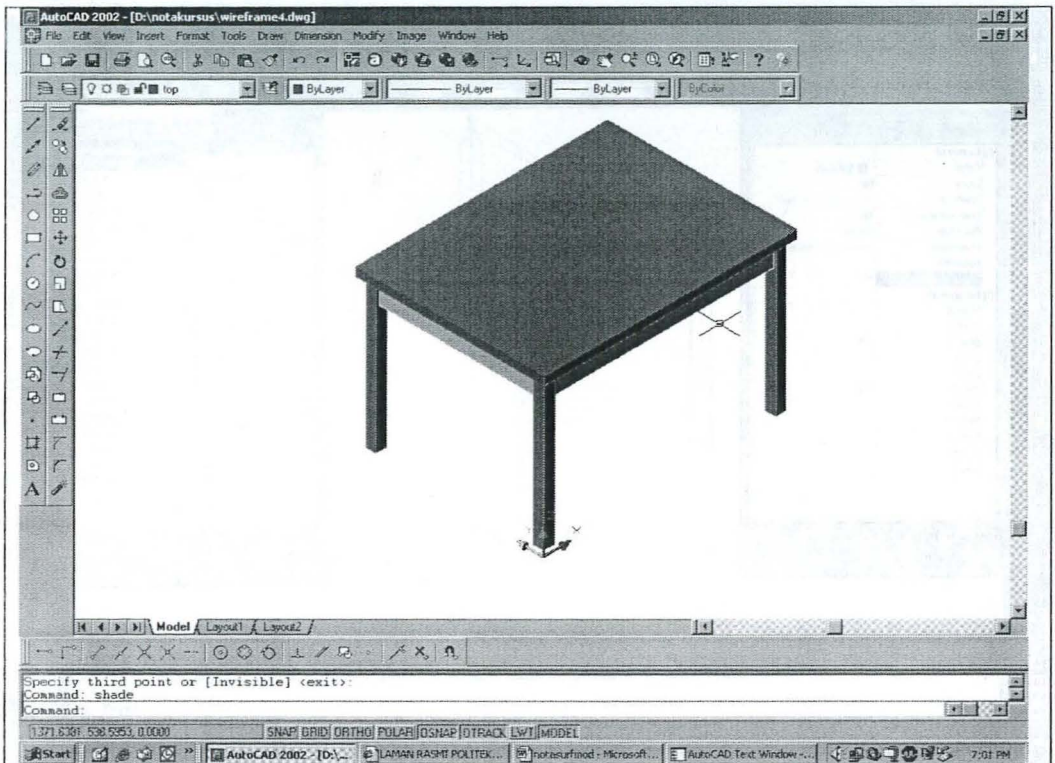
Specify base point or displacement: Specify second point of displacement or

<use first point as displacement>: `@0,0,600`

Command: `_properties`

(Change layer to beam and thickness to 100)





Set top as current layer

Command: 3dface

Specify first point or [Invisible]:

Specify second point or [Invisible]:

Specify third point or [Invisible] <exit>:

Specify fourth point or [Invisible] <create three-sided face>:

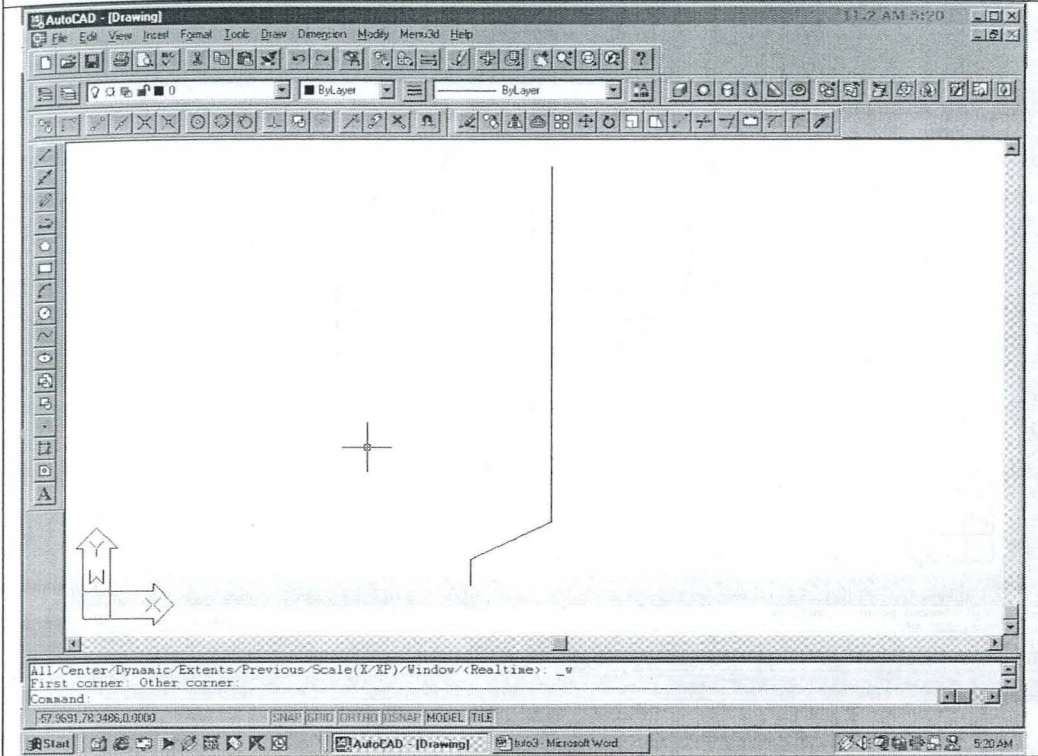
Specify third point or [Invisible] <exit>:

Command: shade

The table is ready



## Reflection 5 – Creating Surface Model - Revsurf



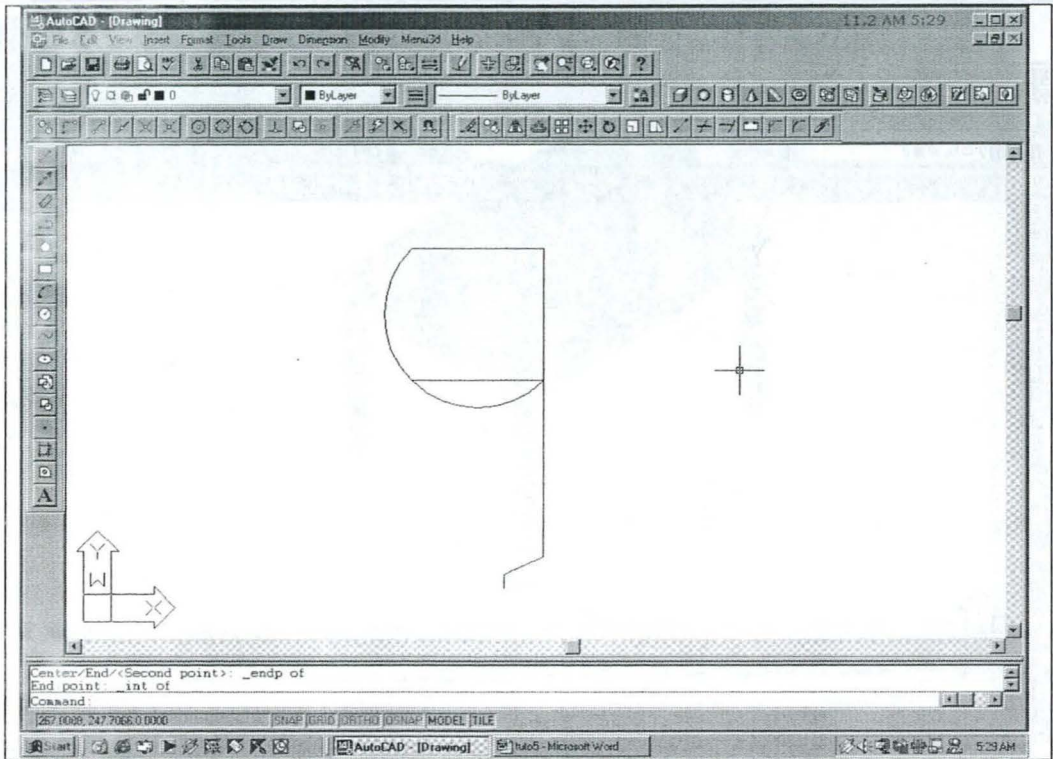
Command: `_line` From point: 0,0

To point: `@15<90`

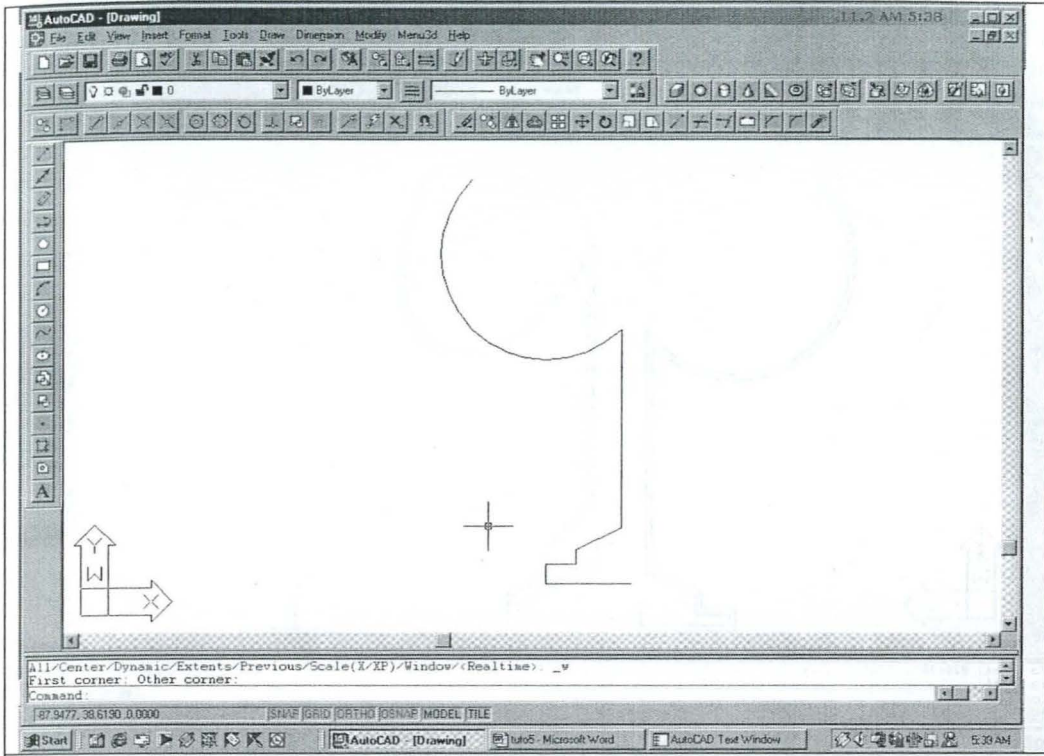
To point: `@50<25`

To point: `@200<90`

## FROM NOTHING TO SOMETHING



Command: \_line From point: \_endp of  
To point: @150<180  
Command: \_offset  
Offset distance or Through <150.0000>:  
Select object to offset:  
Side to offset?  
Command: \_line From point: \_endp of  
To point: \_endp of  
Command: \_arc Center/<Start point>: \_endp of  
Center/End/<Second point>: \_endp of  
End point: \_int of

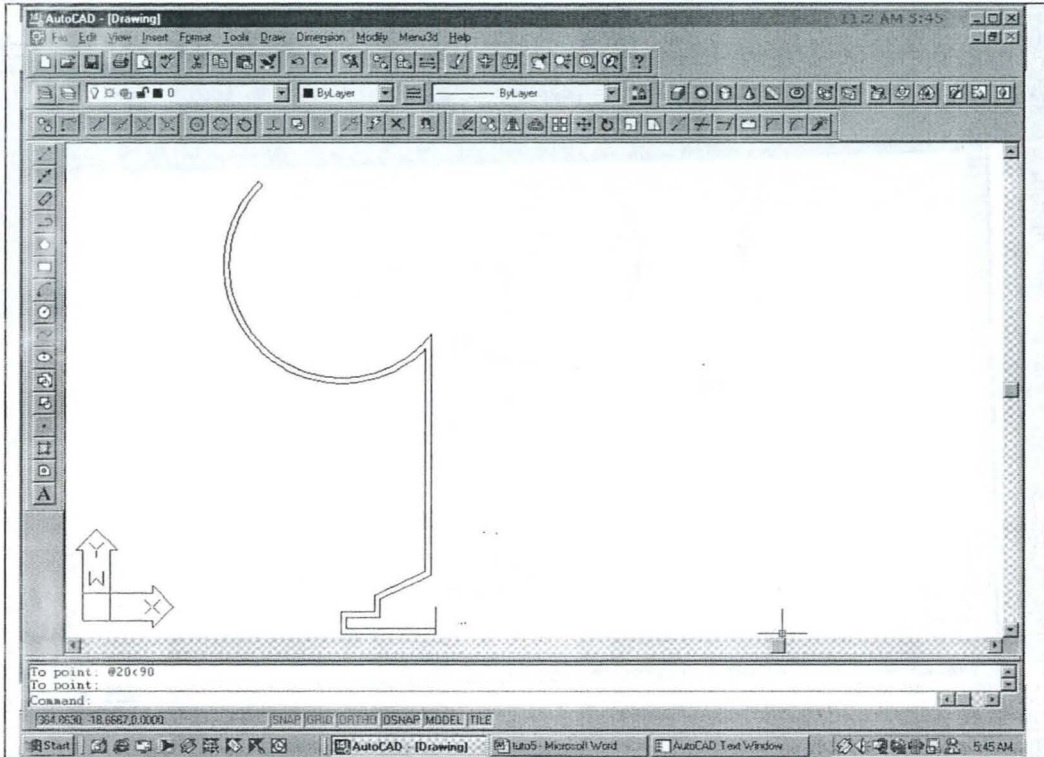


Command: \_erase  
Select objects: 3 found

Command: \_line From point: \_endp of  
To point: @30<180  
To point: @20<-90  
To point: @85<0

Command: '\_zoom  
All/Center/Dynamic/Extents/Previous/  
Scale(X/XP)/Window/<Realtime>: \_w  
First corner: Other corner:





Command: pedit

Select polyline:

Object selected is not a polyline

Do you want to turn it into one? <Y> y

Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo/eXit <X>: join

Select objects: 7 found

Command: \_offset

Offset distance or Through <150.0000>: 5

Select object to offset:

Side to offset?

Command: \_line From point:

To point:

Command: pedit

Select polyline:

Object selected is not a polyline

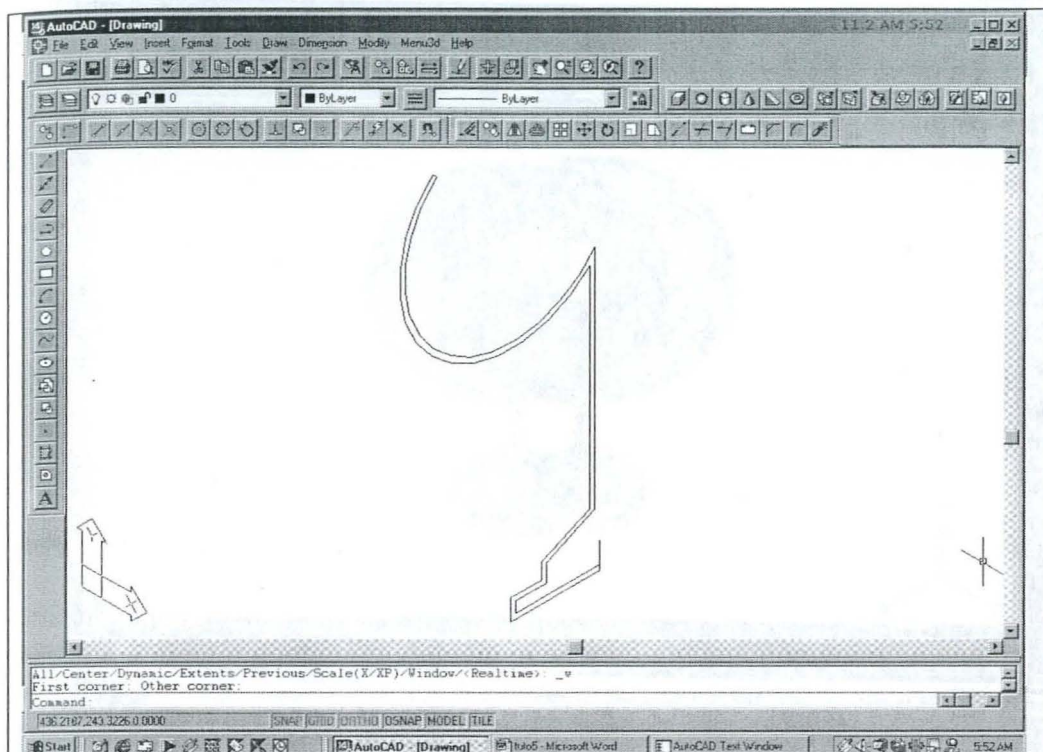
Do you want to turn it into one? <Y>

Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo/eXit <X>: j

Select objects: 2 found

Command: \_line From point:

To point: @20<9

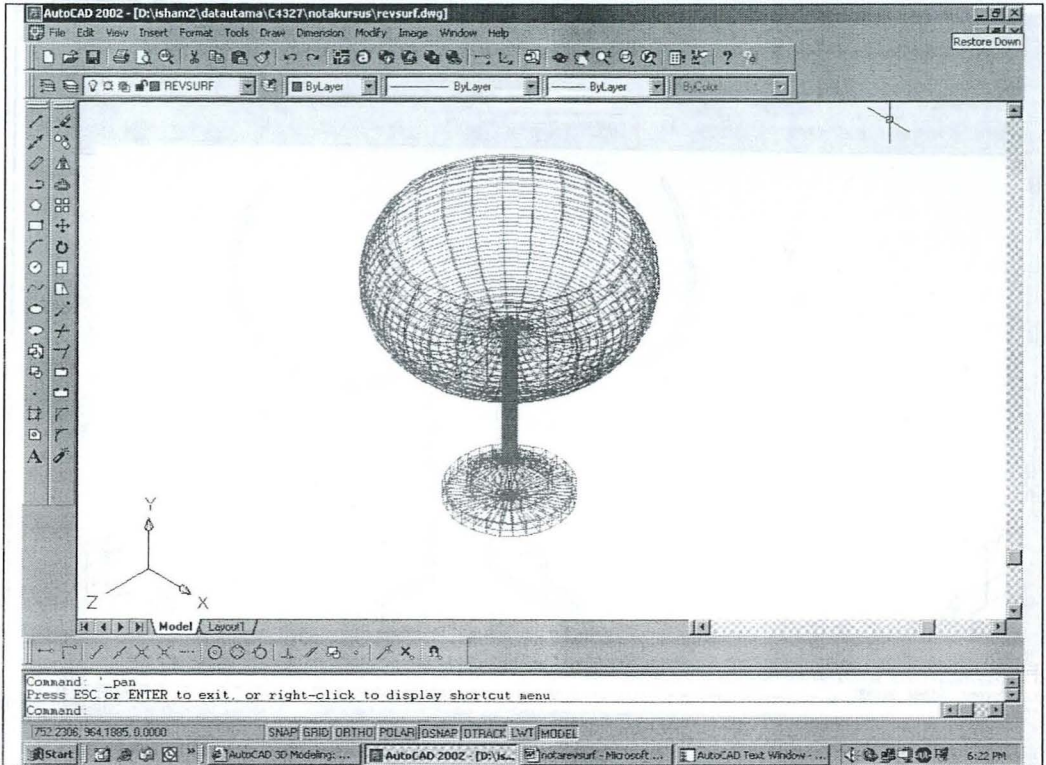


Command: ucs  
 Origin/ZAxis/3point/OBject/View/X/Y/Z/  
 Prev/Restore/Save/Del/?/<World>: x  
 Rotation angle about X axis <0>: 90

Command: ucs  
 Current ucs name: \*NO NAME\*  
 Enter an option [New/Move/orthoGraphic/Prev/  
 Restore/Save/Del/Apply/?/World]  
 <World>: y  
 Specify rotation angle about Y axis <90>: -90

Command: \_rotate  
 Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0  
 Select objects: all  
 2 found

Select objects:  
 Specify base point:  
 Specify rotation angle or [Reference]: -90



Command: '\_layer

Command: surfTAB1

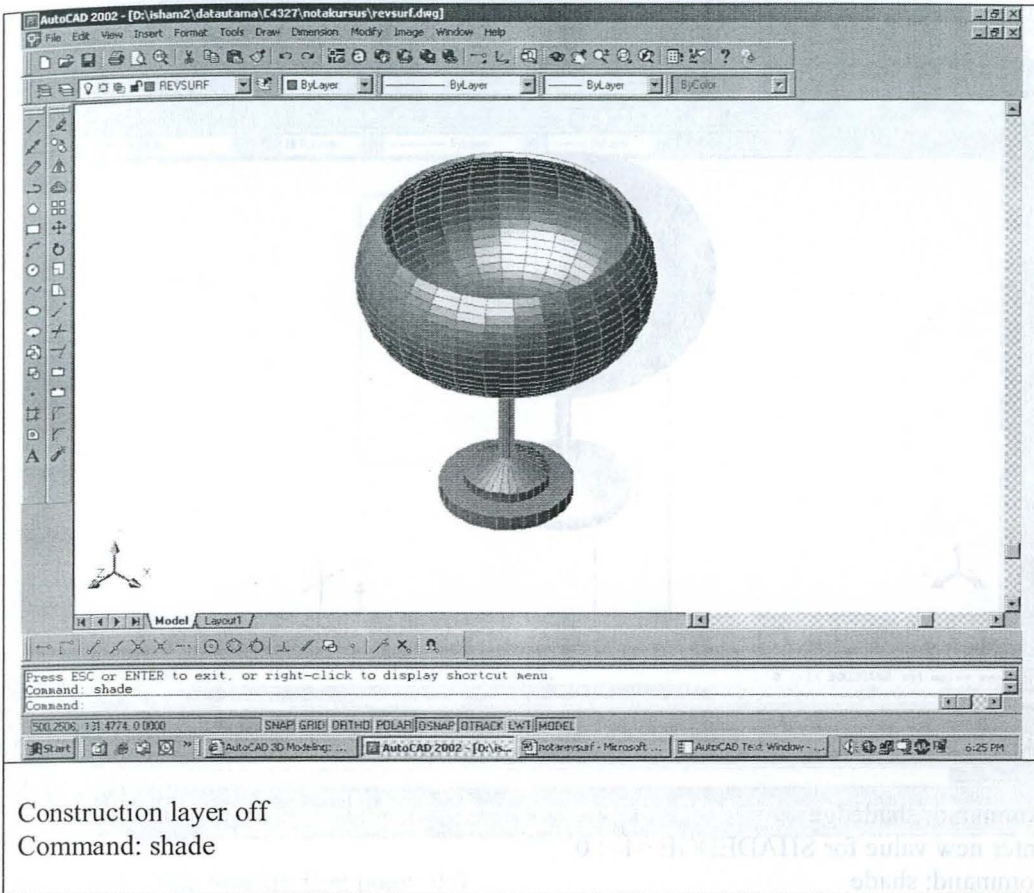
Enter new value for SURFTAB1 <6>: 30

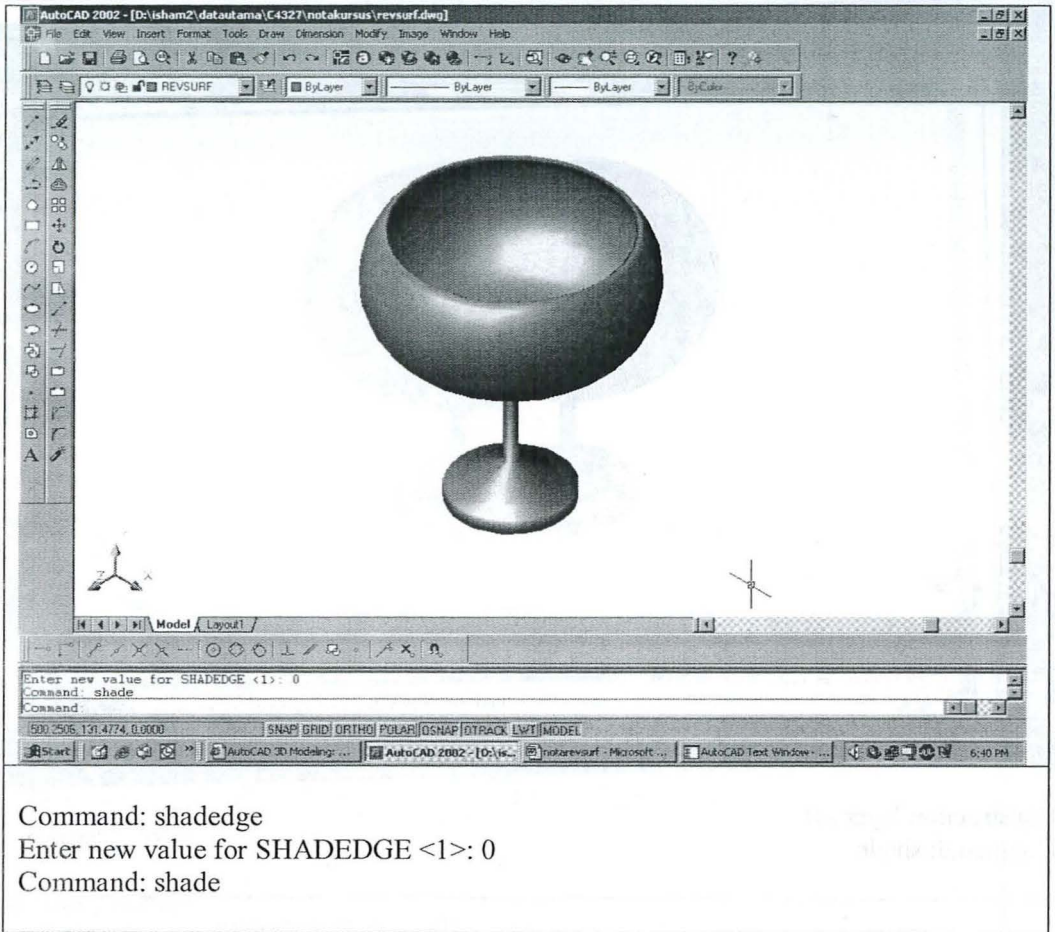
Command: surfTAB2

Enter new value for SURFTAB2 <6>: 30

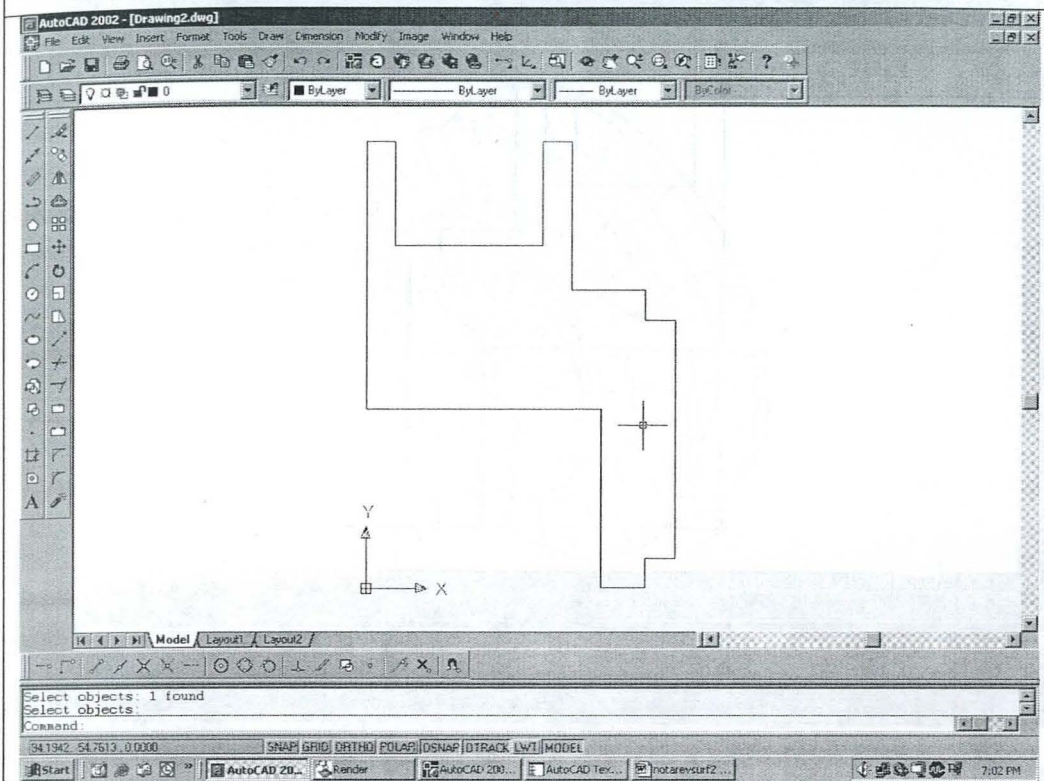
Command: revsurf







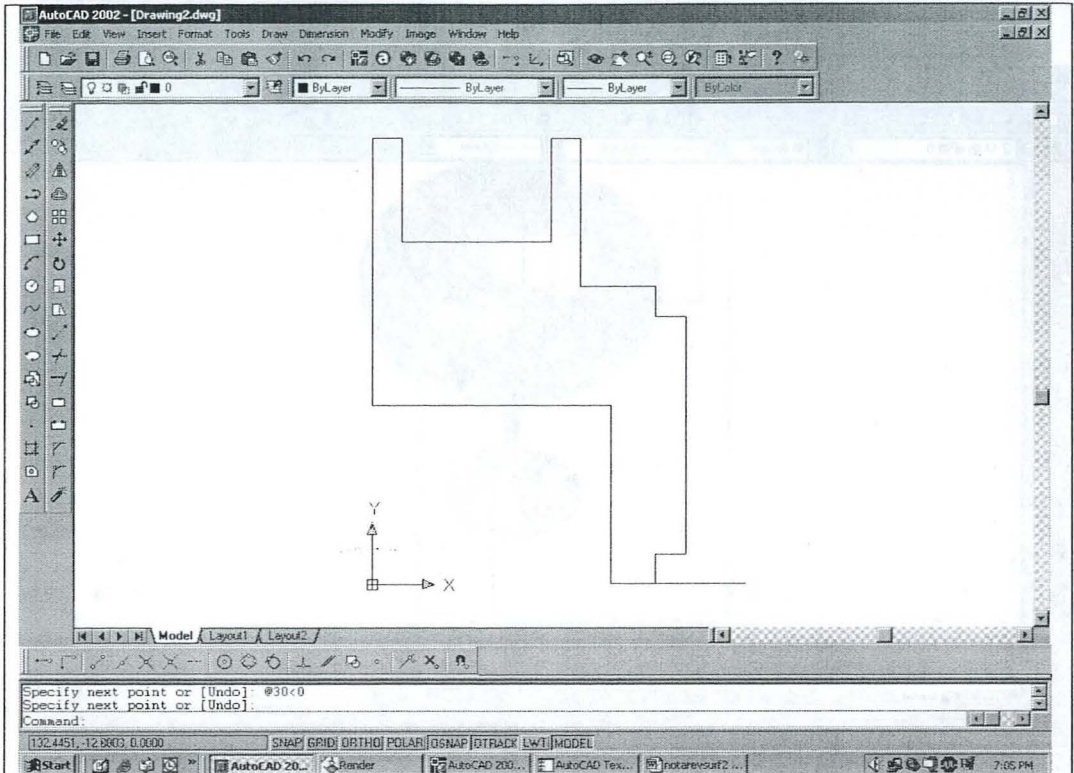
## Reflection 6 – Creating Surface Model - Revsurf



Command: \_line Specify first point: 0,0  
 Specify next point or [Undo]: @150<90  
 Specify next point or [Undo]: @10<0  
 Specify next point or [Close/Undo]: @35<-90  
 Specify next point or [Close/Undo]: @50<0  
 Specify next point or [Close/Undo]: @35<90  
 Specify next point or [Close/Undo]: @10<0  
 Specify next point or [Close/Undo]: @50<-90  
 Specify next point or [Close/Undo]: @25<0  
 Specify next point or [Close/Undo]: @10<-90  
 Specify next point or [Close/Undo]: @10<0  
 Specify next point or [Undo]: @80<-90  
 Specify next point or [Undo]: @10<180  
 Specify next point or [Undo]: @10<-90  
 Specify next point or [Undo]: @15<180  
 Specify next point or [Close/Undo]: @60<90  
 Specify next point or [Close/Undo]: \_per to



## FROM NOTHING TO SOMETHING



Command: pedit

Select polyline or [Multiple]:

Object selected is not a polyline

Do you want to turn it into one? <Y>

Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]: j

Select objects: Specify opposite corner: 14 found

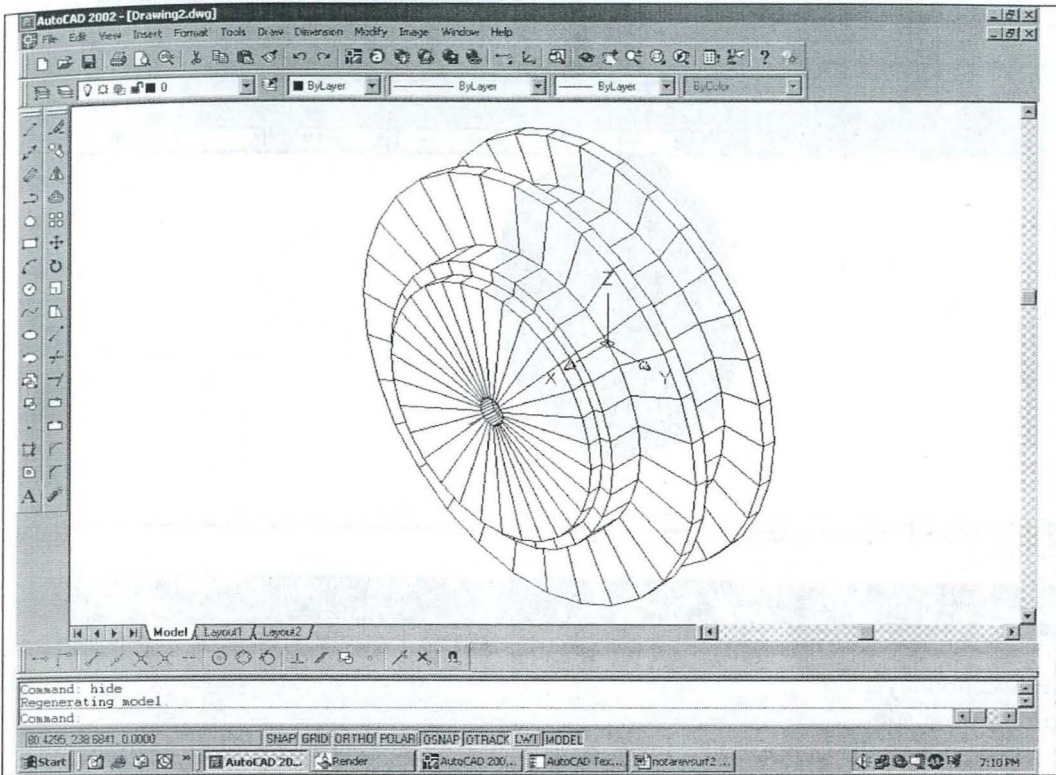
Select objects:

13 segments added to polyline

Enter an option [Open/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]:

Command: \_line Specify first point:

Specify next point or [Undo]: @30<0



Command: surfTAB1

Enter new value for SURFTAB1 <6>: 30

Command: surfTAB2

Enter new value for SURFTAB2 <6>: 30

Command: revsurf

Current wire frame density: SURFTAB1=30 SURFTAB2=30

Select object to revolve:

Select object that defines the axis of revolution:

Specify start angle <0>:

Specify included angle (+ccw, -cw) <360>:

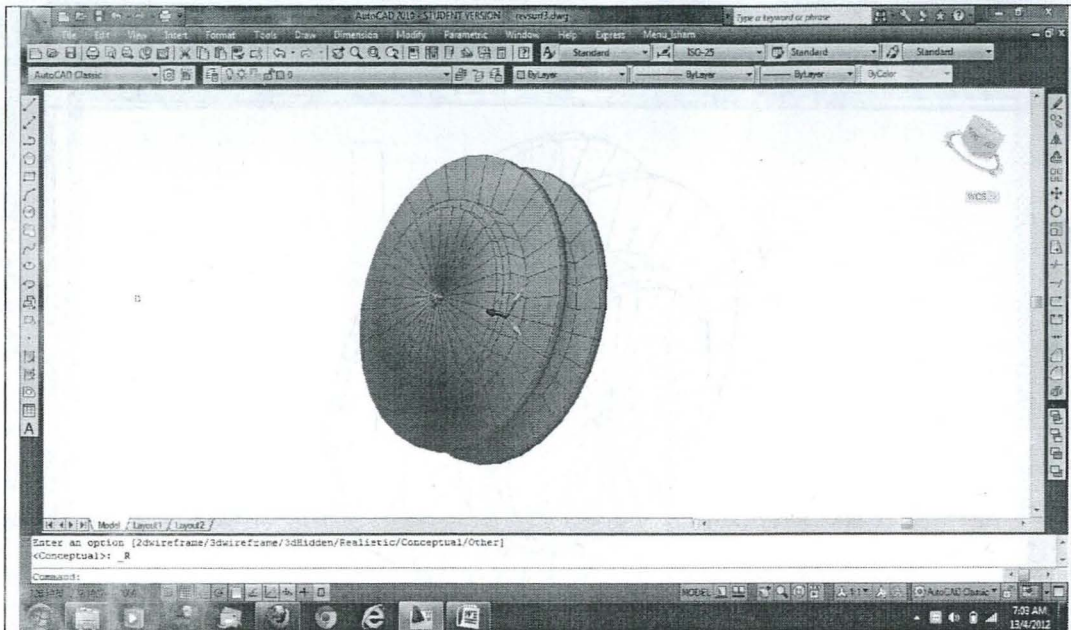
Command: \_view Enter an option

[?/Orthographic/Delete/Restore/Save/Ucs/Window]: \_neiso Regenerating model.

Command: hide

Regenerating model.

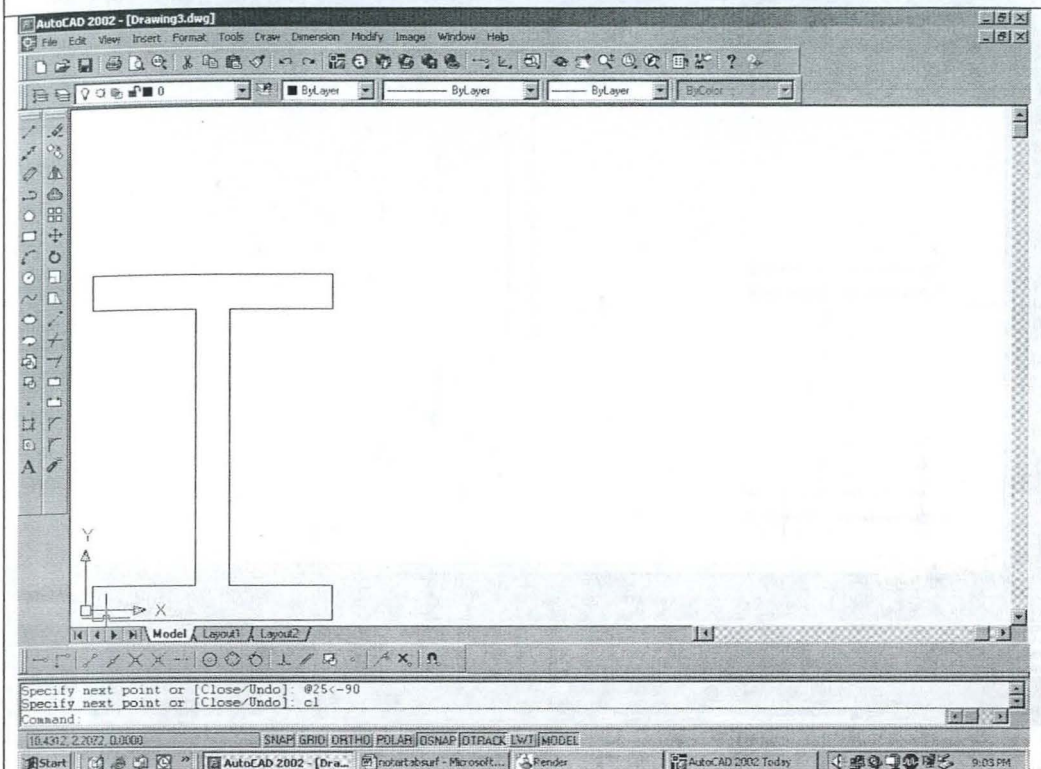
## FROM NOTHING TO SOMETHING



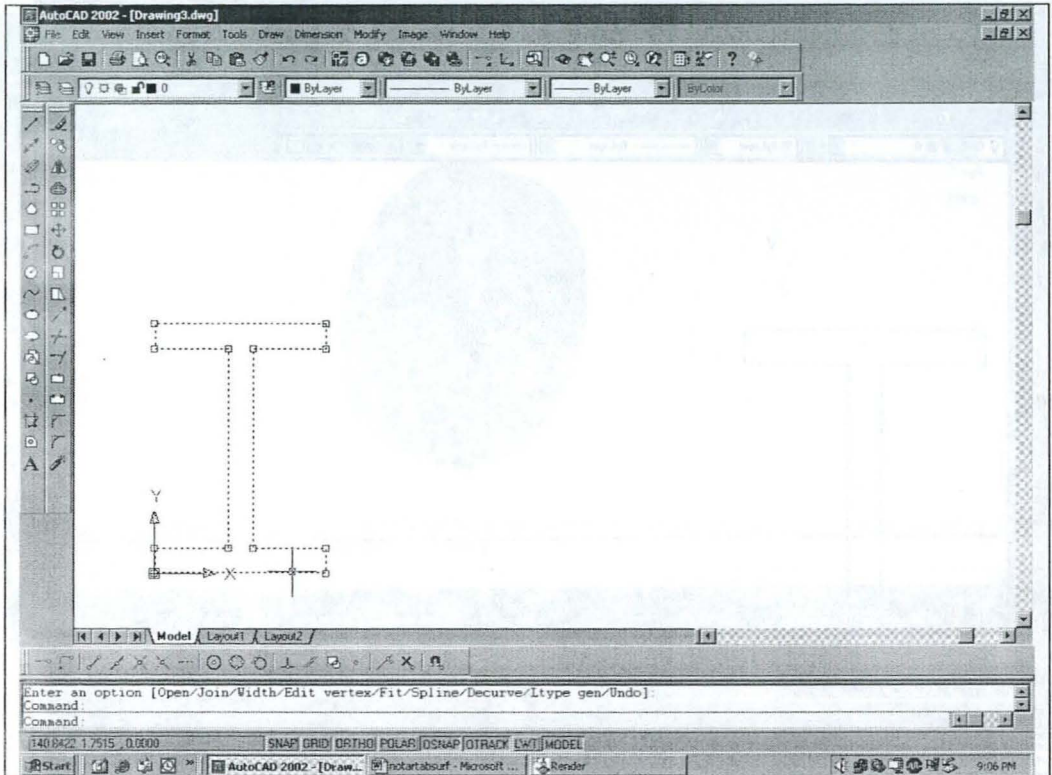
Construction layer off  
Command: shade



## Reflection 7 – Creating Surface Model - Tabsurf



Command: line Specify first point: 0,0  
 Specify next point or [Undo]: @25<90  
 Specify next point or [Undo]: @75<0  
 Specify next point or [Close/Undo]: @200<90  
 Specify next point or [Close/Undo]: @75<180  
 Specify next point or [Close/Undo]: @25<90  
 Specify next point or [Close/Undo]: @175<0  
 Specify next point or [Close/Undo]: @25<-90  
 Specify next point or [Close/Undo]: @75<180  
 Specify next point or [Close/Undo]: @200<-90  
 Specify next point or [Close/Undo]: @75<0  
 Specify next point or [Close/Undo]: @25<-90  
 Specify next point or [Close/Undo]: c1



Command: pedit

Select polyline or [Multiple]: Select polyline or [Multiple]:

Object selected is not a polyline

Do you want to turn it into one? <Y>

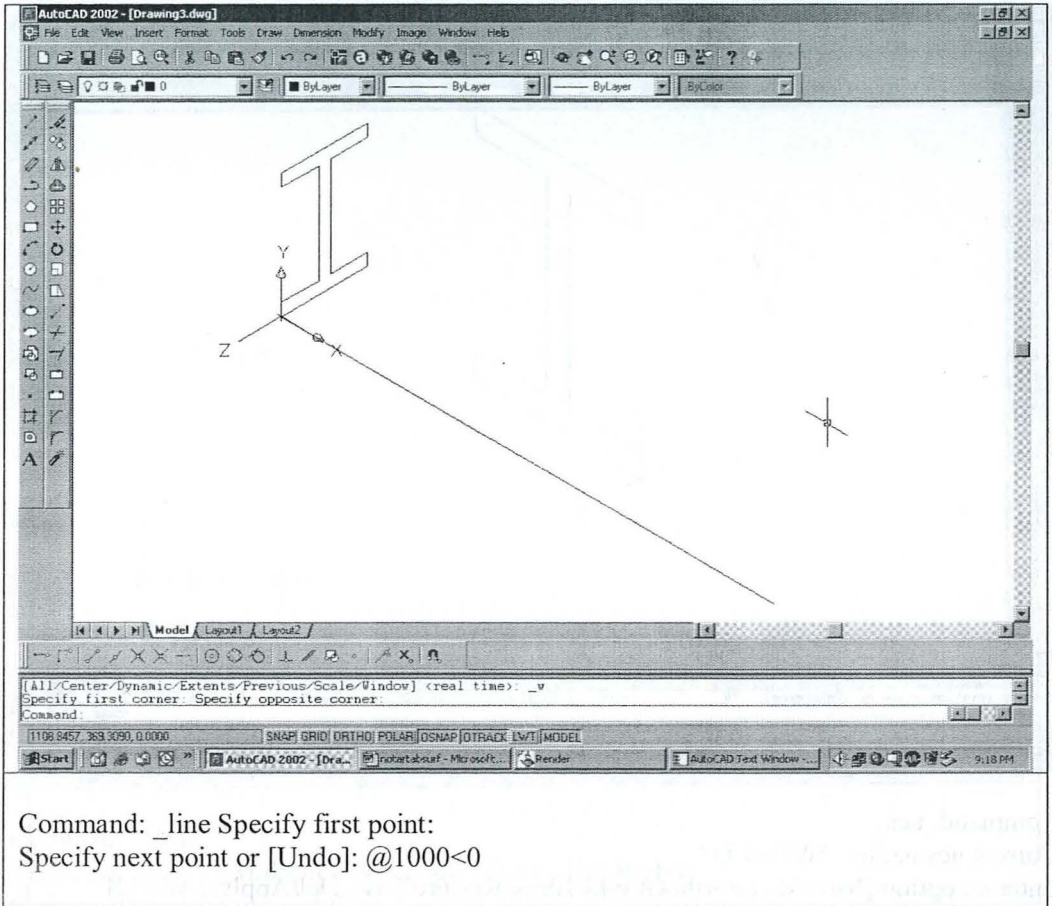
Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]: join

Select objects: Specify opposite corner: 12 found

Select objects:

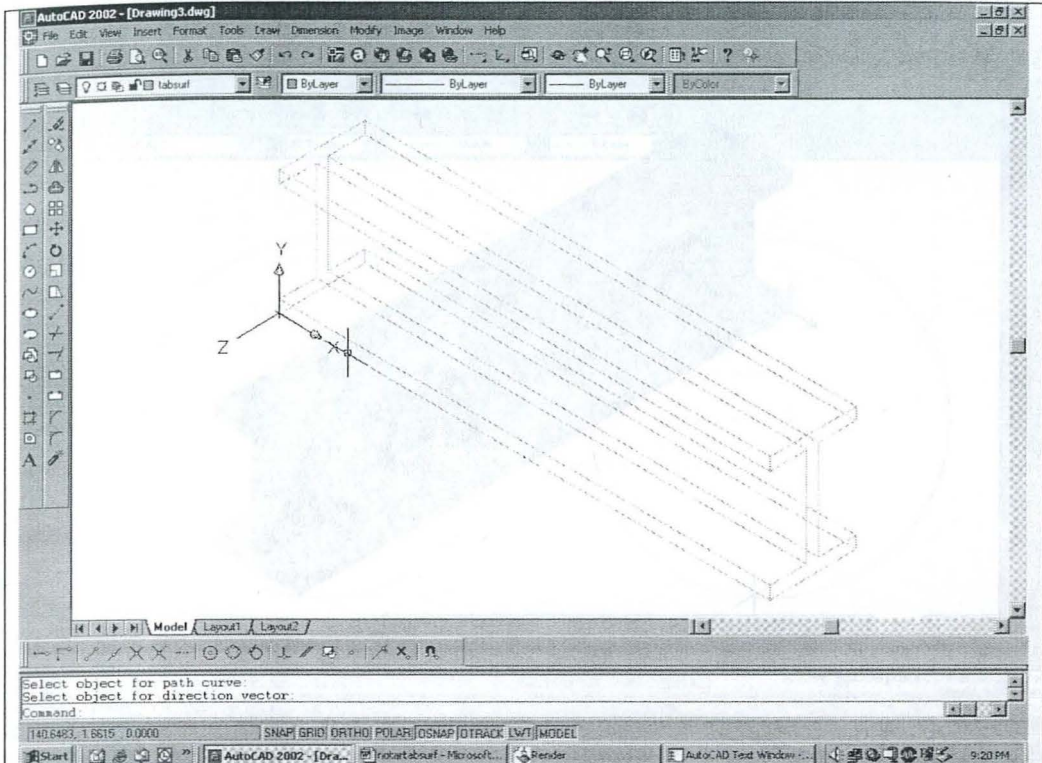
11 segments added to polyline

Enter an option [Open/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]:



Command: \_line Specify first point:  
Specify next point or [Undo]: @1000<0

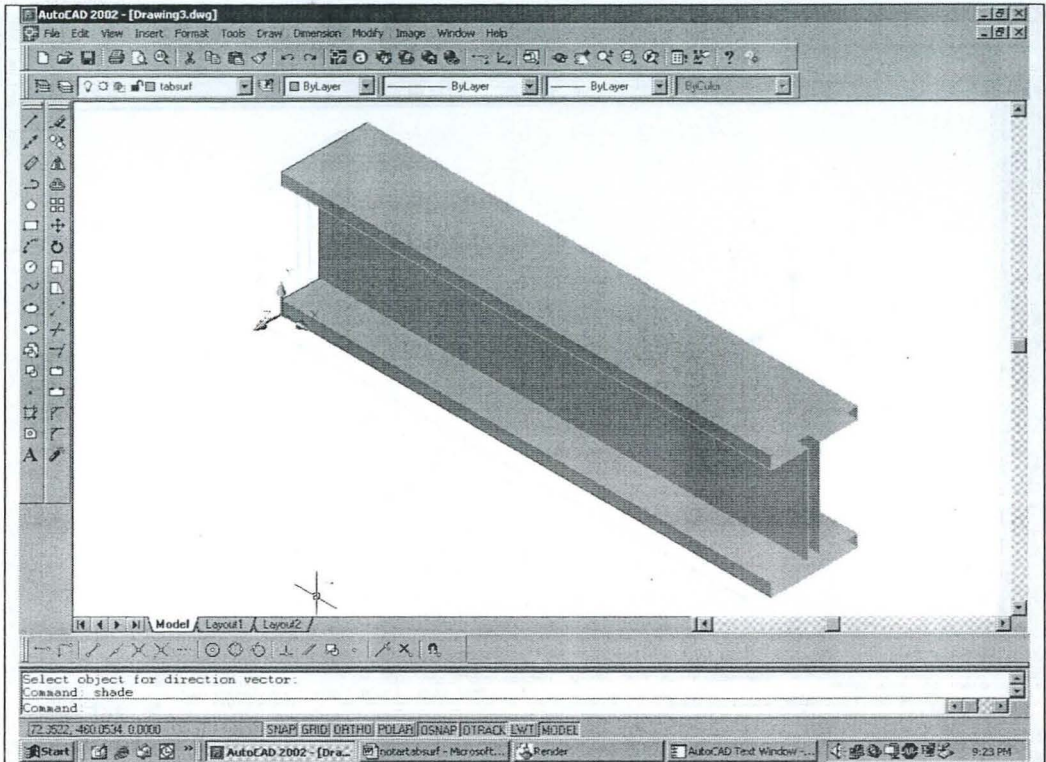




Command: tabsurf

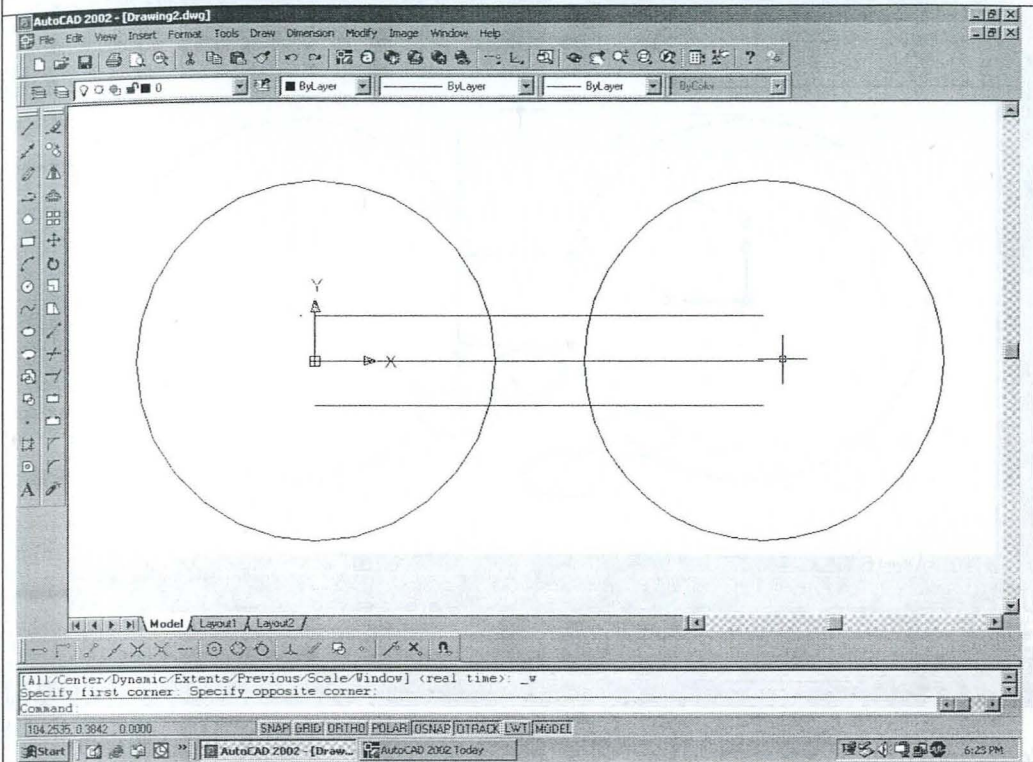
Select object for path curve:

Select object for direction vector:



Command: shade

## Reflection 8 – Creating Surface Model - Tabsurf



Command: `_circle` Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: 0,0

Specify radius of circle or [Diameter]: 40

Command: `_line` Specify first point:

Specify next point or [Undo]: `@100<0`

Command: `_circle` Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: `_endp` of

Specify radius of circle or [Diameter] `<40.0000>`: 40

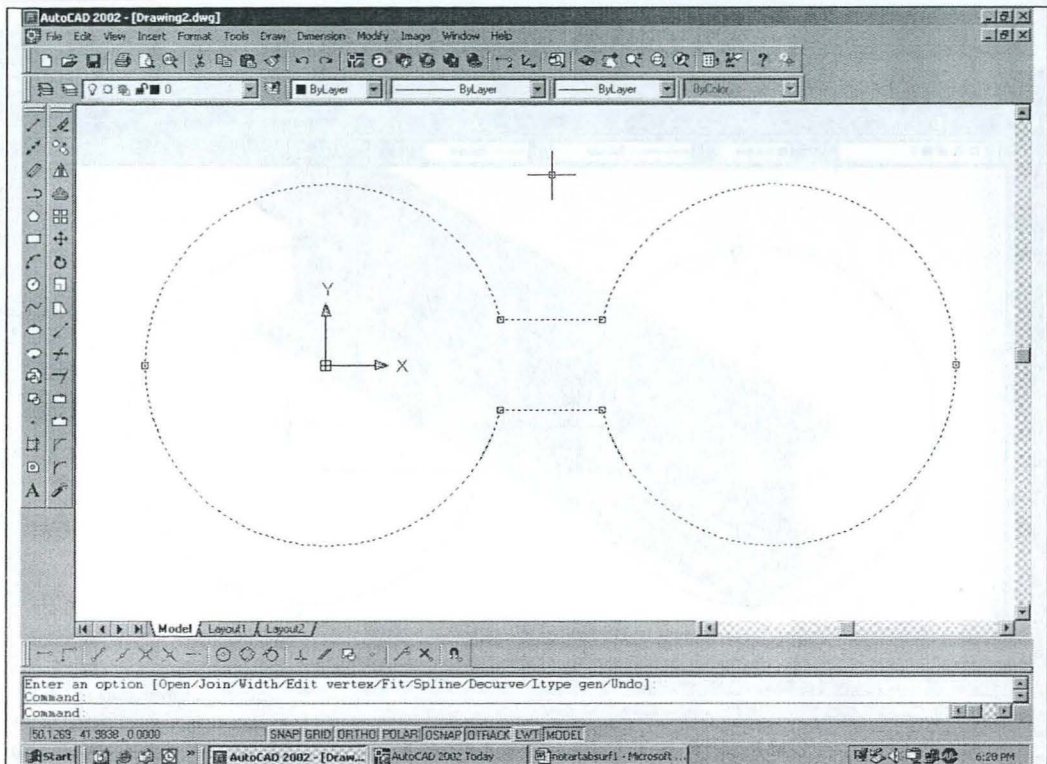
Command: `_offset`

Specify offset distance or [Through] `<5.0000>`: 10

Select object to offset or `<exit>`:

Specify point on side to offset:





Command: trim

Current settings: Projection=UCS, Edge=None

Select cutting edges ...

Select objects: all

5 found

Select objects:

Select object to trim or shift-select to extend or [Project/Edge/Undo]:

Command: \_erase

Select objects: 1 found

Command: pedit

Select polyline or [Multiple]: all

Object selected is not a polyline

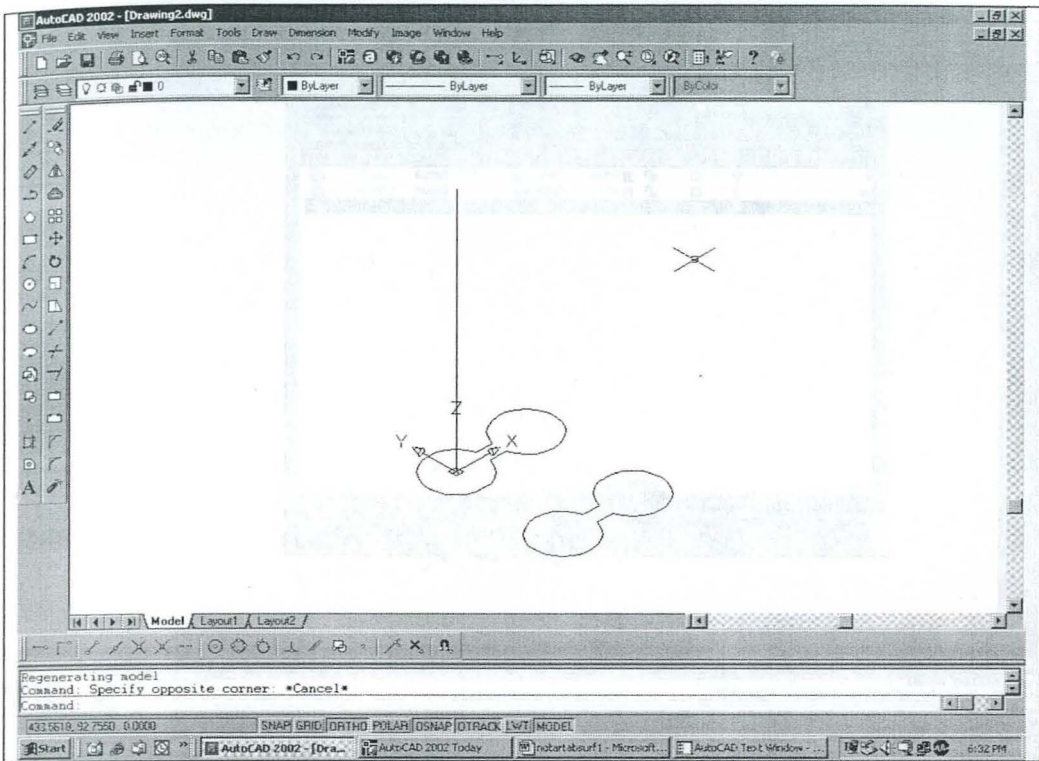
Do you want to turn it into one? <Y>

Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]: j

Select objects: 1 found, 4 total

Select objects:

3 segments added to polyline



Command: `_view` Enter an option

[?/Orthographic/Delete/Restore/Save/Ucs/Window]: `_swiso` Regenerating model.

Command: `_copy`

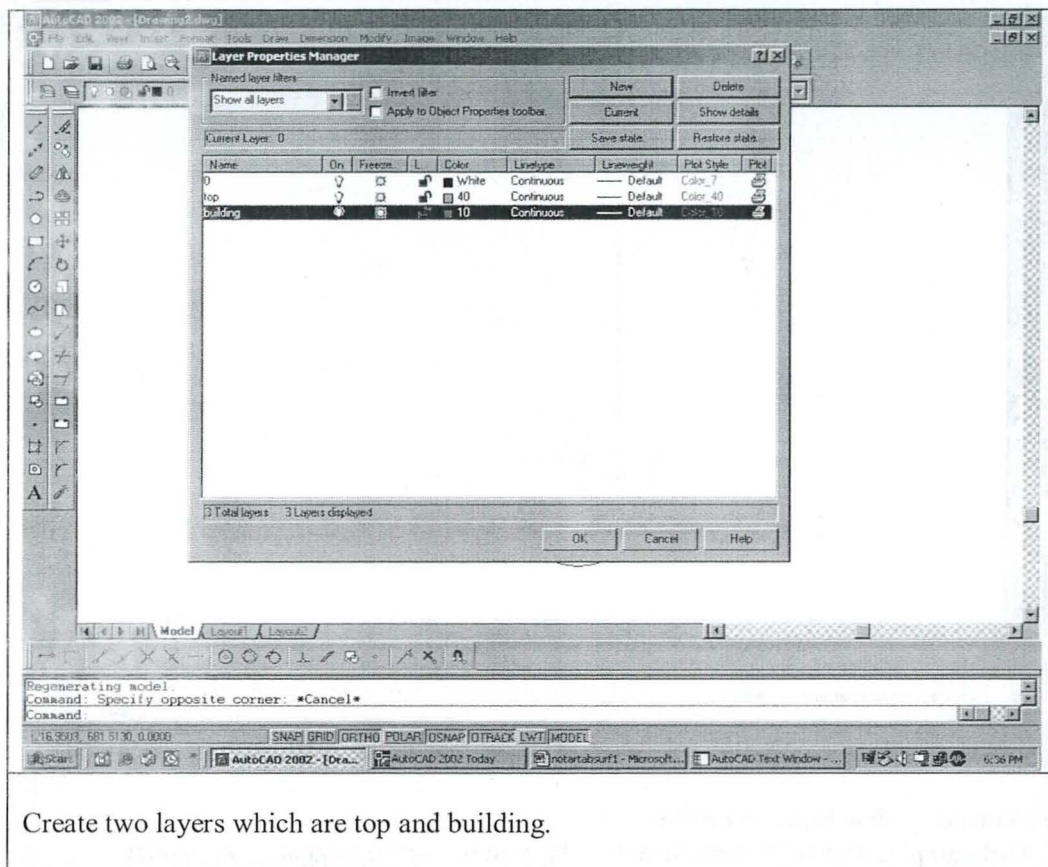
Select objects: 1 found

Select objects:

Specify base point or displacement, or [Multiple]: Specify second point of displacement or <use first point as displacement>: <Ortho on>

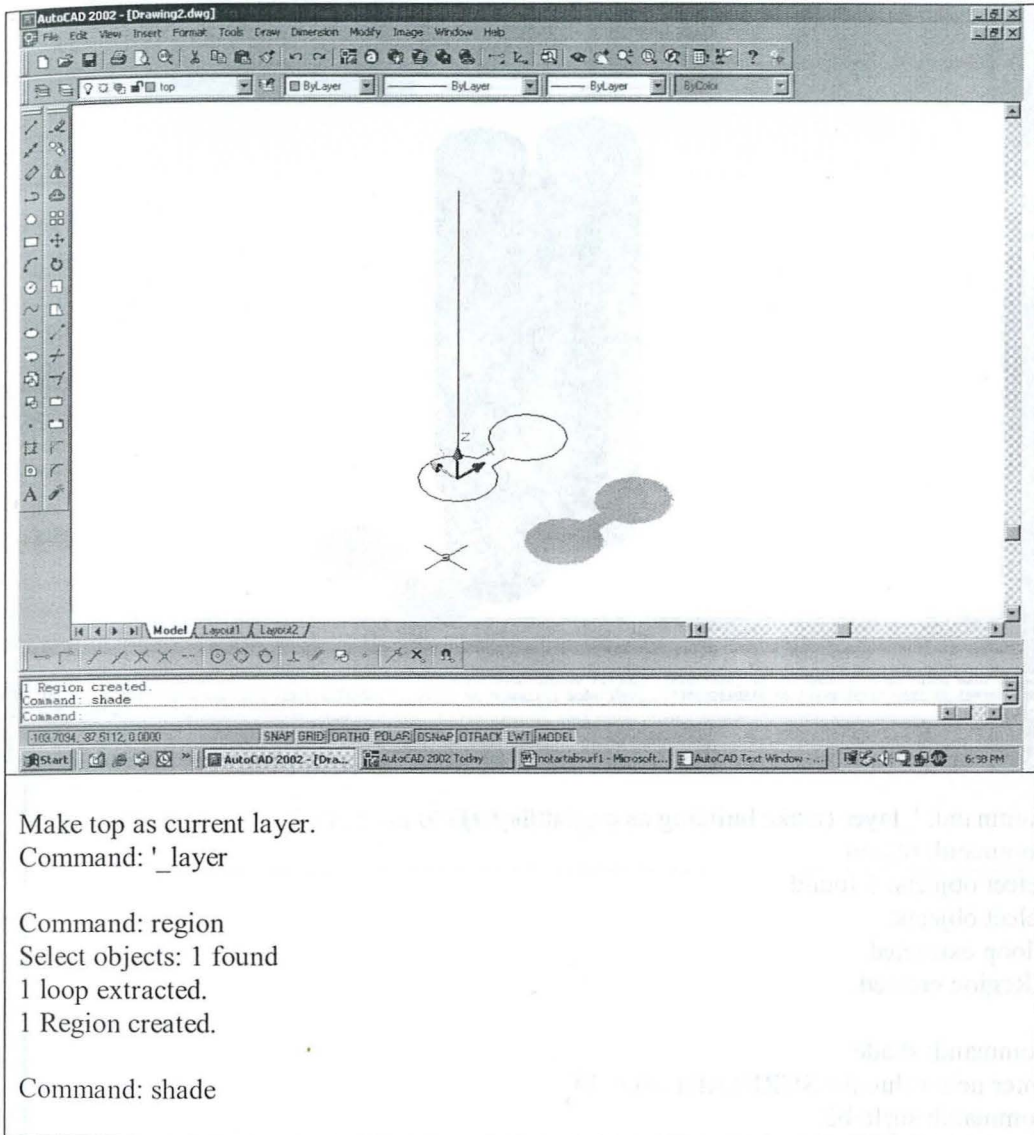
Command: `_line` Specify first point:

Specify next point or [Undo]: `@0,0,350`



Create two layers which are top and building.





Make top as current layer.

Command: '\_layer

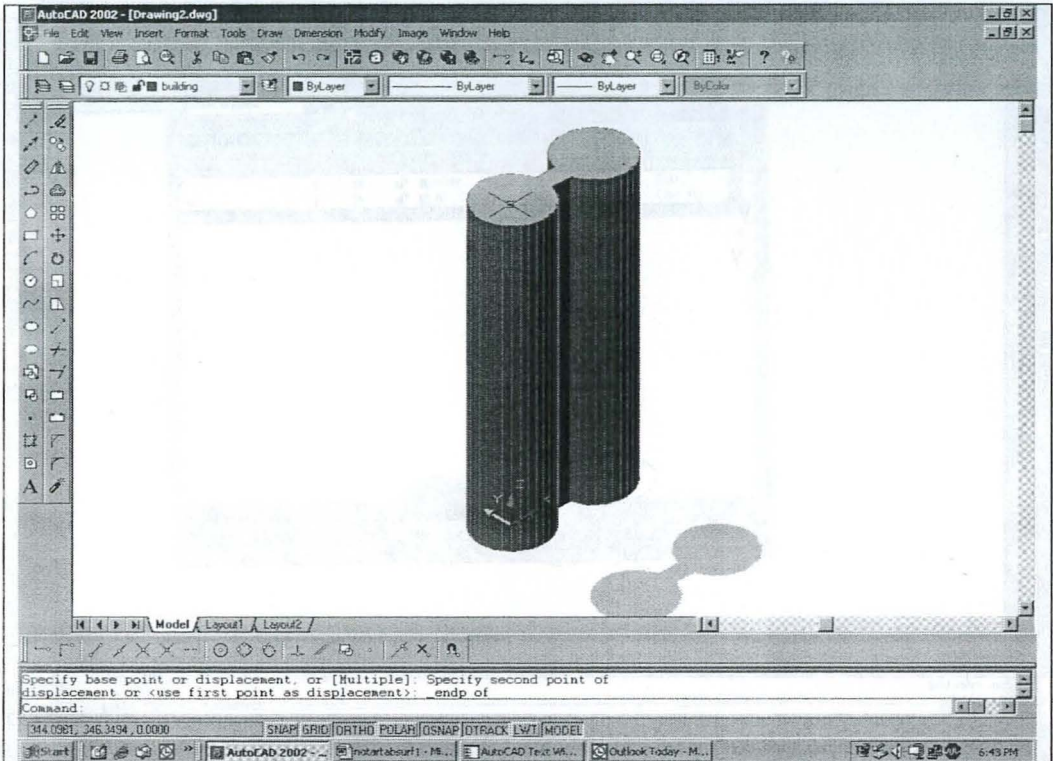
Command: region

Select objects: 1 found

1 loop extracted.

1 Region created.

Command: shade



Command: '\_layer (make building as current layer)

Command: region

Select objects: 1 found

Select objects:

1 loop extracted.

1 Region created.

Command: shade

Enter new value for SURFTAB1 <6>: 30

Command: surfTAB2

Enter new value for SURFTAB2 <6>: 30

Command: tabsurf

Select object for path curve:

Select object for direction vector:

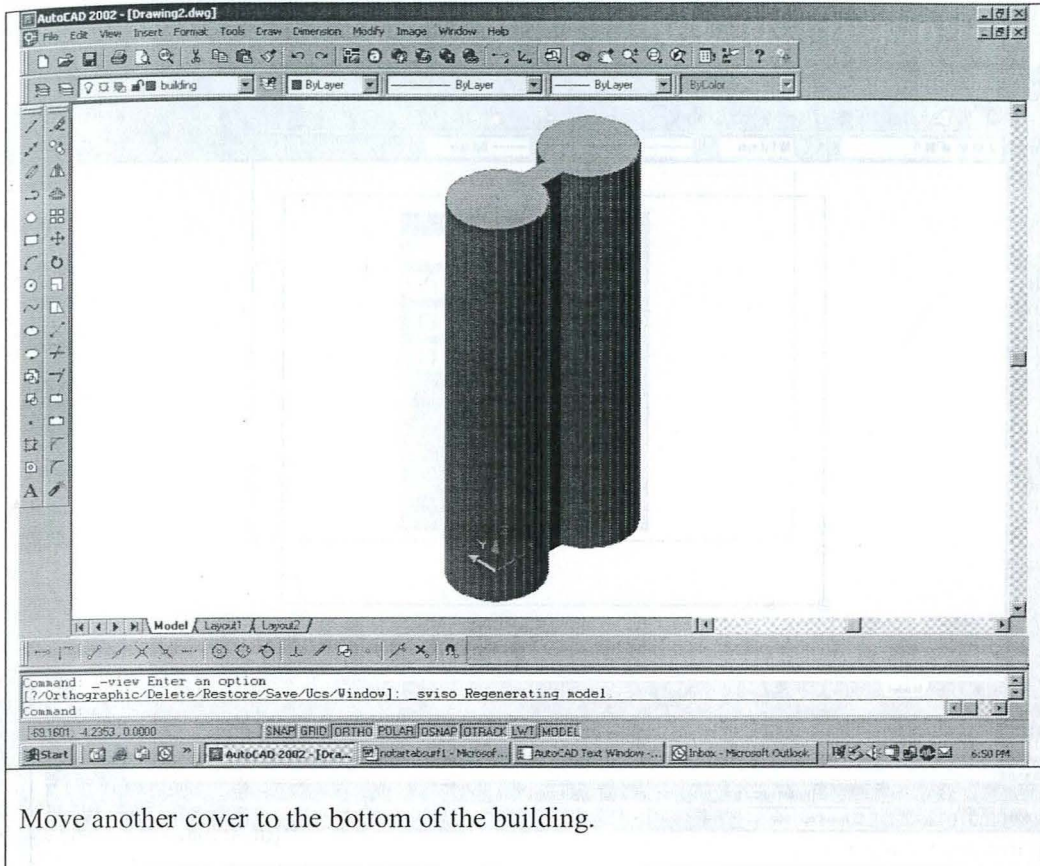
Command: \_copy

Select objects: 1 found

Select objects:

Specify base point or displacement, or [Multiple]: Specify second point of displacement or <use first point as displacement>: \_endp of

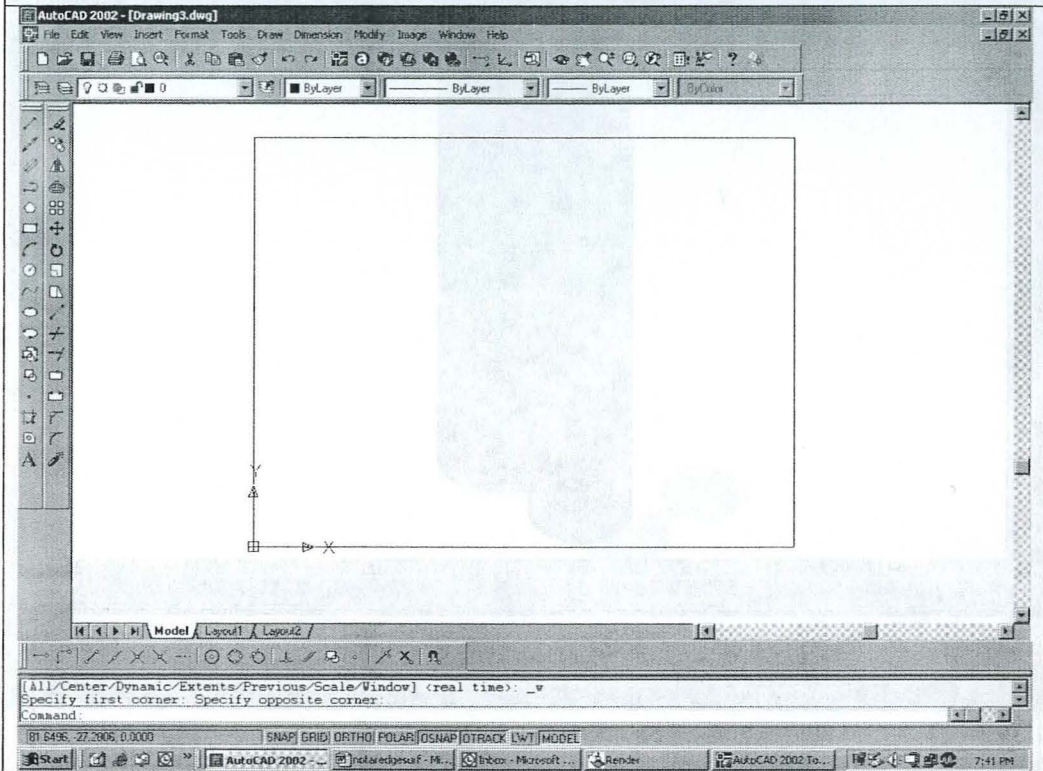
## FROM NOTHING TO SOMETHING



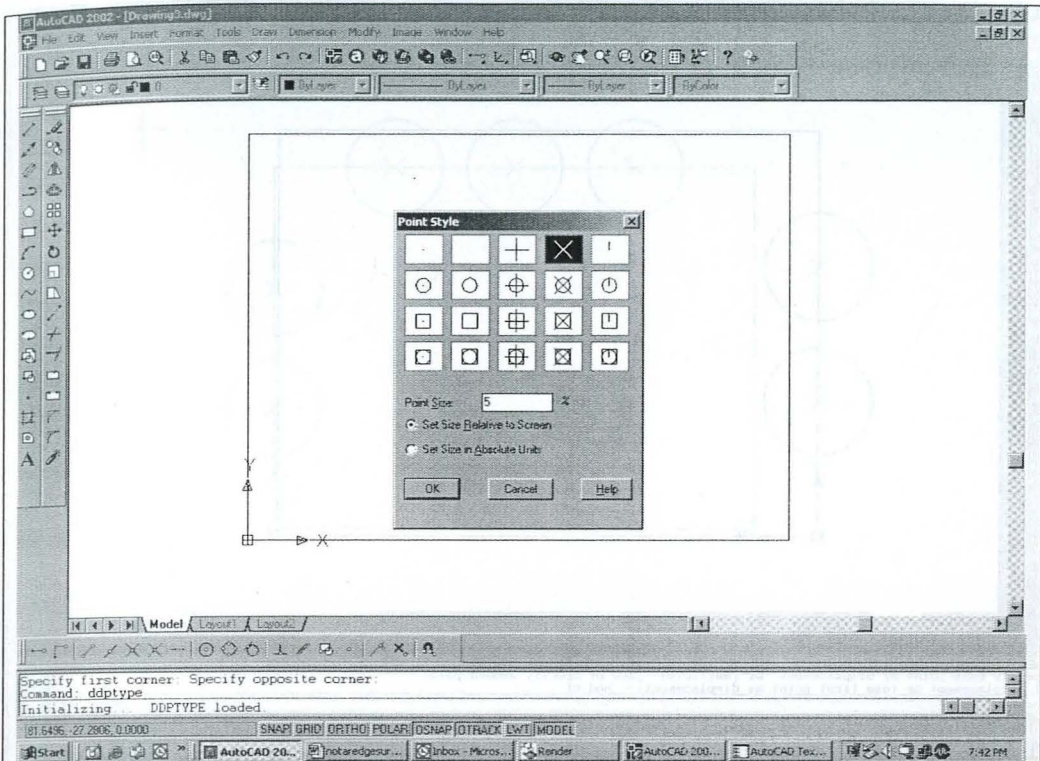
Move another cover to the bottom of the building.



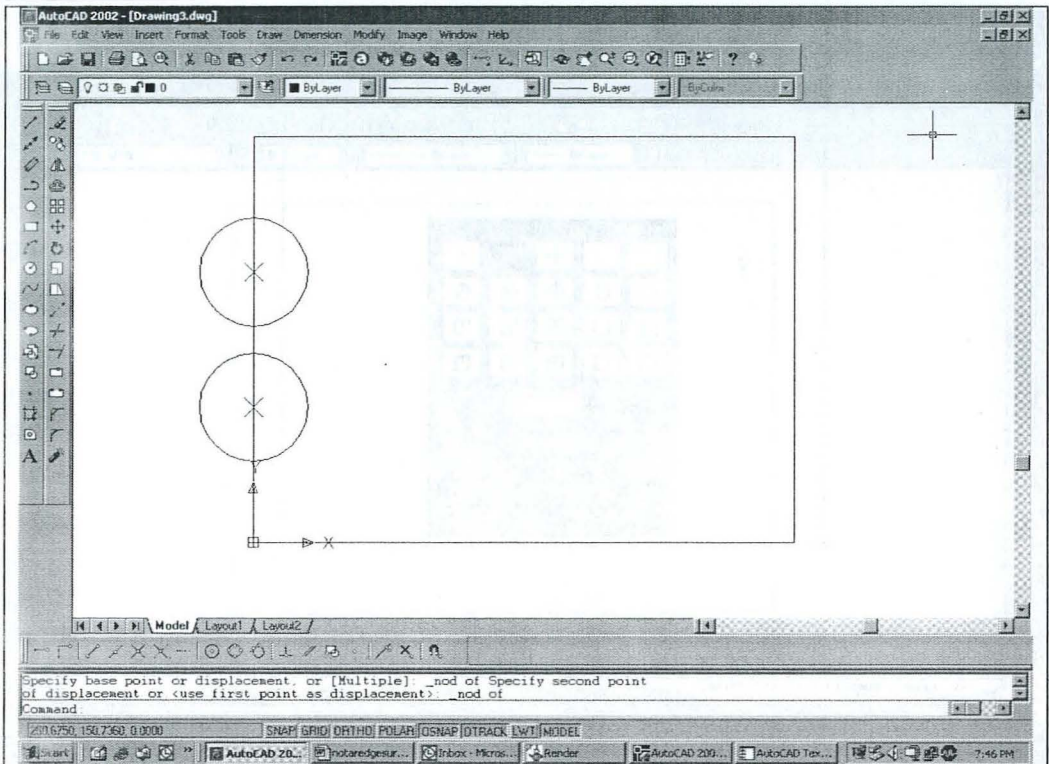
## Reflection 9 – Creating Surface Model - Edgesurf



Command: \_line Specify first point: 0,0  
 Specify next point or [Undo]: @150<90  
 Specify next point or [Undo]: @200<0  
 Specify next point or [Close/Undo]: @150<-90  
 Specify next point or [Close/Undo]: cl



Command: ddptype  
(To select the point style)



Command: divide

Select object to divide:

Enter the number of segments or [Block]: 3

Command: \_circle Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: \_nod of

Specify diameter of circle: 40

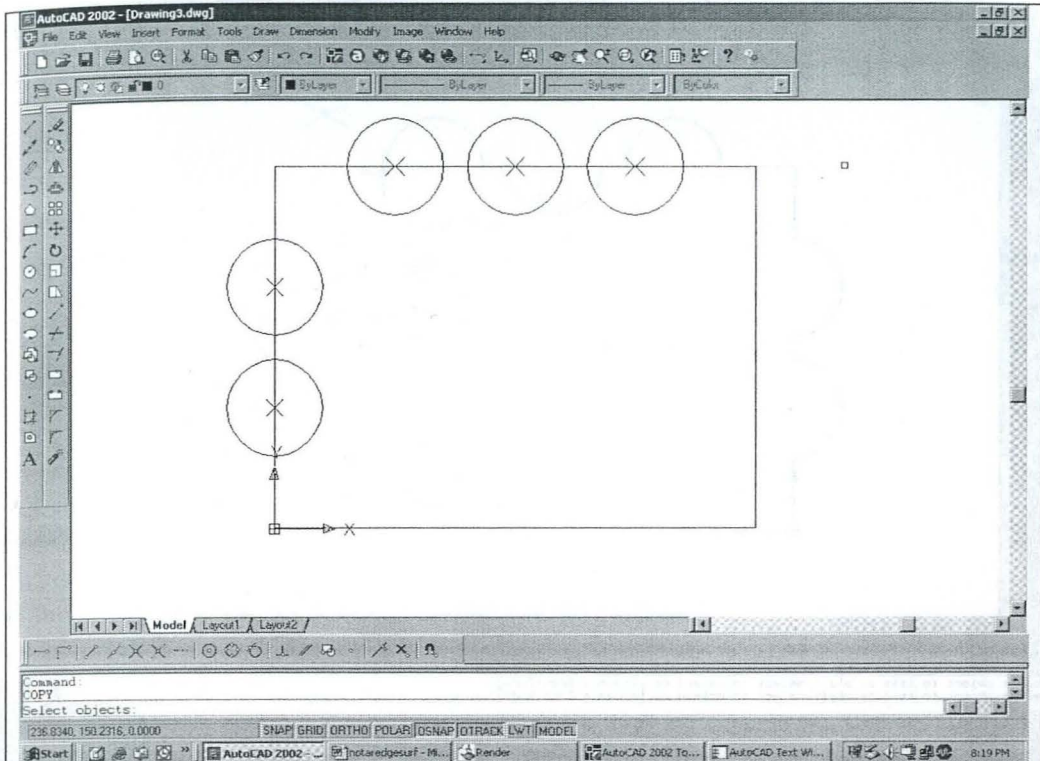
Command: \_copy

Select objects: 1 found

Select objects:

Specify base point or displacement, or [Multiple]: \_nod of Specify second point of displacement or <use first point as displacement>: \_nod of





Select object to divide:

Enter the number of segments or [Block]: 4

Command: \_circle Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: \_nod of

Specify radius of circle or [Diameter] <20.0000>: diameter

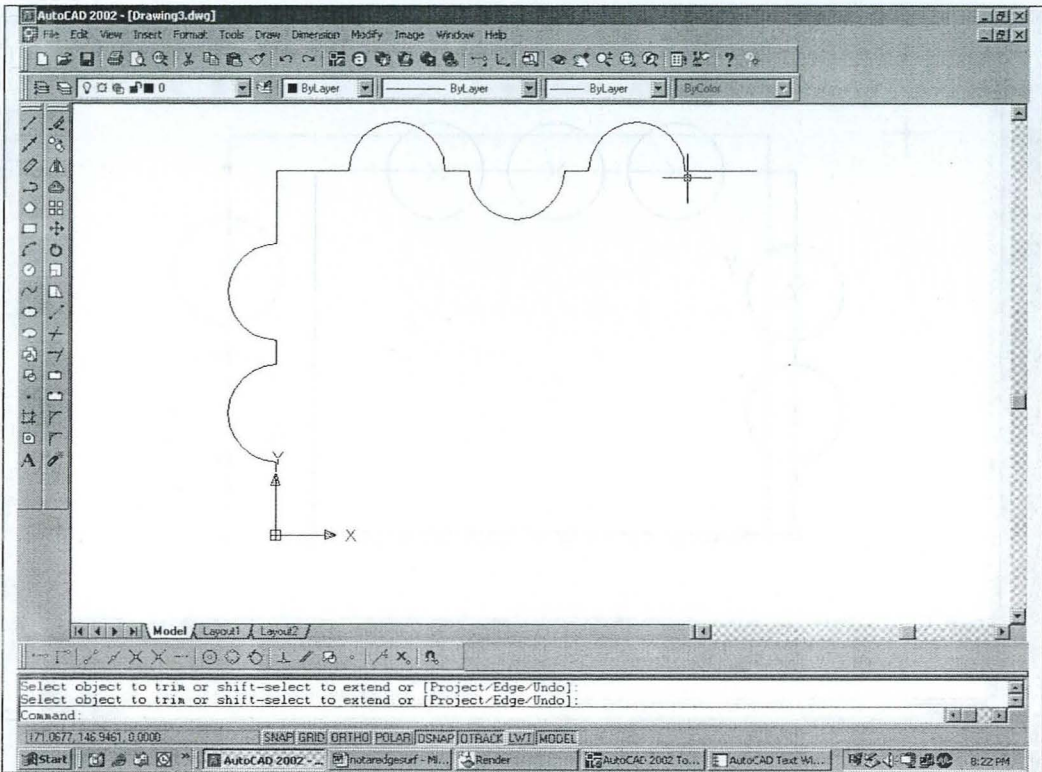
Specify diameter of circle <40.0000>: 40

Command: \_copy

Select objects: 1 found

Select objects:

Specify base point or displacement, or [Multiple]: Specify second point of displacement or <use first point as displacement>: \_nod of



Command: erase

Select objects: 1 found, 7 total

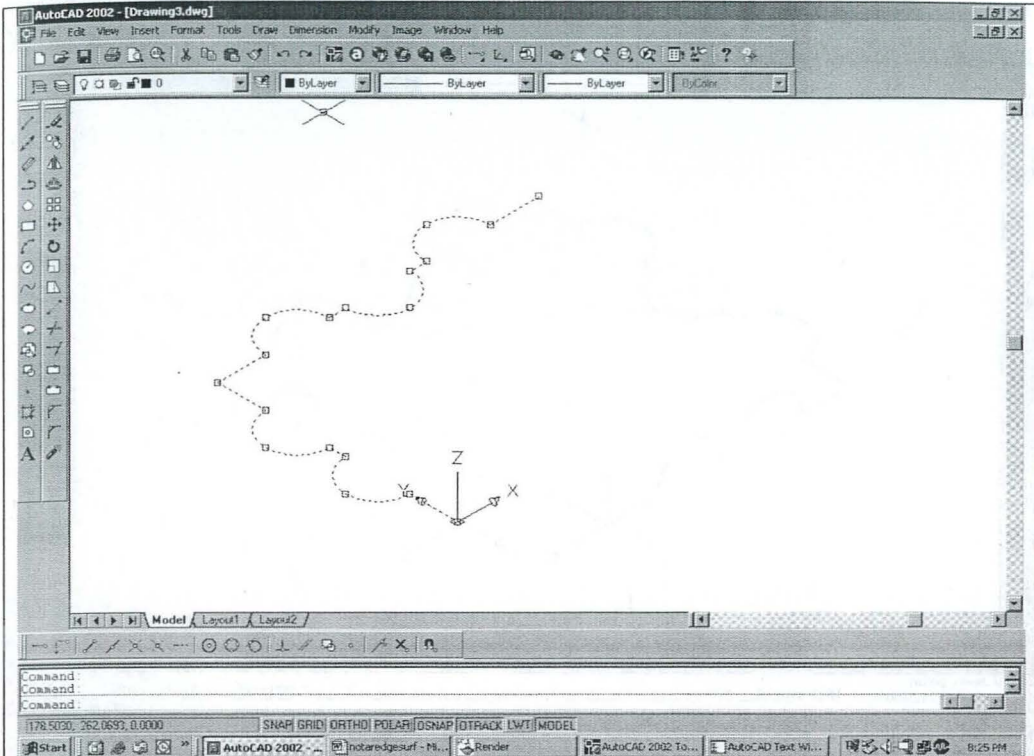
Command: trim

Current settings: Projection=UCS, Edge=None

Select cutting edges ...

Select objects: 1 found, 5 total

Select object to trim or shift-select to extend or [Project/Edge/Undo]:



Command: pedit (Join all the vertical lines)

Select polyline or [Multiple]:

Object selected is not a polyline

Do you want to turn it into one? <Y>

Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]: j

Select objects: 1 found, 5 total (4 segments added to polyline)

Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]:

Command: pedit (Join all the horizontal lines)

Select polyline or [Multiple]:

Object selected is not a polyline

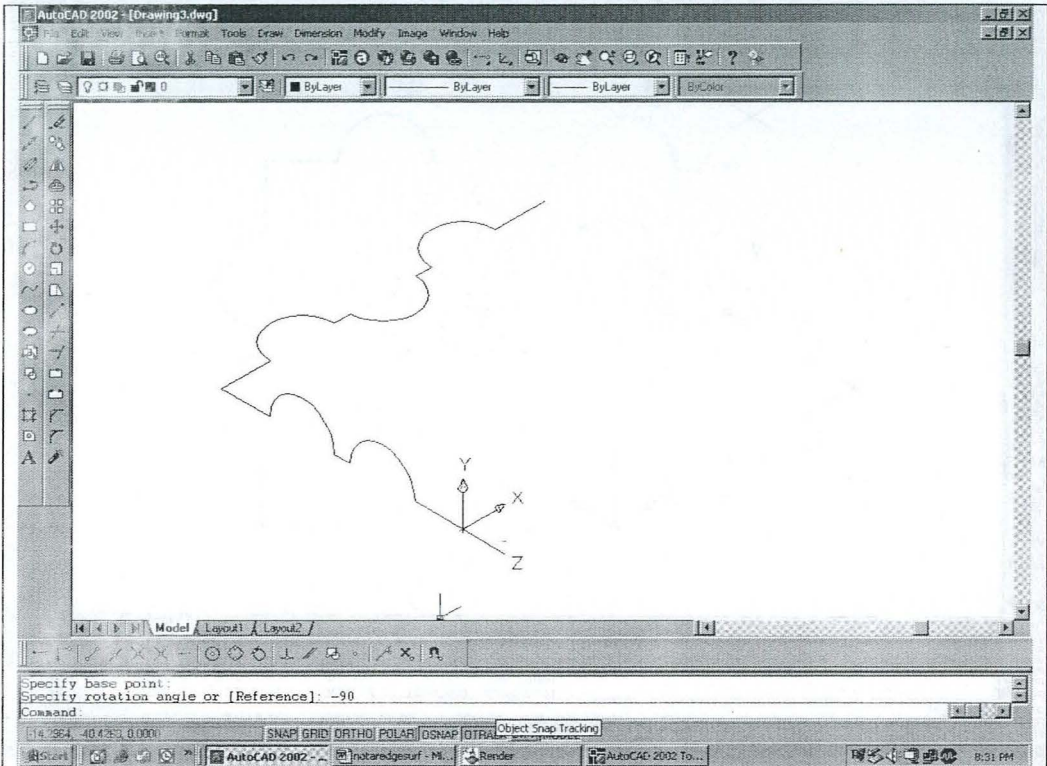
Do you want to turn it into one? <Y>

Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]: j

Select objects: 1 found, 7 total (4 segments added to polyline)

Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltype gen/Undo]:





Command: ucs

Current ucs name: \*WORLD\*

Enter an option [New/Move/orthoGraphic/Prev/Restore/Save/Del/Apply/?/World]

<World>: x

Specify rotation angle about X axis <90>:

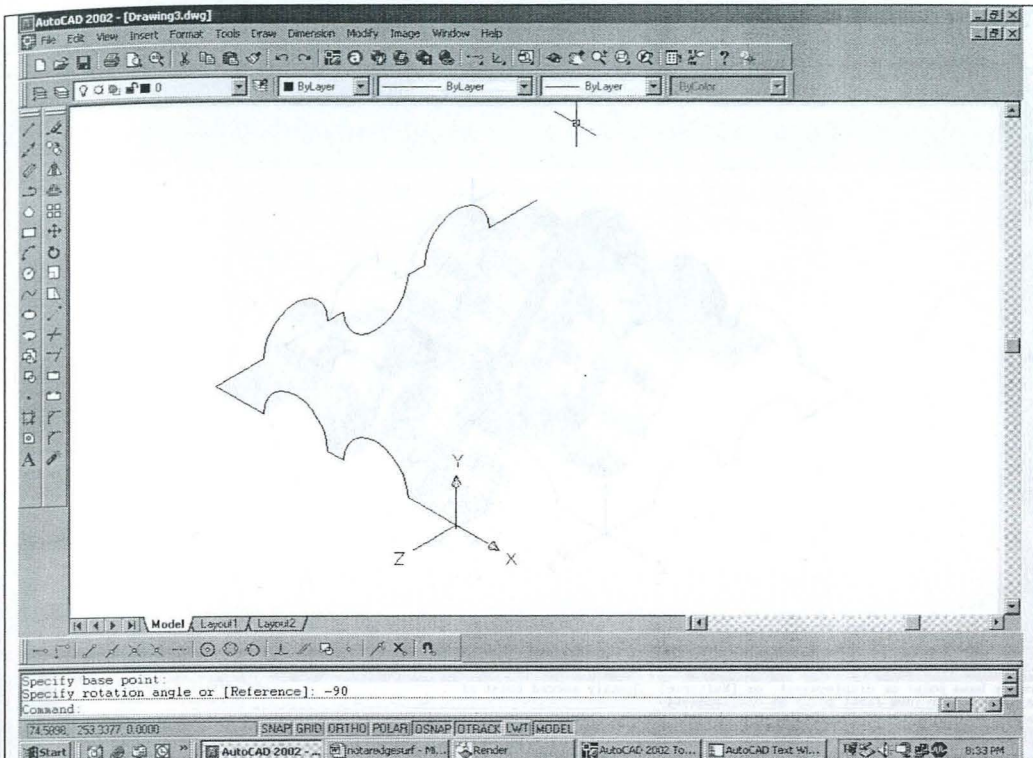
Command: \_rotate

Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0

Select objects: 1 found

Specify base point:

Specify rotation angle or [Reference]: -90



Command: ucs

Current ucs name: \*NO NAME\*

Enter an option [New/Move/orthoGraphic/Prev/Restore/Save/Del/Apply/?/World]

<World>: y

Specify rotation angle about Y axis <90>: -90

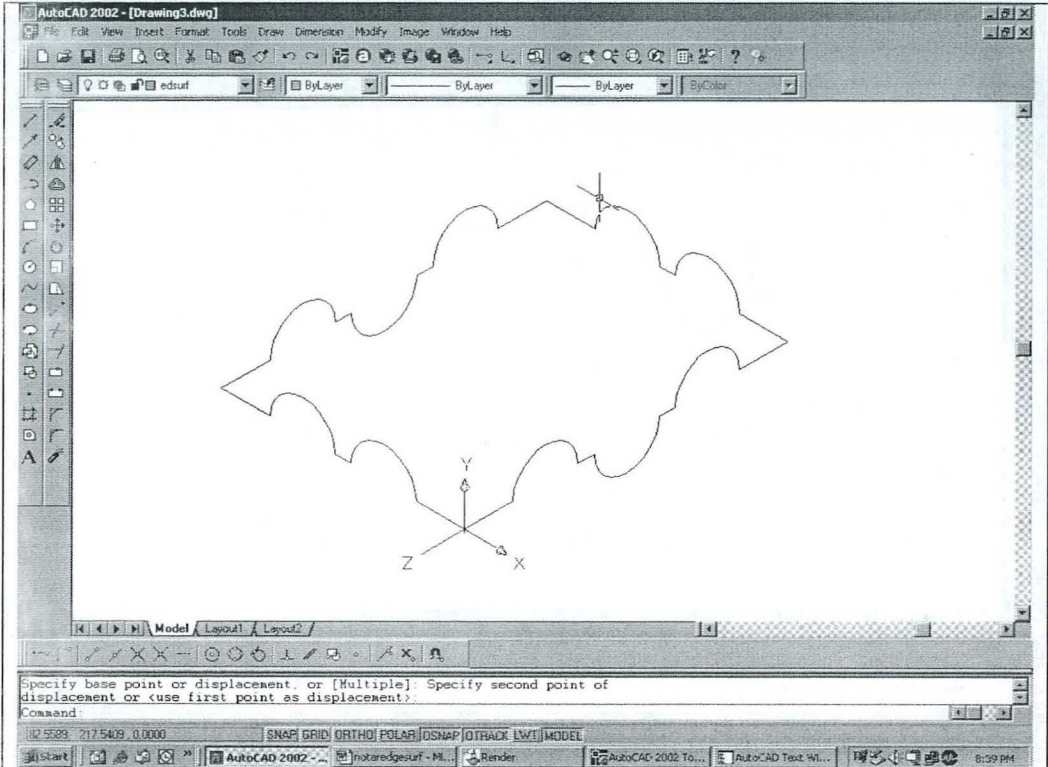
Command: \_rotate

Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0

Select objects: 1 found

Specify base point:

Specify rotation angle or [Reference]: -90



Command: `_copy`

Select objects: 1 found

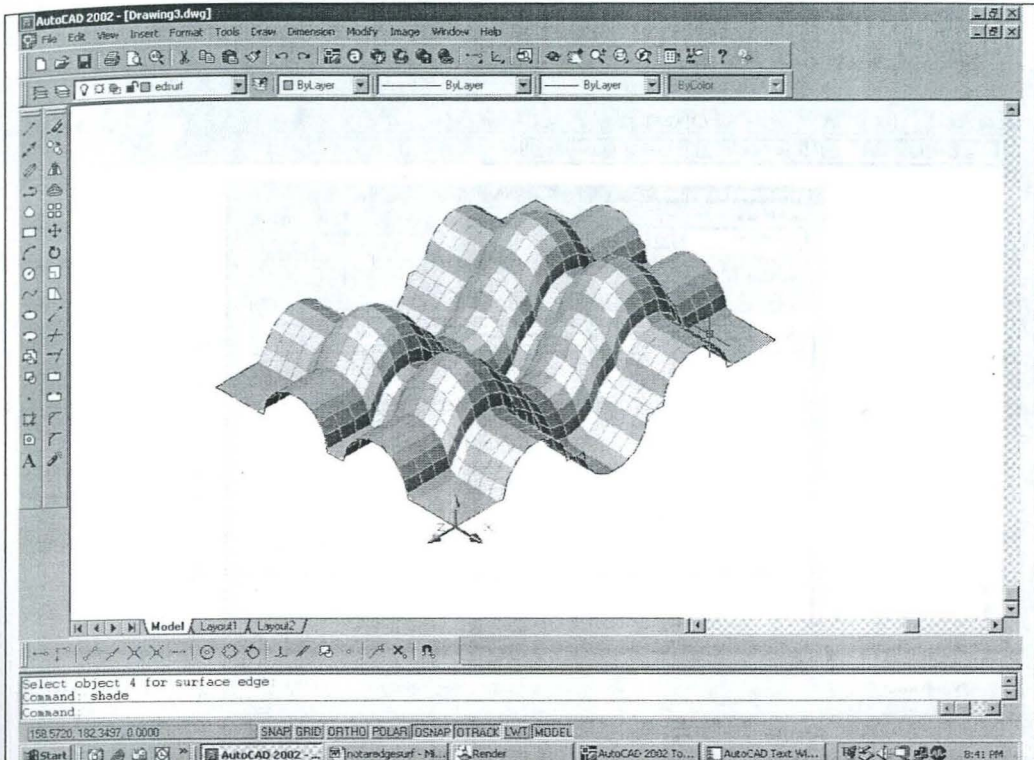
Specify base point or displacement, or [Multiple]: Specify second point of displacement or <use first point as displacement>:

Command: `_copy`

Select objects: 1 found

Specify base point or displacement, or [Multiple]: Specify second point of displacement or <use first point as displacement>:





Command: surfTAB1

Enter new value for SURFTAB1 <6>: 30

Command: surfTAB2

Enter new value for SURFTAB2 <6>: 30

Command: edgesurf

Current wire frame density: SURFTAB1=30 SURFTAB2=30

Select object 1 for surface edge:

Select object 2 for surface edge:

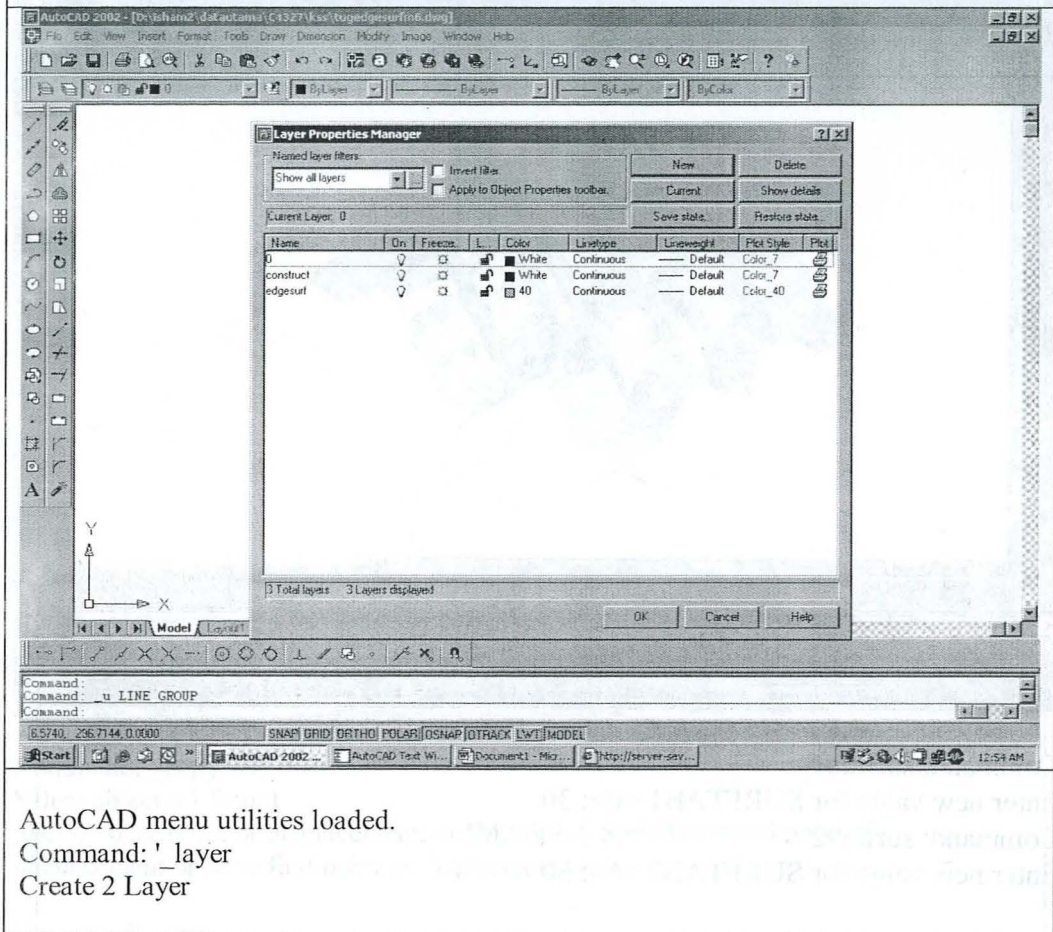
Select object 3 for surface edge:

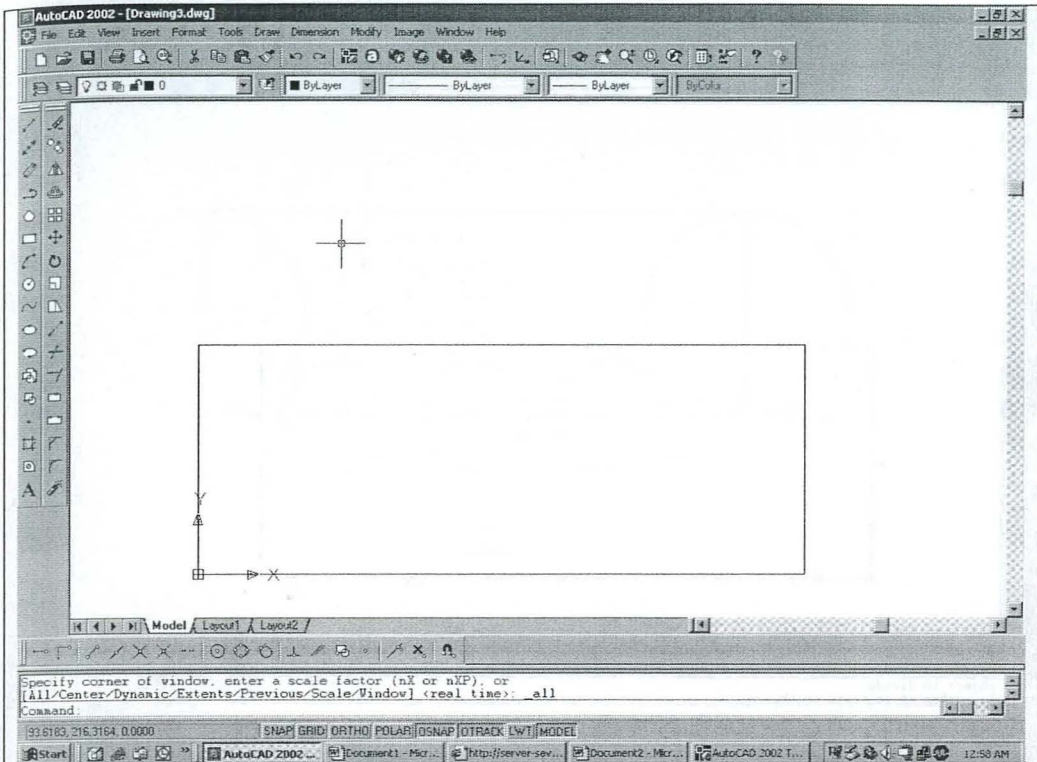
Select object 4 for surface edge:

Command: shade

The object is done

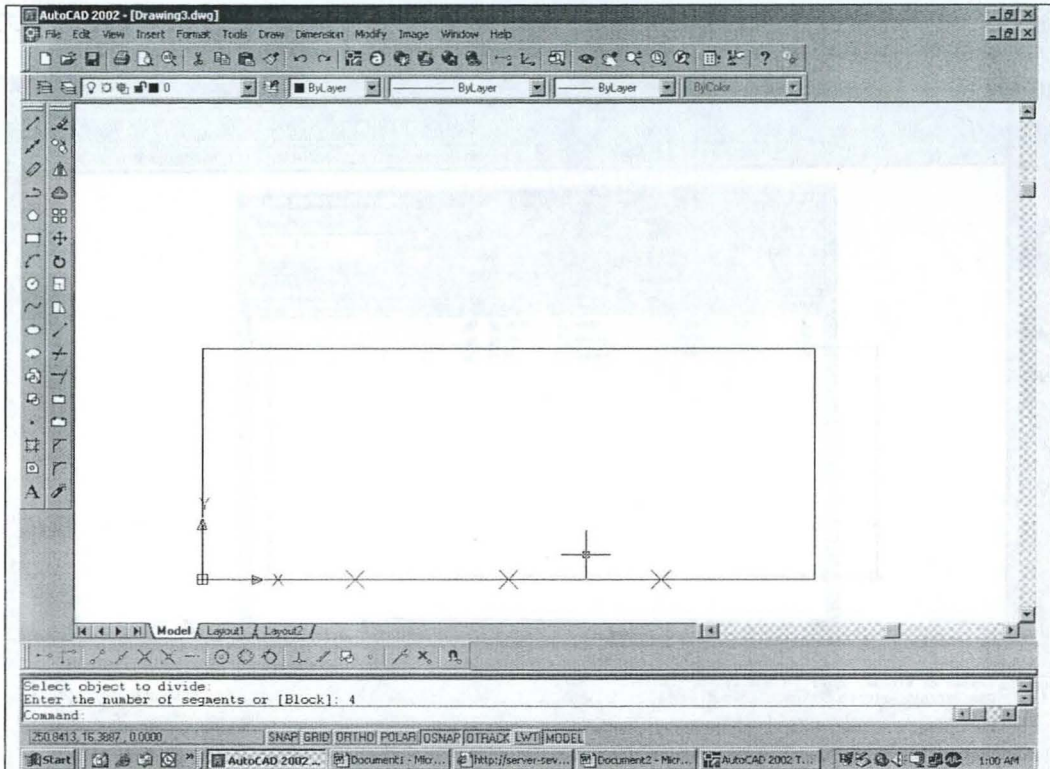
## Reflection 10 – Creating Surface Model - Edgesurf





Command: \_line Specify first point: 0,0  
 Specify next point or [Undo]: @150<90  
 Specify next point or [Undo]: @400<0  
 Specify next point or [Close/Undo]: @150<-90  
 Specify next point or [Close/Undo]: cl



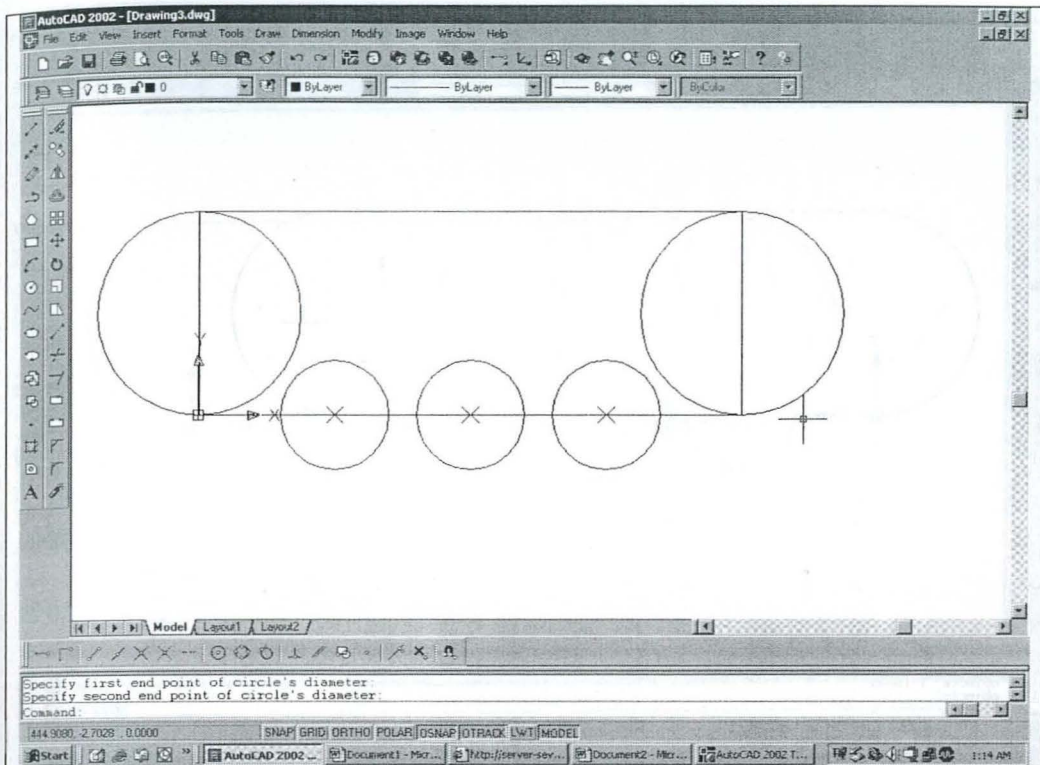


Command: ddptype

Command: divide

Select object to divide:

Enter the number of segments or [Block]: 4

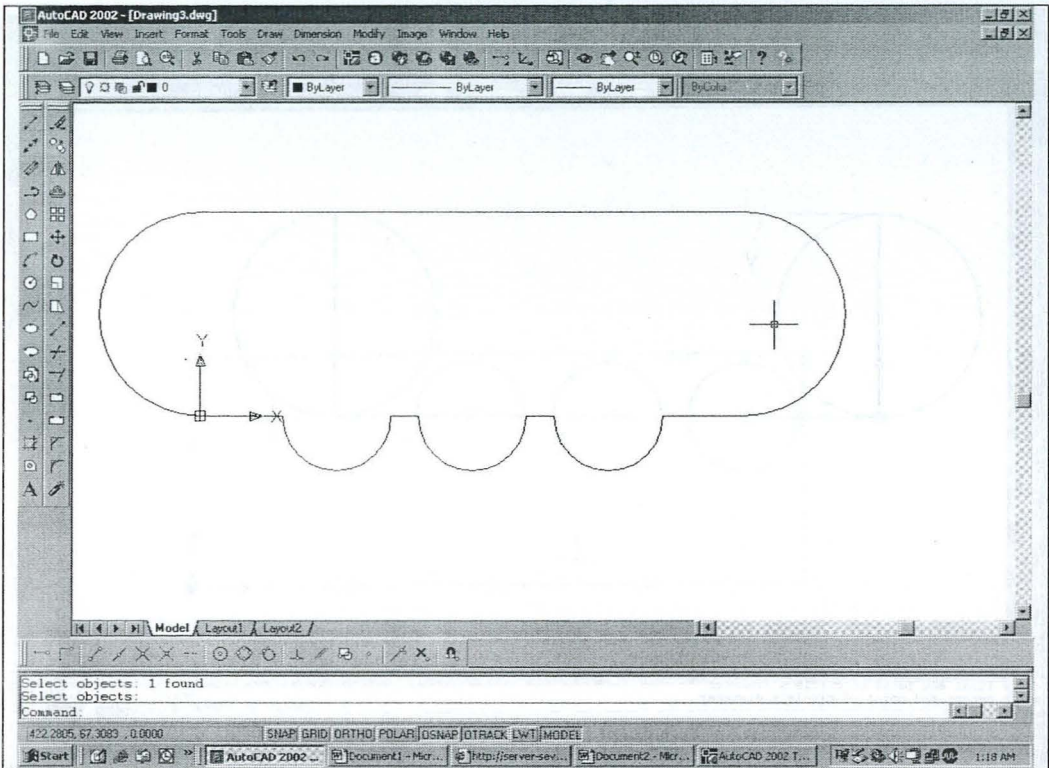


Command: `_circle` Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: `_nod` of  
Specify radius of circle or [Diameter]: 40

Command: `_copy`  
Select objects: 1 found  
Select objects:

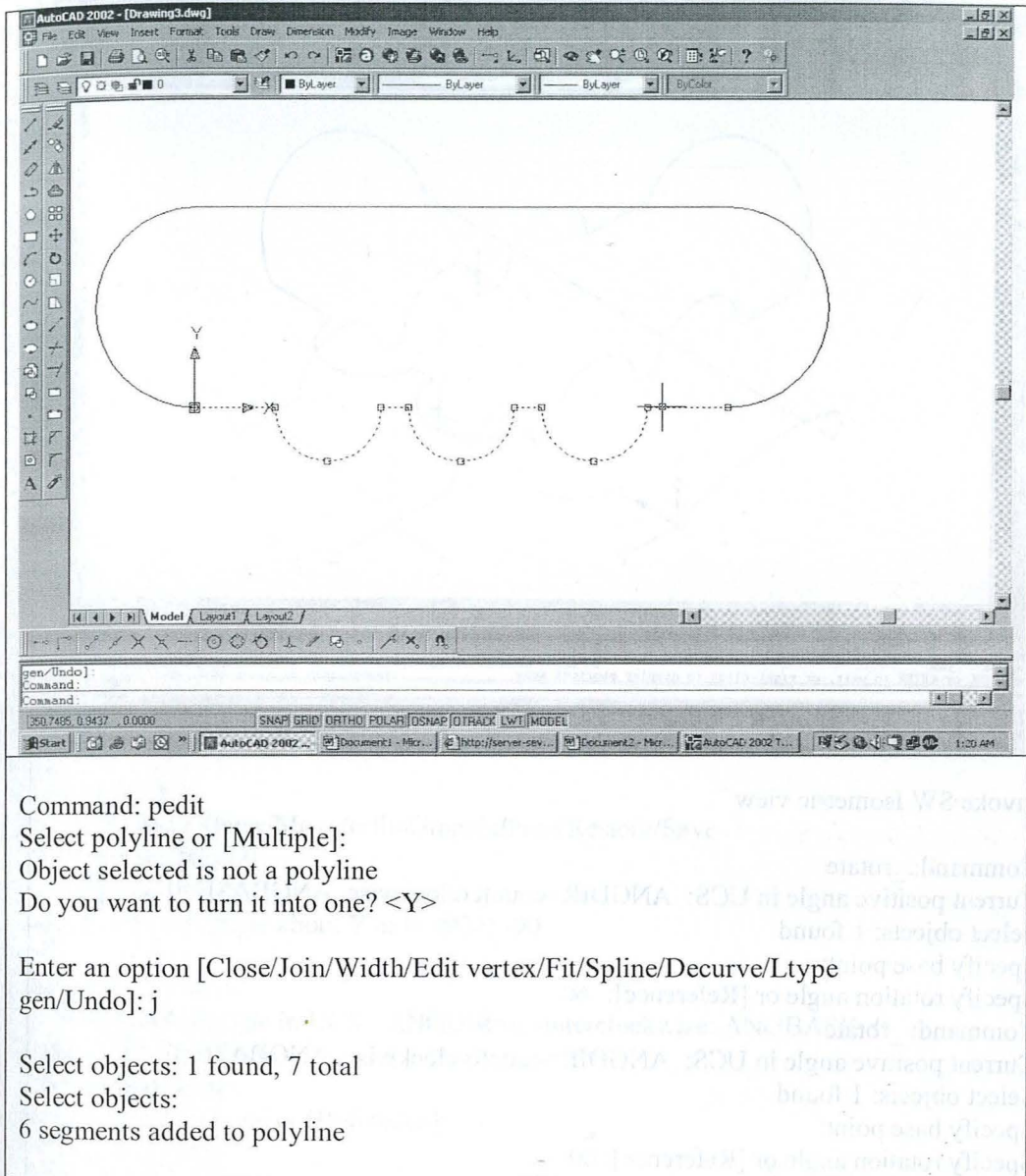
Specify base point or displacement, or [Multiple]: `m`  
Specify base point: Specify second point of displacement or <use first point as displacement>: `_nod` of Specify second point of displacement or <use first point as displacement>: `_nod` of Specify second point of displacement or <use first point as displacement>:

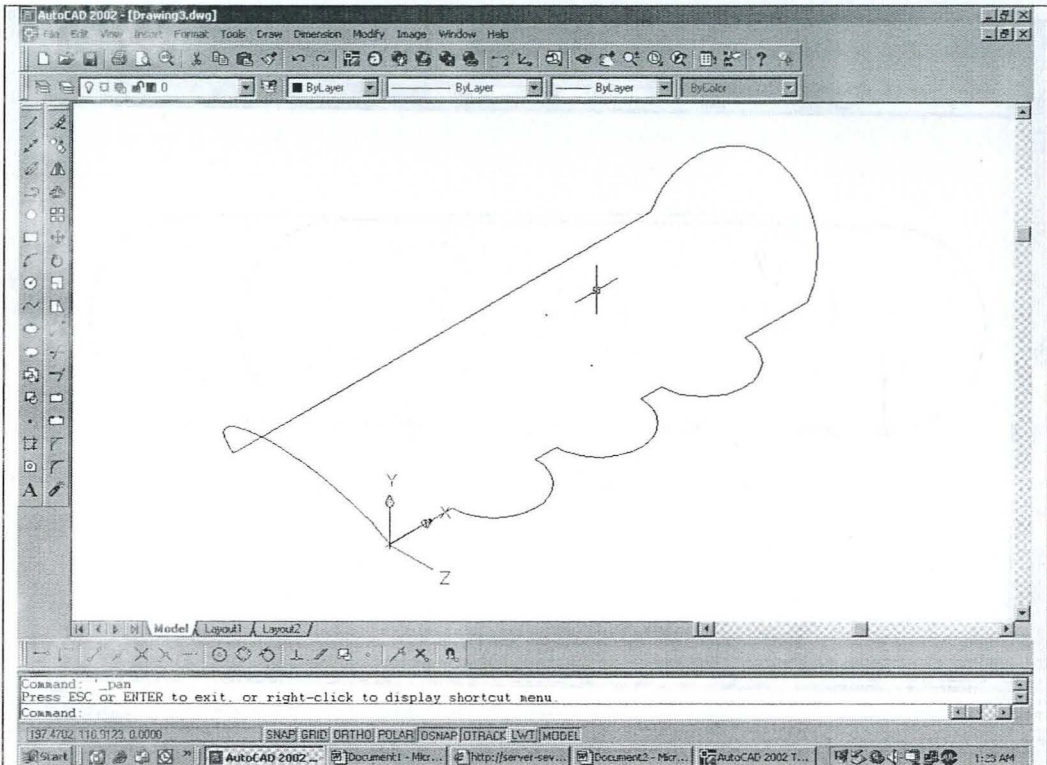
Command: `_circle` Specify center point for circle or [3P/2P/Ttr (tan tan radius)]: `2p`  
Specify first end point of circle's diameter:  
Specify second end point of circle's diameter:



Command: trim  
 Current settings: Projection=UCS, Edge=None  
 Select cutting edges ...  
 Select objects:  
 Select object to trim or shift-select to extend or [Project/Edge/Undo]:







Invoke SW Isometric view

Command: \_rotate

Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0

Select objects: 1 found

Specify base point:

Specify rotation angle or [Reference]: -60

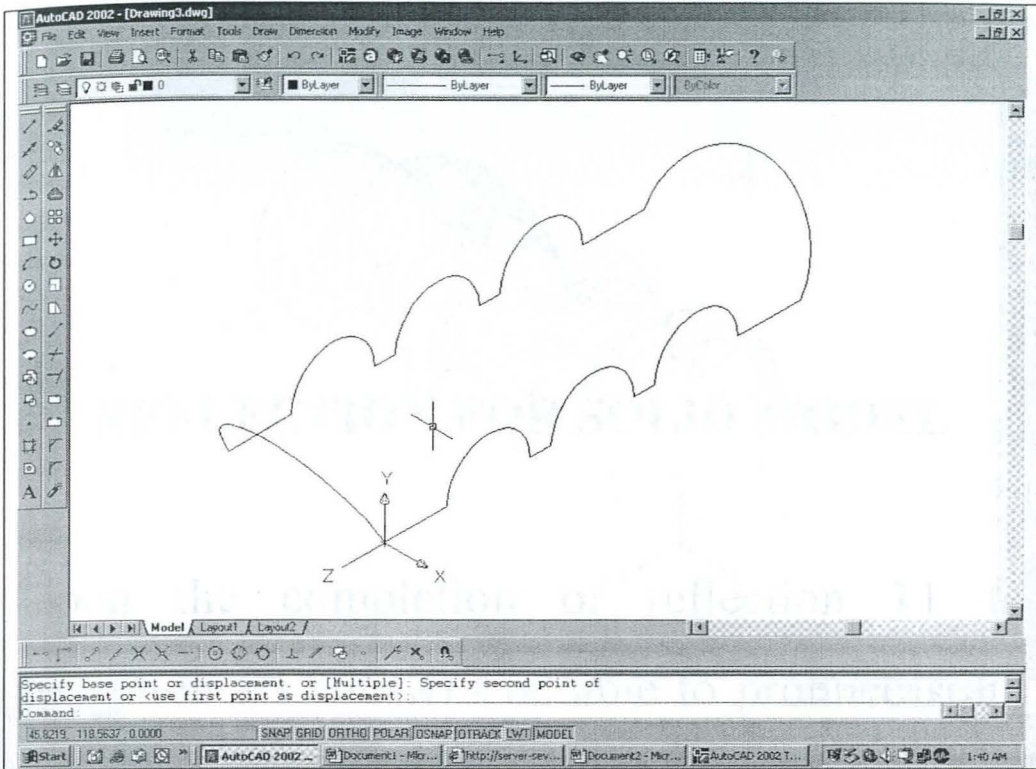
Command: \_rotate

Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0

Select objects: 1 found

Specify base point:

Specify rotation angle or [Reference]: 60



Command: ucs

Enter an option [New/Move/orthoGraphic/Prev/Restore/Save  
/Del/Apply/?/World]

<World>: y

Specify rotation angle about Y axis <90>: -90

Command: \_rotate

Current positive angle in UCS: ANGDIR=counterclockwise ANGBASE=0

Select objects: 1 found

Specify base point:

Specify rotation angle or [Reference]: 90

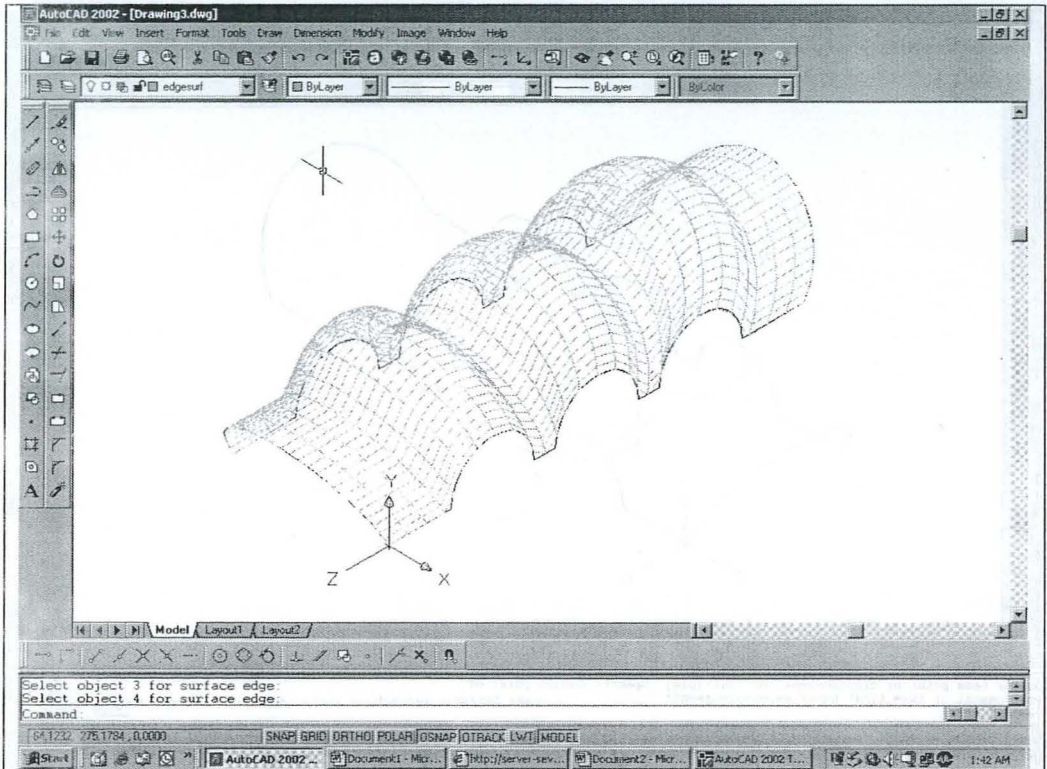
Command: \_copy

Select objects: 1 found

Select objects:

Specify base point or displacement, or [Multiple]: Specify second point of displacement or <use first point as displacement>:





Command: surfTAB1

Enter new value for SURFTAB1 <6>: 30

Command: surfTAB2

Enter new value for SURFTAB2 <6>: 30

Command: edgesurf

Current wire frame density: SURFTAB1=30 SURFTAB2=30

Select object 1 for surface edge:

Select object 2 for surface edge:

Select object 3 for surface edge:

Select object 4 for surface edge:

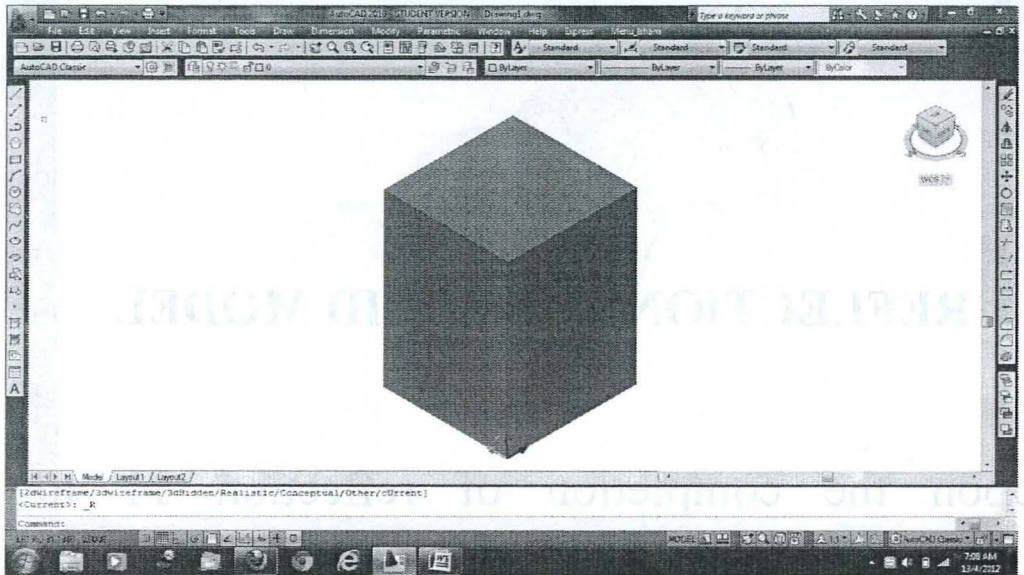
The surface model is constructed

## CHAPTER 4

# REFLECTION FOR SOLID MODEL

Upon the completion of reflection 11 to reflection 15 you will be able to produce solid model based on

1. Region and extrude command
2. Revolve command
3. Extrude and path command
4. Boolean command

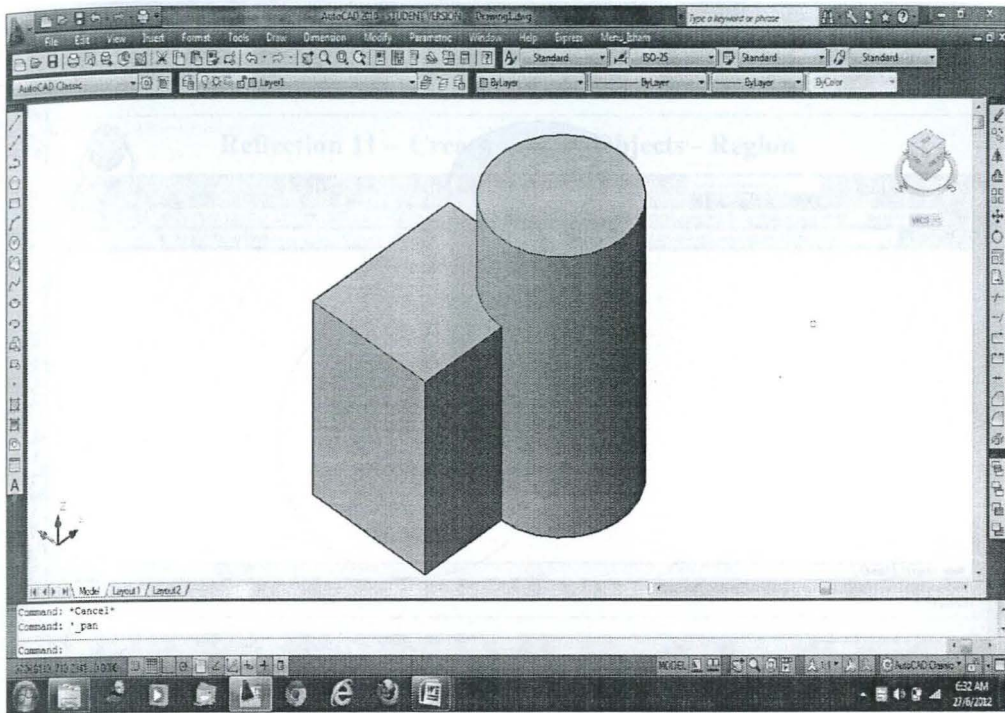


The object can be created by using height or path

### Creating Solid Objects

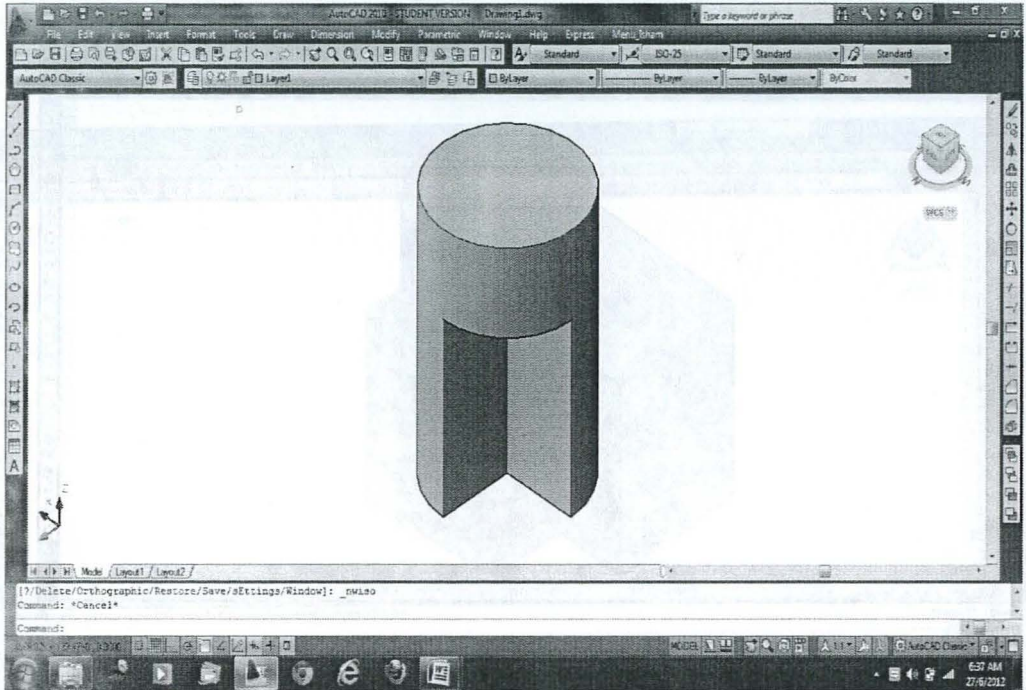
A solid object represents the entire volume of an object. Solids are the most informationally complete and least ambiguous of the 3D modeling types. Complex solid shapes are also easier to construct and edit than wireframes and meshes. You create solids from one of the basic solid shapes of box, cone, cylinder, sphere, torus, and wedge or by extruding a 2D object along a path or revolving a 2D object about an axis. Once you have created a solid in this manner, you can create more complex shapes by combining solids. You can join solids, subtract solids from each other, or find the common volume (overlapping portion) of solids.





### Create a Composite Solid with Union

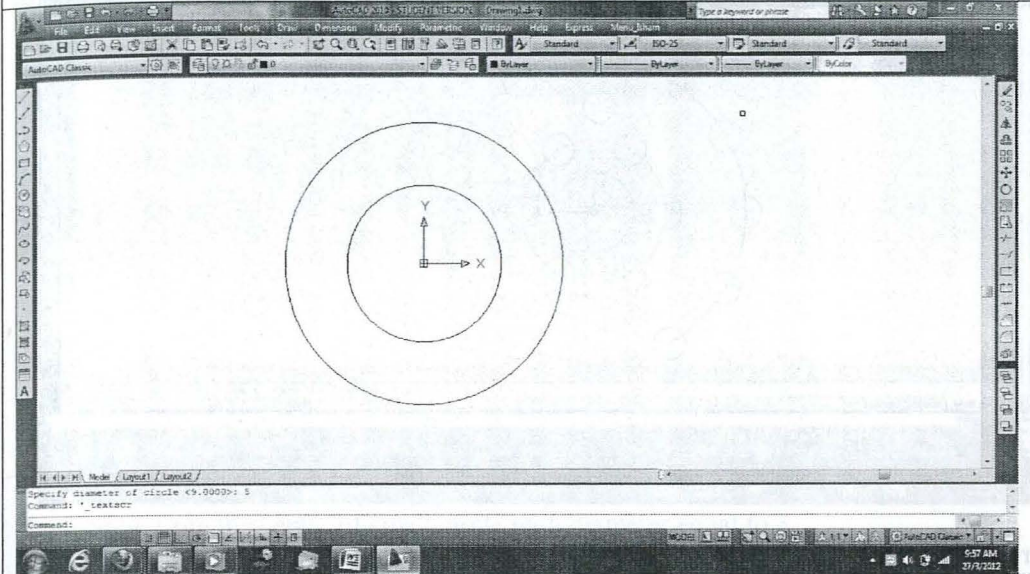
You can combine, subtract, and find the intersection of existing solids to create composite solids. With UNION, you can combine the total volume of two or more solids or two or more regions into a composite object. When the objects being union it will become one entity.



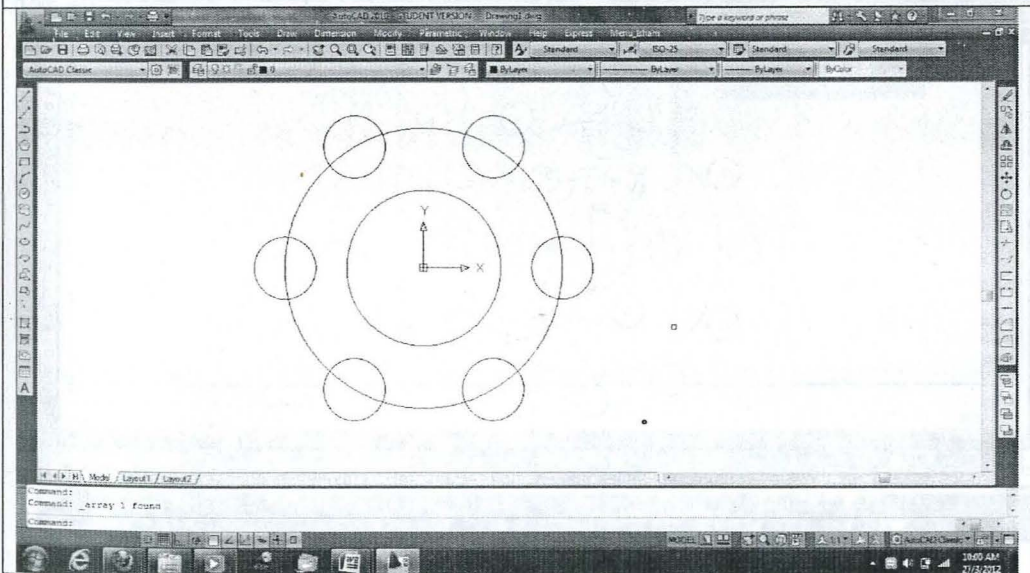
### Create a Composite Solid with Subtract

With SUBTRACT, you can remove the common area of one set of solids from another. For example, you can use SUBTRACT to add holes to a mechanical part by subtracting cylinders from the object.

## Reflection 11 – Creating Solid Objects - Region



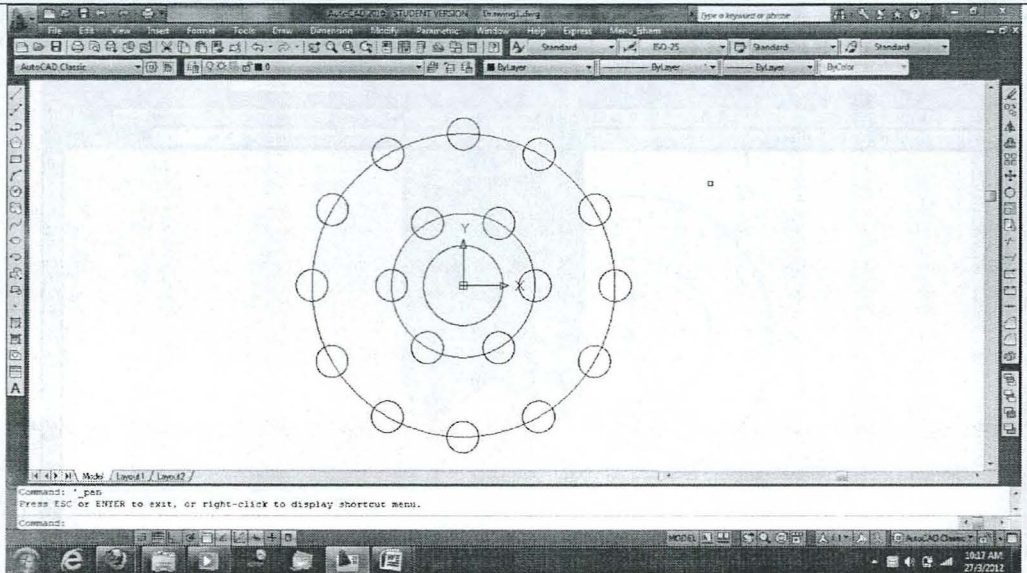
Draw big circle with diameter equal to 9  
Draw second circle with diameter equal to 5



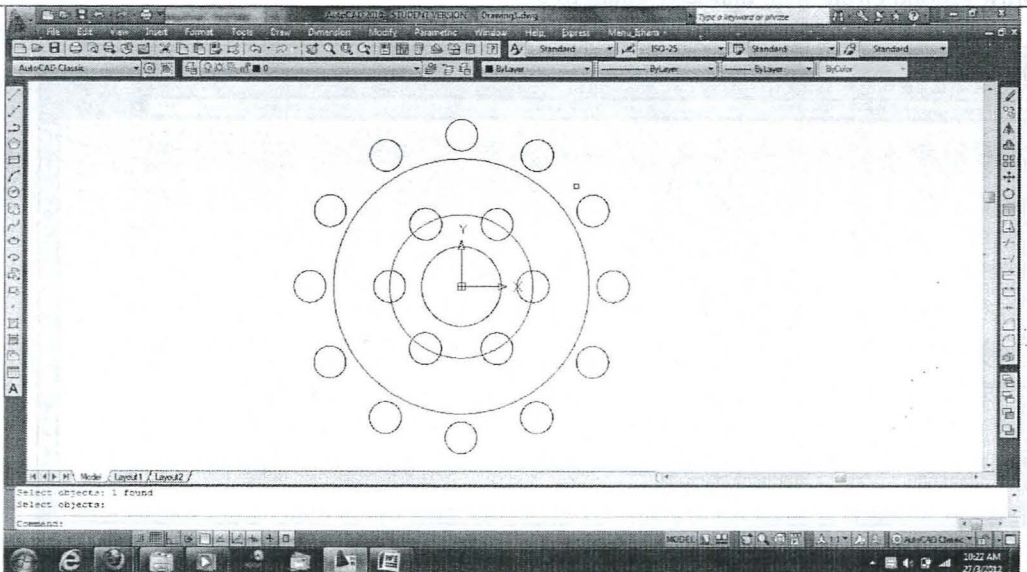


## FROM NOTHING TO SOMETHING

Draw small circle with diameter equal to 2 from edge of big circle.  
Use polar array to array the small circle. Array to the amount of 6.

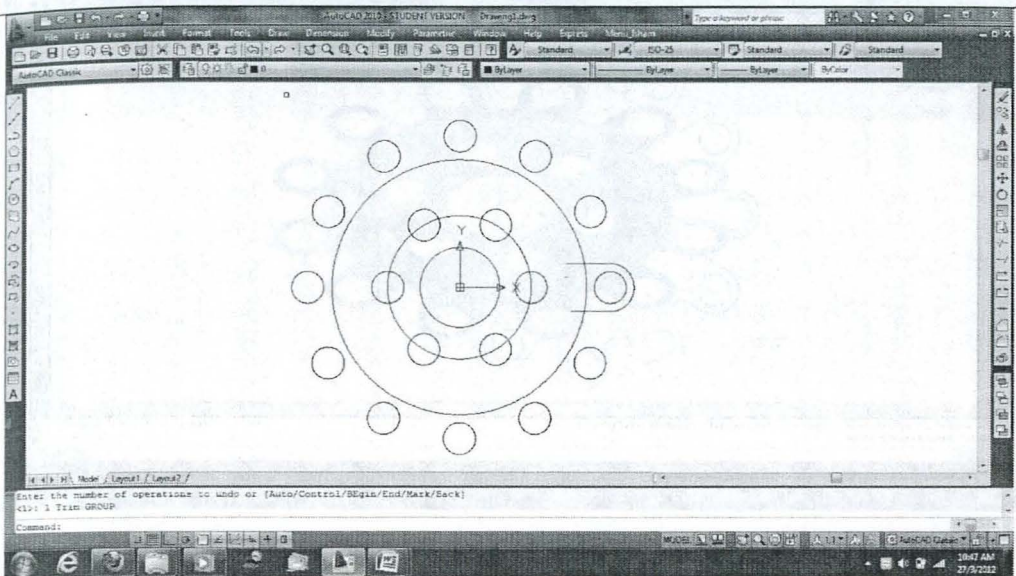


Draw big circle with diameter equal to 19  
Draw small circle with diameter equal to 2 from edge of big circle.  
Use polar array to array the small circle. Array to the amount of 12.

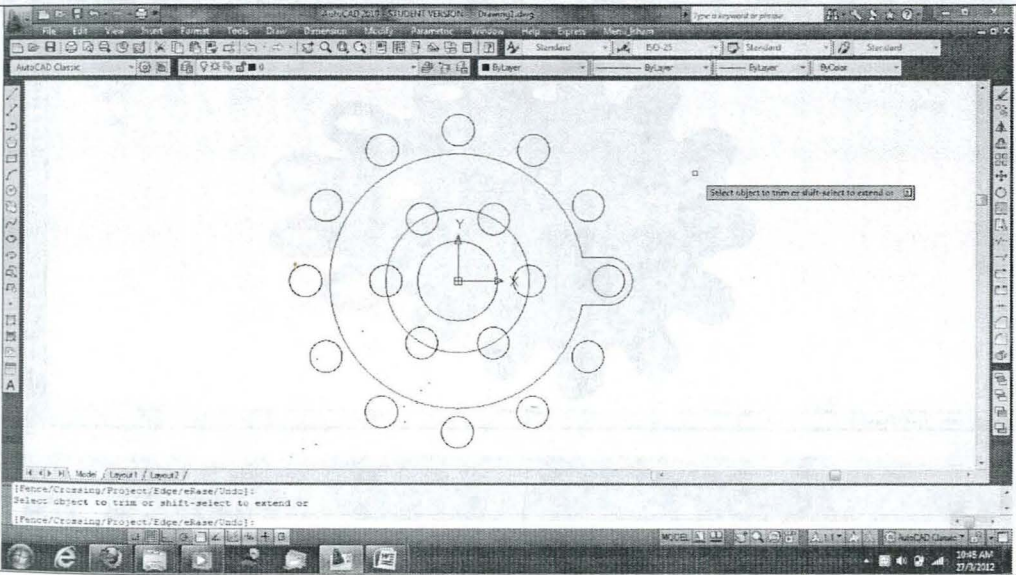


Draw circle with diameter equal to 16

Erase the largest circle



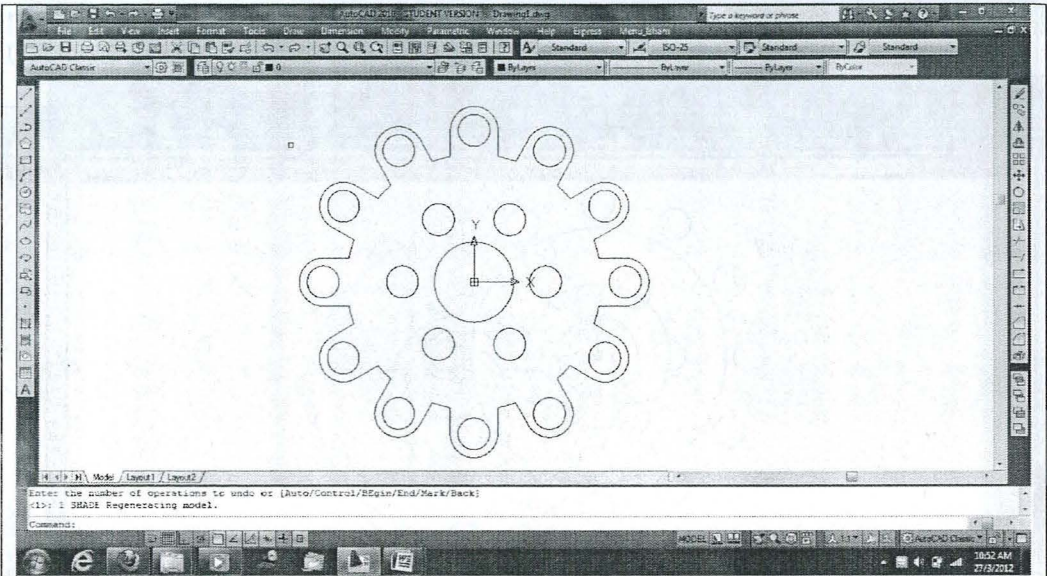
Draw circle from the center of small circle with diameter equal to 3  
Draw two lines from quadrant of small circle to pass through the big circle



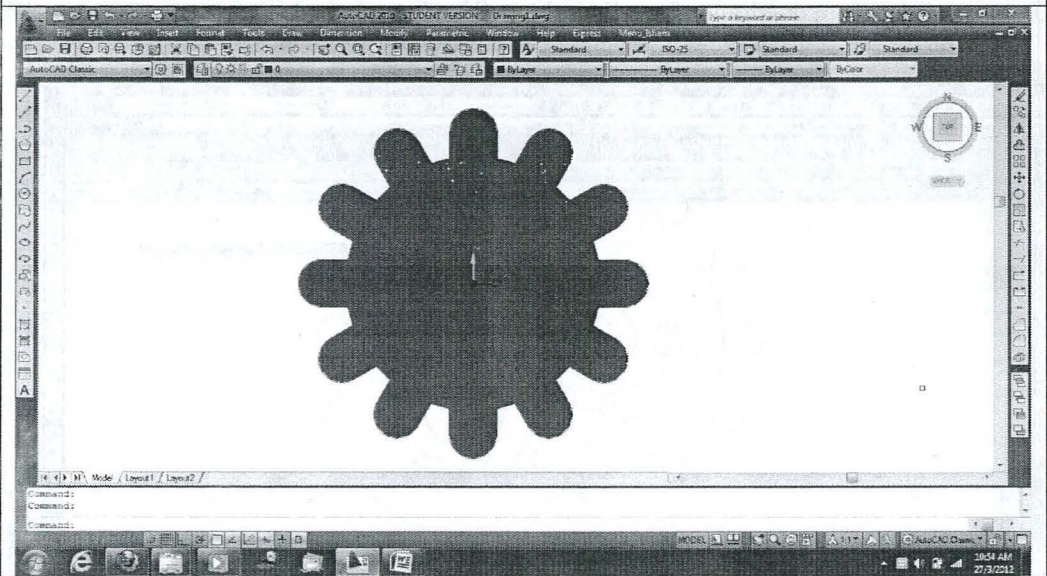
Invoke trim command to get shape as shown above



## FROM NOTHING TO SOMETHING



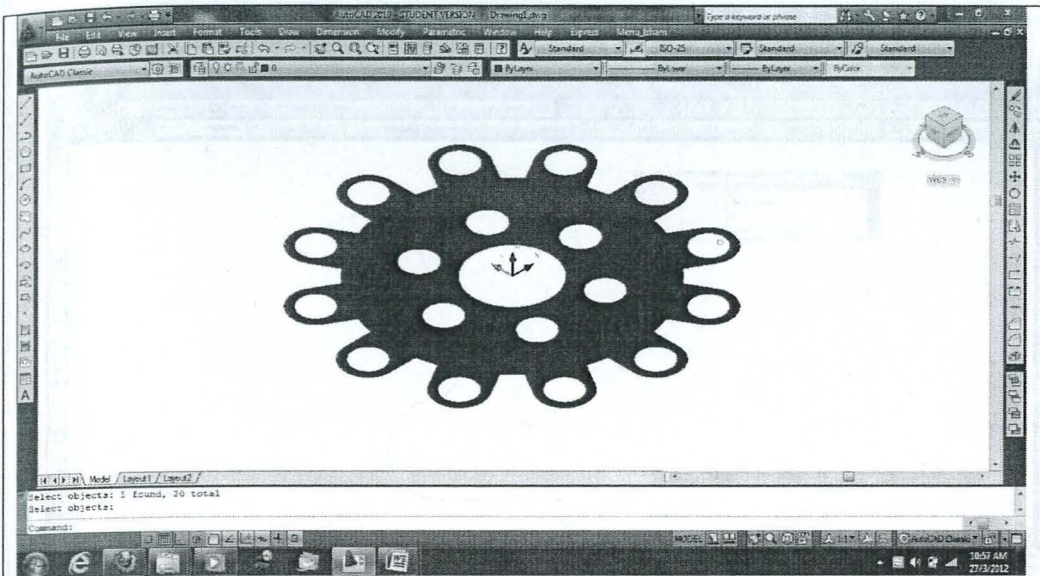
Invoke polar array command to the extended shape. Make the amount equal to 12. Invoke trim command to get shape as shown above. Erase the middle circle.



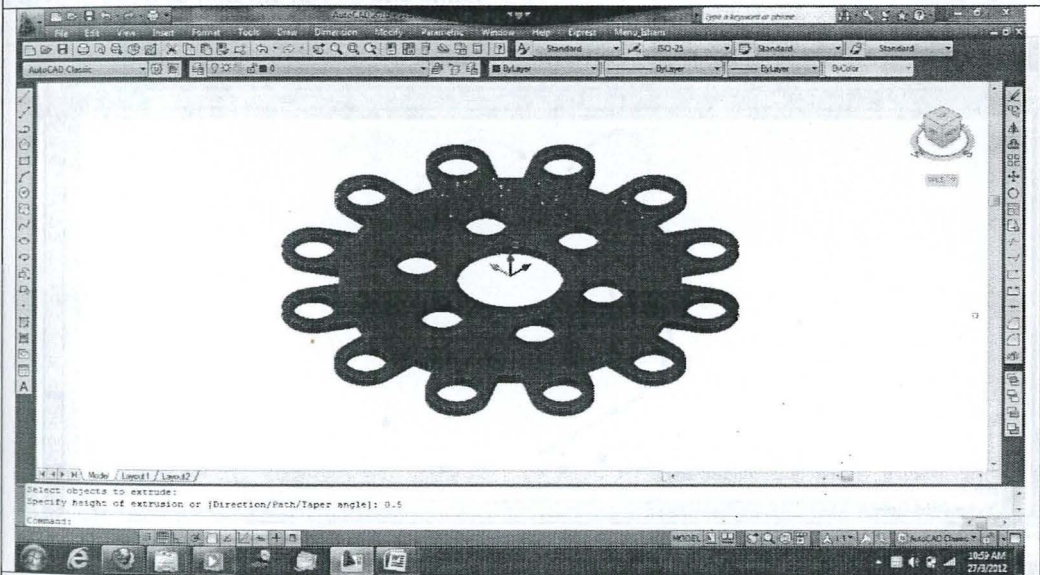
Invoke region command. Select all the objects. 67 found  
20 loops extracted.  
20 Regions created.  
Command: shade



## FROM NOTHING TO SOMETHING

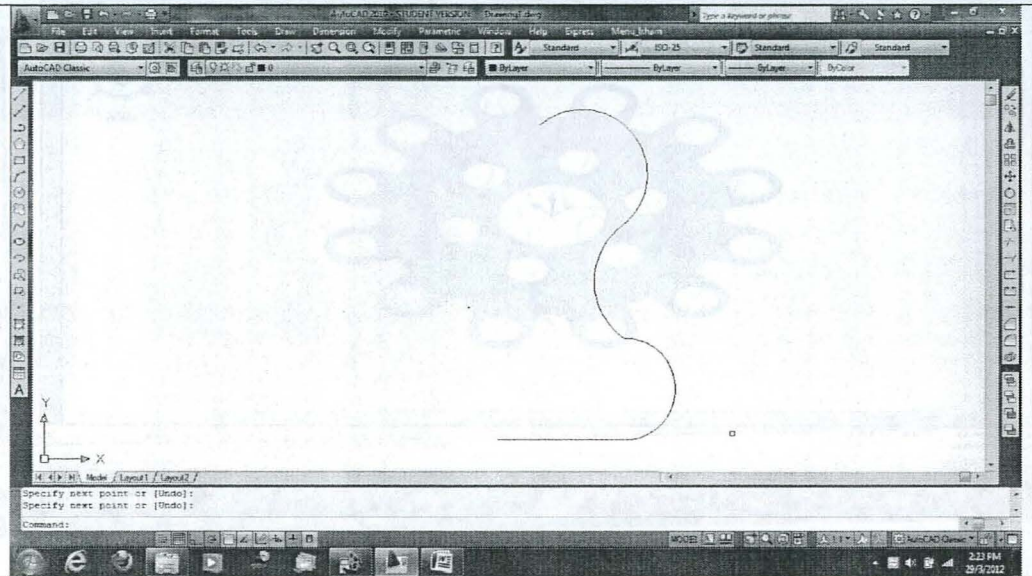


Apply the sw isometric view. Invoke subtrac command. Subtract the small circle from the largest shape.

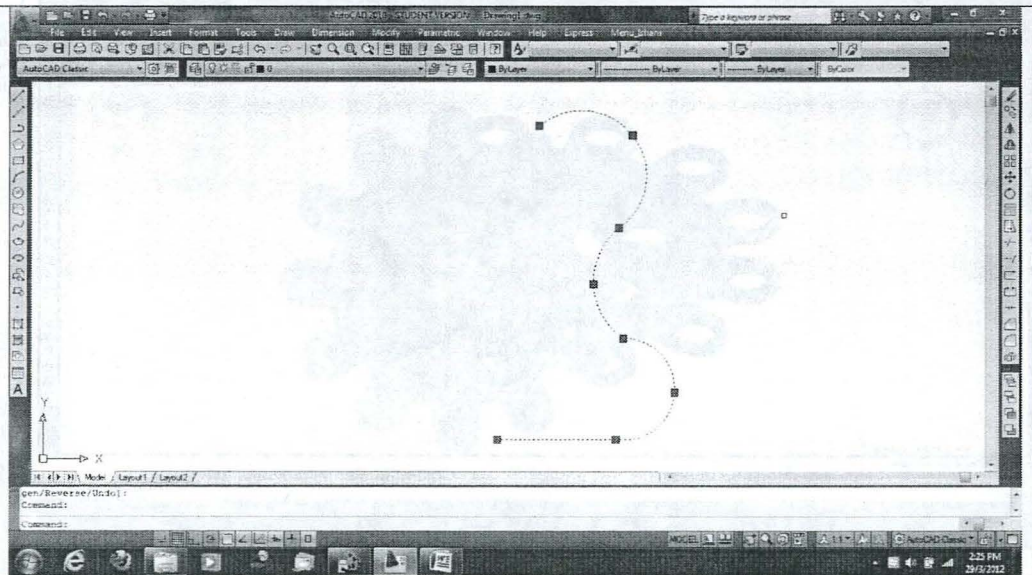


Invoke the extrude command with the amount equal to 0.5. The gear box is done using region command.

## Reflection 12 – Creating Solid Object – Revolve Command



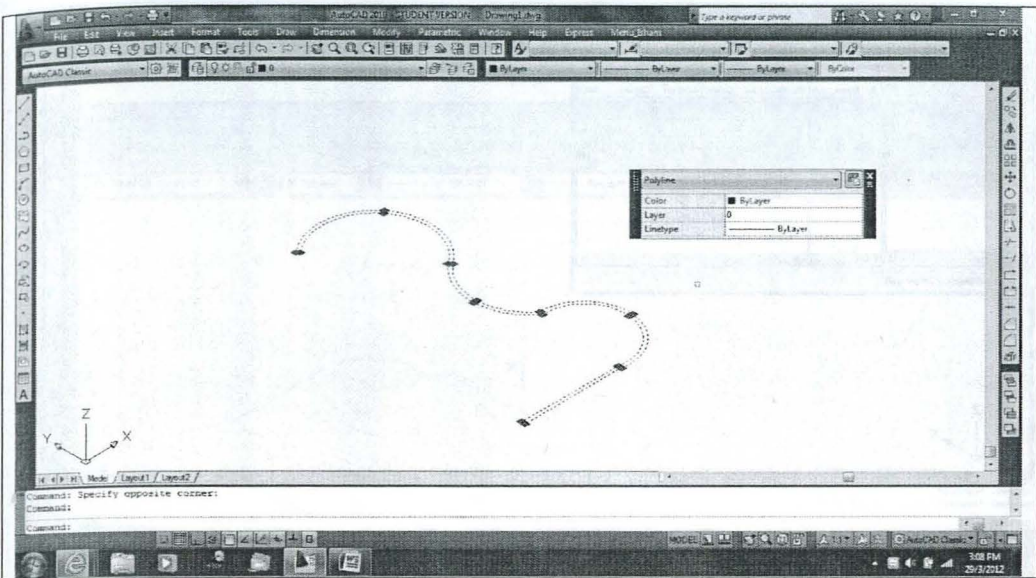
Using 3point arch creates line as shown above



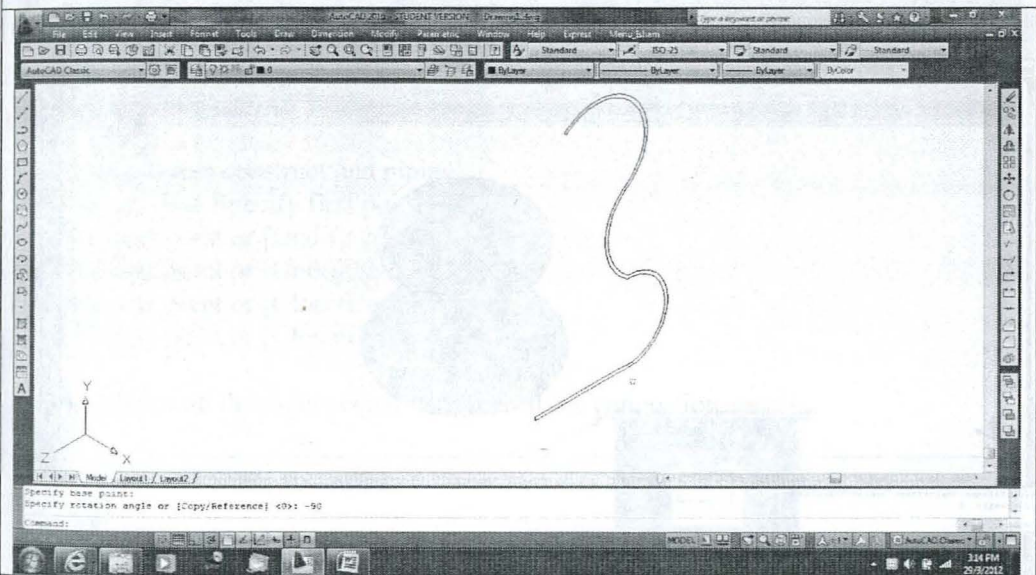
Invoke pedit command to join the line as one entity



## FROM NOTHING TO SOMETHING



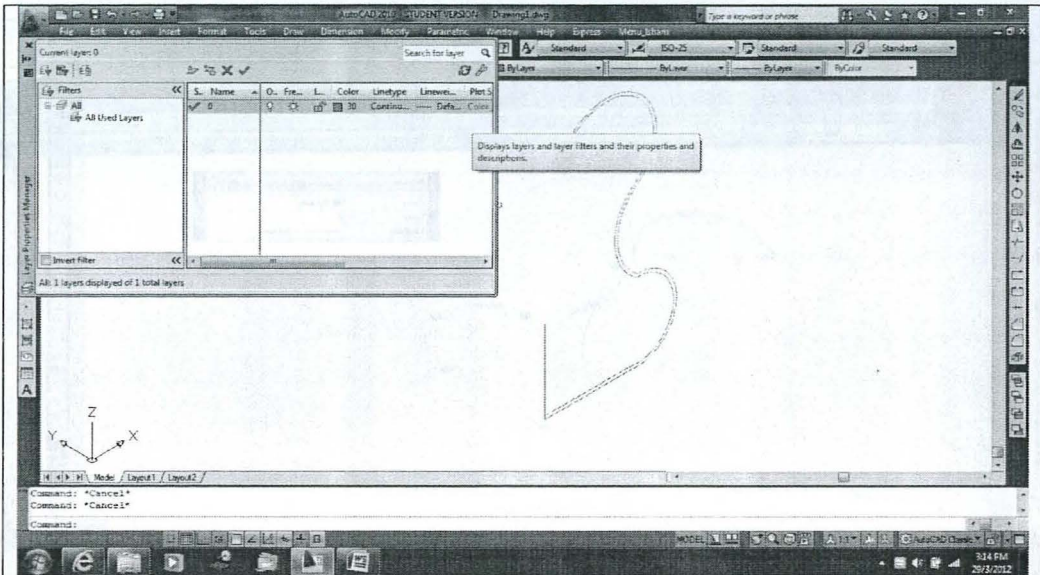
Invoke the Sw Isometric view  
 Offset the line by 10 units  
 Invoke pedit to join the line as one entity



Rotate the UCS by X axis at 90  
 Then rotate the UCS by Y axis at -90  
 Rotate the line at current UCS at -90



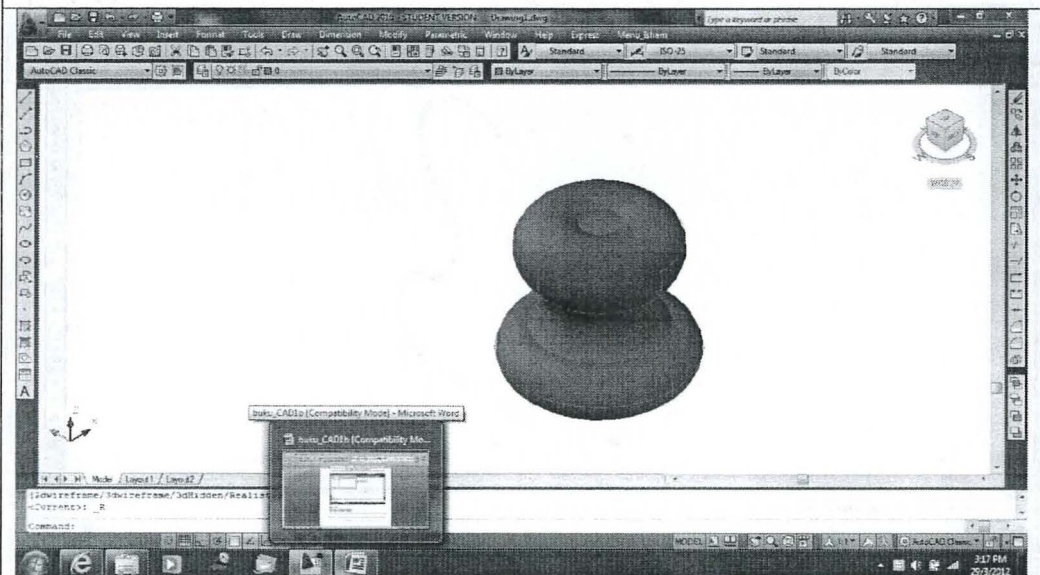
## FROM NOTHING TO SOMETHING



Set UCS to WCS

Change the layer colour to orange

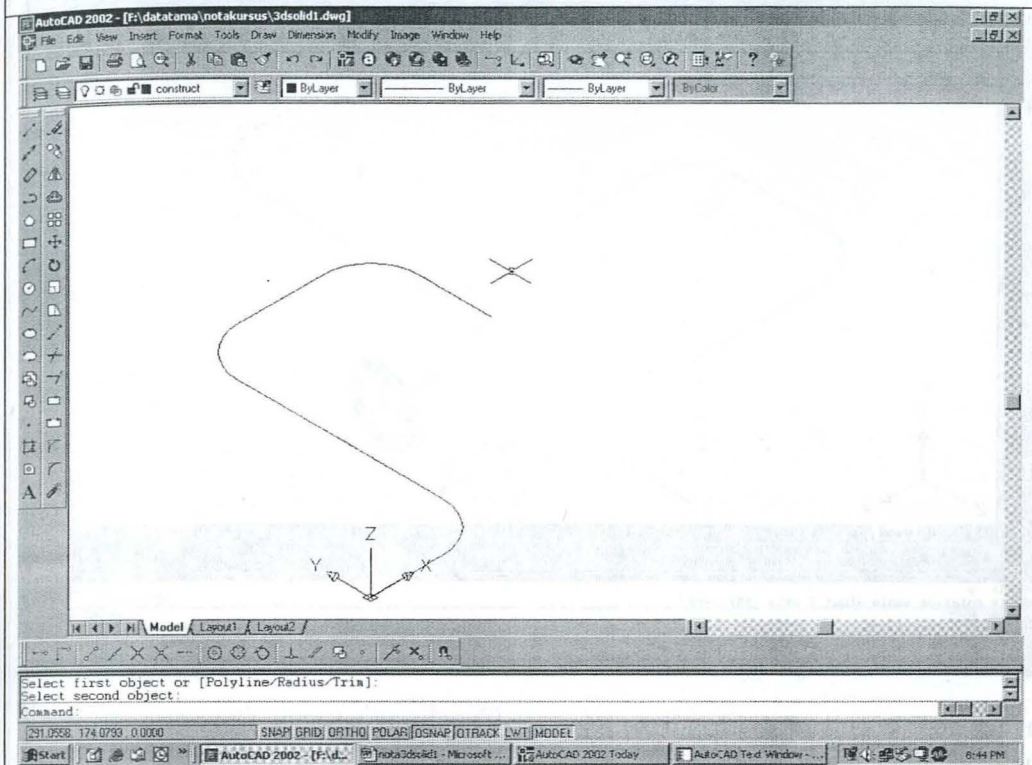
Draw short vertical line as shown



Invoke the revolve command. Select the object. Then the axis of revolution.

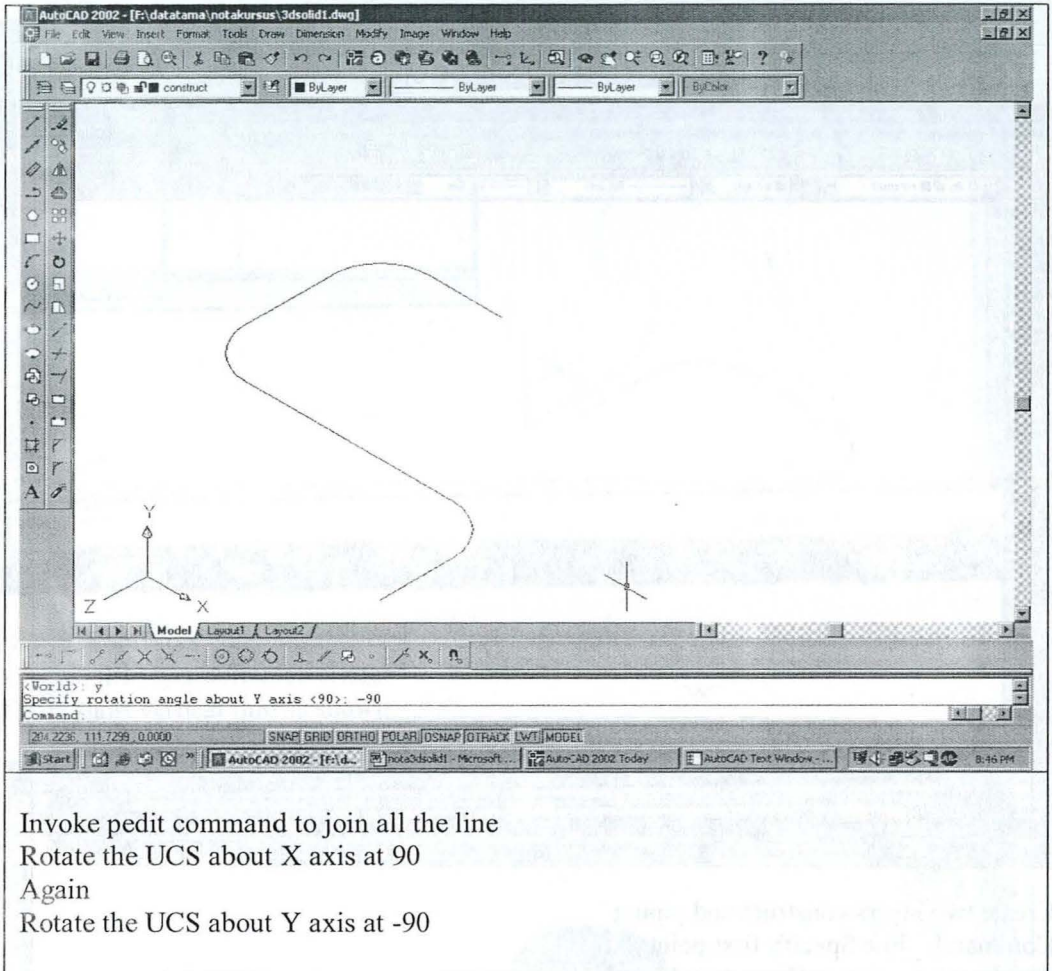
Set the degree of revolution to 360. Invoke command shade. Use realistic as visual style. The object is done.

### Reflection 13 – Creating Solid Object - Path



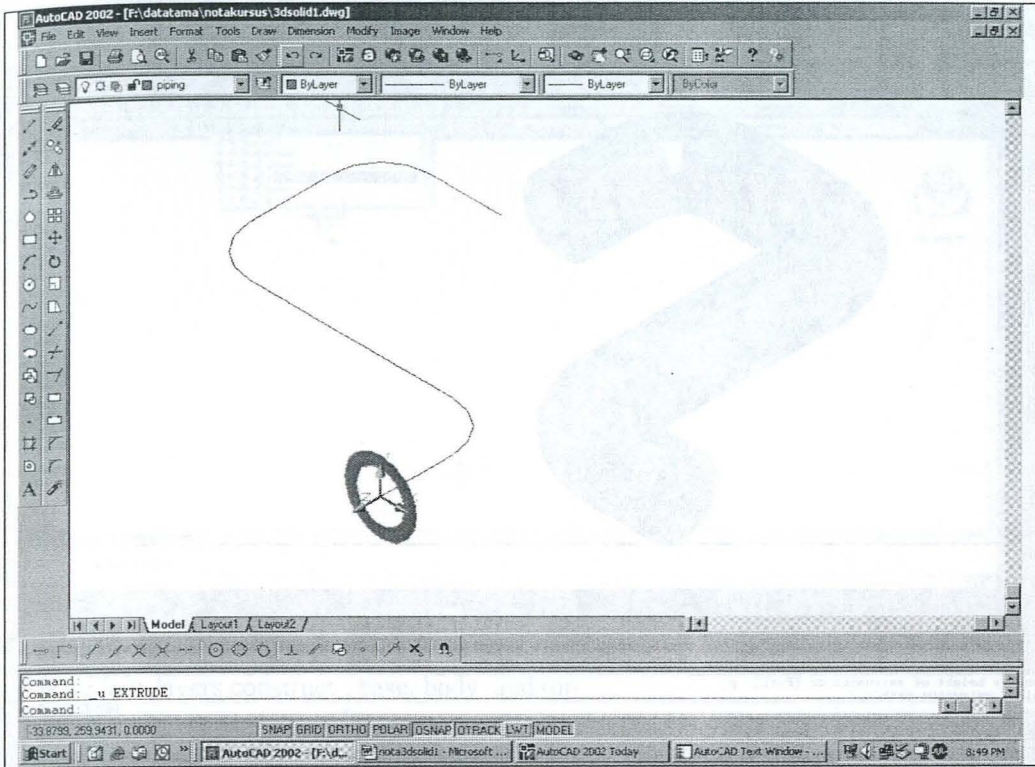
Create two layers construct and piping  
 Command: `_line` Specify first point: 0,0  
 Specify next point or [Undo]: `@100<0`  
 Specify next point or [Undo]: `@250<90`  
 Specify next point or [Close/Undo]: `@150<0`  
 Specify next point or [Close/Undo]: `@100<-90`

Invoke fillet with the radius equal to 40 for all the connection

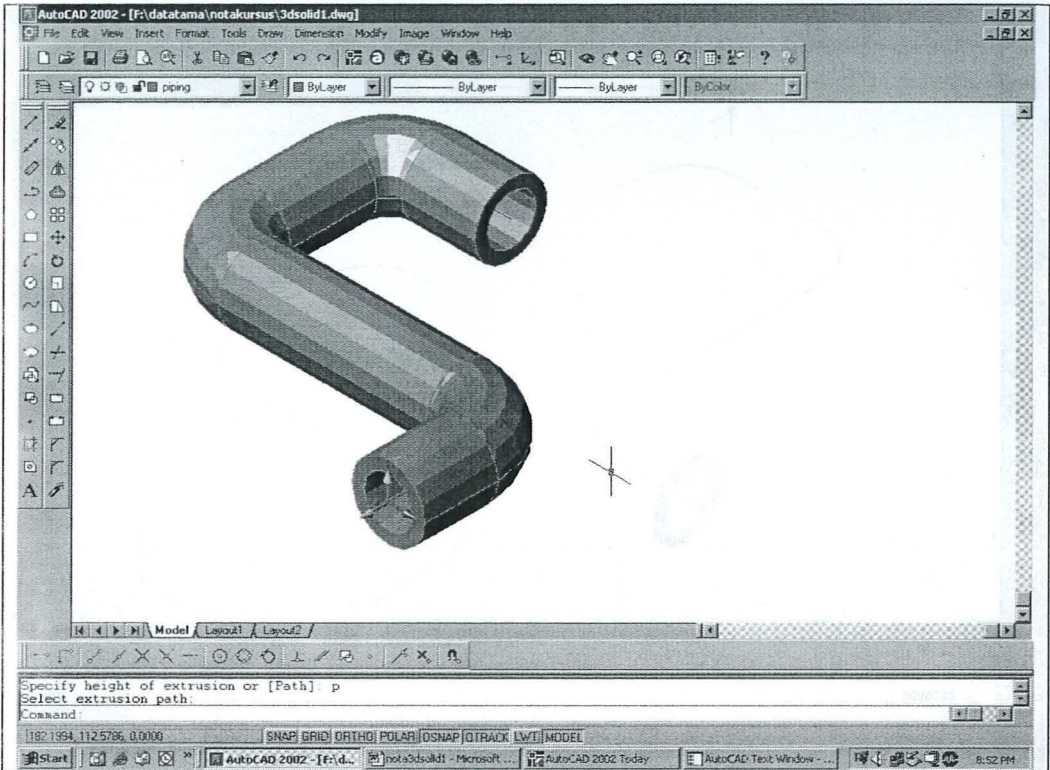


Invoke pedit command to join all the line  
 Rotate the UCS about X axis at 90  
 Again  
 Rotate the UCS about Y axis at -90



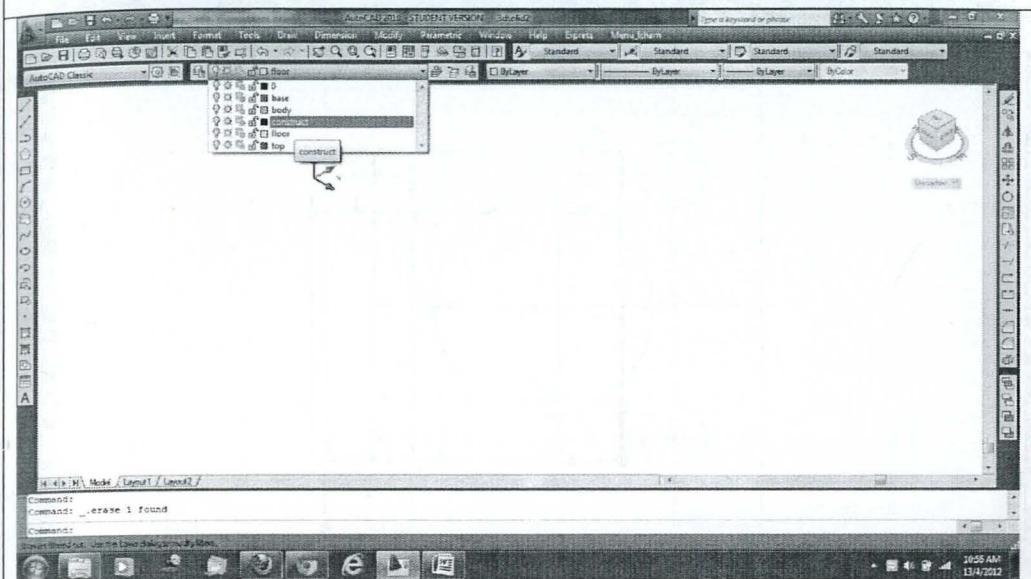


- Draw circle one with diameter equal to 40
- Draw circle two with diameter equal to 60
- Invoke region command. Select both circles.
- Invoke subtract command.
- Subtract small circle from the big circle.



Invoke extrude command using path.  
 Select the circle as an object  
 Select Command: extrude  
 Specify the path by selecting the curving line as path  
 One path is selected the 3D object is done.

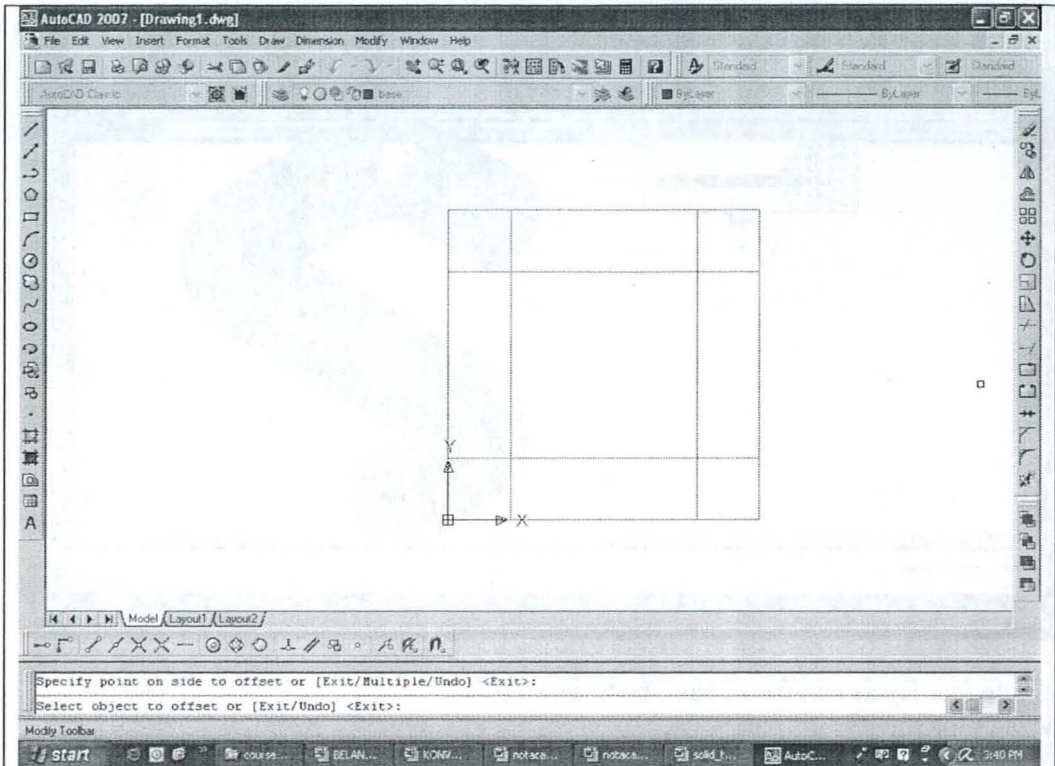
## Reflection 14 – Creating Simple Solid Object – Boolean Command



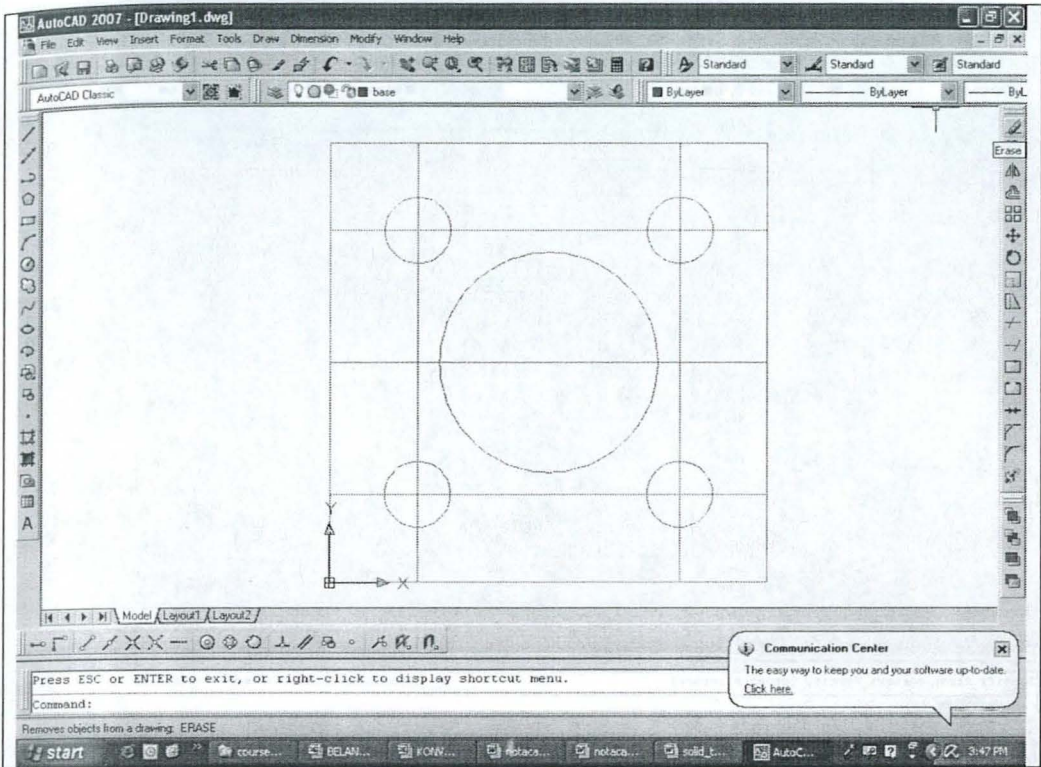
Create four layers construct , base, body and top  
Make construct as a current layer



## FROM NOTHING TO SOMETHING



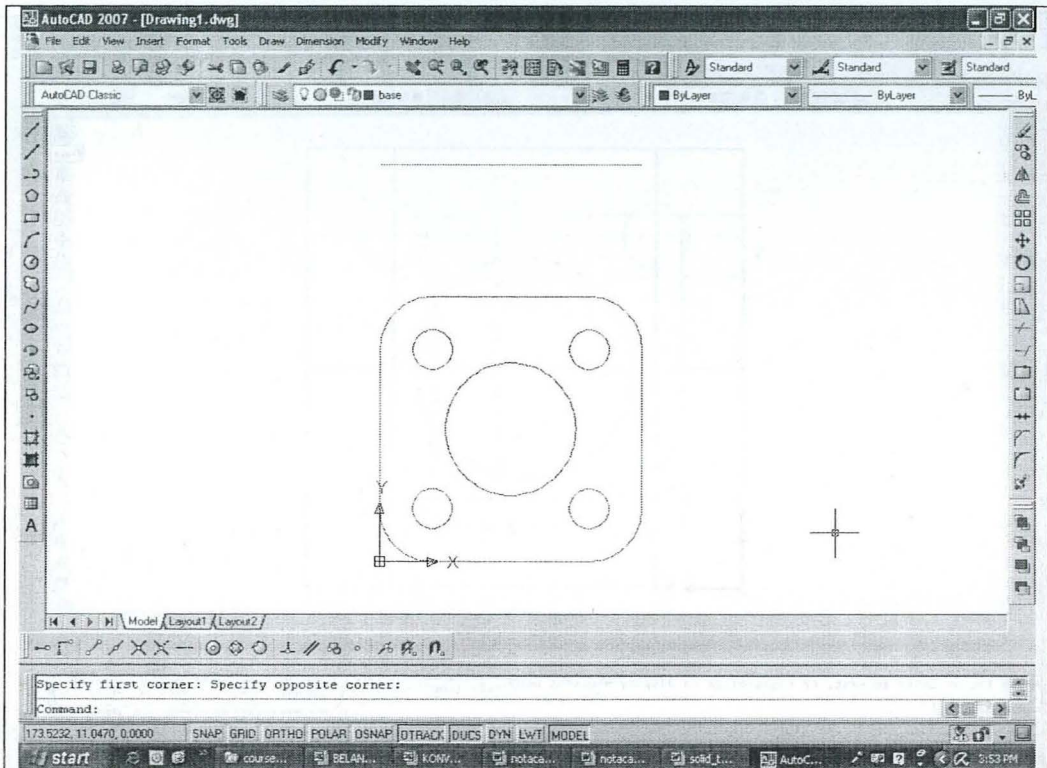
Set base as current layer.  
Draw the line with the size of 100 by 100  
Offset each line inward with the size of 20



Draw horizontal line from the middle of the line on the right to the middle of the line on the left.

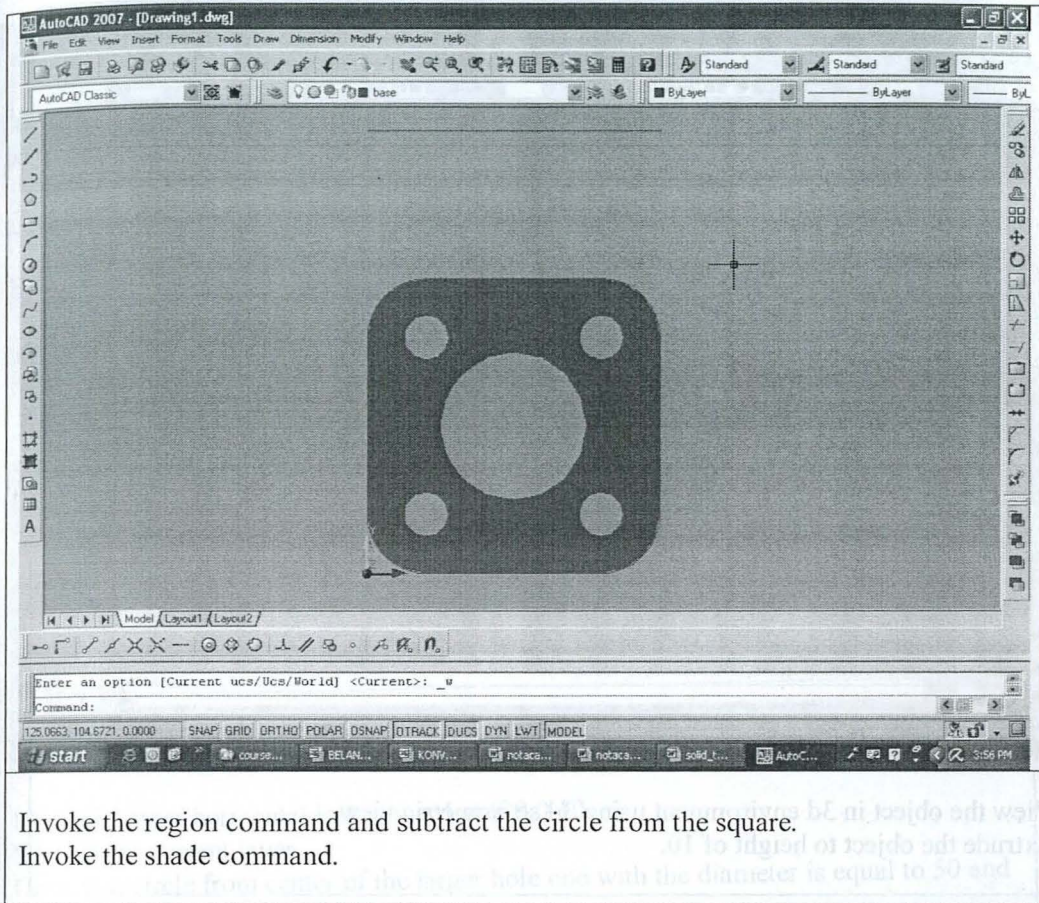
Draw circle in the middle of the square with its diameter is equal to 50

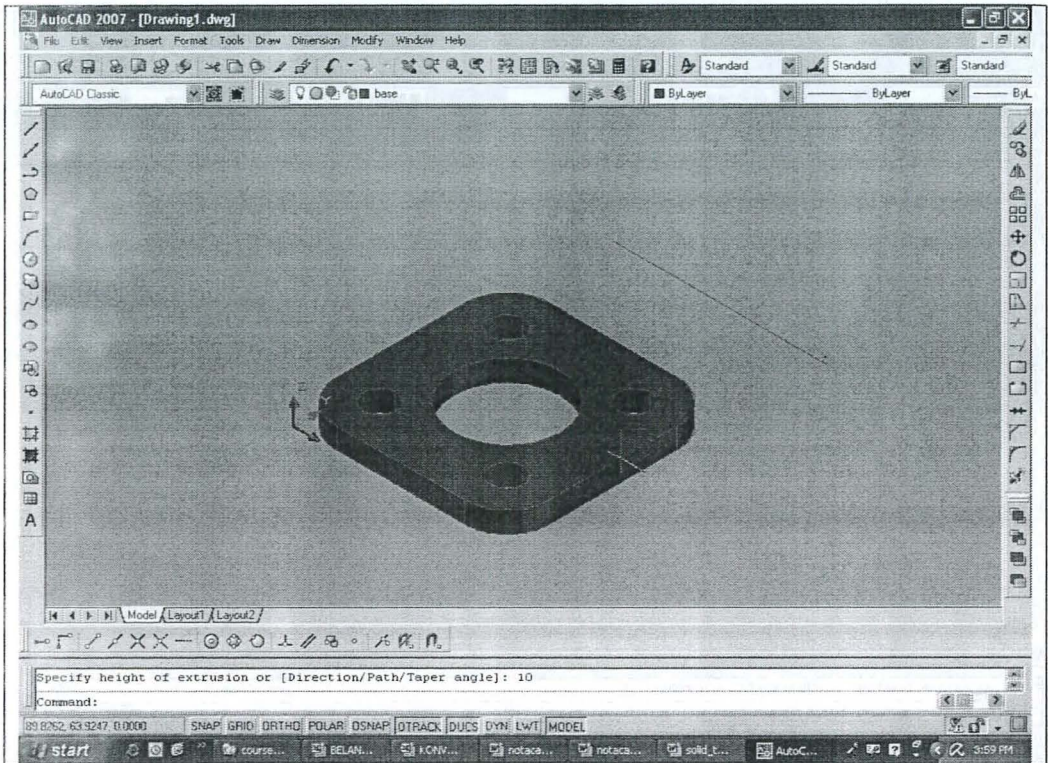
Draw 4 small circle at each intersection with its diameter is equal to 15



Fillet each corner using the radius of 20(4 times)  
 Offset the middle line with the distance of 100  
 Erase all the interior line.

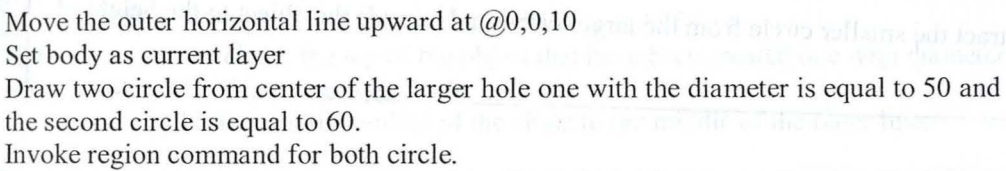




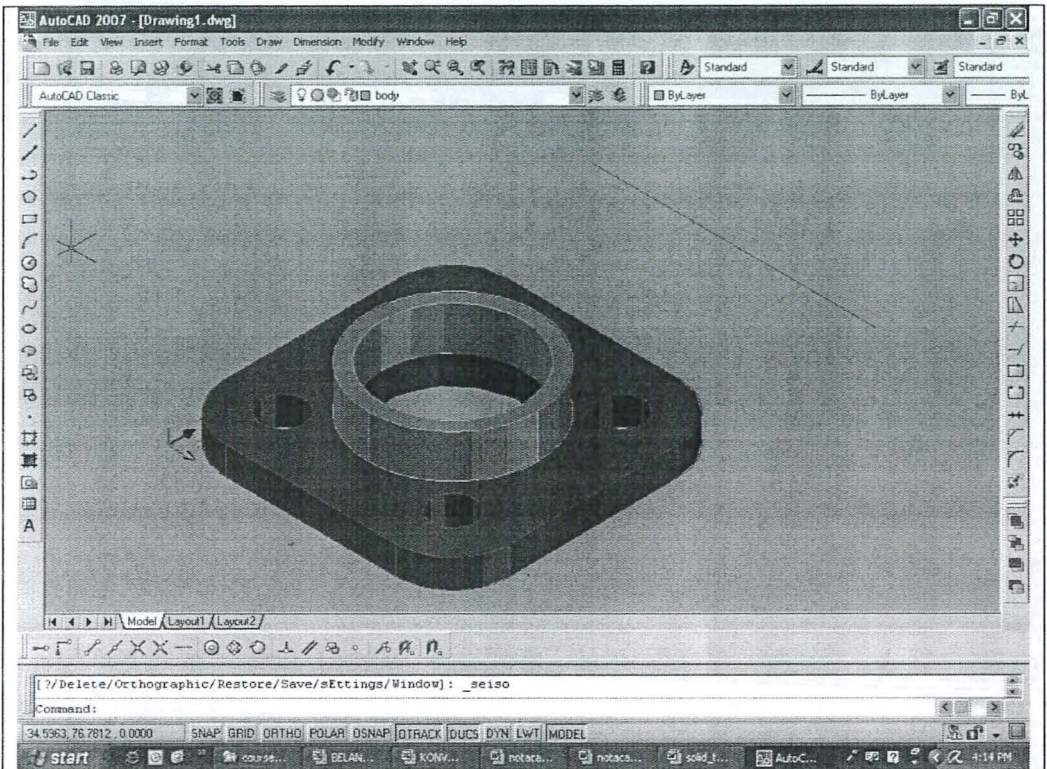


View the object in 3d environment using 3d se isometric view  
Extrude the object to height of 10.



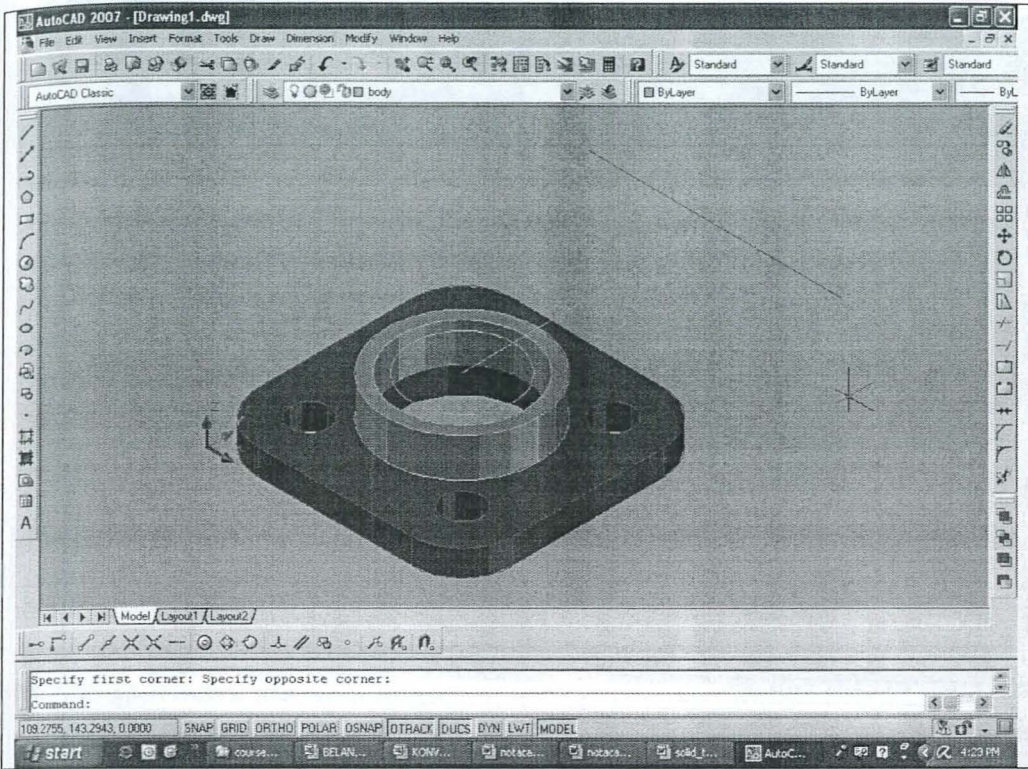






Subtract the smaller circle from the larger circle and extrude the object to the height of 15.

## FROM NOTHING TO SOMETHING



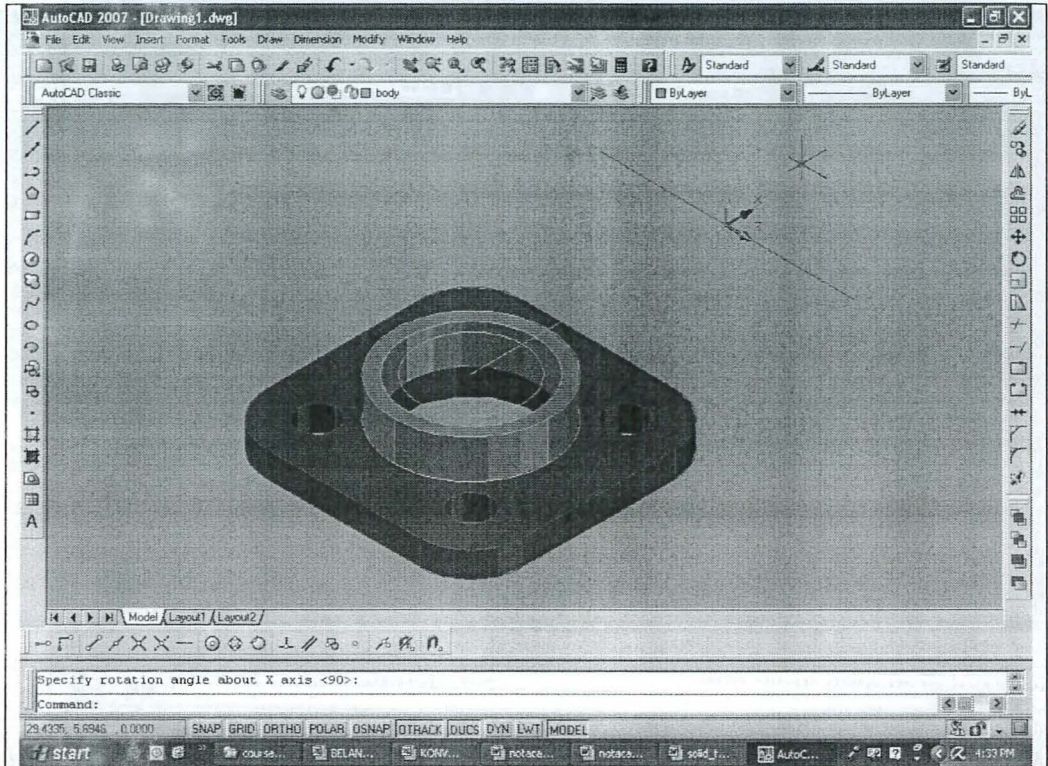
Move the outer line upward to the displacement of @0,0,15

Again draw two circle on the top of the object that have been created one with diameter equal to 50 and the other one equal to 40

Draw horizontal line from the middle of the circle to the middle of the outer line.

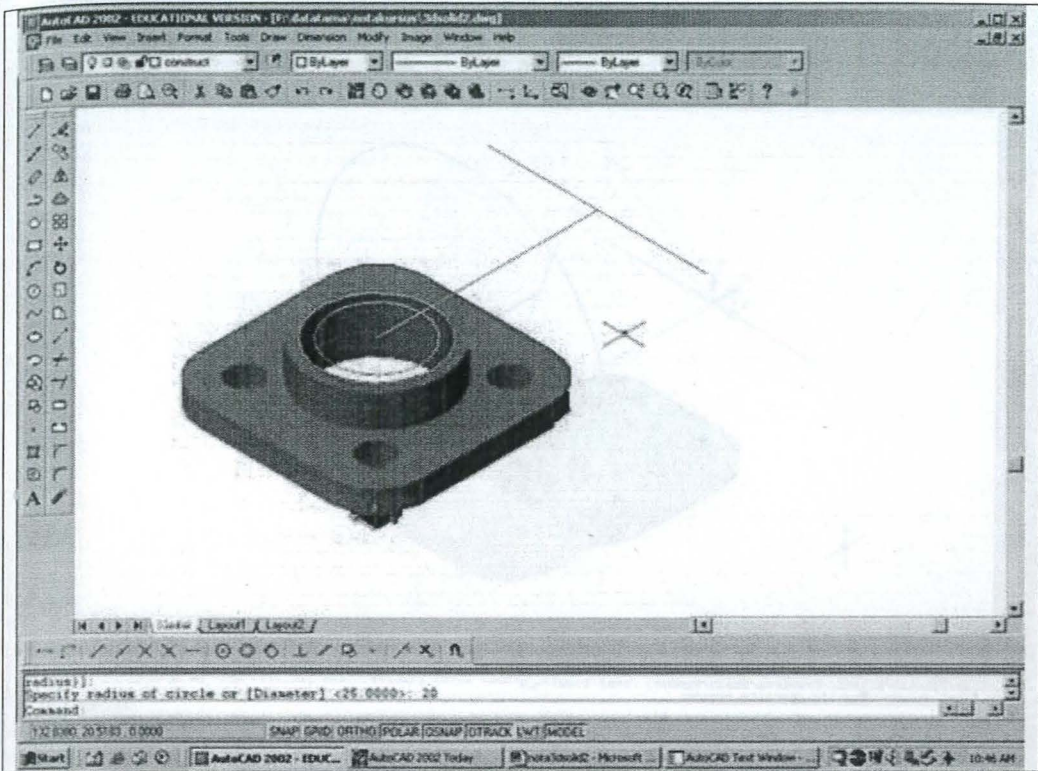


## FROM NOTHING TO SOMETHING



Move the UCS to middle of the outer line  
Set the UCS to be parallel to the screen as shown





Make construct as current layer

Command: `_move`

Select objects: 1 found

Select objects: Specify opposite corner: 0 found

Select objects: 1 found, 2 total

Select objects:

Specify base point or displacement: Specify second point of displacement or

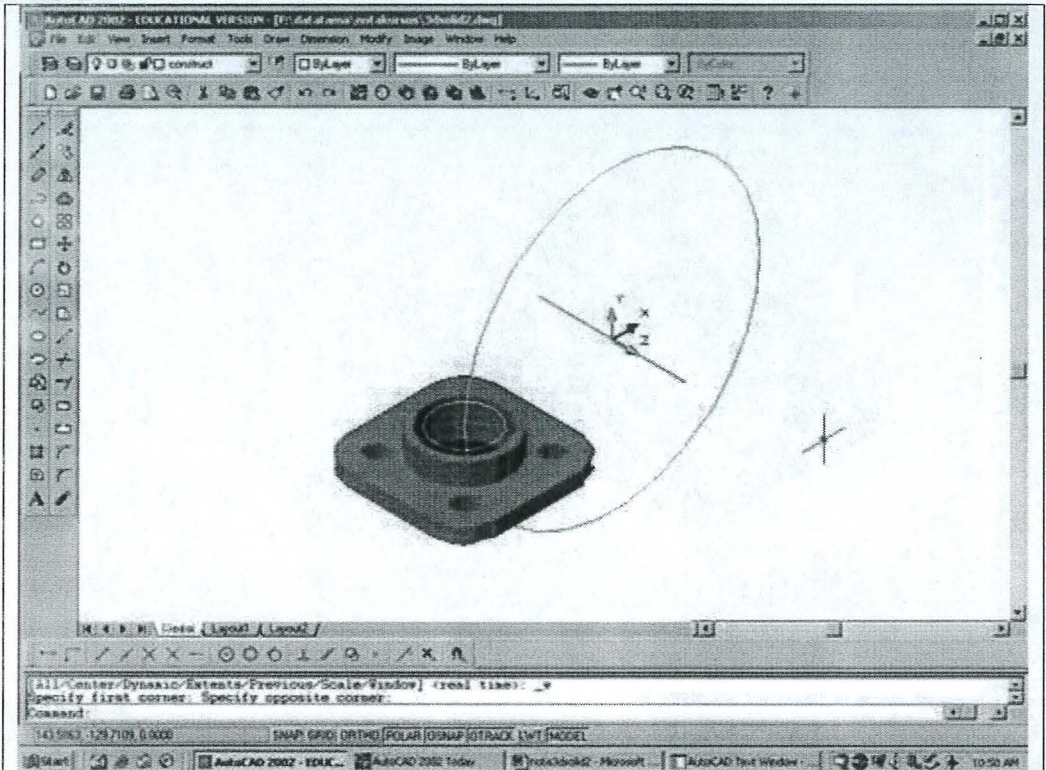
<use first point as displacement>: `@0,0,15`

Command: `_circle` Specify center point for circle or [3P/2P/Ttr (tan tan radius)]:

Specify radius of circle or [Diameter] <30.0000>: 25

Command: `_circle` Specify center point for circle or [3P/2P/Ttr (tan tan radius)]:

Specify radius of circle or [Diameter] <25.0000>: 20



Command: ucs

Current ucs name: \*WORLD\*

Enter an option [New/Move/orthoGraphic/Prev/Restore/Save/Del/Apply/?/World]

<World>: x

Specify rotation angle about X axis <90>:

Command: ucs

Current ucs name: \*NO NAME\*

Enter an option [New/Move/orthoGraphic/Prev/Restore/Save/Del/Apply/?/World]

<World>: or

Specify new origin point <0,0,0>:

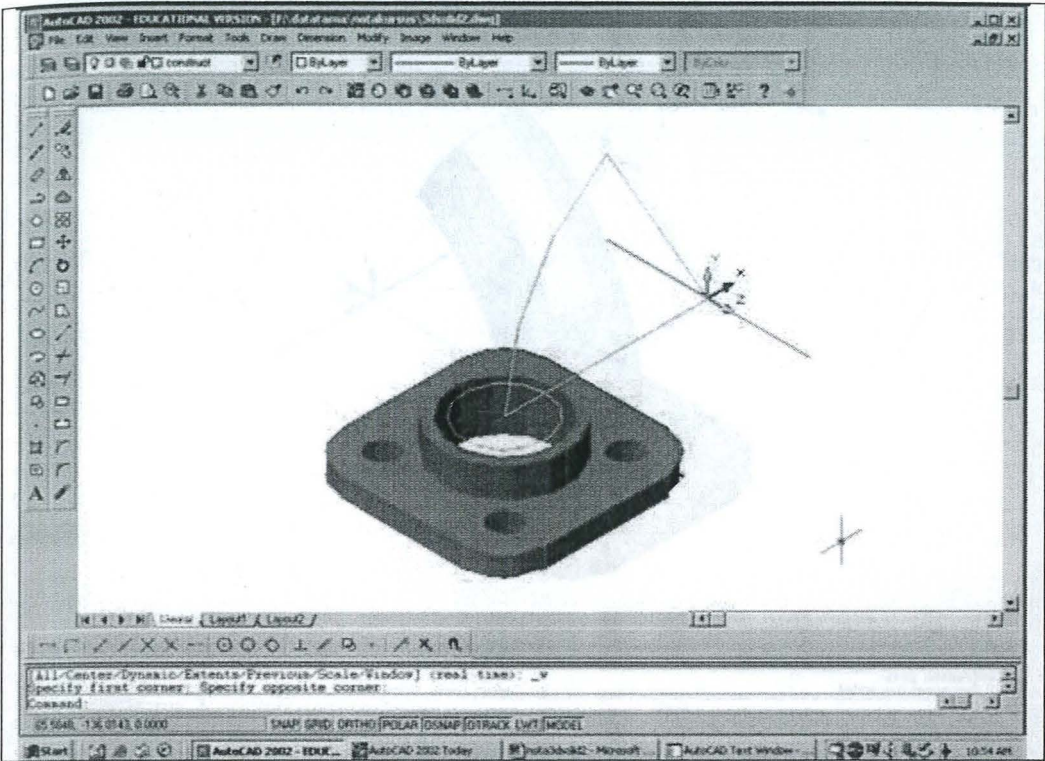
Command: \_circle Specify center point for circle or [3P/2P/Ttr (tan tan radius)]:

Specify radius of circle or [Diameter] <20.0000>: \_endp of

Command: \_erase

Select objects: 1 found



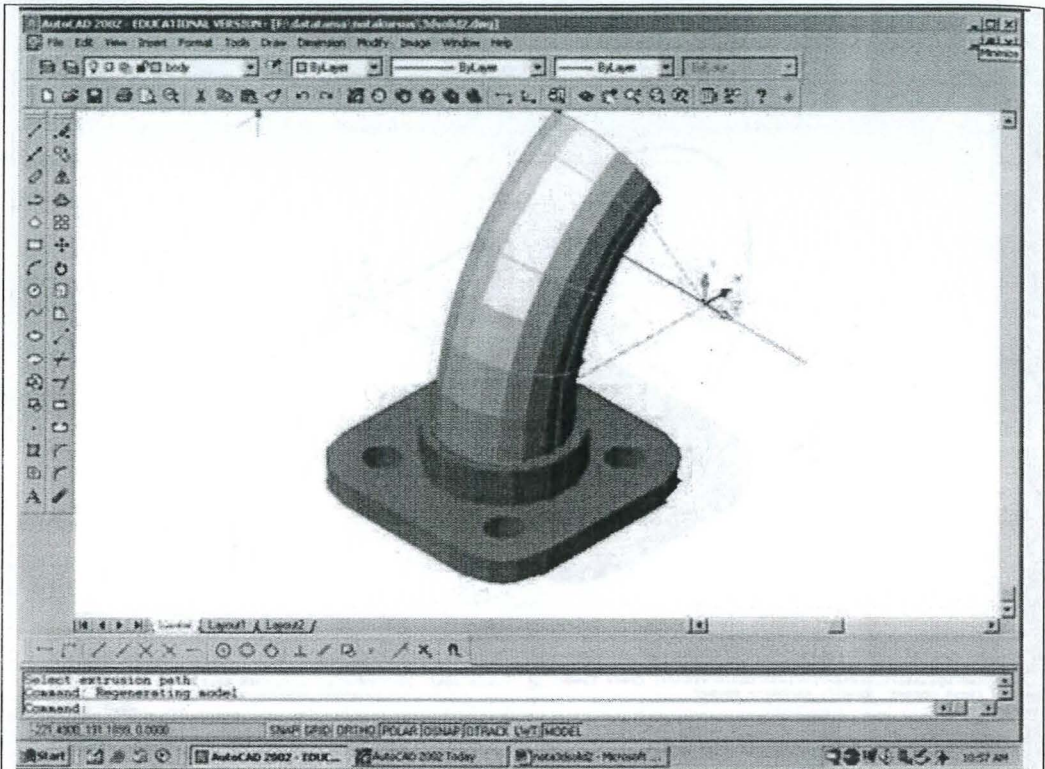


Command: \_line Specify first point:  
Specify next point or [Undo]: @100<120

Command: trim  
Current settings: Projection=UCS, Edge=None  
Select cutting edges ...  
Select objects: 2 found  
Select objects:

Select object to trim or shift-select to extend or [Project/Edge/Undo]:



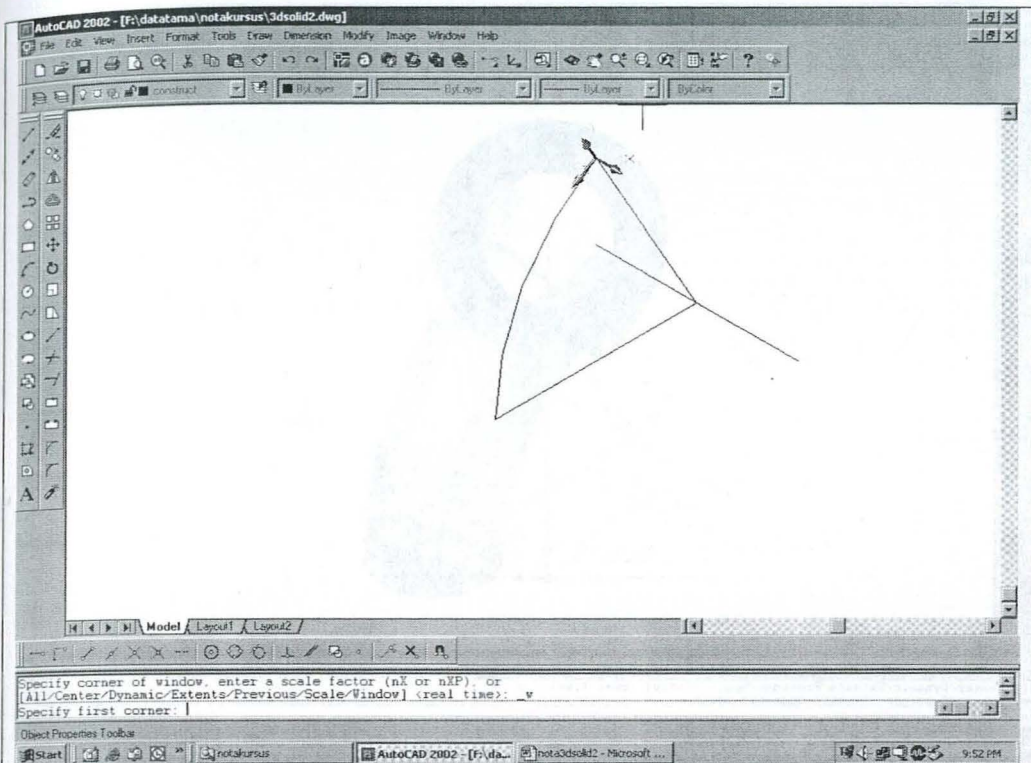


Turn of the base layer  
 Set body as current layer  
 Invoke region command to the body outline.

Invoke subtract command to the body basic shape.  
 Subtract the small circle from the big circle

Invoke extrude command to the body outline.  
 Select the line as extrusion path

Invoke the shade command  
 Regenerating the model

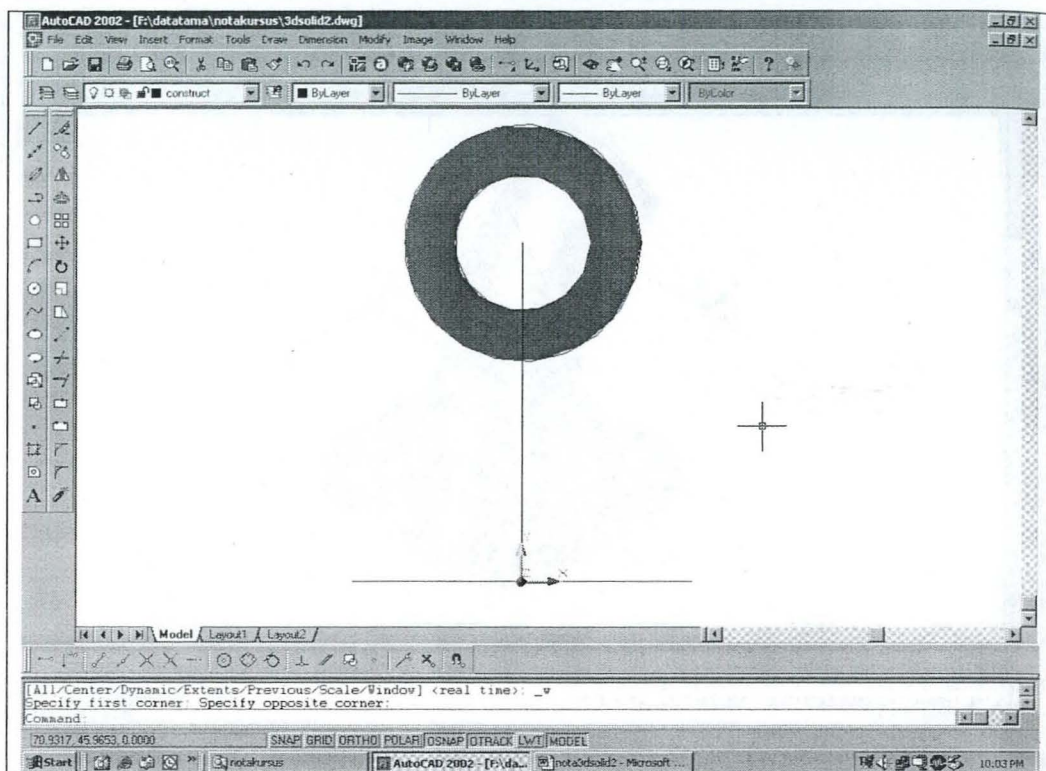


Make construction as current layer and turn off layer body and base.

Rotate the UCS about X axis at the angle of -30

Set the new origin of the UCS at the position shown

Rotate the UCS about Y axis at the angle of 90



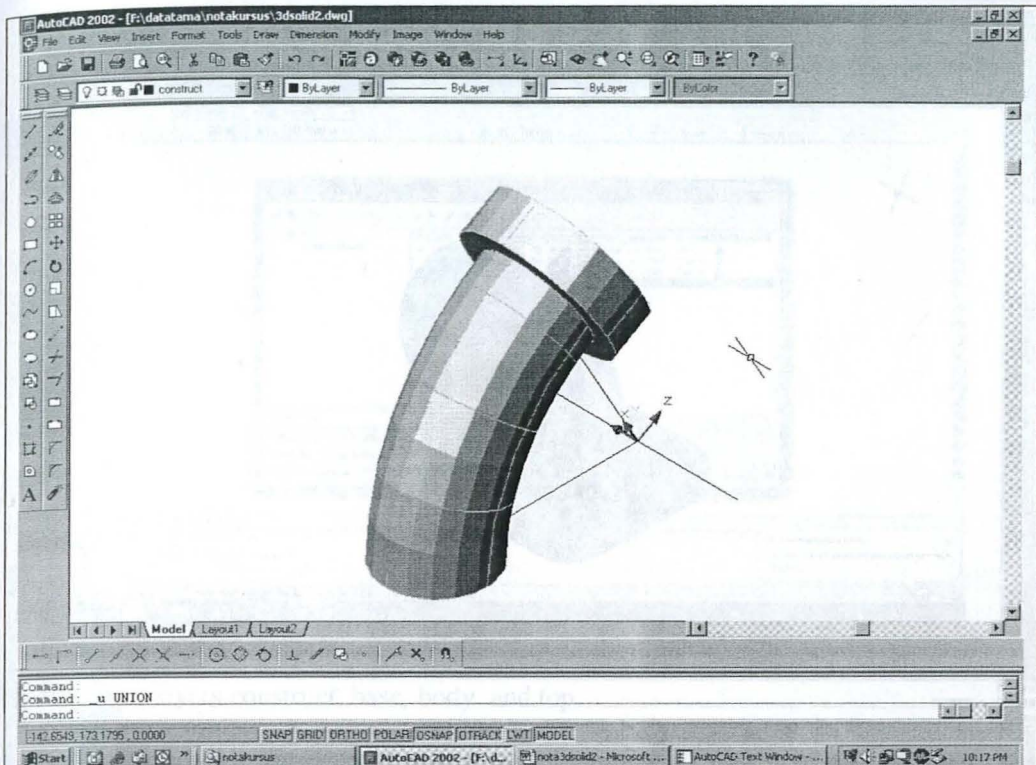
Make construction as current layer and turn off layer body and base  
Invoke the plan view

Draw circle one with radius equal to 20  
Draw circle two with radius equal to 35

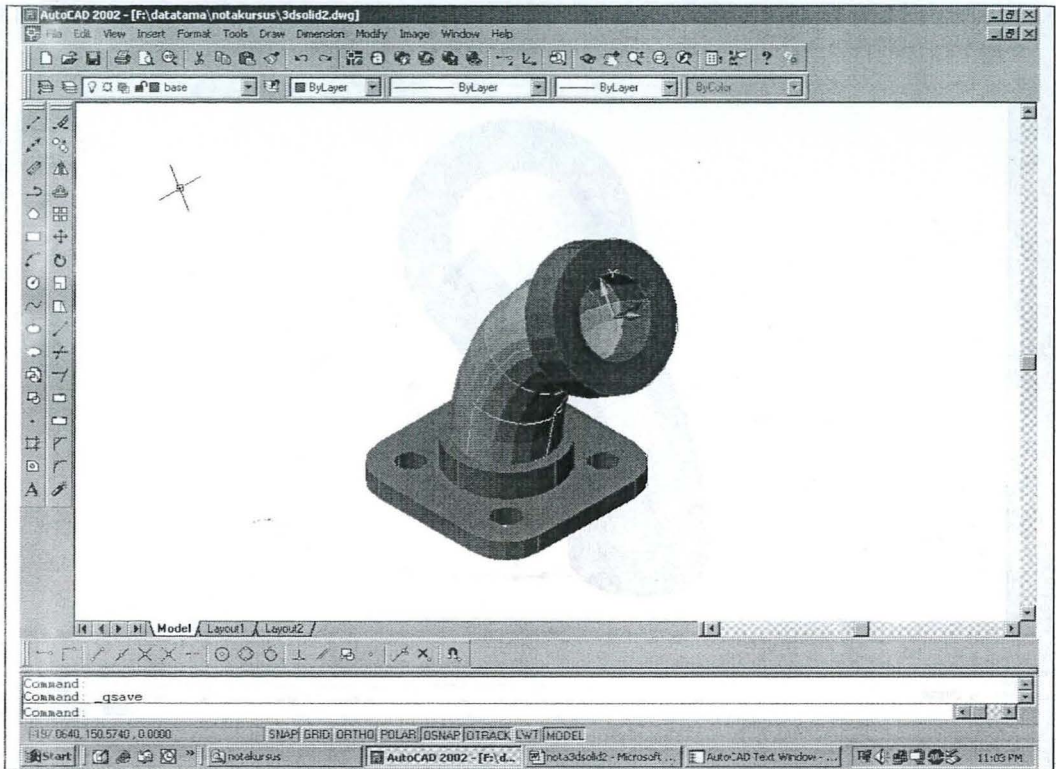
Invoke the region command  
Select both circles  
2 loops extracted.  
2 Regions created.

Invoke the subtract command.  
Subtract the small circle from the large circle.  
Apply shade





Invoke SW isometric view.  
 Extrude the top to the height of 20  
 Change the properties of top to body.



Turn on all the layer except construction

Command: `_view` Enter an option

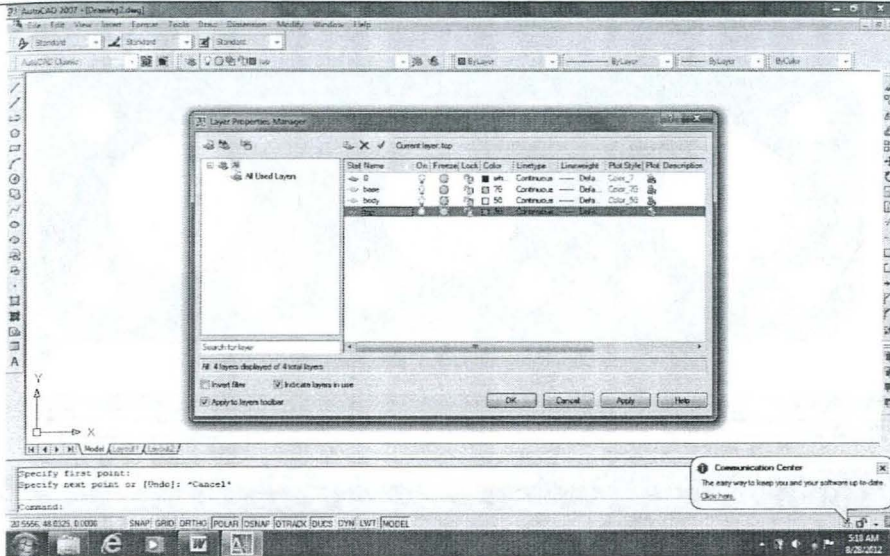
[?/Orthographic/Delete/Restore/Save/Ucs/Window]: `_seiso` Regenerating model.

Command: `_properties`

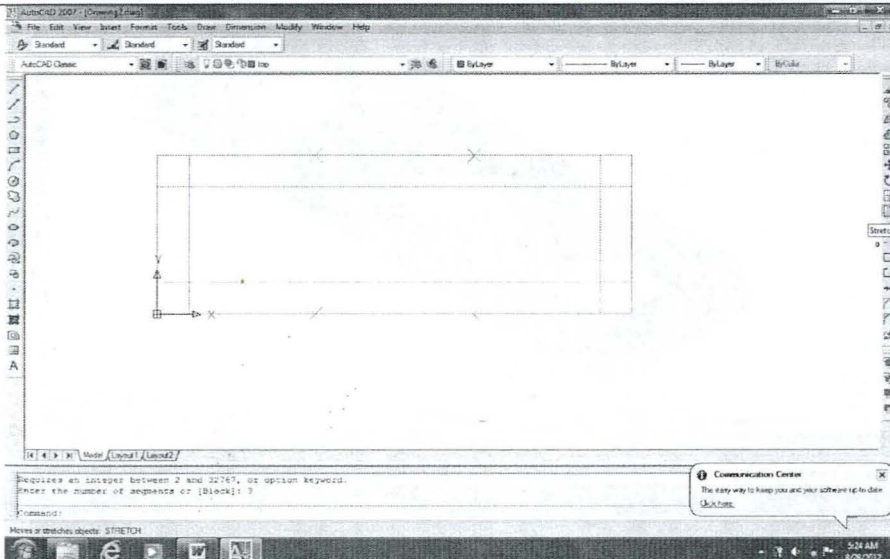
Change layer for top object from body to top

The object is done.

## Reflection 15 – Creating Simple Solid Object – Boolean Command



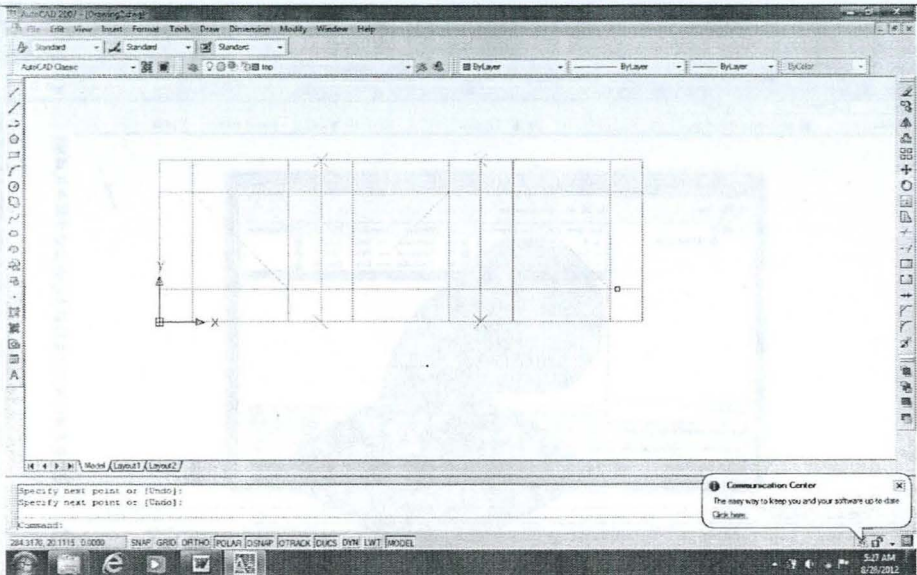
Create four layers construct, base, body and top  
Make construct as a current layer



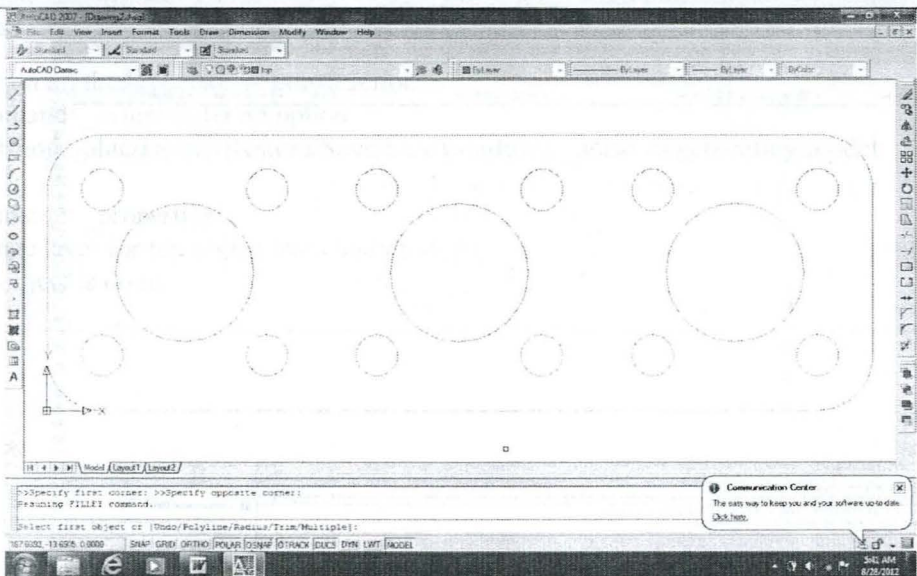
Set base as current layer. Draw the line with the size of 100 by 300  
Divide both line into 3 segments  
Offset each line inward with the size of 20



## FROM NOTHING TO SOMETHING

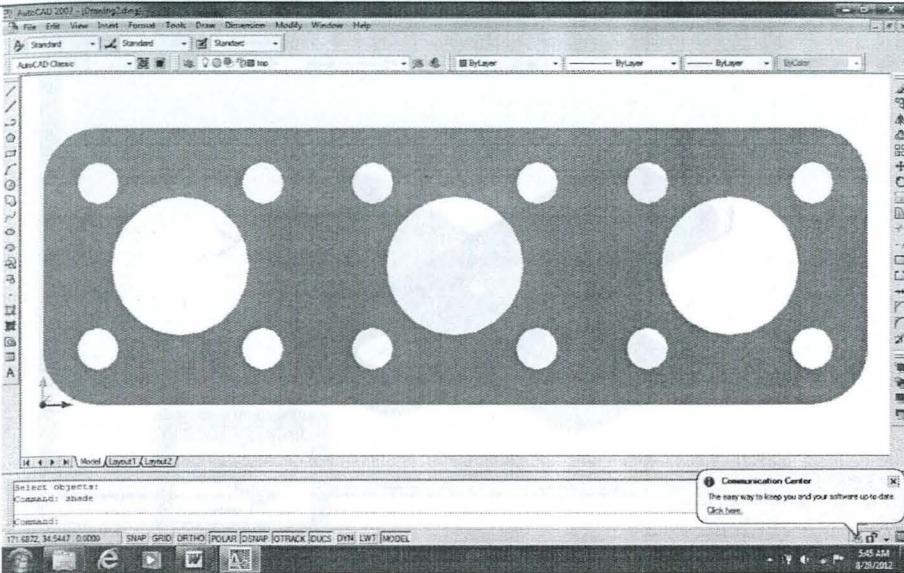


Draw from one node to another node.  
Offset the line inward by 20  
Draw diagonal line

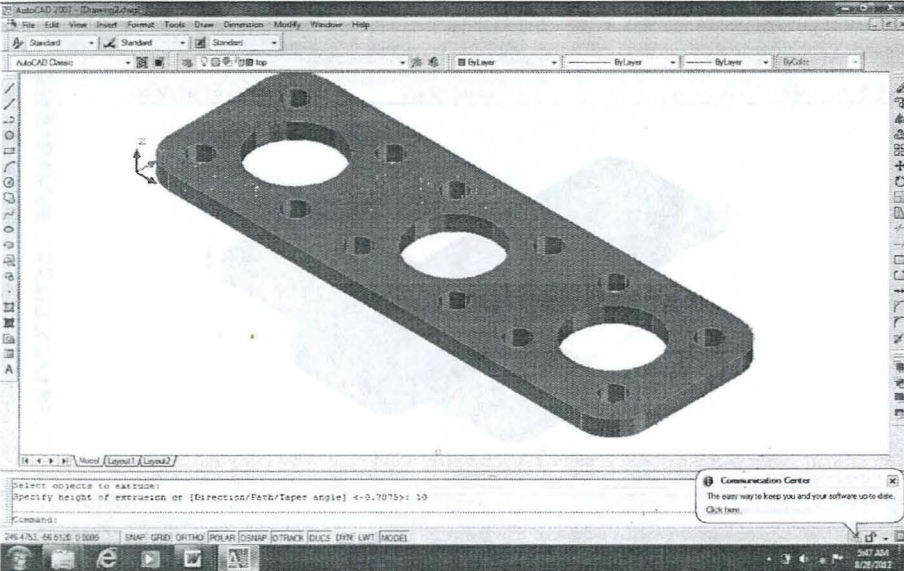


Draw small circle with diameter equal to 15  
Draw three circle with diameter equal to 50  
Fillet the corner with radius equal to 20

## FROM NOTHING TO SOMETHING

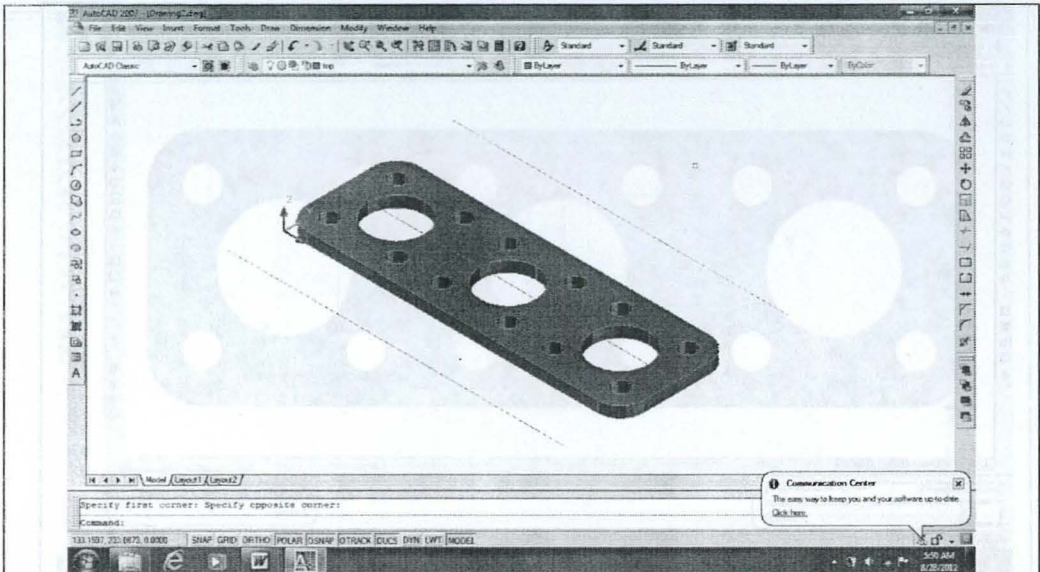


Invoke the region command and subtract the circles from the square.  
Invoke the shade command.

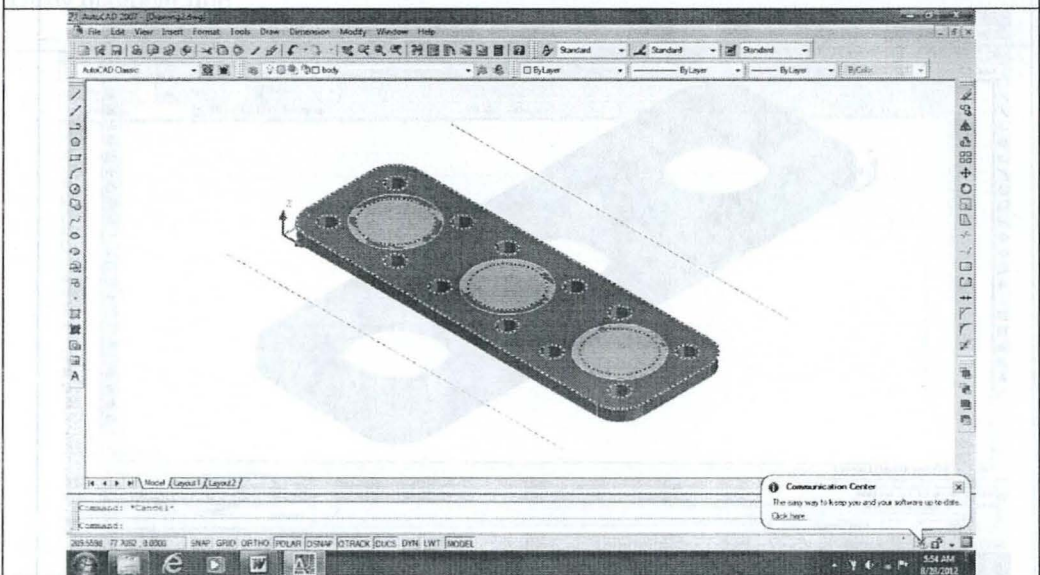


View the object in 3d environment using 3d  
SE isometric view  
Extrude the object to height of 10.



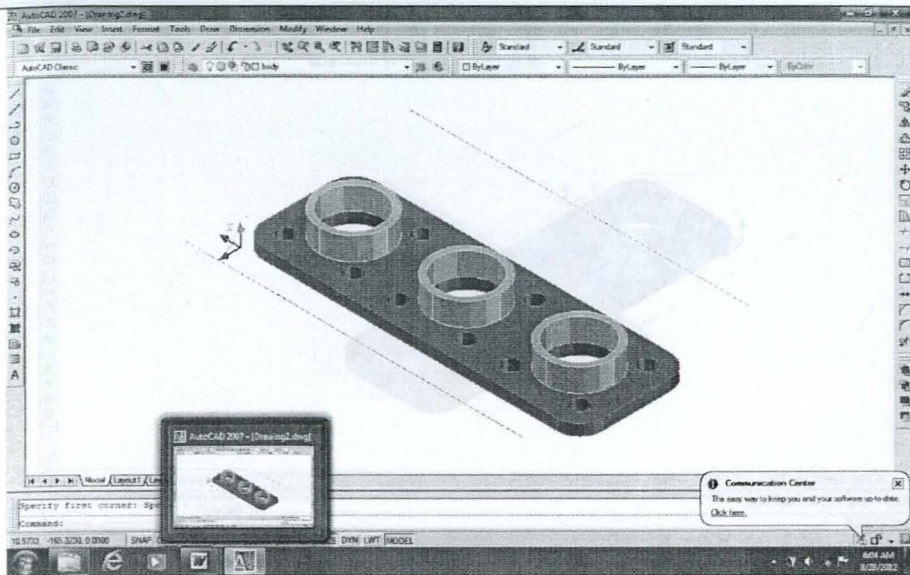


Draw line from the mid of left edge to the mid of right edge.  
Offset the line 100 to the top and the bottom

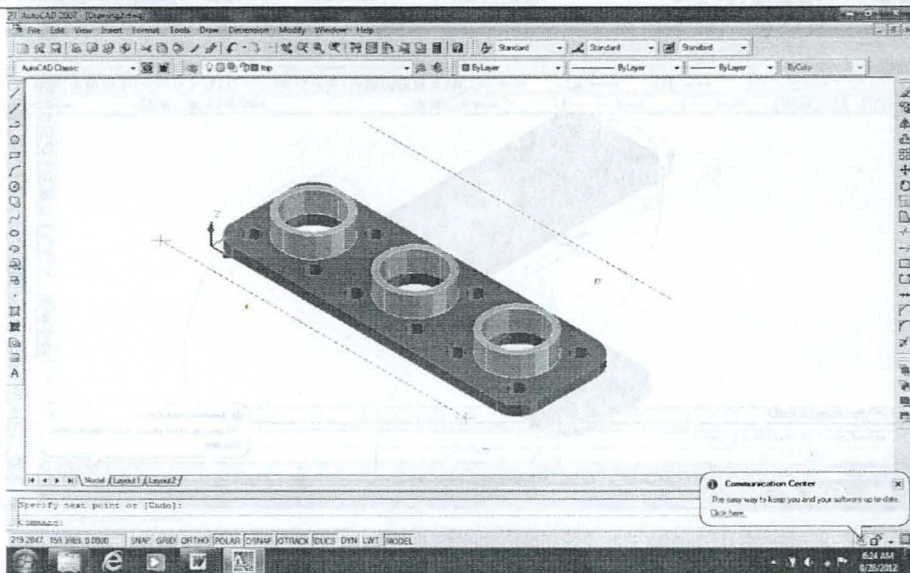


Set body as current layer  
Draw three sets of two circles from center of the larger hole one with the diameter is equal to 50 and the second circle is equal to 60.  
Invoke region command for both circles.

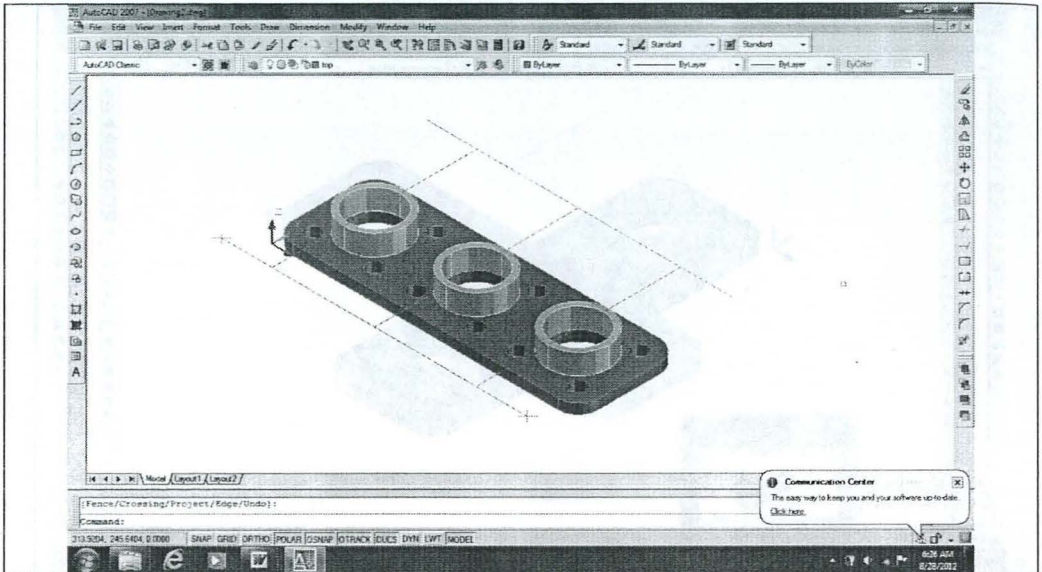




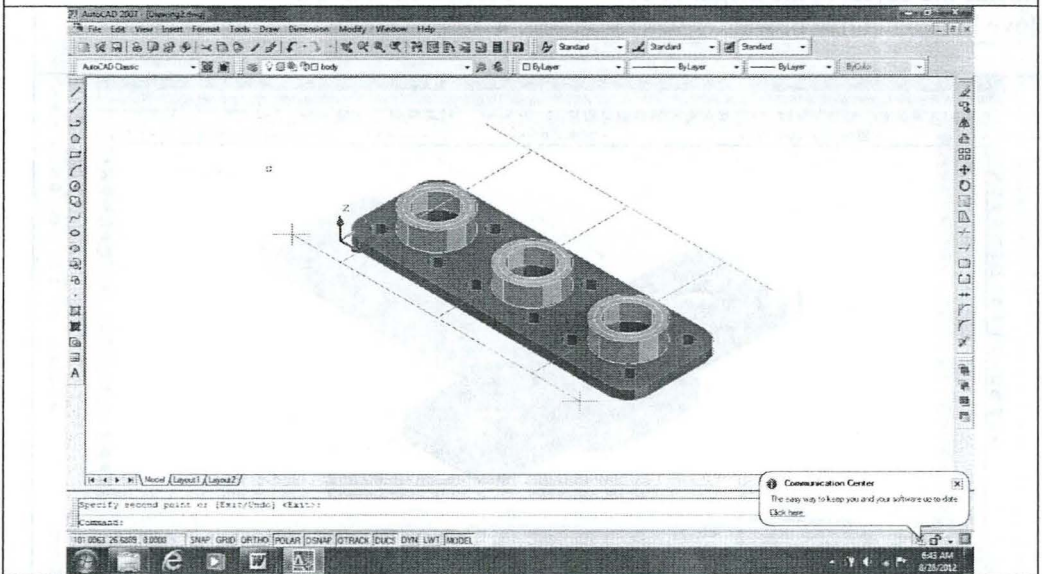
Subtract the smaller circle from the larger circle  
 Extrude the object to the height of 15.  
 Move horizontal line upward @0,0,15



Draw line on top circle



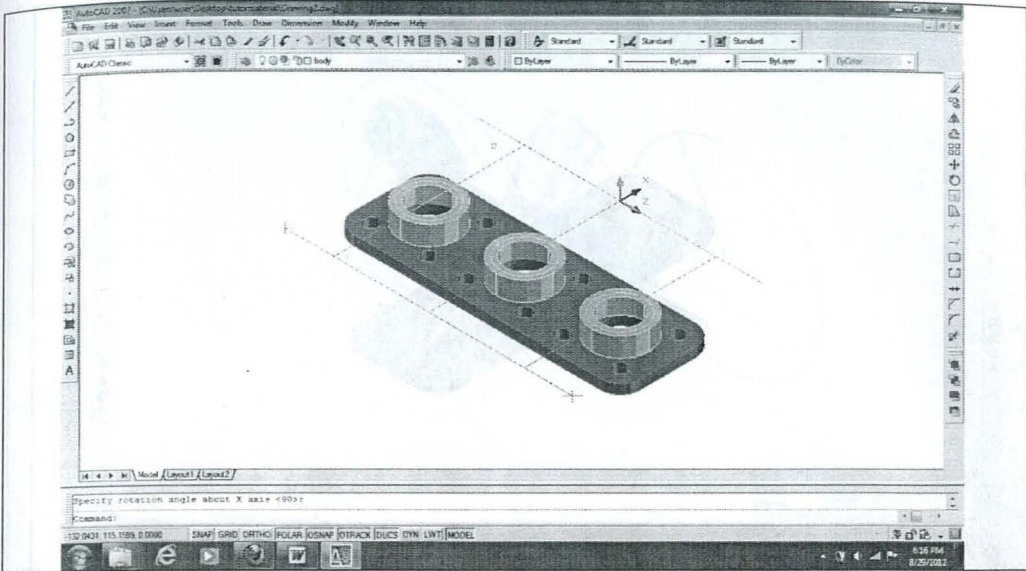
Invoke the extend command to join both horizontal line



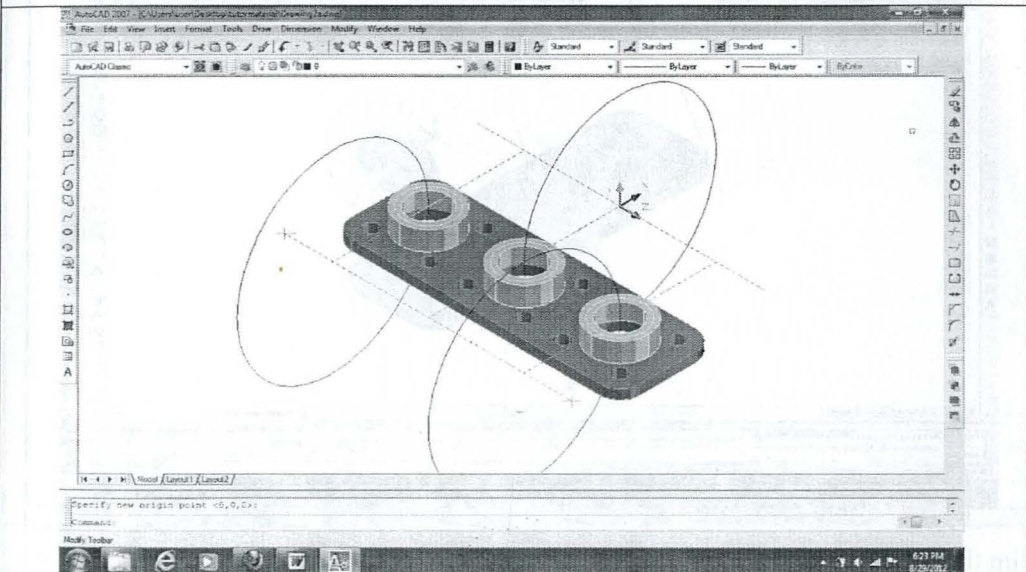
Draw two circle inside the cylinder  
 Circle 1 diameter equal to 40  
 Circle 2 diameter equal to 50



## FROM NOTHING TO SOMETHING



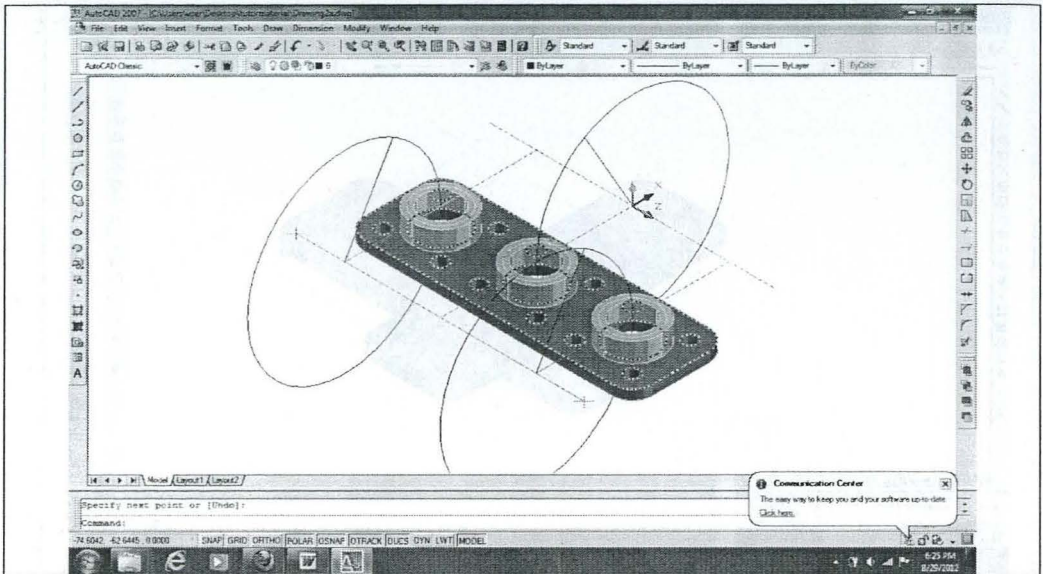
Type UCS and type or. Click outer line intesection at the middle.  
 This move the UCS  
 Type UCS again, type Z, type angle 90. Type UCS again, type X, type angle 90  
 This rotate UCS to face screen



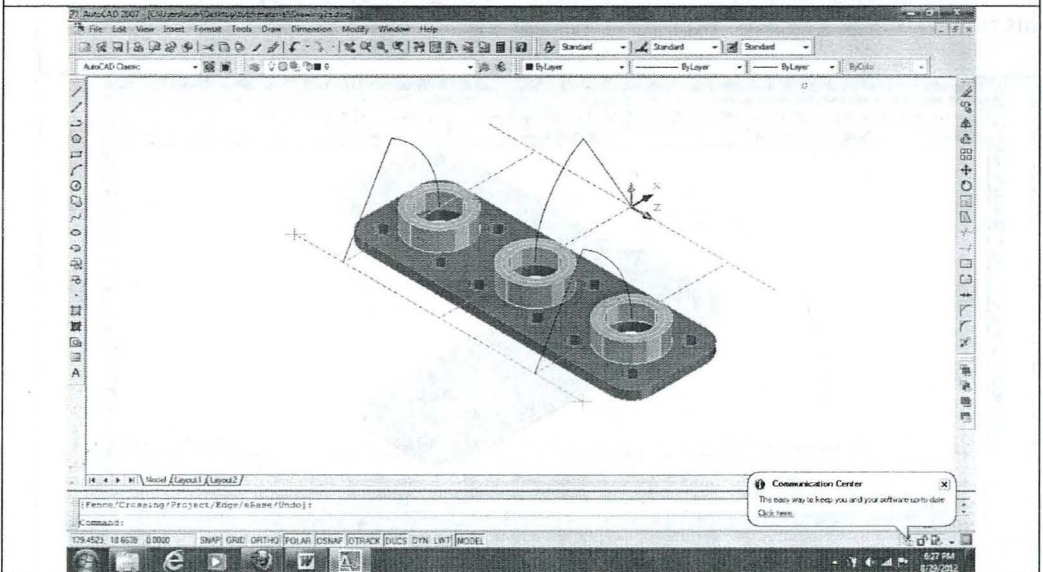
Draw three construction as shown  
 Use int as center and mid of line as radius



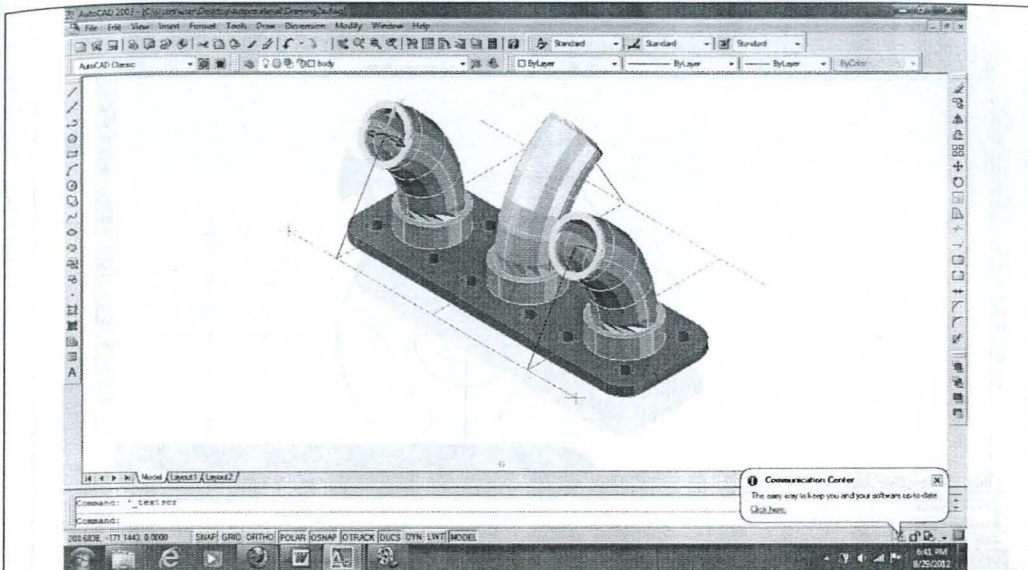
## FROM NOTHING TO SOMETHING



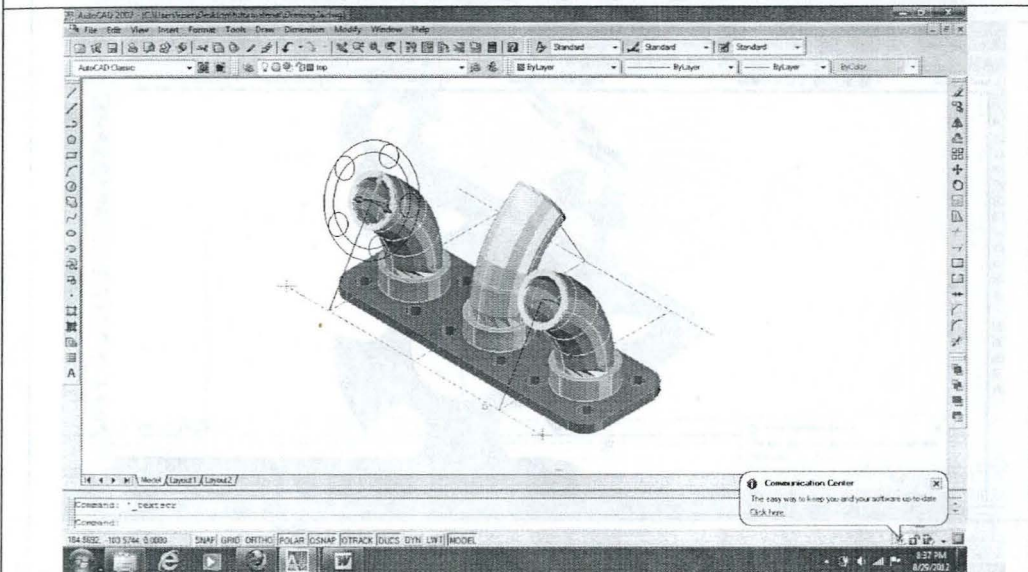
Draw line from center of middle circle @100<120  
Draw line from both circles @100<60



Trim the construction line

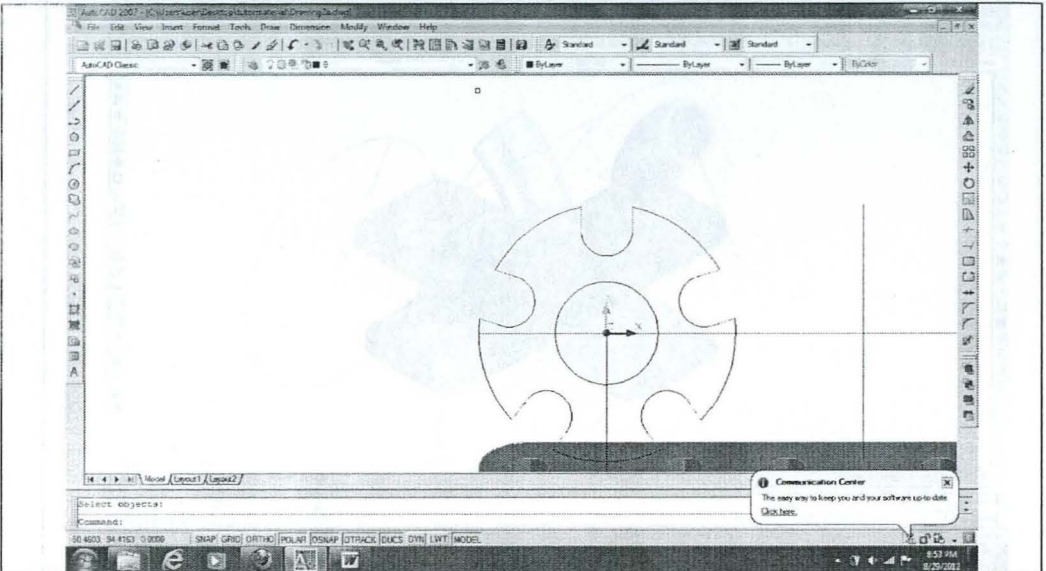


Type UCS and type OR bring the UCS to the mouth of cylinder  
 Type Y, type angle -90. Type X, type angle -30  
 This bring UC parallel to mouth of cylinder

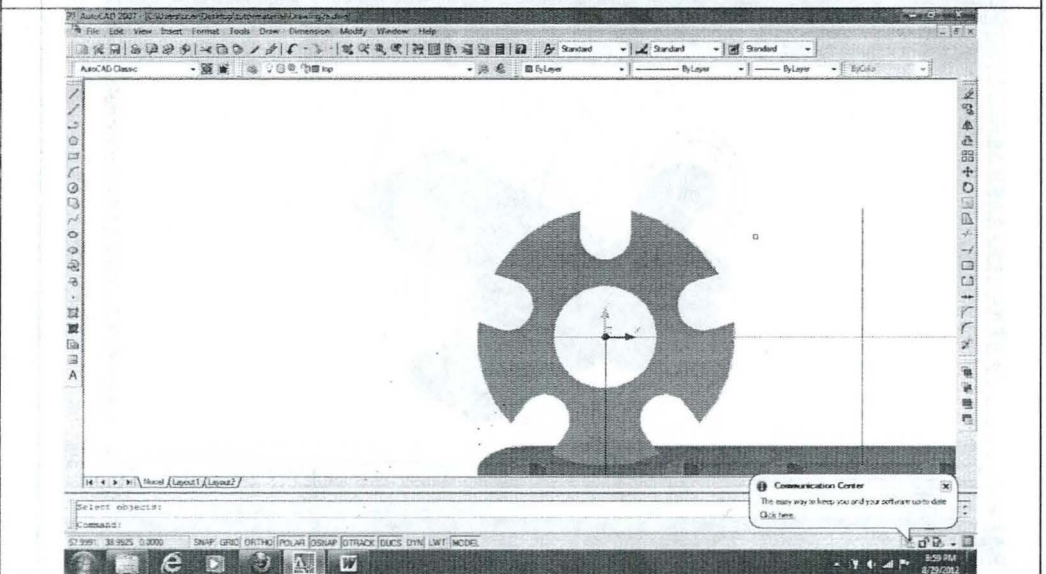


Draw three circles  
 Circle 1 diameter = 50, Circle 2 diameter = 40, Circle 3 diameter = 20  
 Draw small circle from center of circle 2 to edges of larger circle 1  
 Array small circle to 5 units

## FROM NOTHING TO SOMETHING

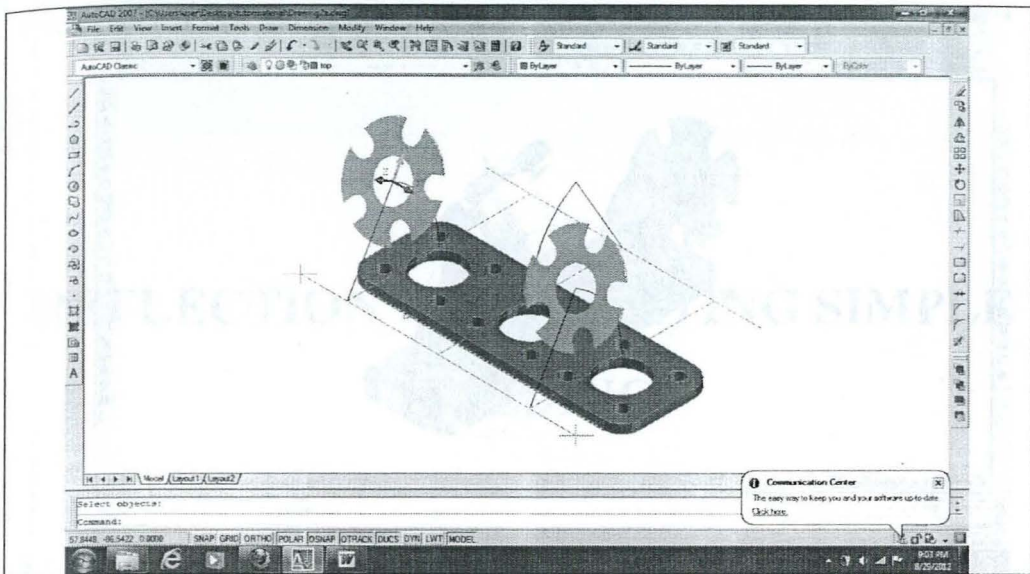


Turn off the body layer  
Set view using plan current UCS  
Trim and erase the interior line

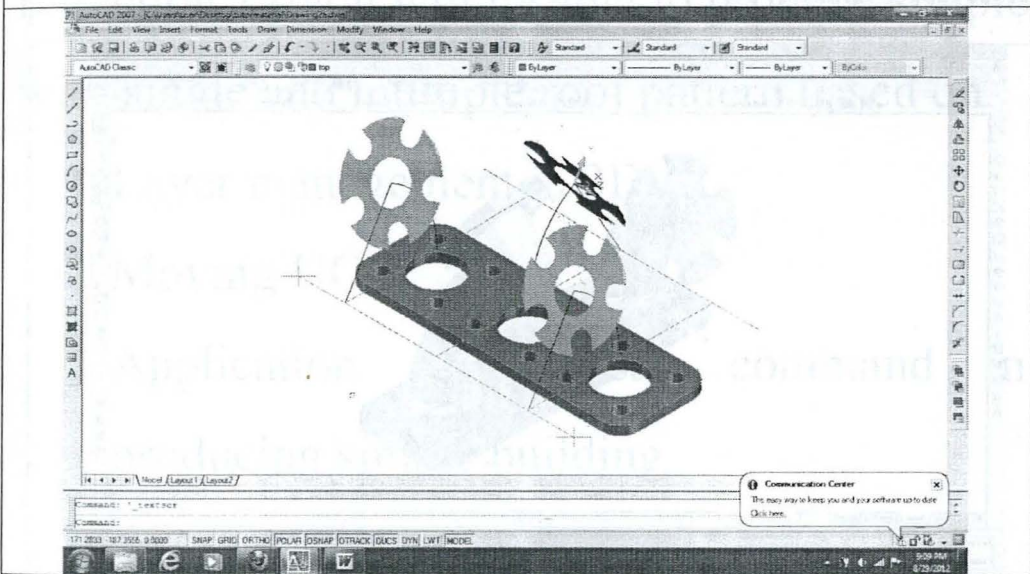


Invoke the region command to create surface  
Subtract small circle from the big circle





Copy one shape and put it on the other cylinder.



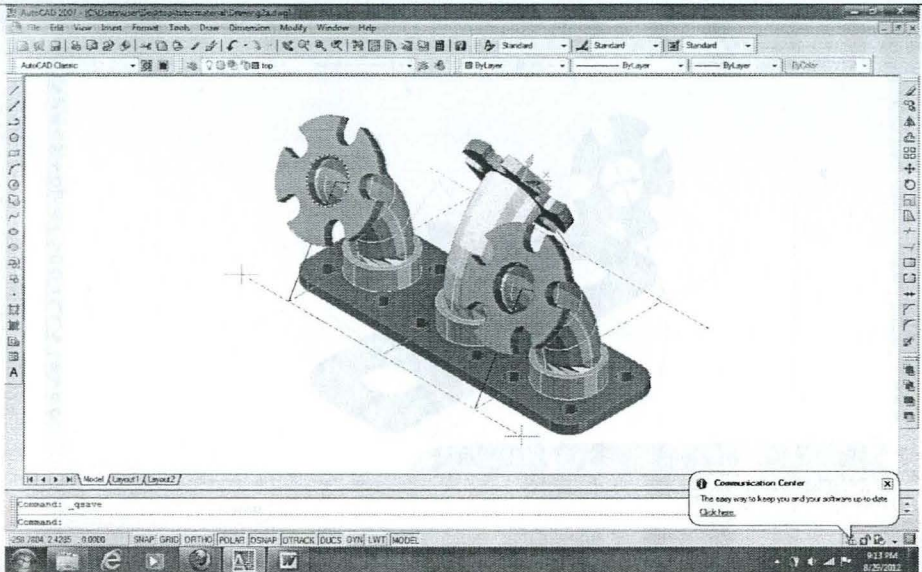
Copy the shape and move it to the other cylinder

Type UCS

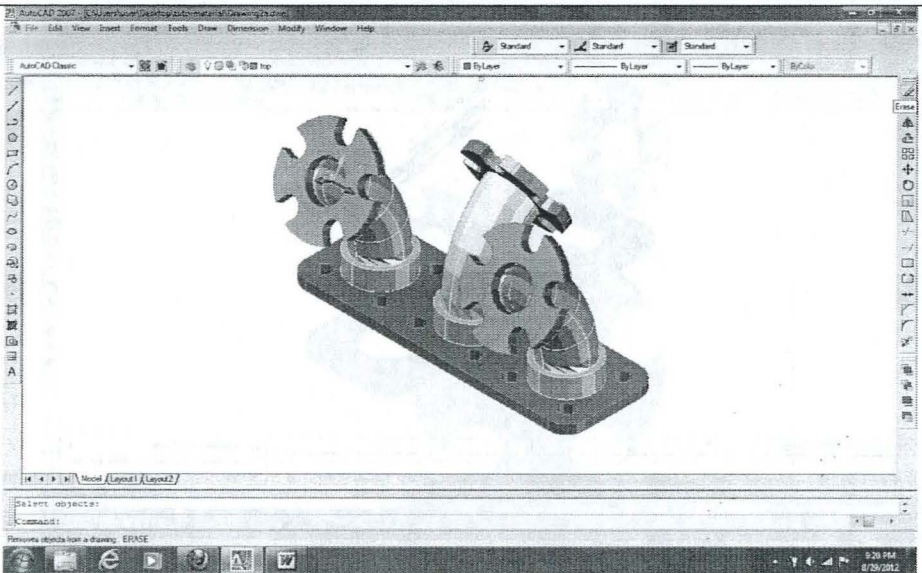
Type Y, rotate 90

Rotate object by 60

## FROM NOTHING TO SOMETHING



Turn on the cylinder layer  
Extrude the top object by 10



Turn off the construction line  
Clear all unnecessary line  
The object is done

CHAPTER FIVE

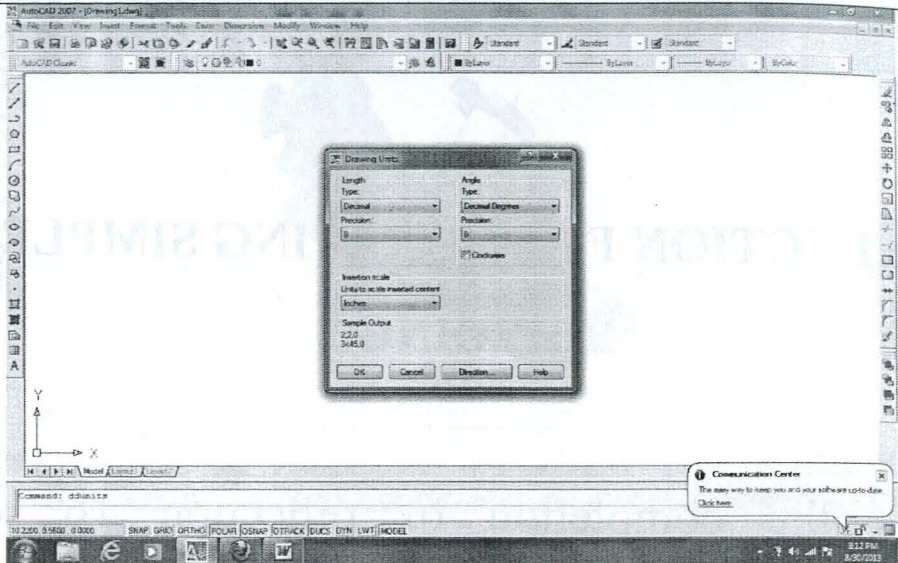
## **REFLECTION FOR CREATING SIMPLE BUILDING**

Upon the completion of reflection 16 to reflection 17 you will be able to produce simple with single and multiple roof pattern based on

1. Layer management in 3D
2. Moving UCS
3. Application of Boolean command in producing simple building

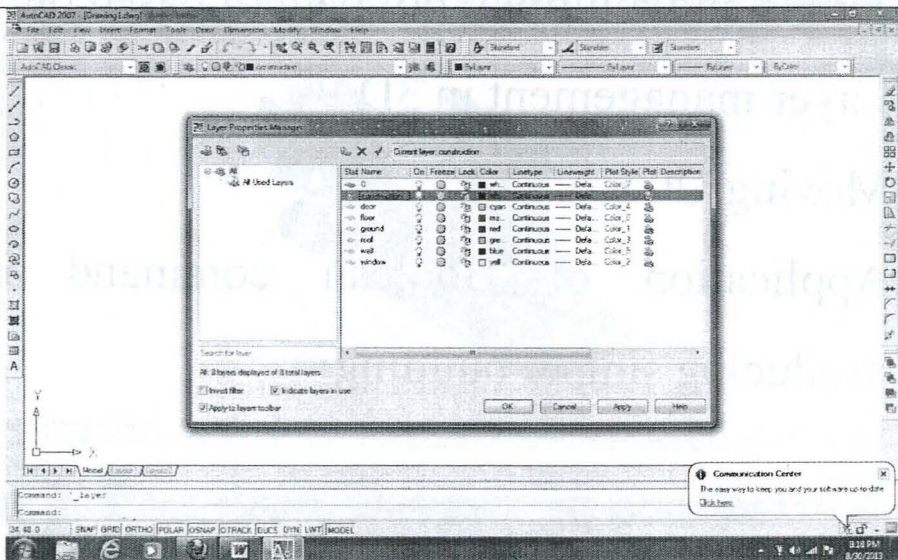


## Reflection 16 – Creating Simple Building



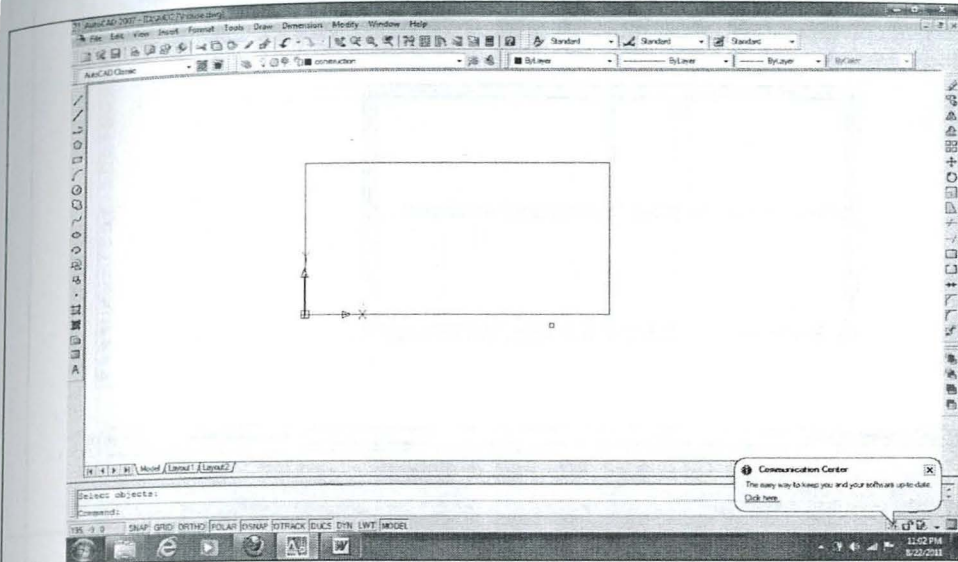
Type ddunits

Command: '\_units. Change the unit from mm to inches. Don't use decimal point

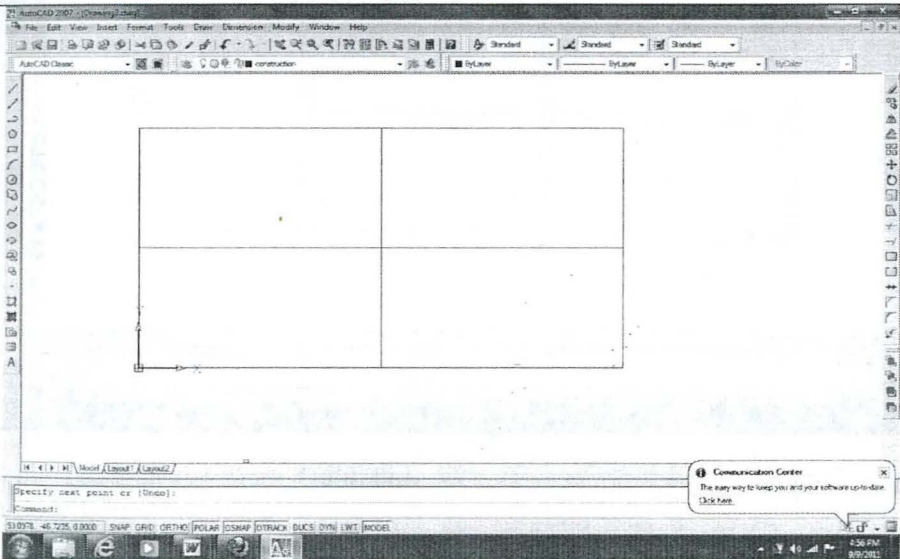


Command: '\_layer

(create 7 layers which are window, floor, door, roof, wall, ground, pediment, corridor and construction)



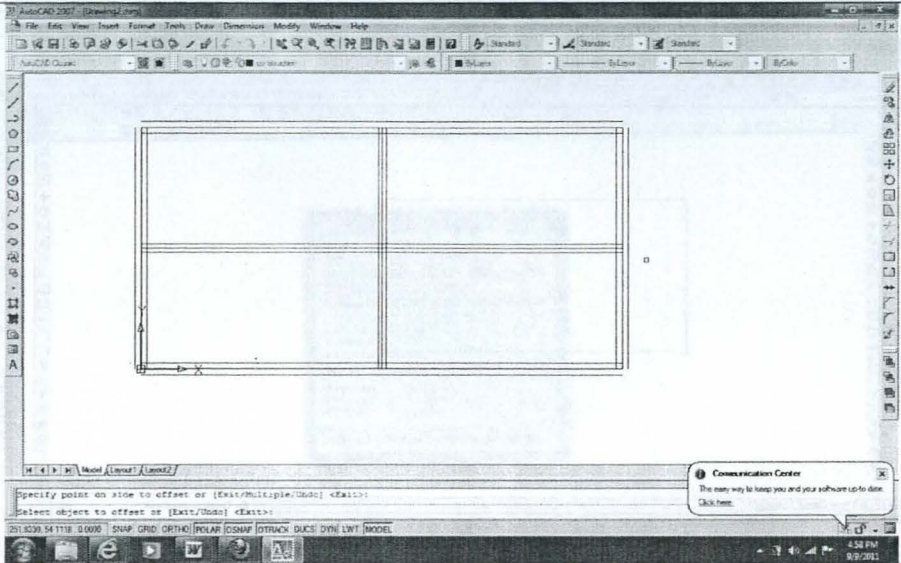
Command: `_line` Specify first point: 0,0  
Specify next point or [Undo]: `@120<90`  
Specify next point or [Undo]: `@240<0`  
Specify next point or [Close/Undo]: `@120<-90`  
Specify next point or [Close/Undo]: `cl`



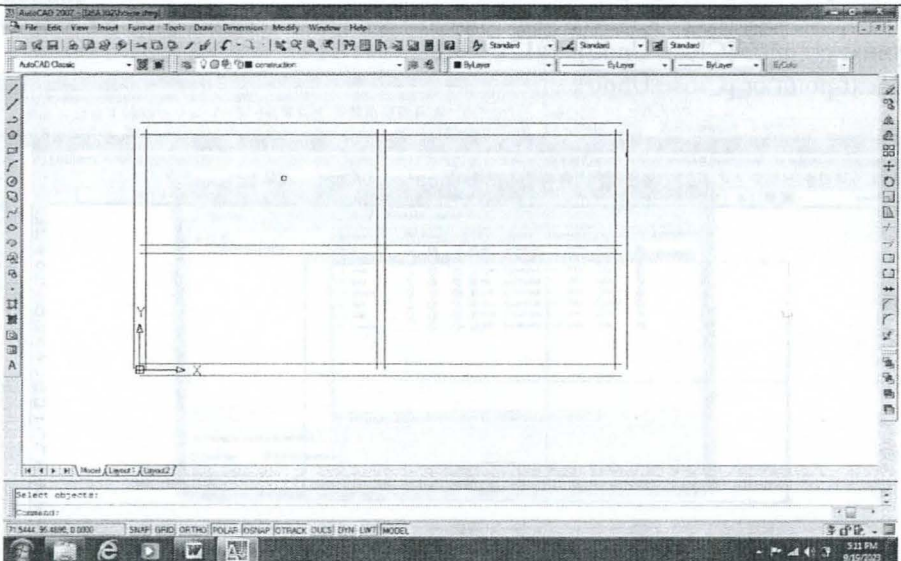
Draw the line from the mid of each line as shown.



## FROM NOTHING TO SOMETHING

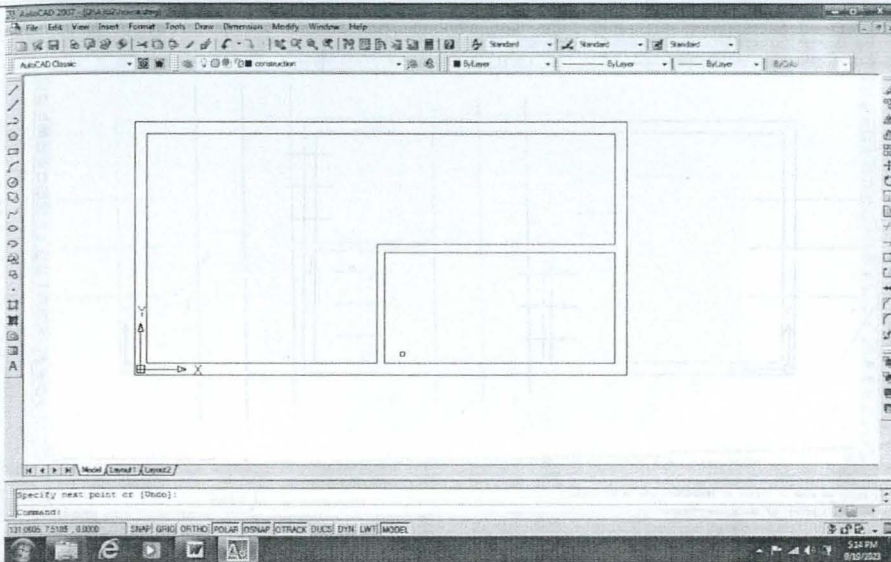


Offset interior line by 2 units at each side.  
Offset exterior line by 3 units at each side

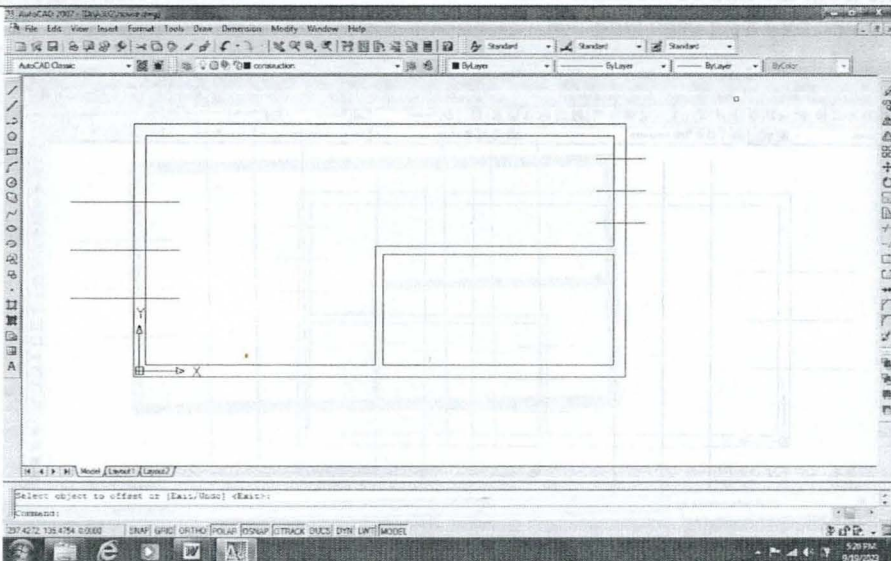


Clear all the middle lines.



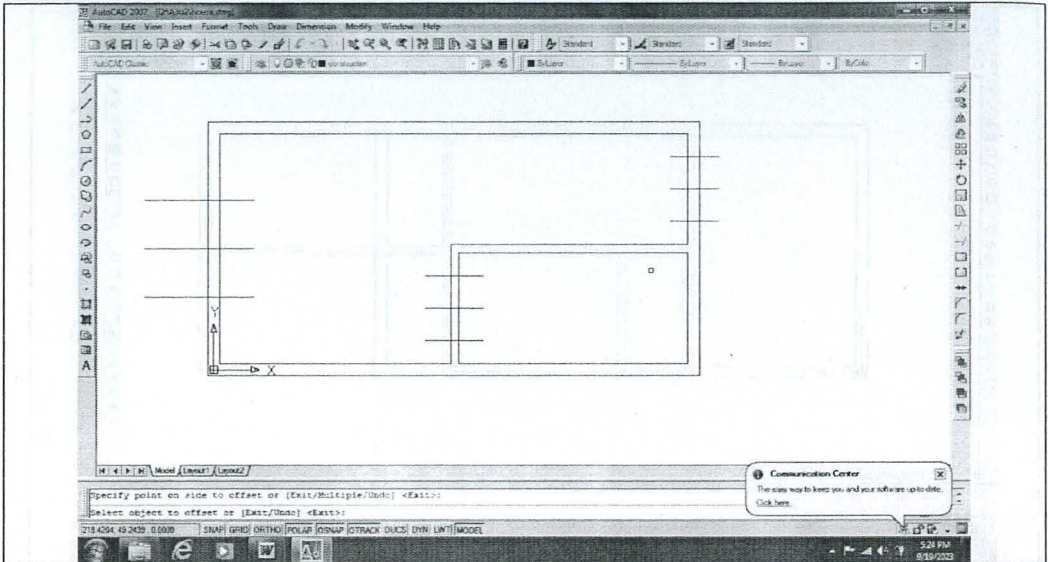


Use fillet to fix the outer lines.  
Use trim and erase to fix the inner lines.



## Creating The Exterior Door Guideline

Outer door 1 draw line from the mid of the inner front line.  
Offset the line by 24 on each side.  
Outer door 2 draw line from the mid of the inner back line.  
Offset the line by 16 on each side

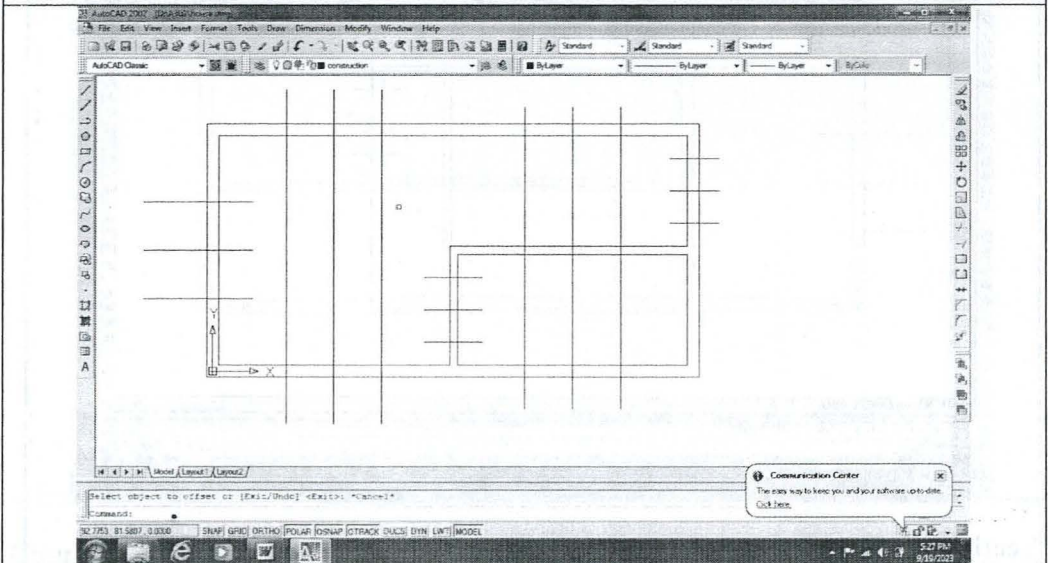


## Creating The Interior Door Guideline

Inner door 1.

Draw line from the mid of the inner line.

Offset the line by 16 on each side.

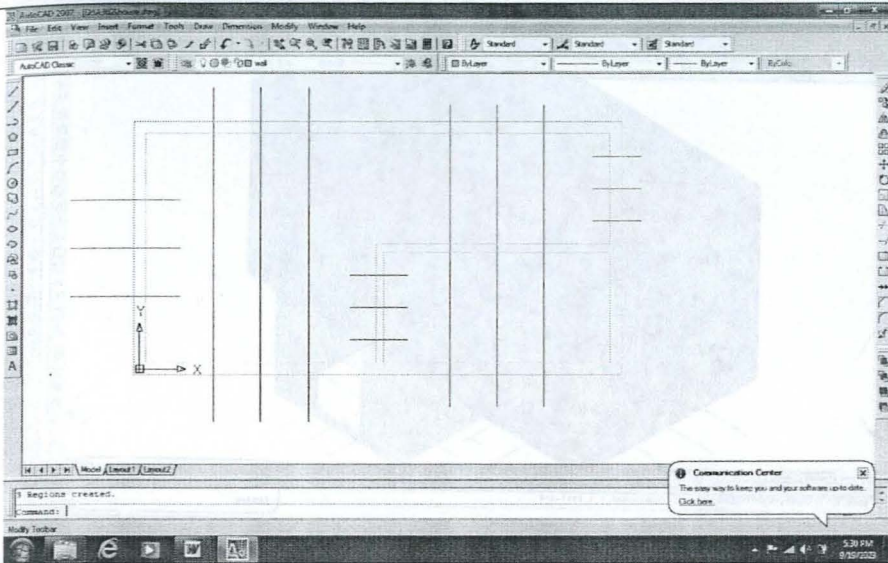


## Creating The Window Guideline

Draw two line from the mid on inner wall from the bottom.

Offset both lines by 24 from each side.

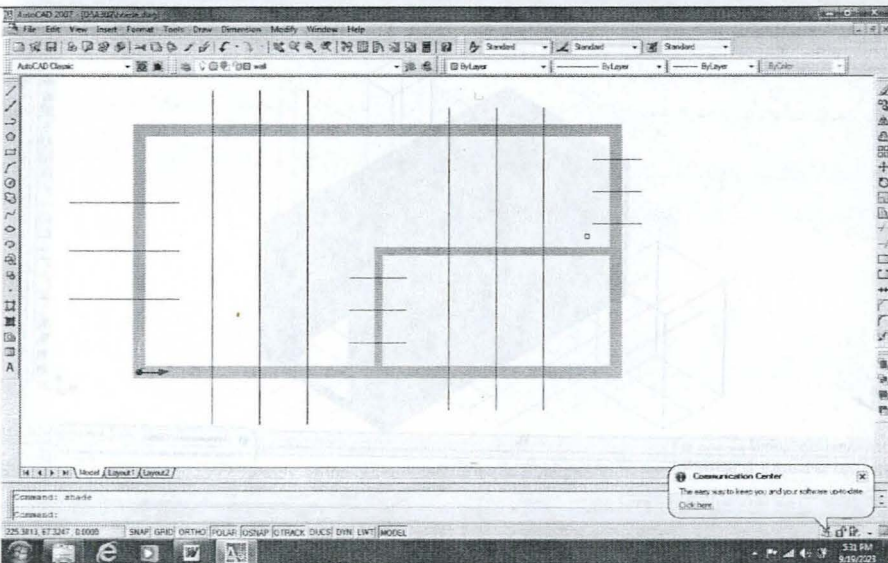




## Creating The Wall

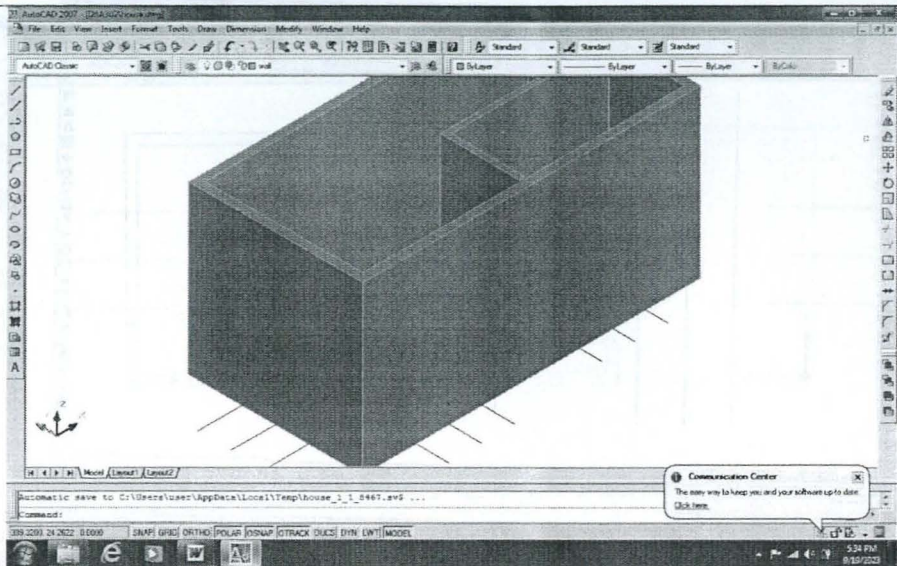
Set wall as current layer.

Invoke region select all lines EXCEPT the window and door guidelines.

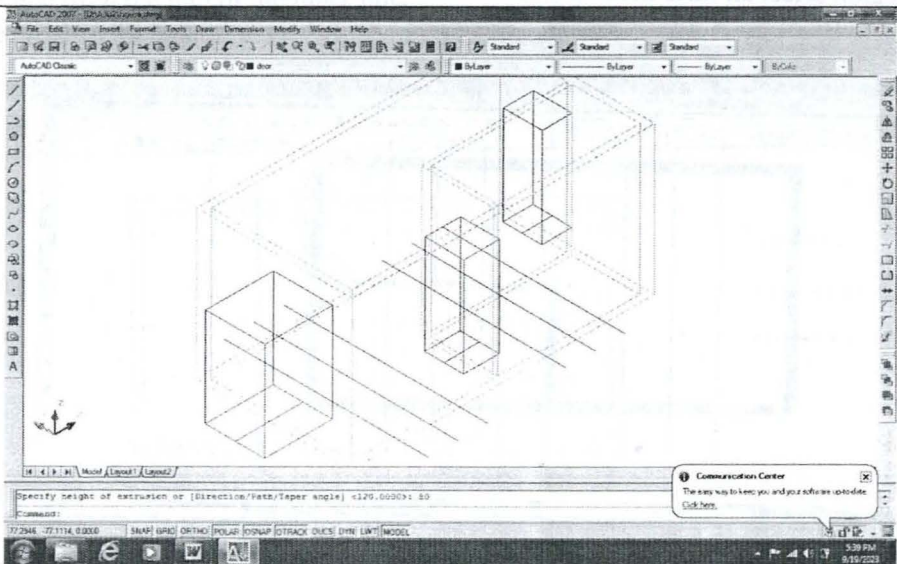


Subtract the inner rectangle from the bigger rectangle.  
Apply shade.



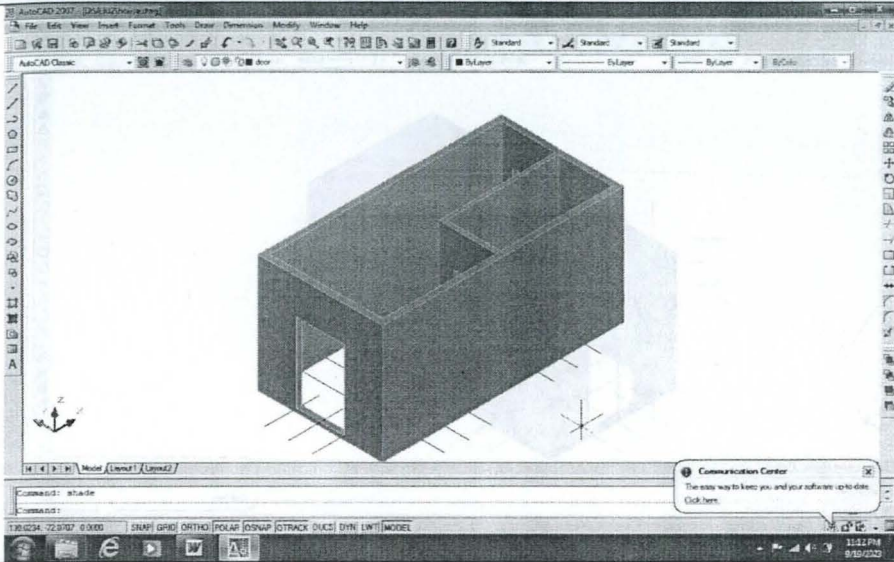


Set the view to SW  
Extrude the wall by 120

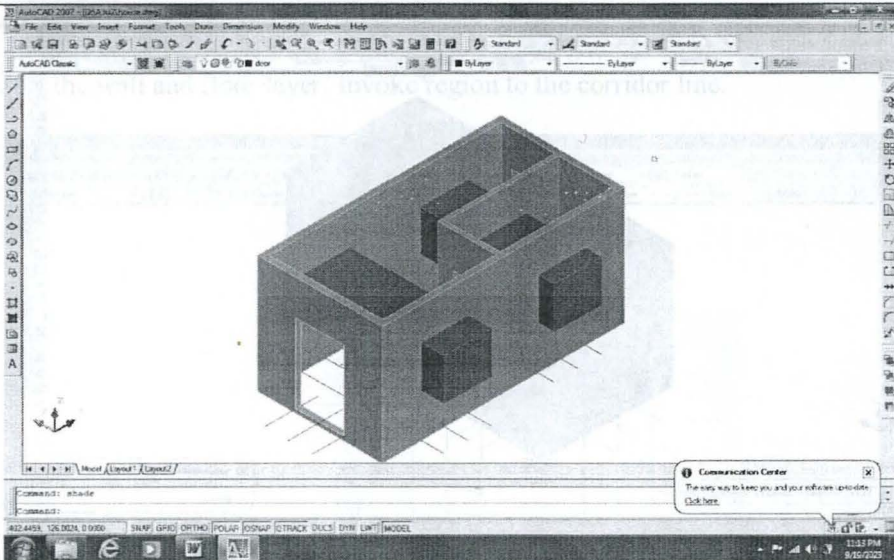


### Creating The Door Holes

Set the door layer as current.  
Move the door guidelines upward by @0,0,4.  
Draw rectangle at the door guidelines.  
Extrude the rectangle by 80



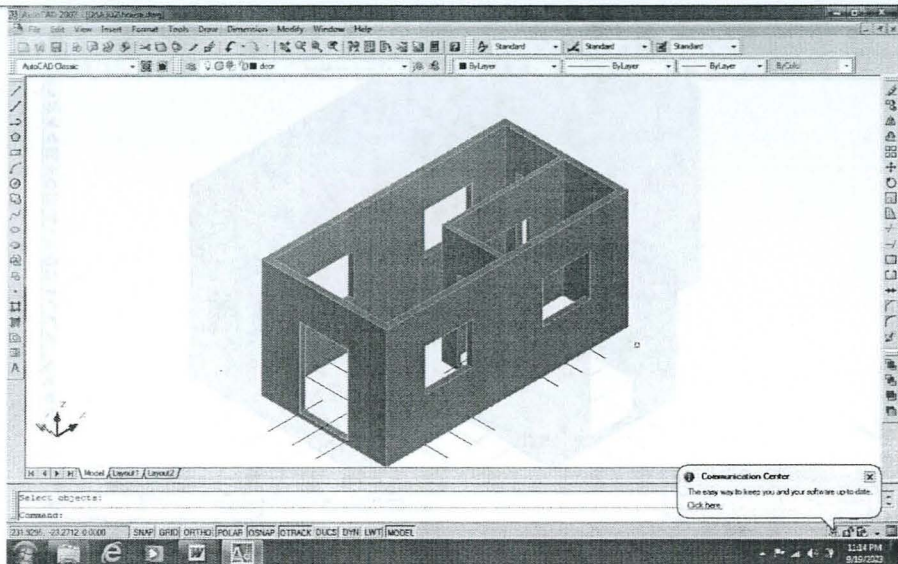
Subtract the door rectangle from the wall rectangle.  
Apply shade.



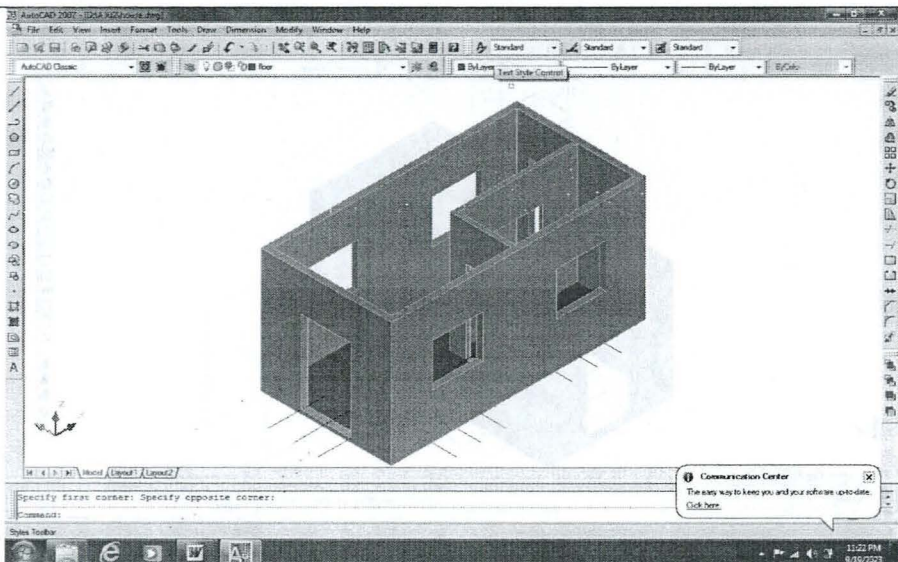
## Creating The Window Holes

Set the window layer as current.  
Move the window guidelines upward by @0, 0, 44.  
Draw rectangle at the window guidelines.  
Extrude the rectangle by 42





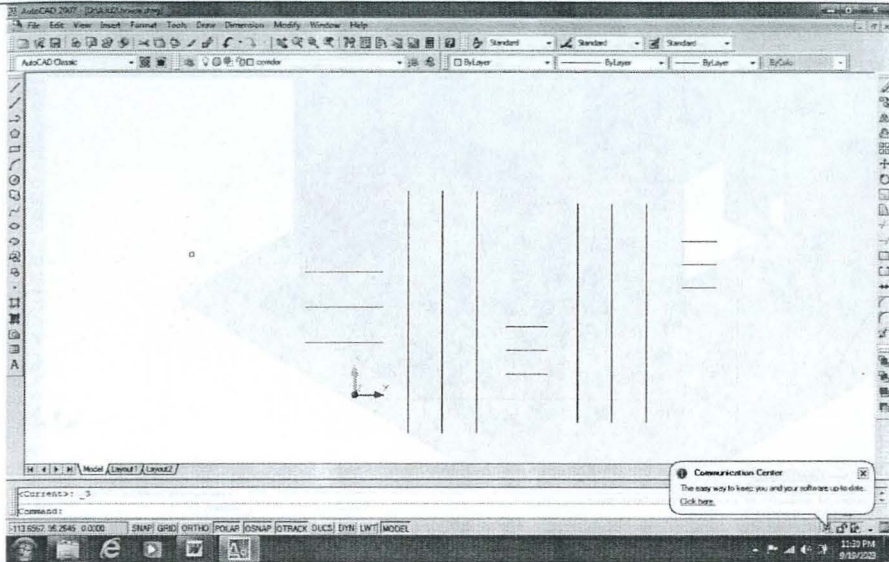
Subtract the window rectangle from the wall rectangle.  
Apply shade.



## Creating The Floor

Set floor as current layer. Set view style as 3d wireframe. Set floor plan view.  
Draw the floor line inside the inner wall. Set view as SW 3D view.  
Turn off the wall layer. Invoke region to the floor line.  
Extrude the floor line by 4. Turn on the wall layer and shade.





## Creating The Corridor

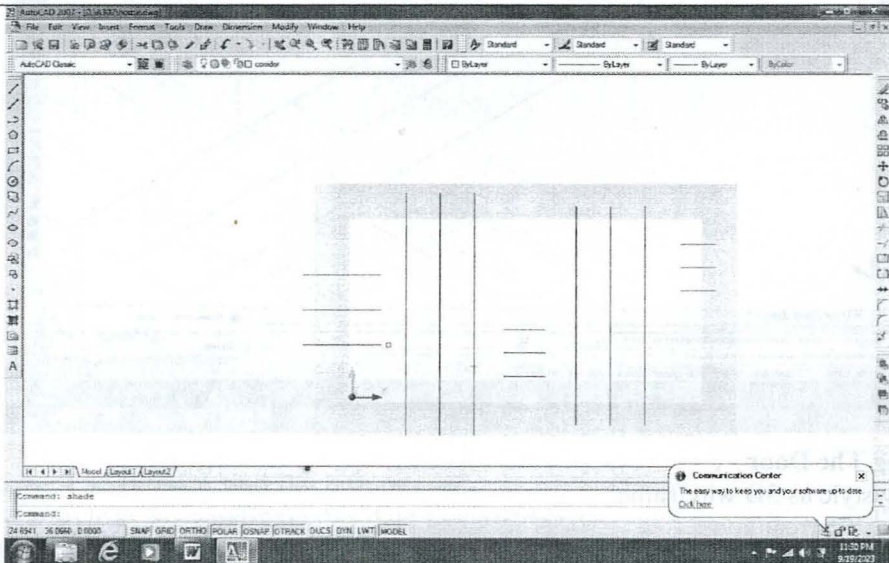
Set corridor as current layer. Set view style as 3d wireframe.

Set floor plan view based on WCS.

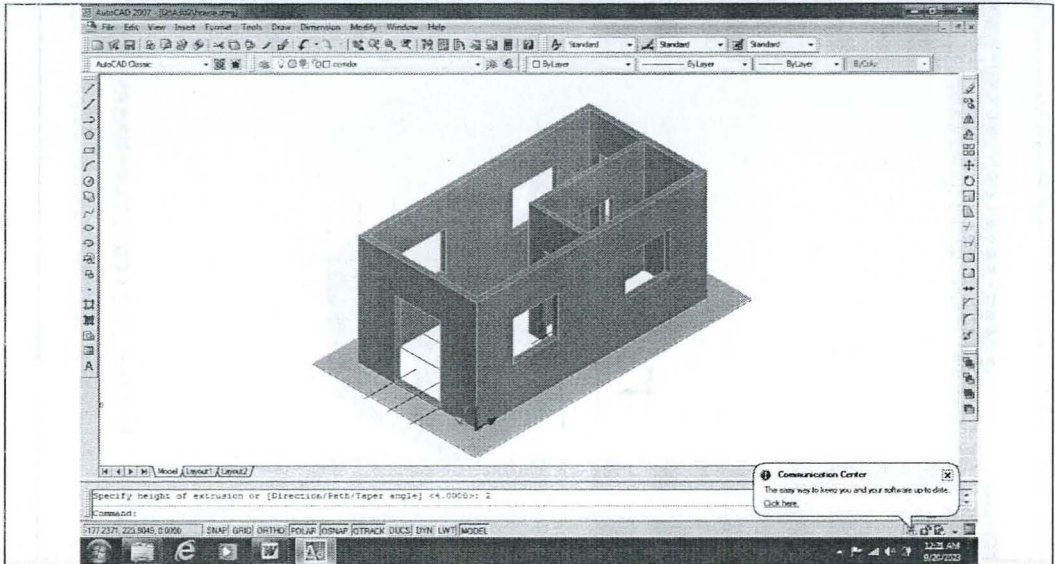
Draw the corridor line outside the outer wall. Offset the line by 24

Join all the corner of the line using fillet. Set view as SW 3D view.

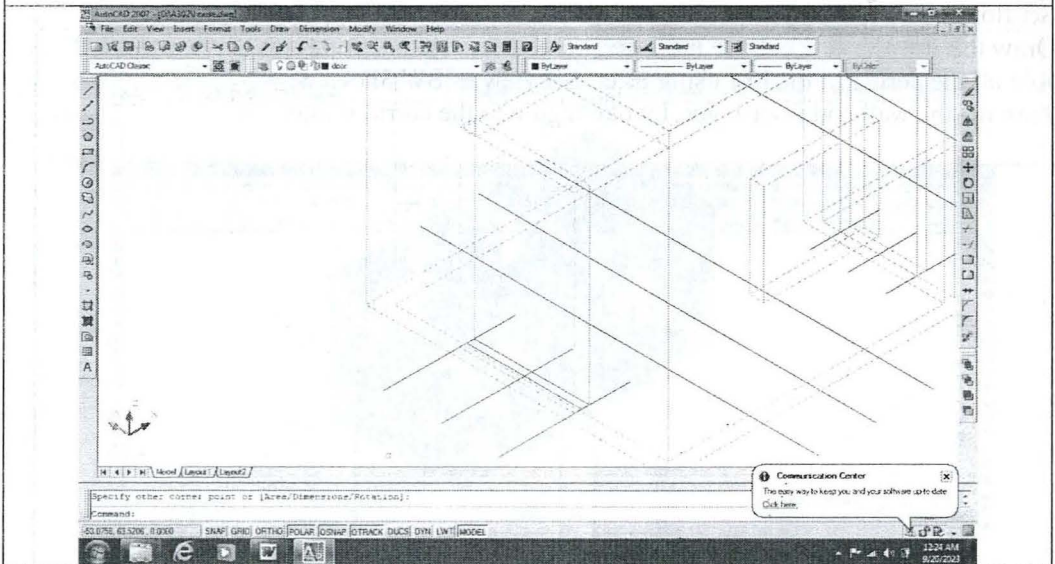
Turn off the wall and floor layer. Invoke region to the corridor line.



Subtract the window rectangle from the wall rectangle. Apply shade.



Extrude the corridor by 2. Set the SW 3D view. Turn on the wall layer.



### Creating The Door

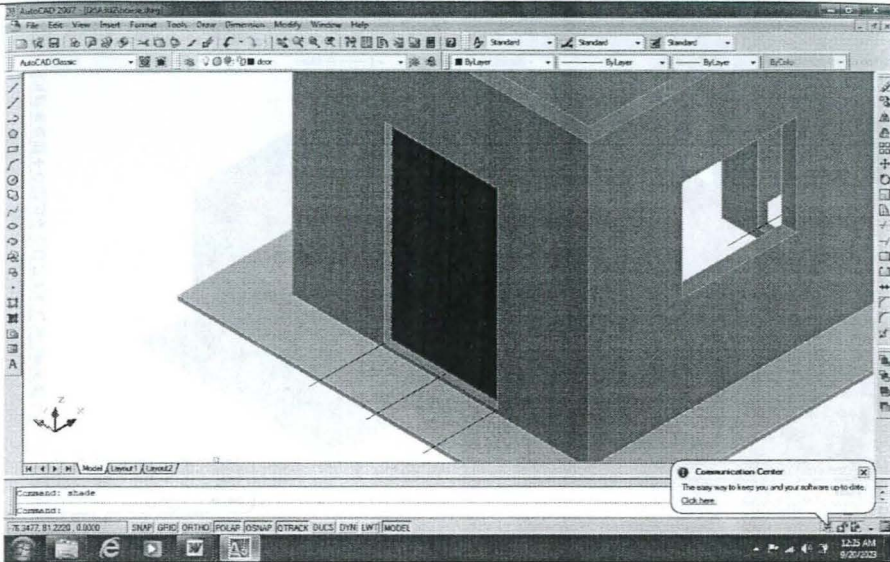
Set view style as 3D wireframe.

Set door as current layer.

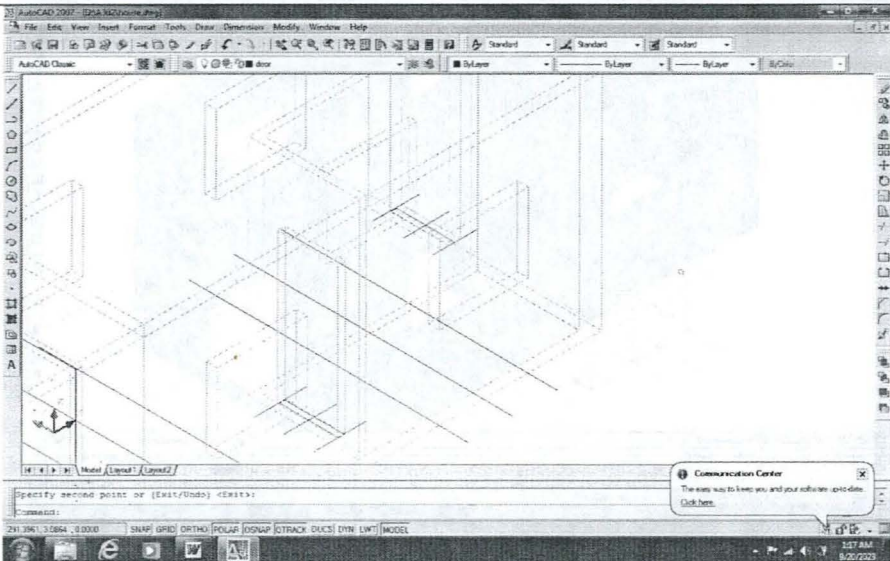
Zoom to the front door first.

Draw rectangle from mid of the door line to the edge of inside door line as shown.





Extrude the rectangle by 80.  
Invoke shade.



## Creating The Interior and Back Door

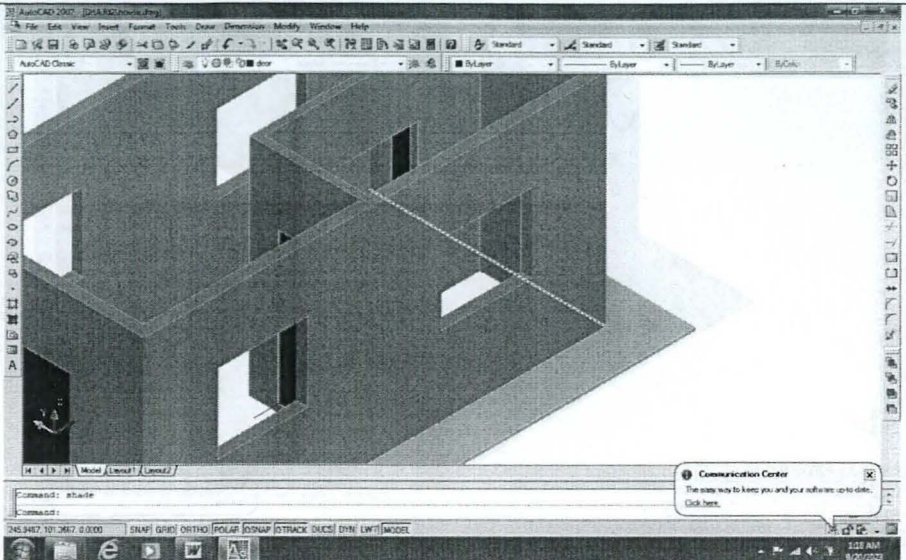
Set view style as 3D wireframe. Set door as current layer.

Zoom to the back door first.

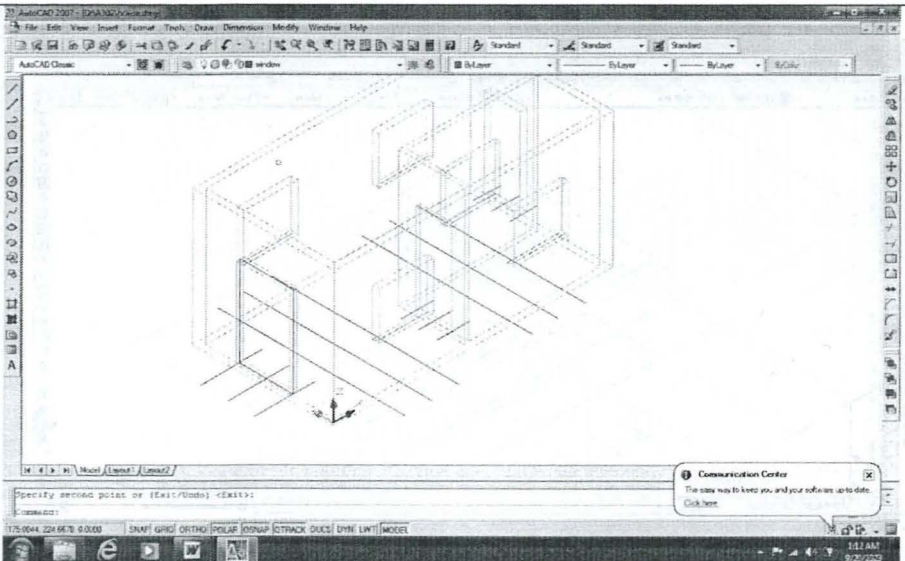
Draw rectangle from mid of the door line to the edge of inside door line as shown.

Copy and paste the door rectangle to the other door hole.





Extrude the rectangle by 80. Invoke shade.



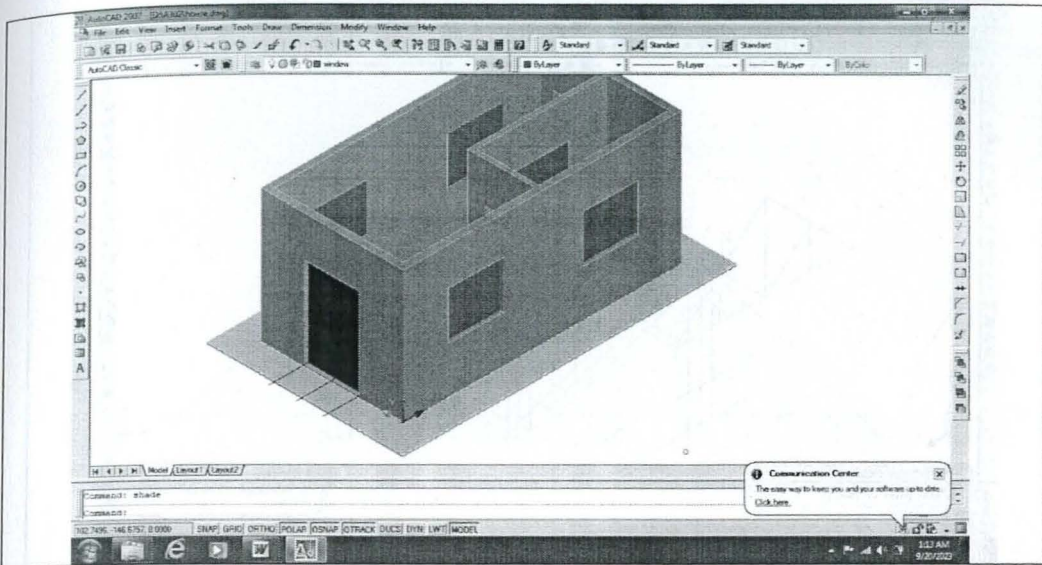
## Creating The Window

Set view style as 3D wireframe. Set window as current layer.

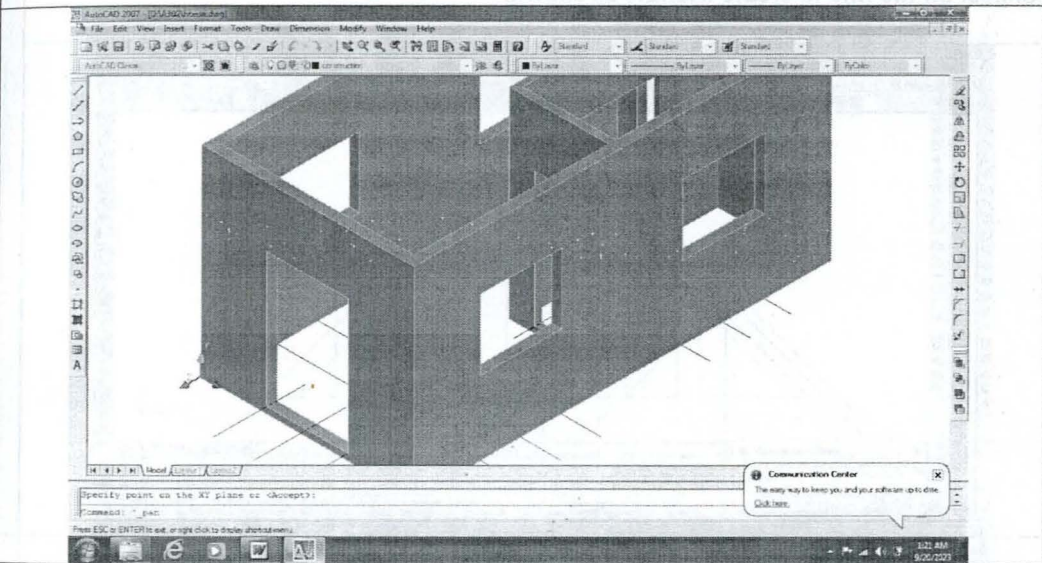
Zoom to the nearest window first.

Draw rectangle from mid of the window line to the edge of inside window line as shown.

Copy and paste the window rectangle to the window hole



Extrude the rectangle by 36. Invoke shade.

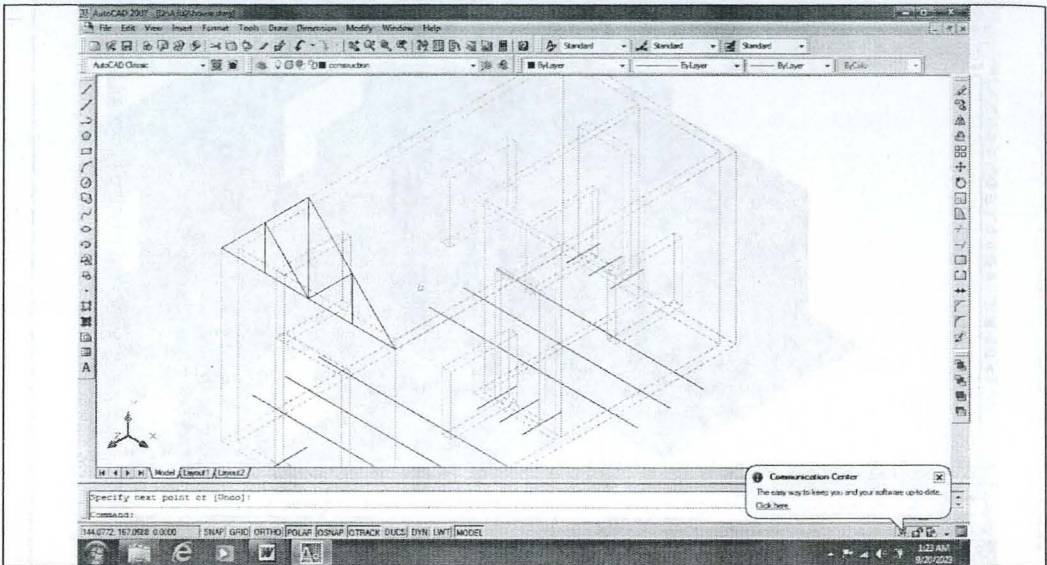


## Creating The Pediment

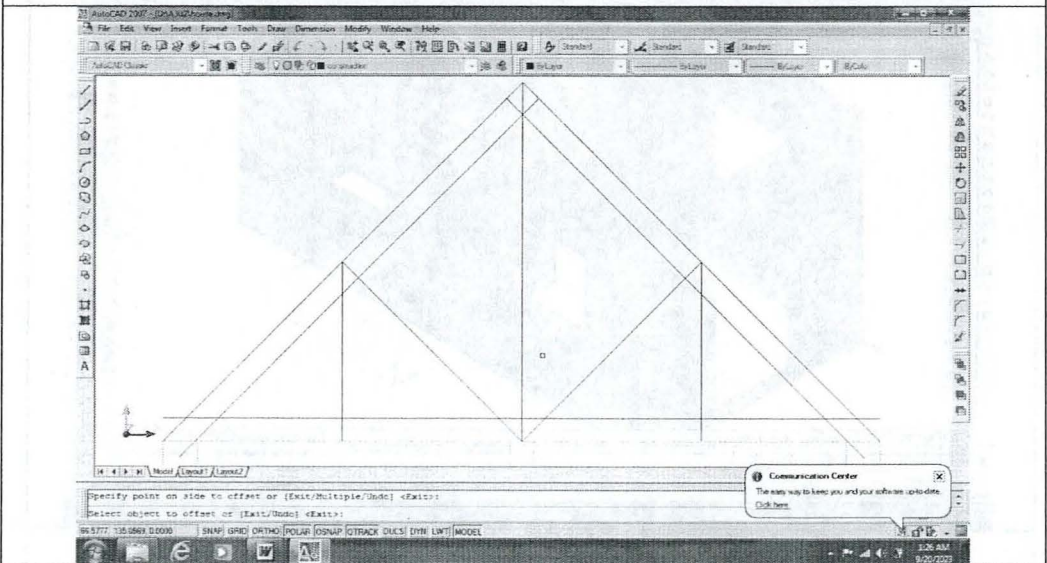
Set construction line as current.  
Turn off other layer EXCEPT wall.  
Set UCS using 3p as shown.



## FROM NOTHING TO SOMETHING

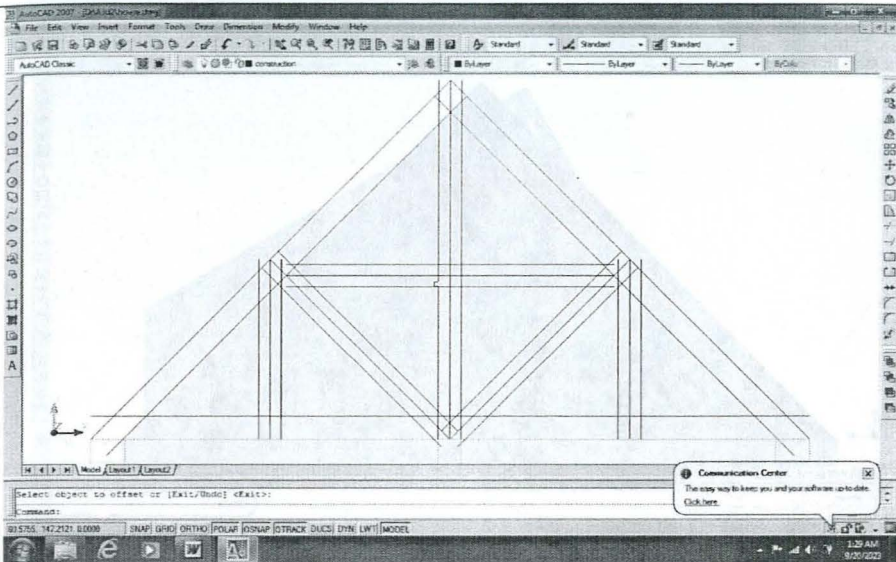


Draw line from mid of outer line upward @63<90.  
Connect all the line to create triangle as shown.

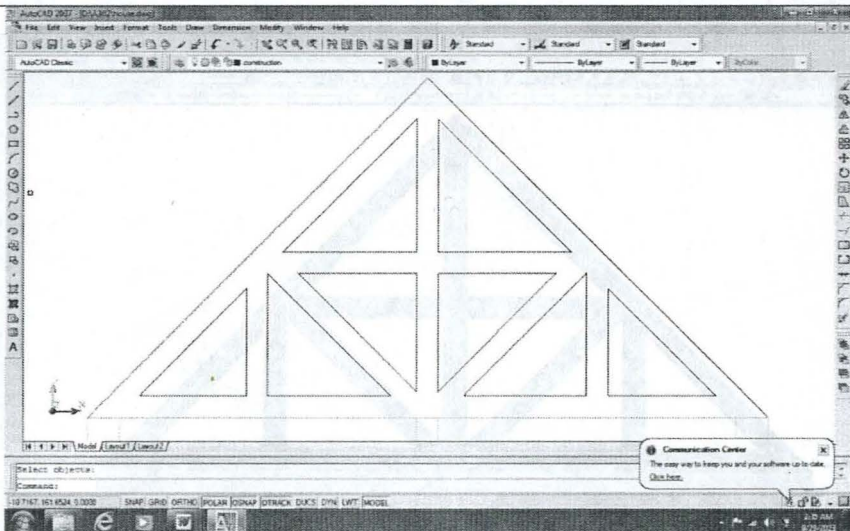


Set view floor plan via current UCS.  
Offset each exterior triangle line by 4.



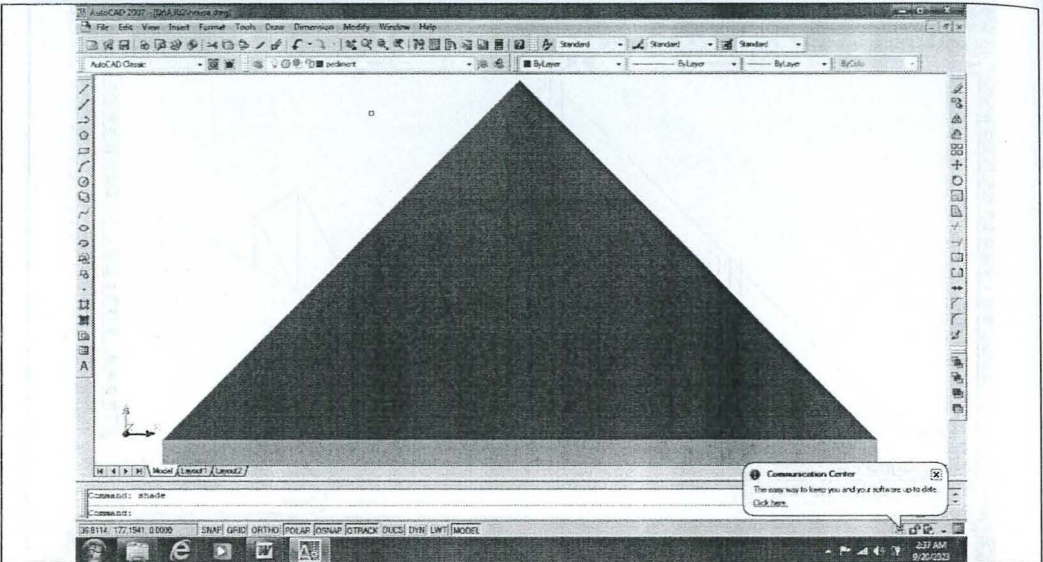


Offset each interior triangle line by 2 on each side.

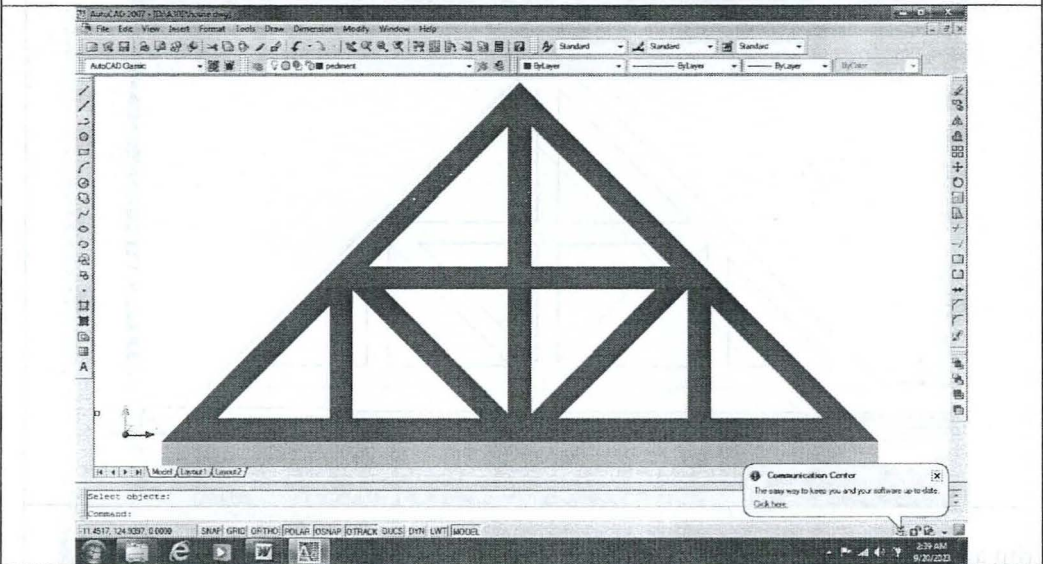


Trim and erase the line to create pediment as shown.

## FROM NOTHING TO SOMETHING

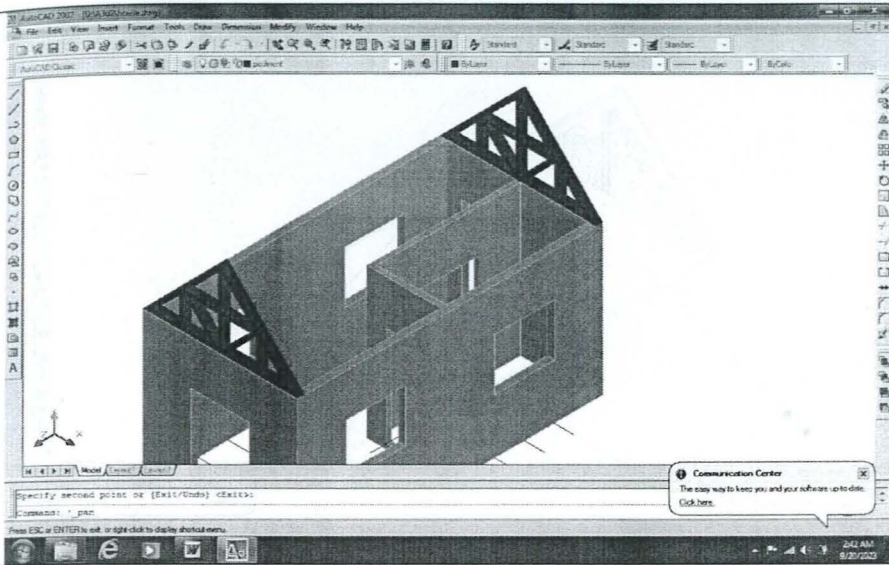


Set pediment as current layer. Invoke region command.  
Selects only the pediment line.

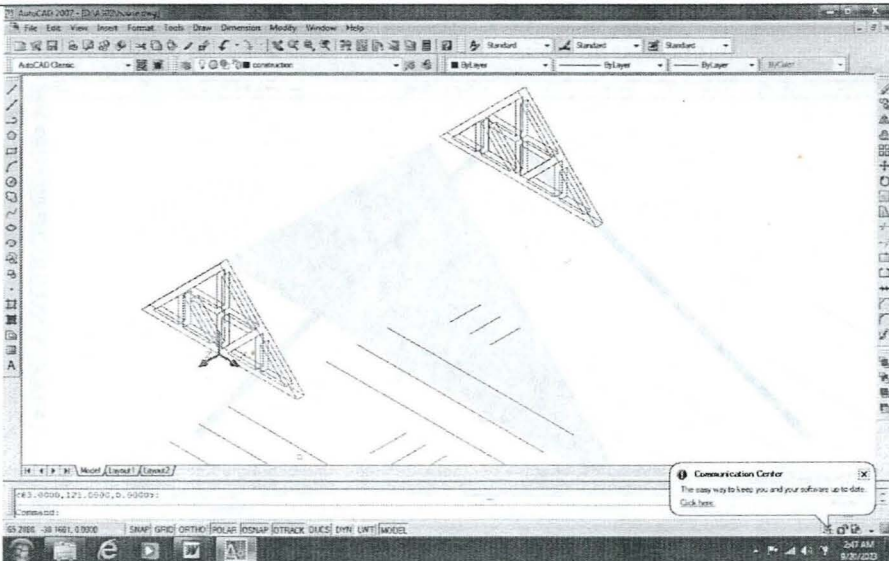


Subtract smaller triangle from the larger triangle.





Set the view to SW 3Dview. Extrude the pediment by -6  
Copy the pediment and move it to the other edge of the wall.

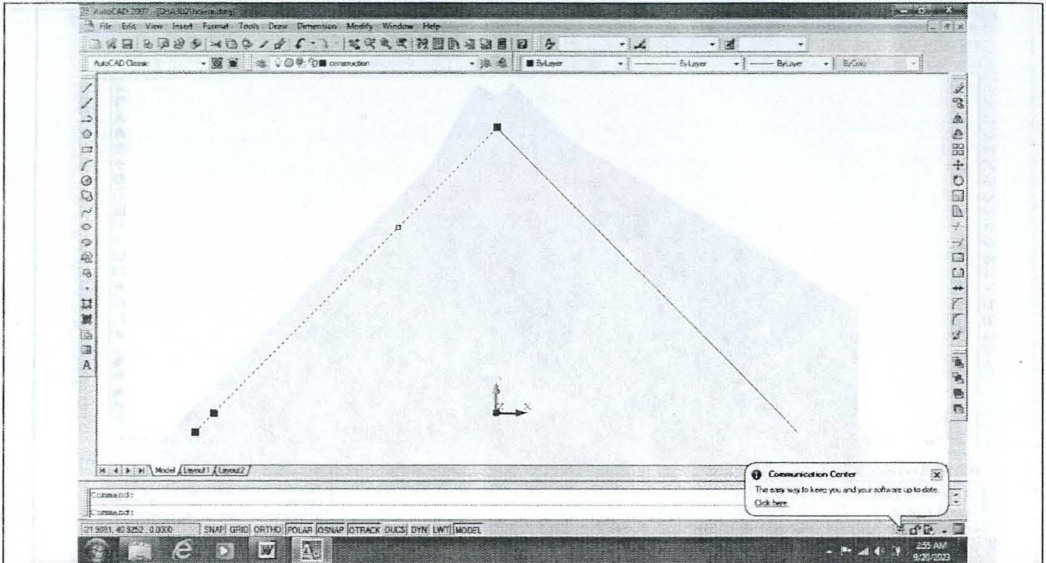


## Creating The Roof

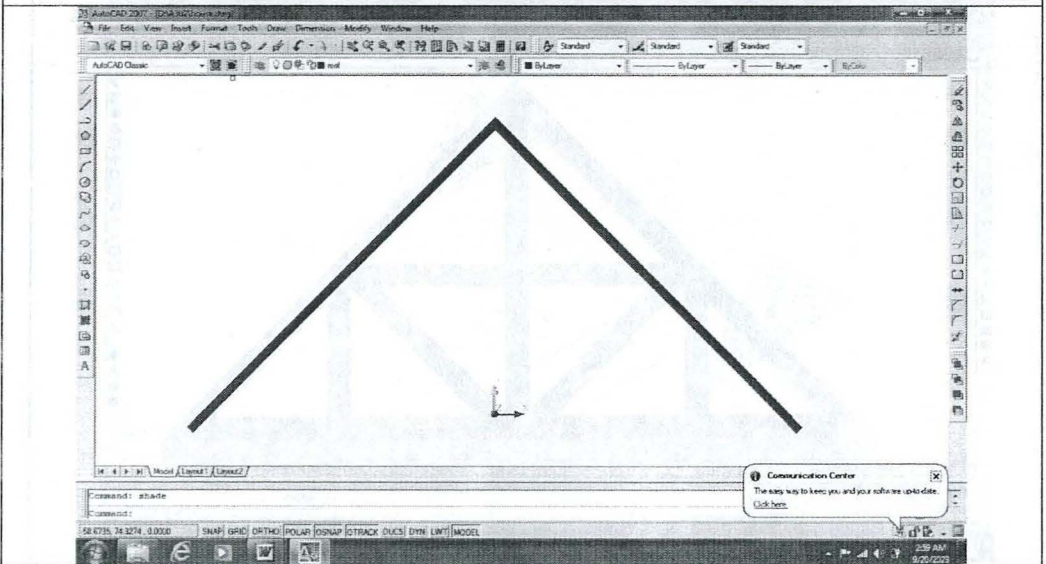
Set construction as current layer.  
Set UCS as shown using 3p.  
Set visual style as 3D wireframe.  
Turn the other layer off except pediment and construction.



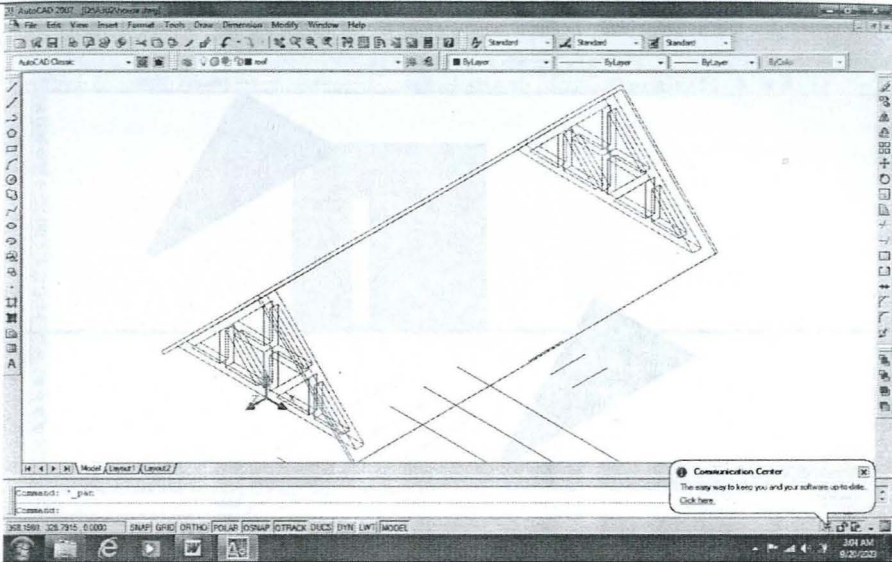
## FROM NOTHING TO SOMETHING



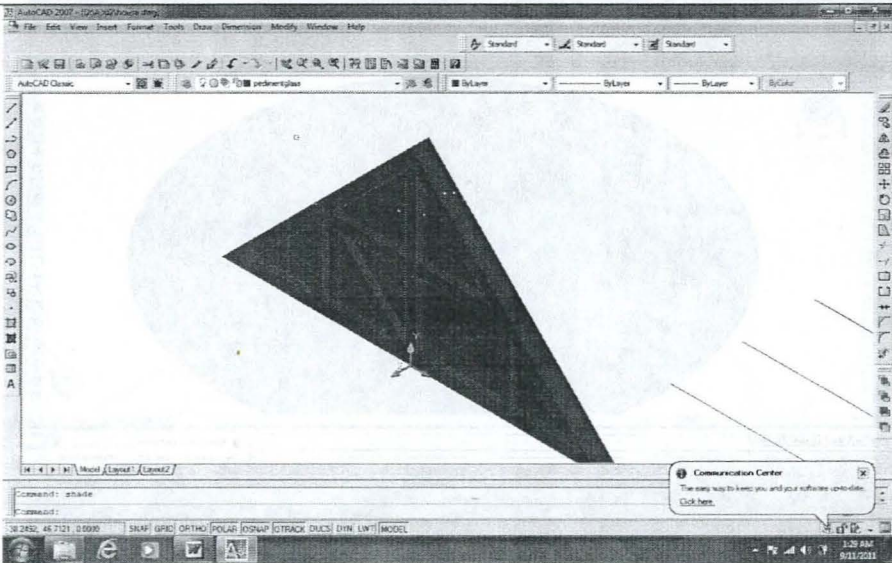
Set floor plan view using current UCS. Extend the line on right @6<-45  
Extend the line on left @6<225 Join each line using pedit as shown.



Set roof as current layer. Offset the roof by 2.  
Join the roof. Invoke region.  
Apply shade.



Set SW 3Dview. Turn on the pediment.  
Move roof plane @0,0,6. Extrude the roof plane by  $-(258)$



## Creating The Pediment Glass

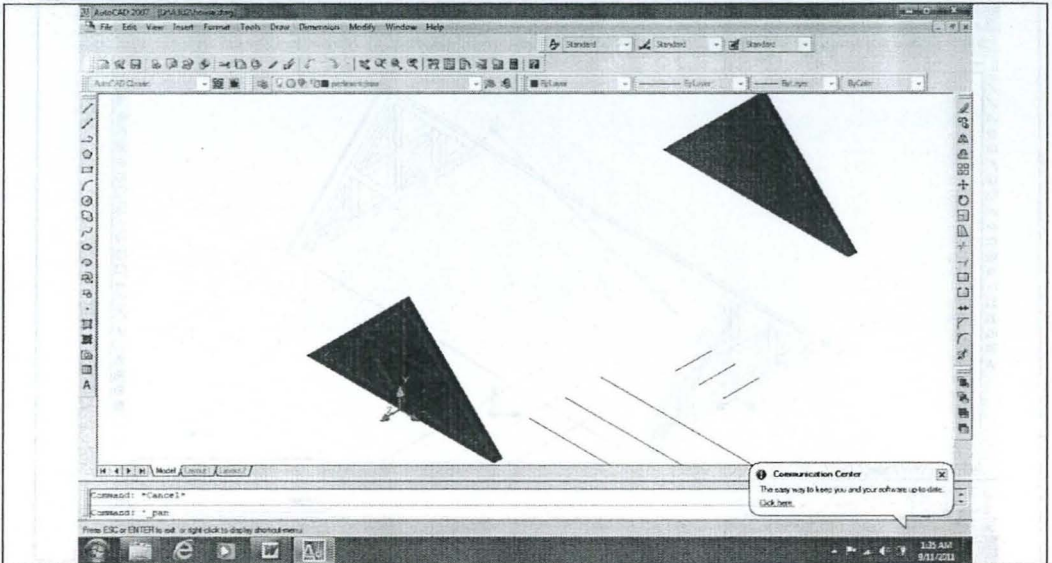
Create new layer call pediment glass.

Turn on pediment and pediment glass layer.

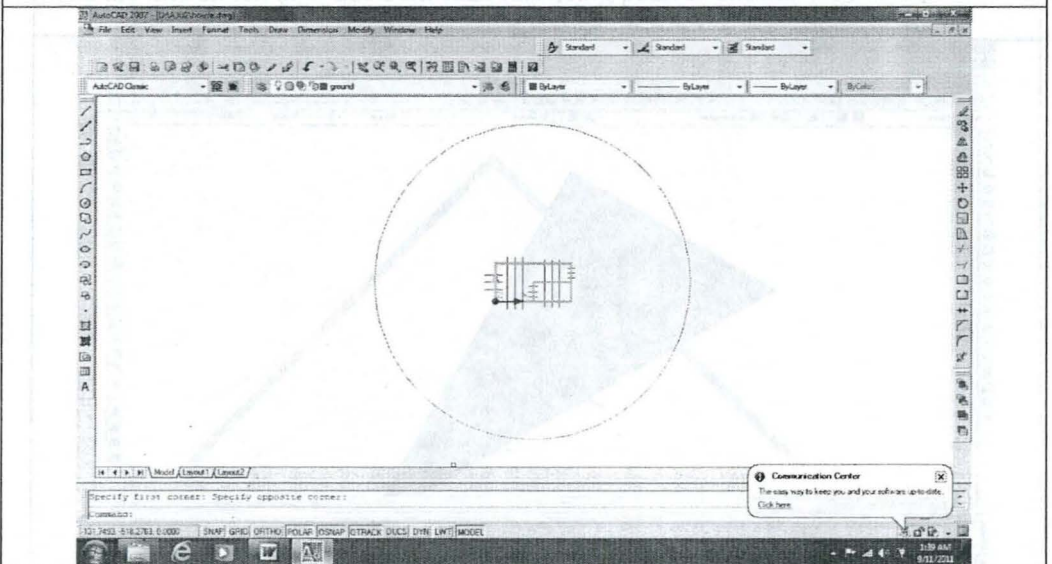
Draw triangle line through each pediment hole. Invoke region command.

Extrude the glass by 4. Apply same method for each hole in the triangle.





Copy all the pediment glass and put it on the other side of the pediment



### Creating The Ground

Set ground as current layer.

Turn on only wall.

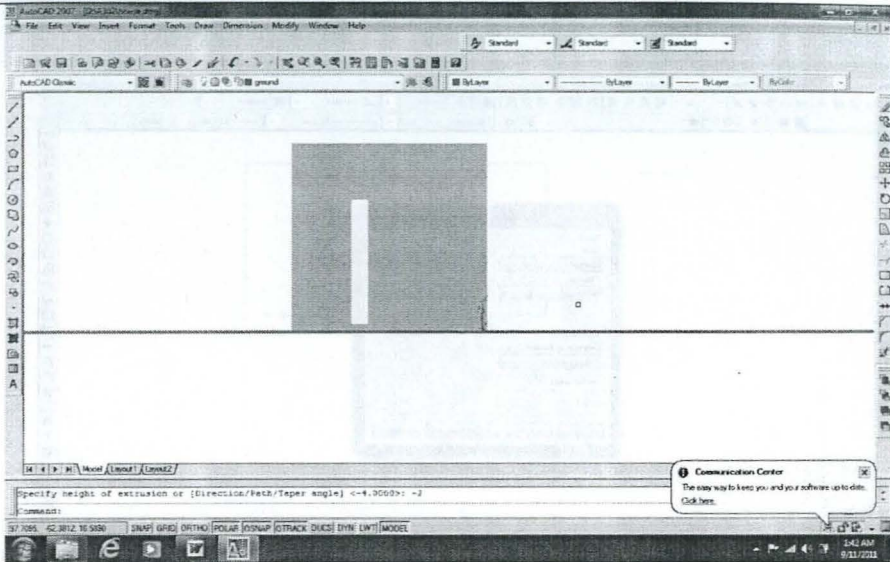
Set UCS to WCS

View floor plan.

Draw circle with radius equal to 500.

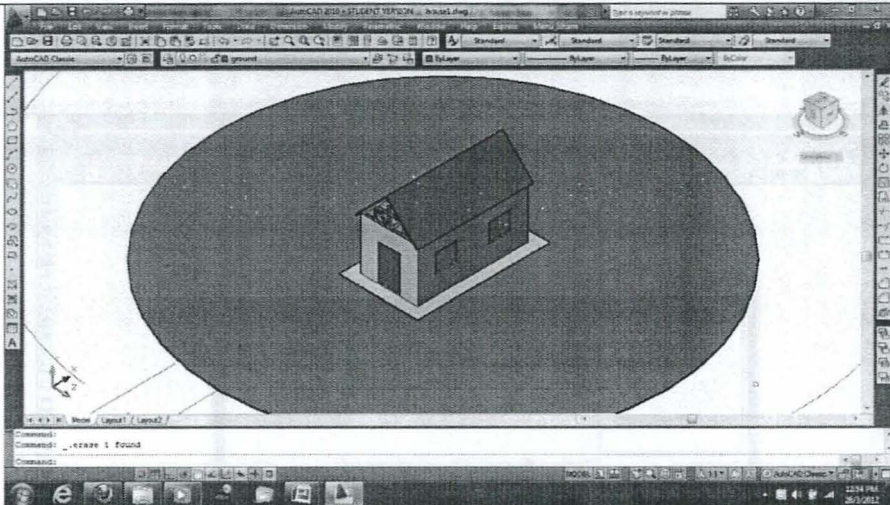


## FROM NOTHING TO SOMETHING



View front elevation.

Extrude the ground by -2



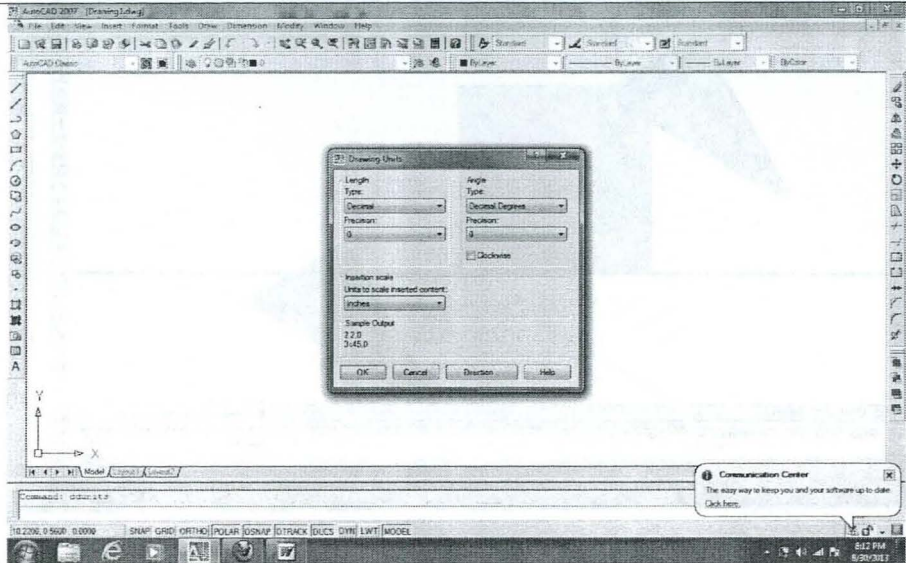
Turn on all the layers except construction layer

Set SW Isometric view

Invoke shade command

The simple building is done

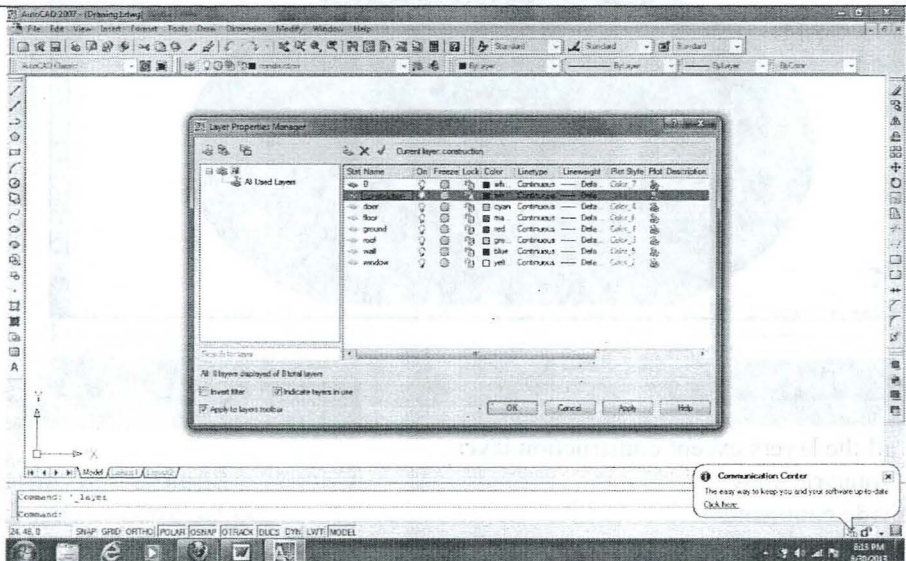
## Reflection 17 – Creating Medium Level Building



Type ddunits

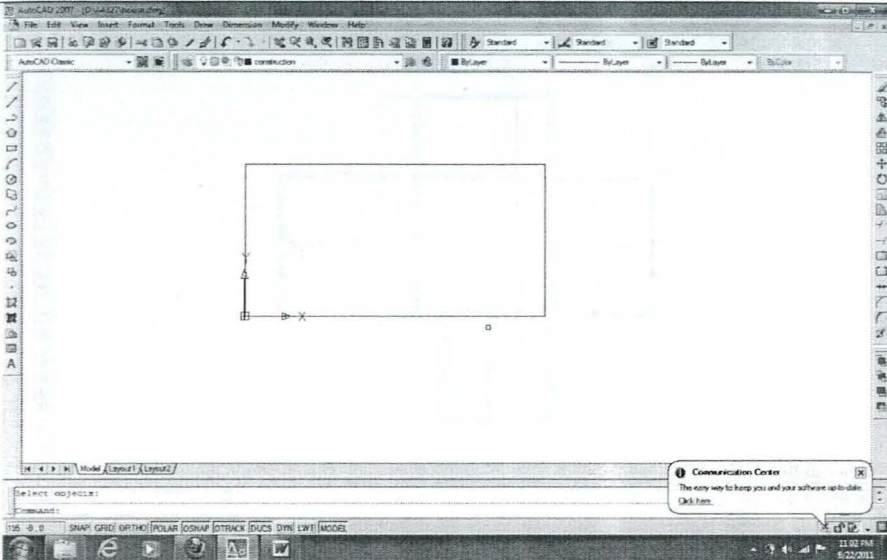
Command: '\_units. Drawing unit dialog box will occur.

Change the unit from mm to inches. Don't use decimal point.

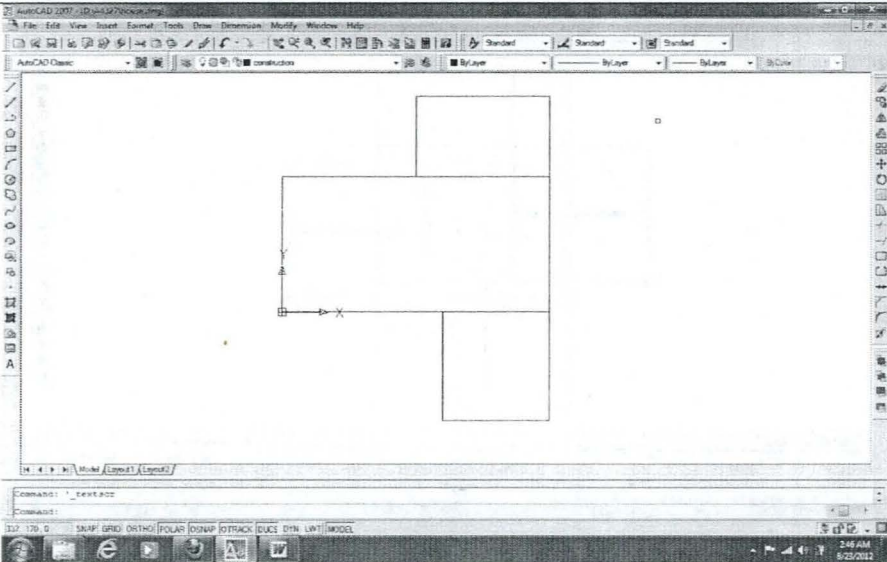


Command: '\_layer (create 7 layers which are window,floor,door,roof,wall, ground and construction)



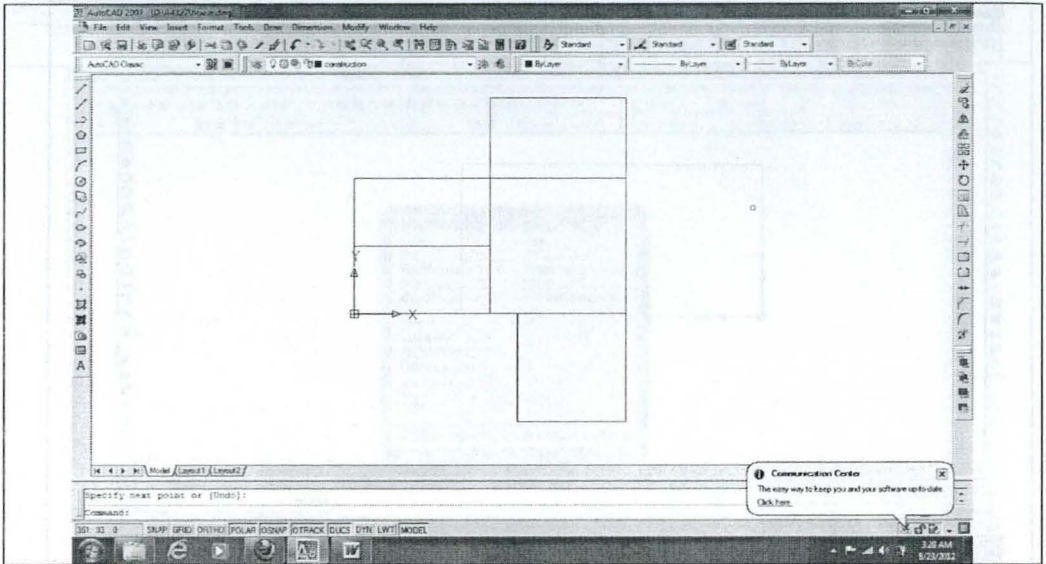


Command: `_line` Specify first point: 0,0  
then `@120<90`, then `@240<0`, then `@120<-90`, then `cl`

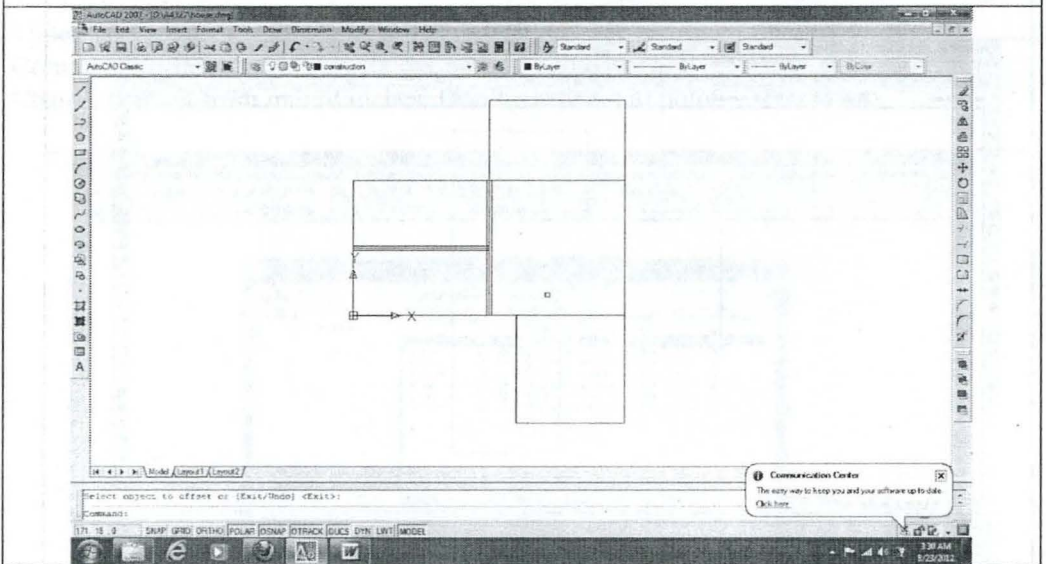


Line start from the bottom of the box, then `@96<-90`, `@96<180` and `@96<90`  
Line from the middle of the upper line then, `@72<90`, then `@120<0` and `@72<-90`



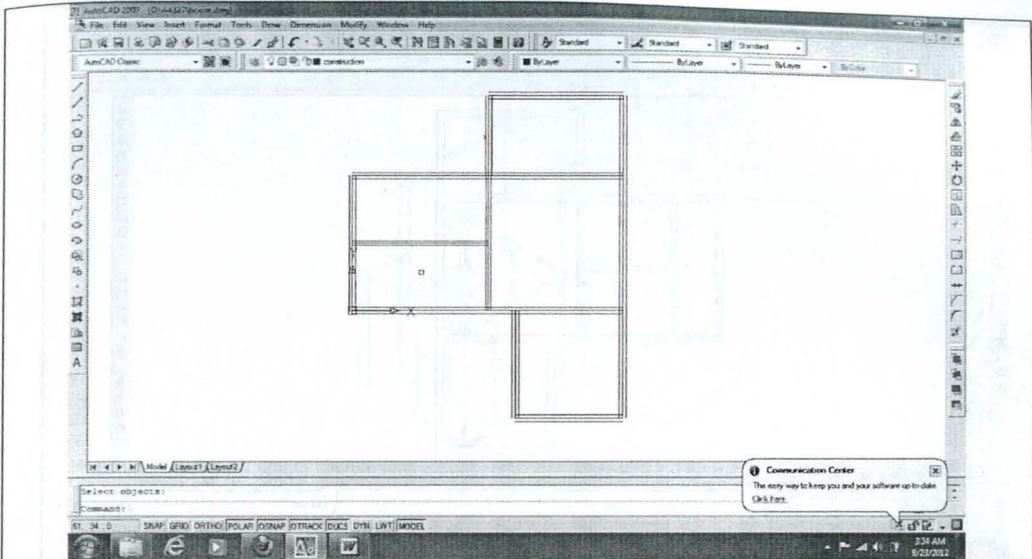


Draw line from mid of left line to mid of right line

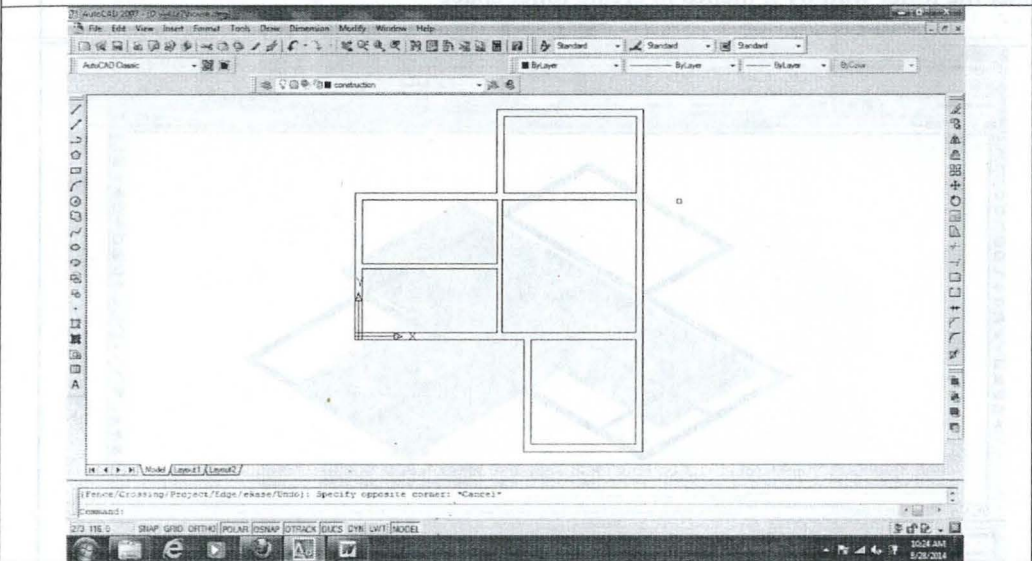


Offset the interior line 2 inch from the middle to the left and right of the interior wall

## FROM NOTHING TO SOMETHING



Offset the exterior line 3 inch from the middle to the left and right of the exterior wall

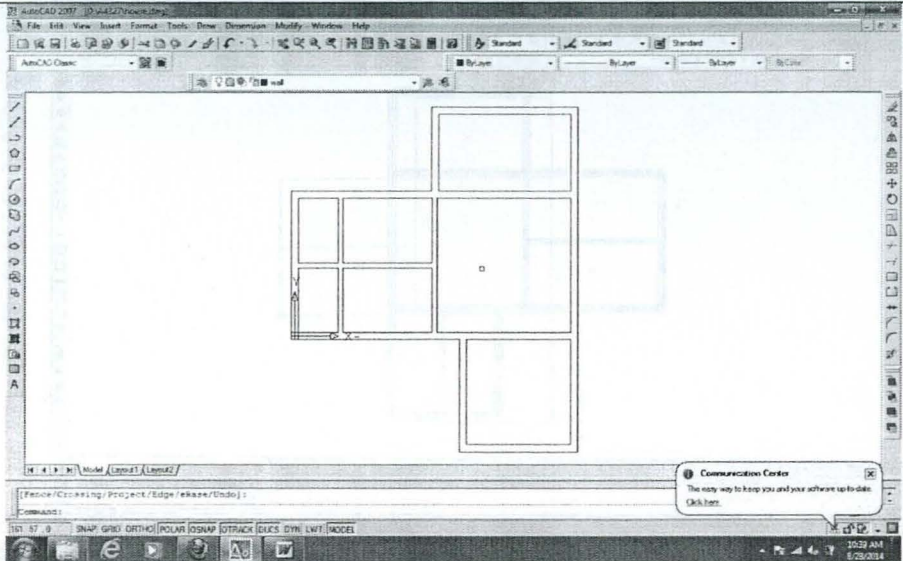


Use erases to clear the middle line.

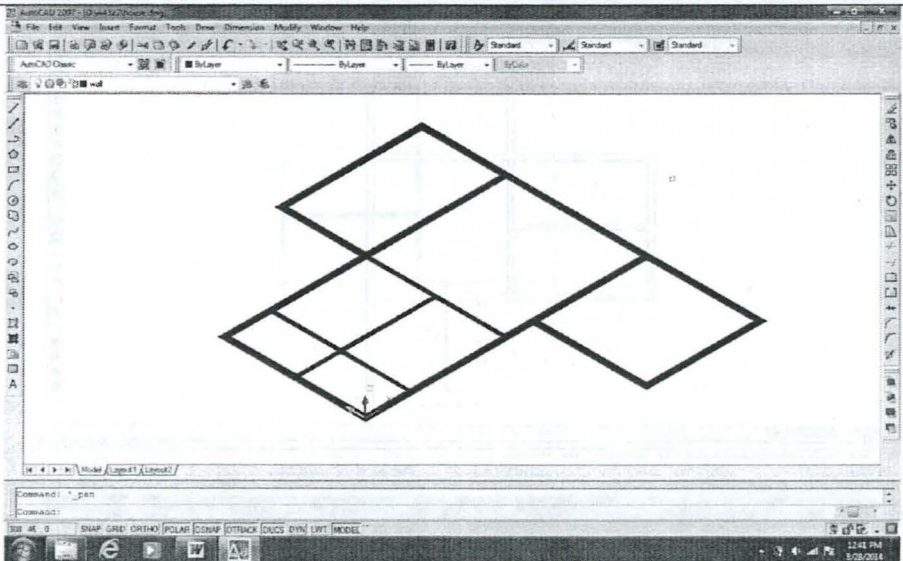
Use fillet, radius = 0 to join and smooth out the outer line.

Use trim to clear the interior line.

## FROM NOTHING TO SOMETHING

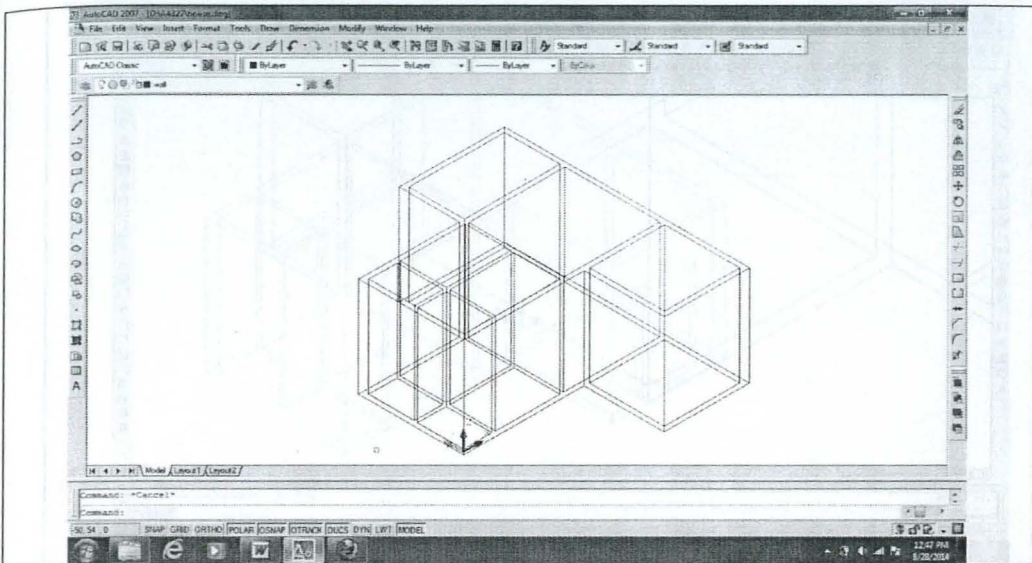


Offset the left line by 36  
Offset the toilet wall by 2 inches to create toilet space

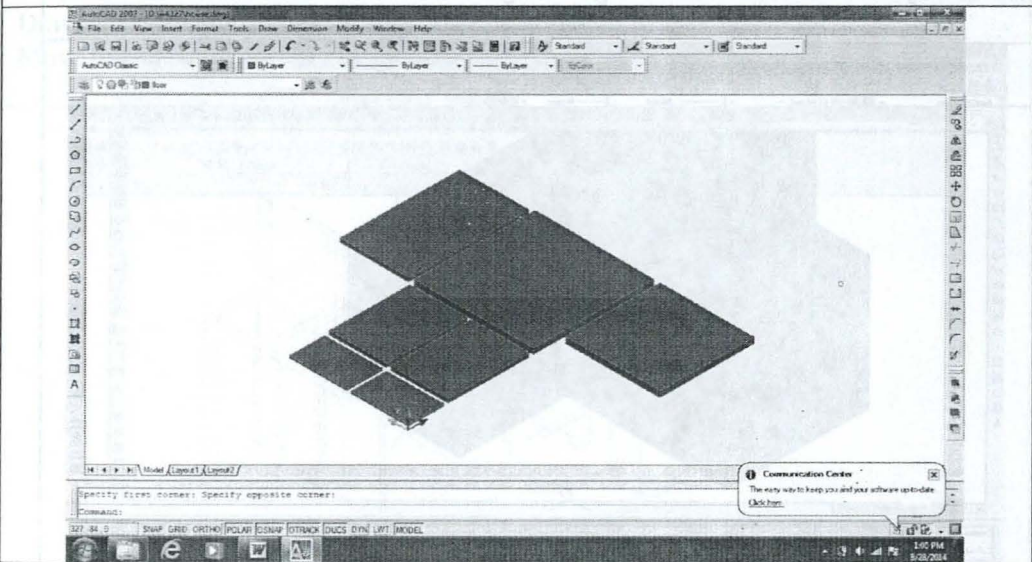


Set wall as current layer  
Invoke region command  
Subtract small rectangle from the larger rectangle  
Invoke shade command  
View in SW view



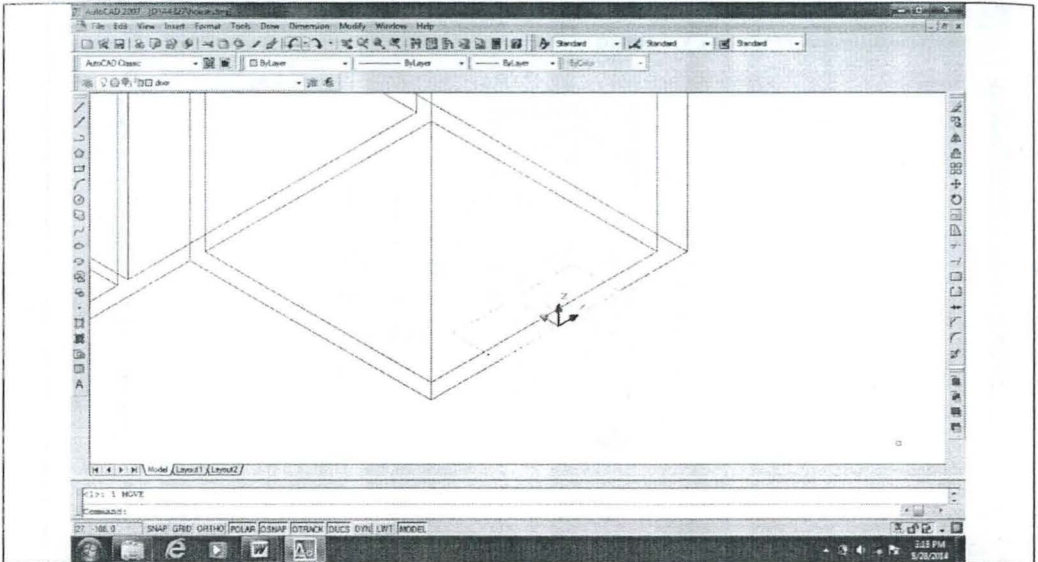


Extrude the wall by 120  
View in 3D wire frame style

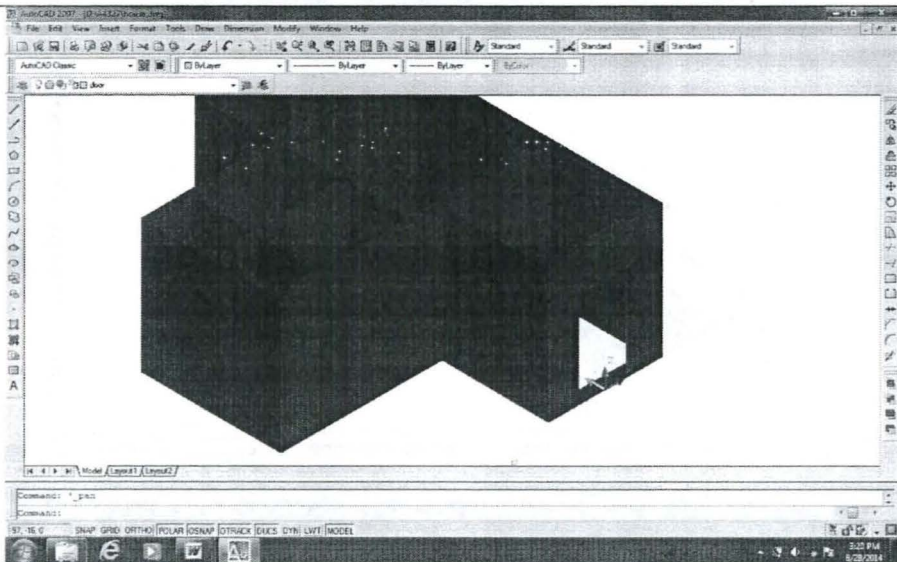


Set floor as current layer. Draw the floor line  
Region the floor line  
Extrude space 1 and 2 to the height of 6  
Extrude space 3 and 4 to the height of 4  
Extrude space 5 and 6 to the height of 2

## FROM NOTHING TO SOMETHING

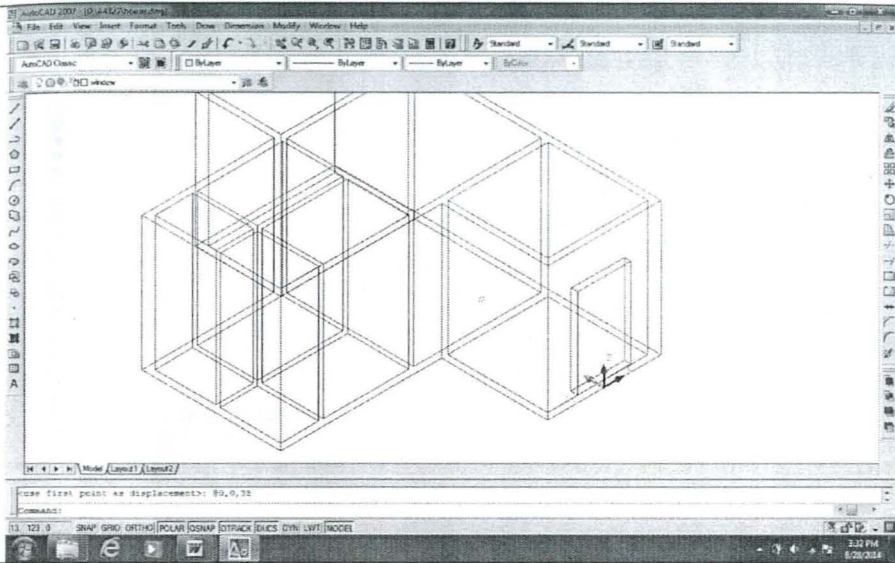


Set door as current layer. Turn off the floor layer  
Zoom to the outer wall. Draw line from the middle of outer line  
Offset line by 24 on both side. Draw big rectangle as shown

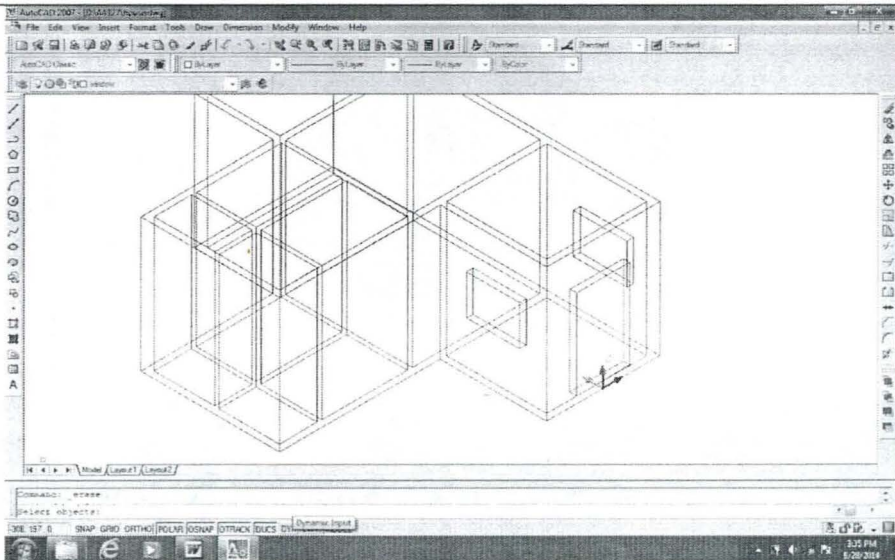


Move the rectangle @0,0,6  
Extrude the rectangle by 80.  
Subtract the box from the house.  
Shade the building.

## FROM NOTHING TO SOMETHING



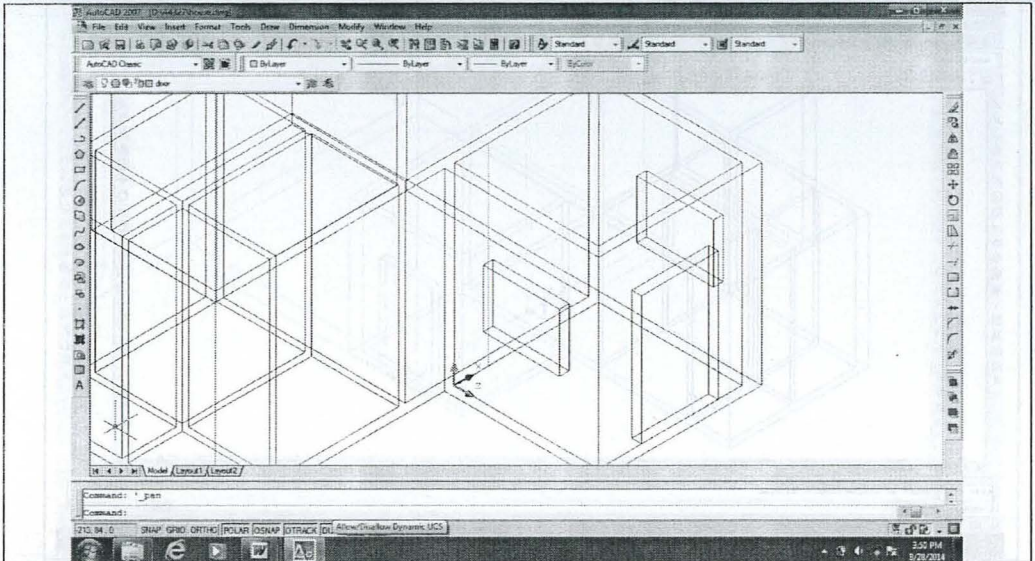
Set window as current layer.  
Draw line from mid of one wall to mid of other wall  
Offset the line 24 on both side  
Draw big rectangle as shown  
Move the rectangle upward at @0,0,44



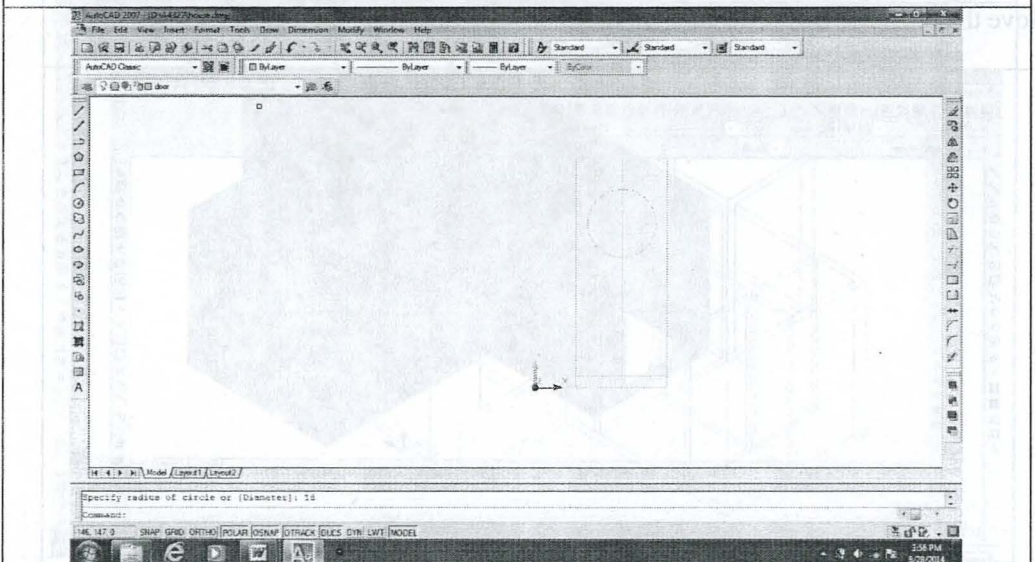
Extrude the rectangle by 36  
Subtract the box from the house to create hole for window



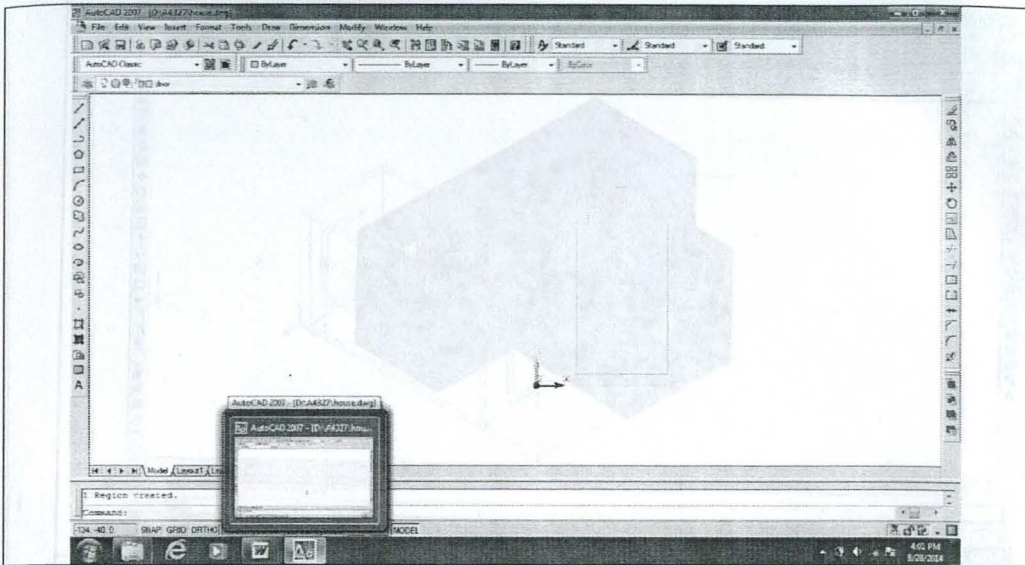
## FROM NOTHING TO SOMETHING



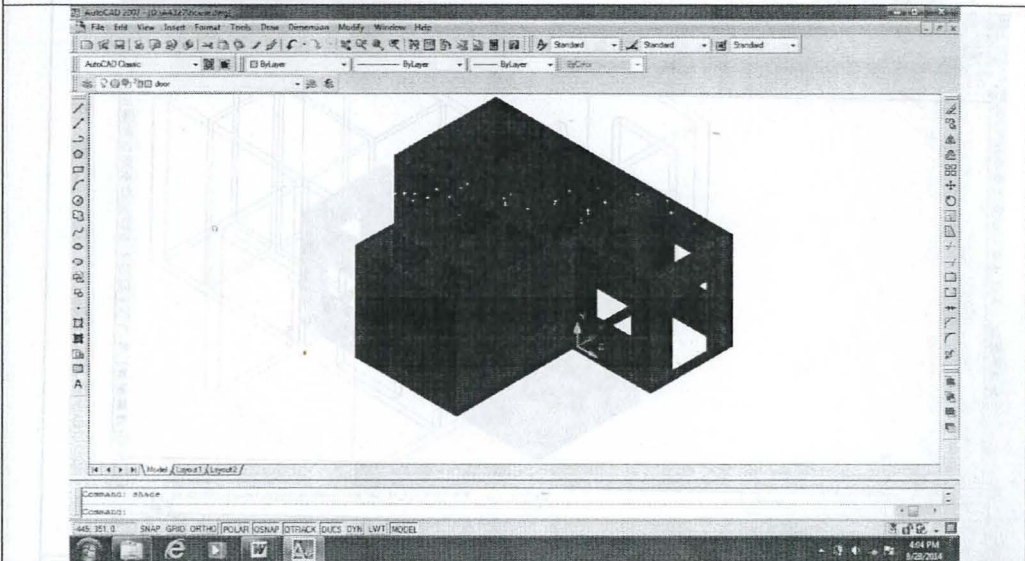
Draw the interior door. Set UCS base using 3p method as shown.  
 Draw line from middle at the bottom to middle at the top  
 Offset the line by 24 at both side



View plan current UCS  
 Connect the vertical line at the bottom. Offset the line by 6  
 Offset the bottom line by 80  
 Draw circle at the middle of the offset line with diameter equal to 20



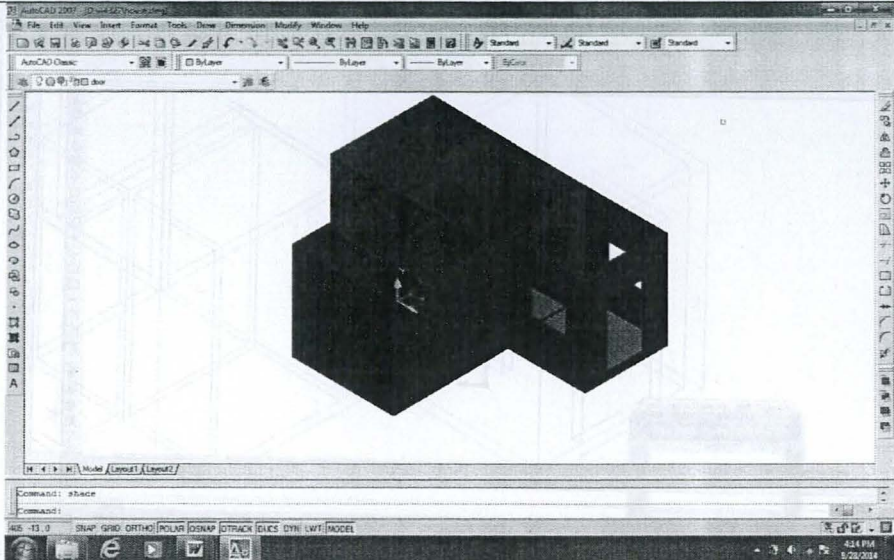
Trim the line and create the shape shown.  
Invoke the region command.



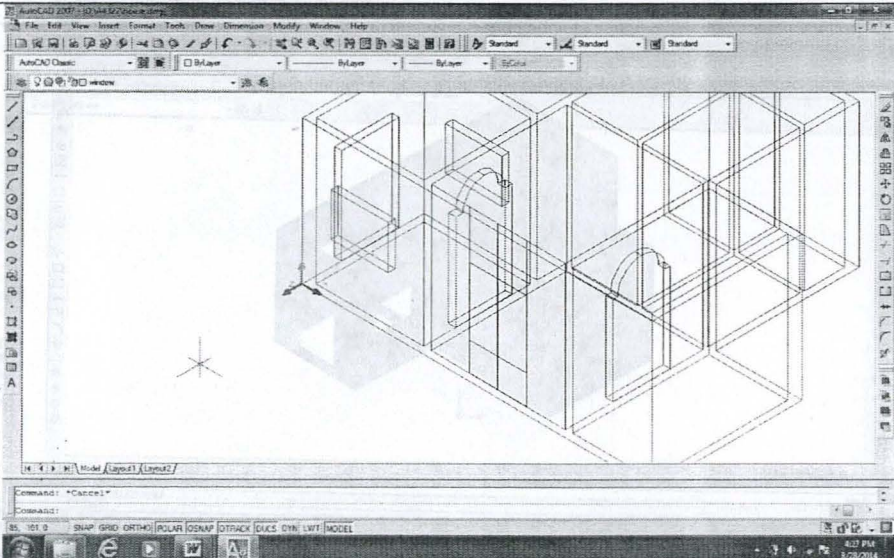
Set the view to SW  
Extrude the shape to the height of -8  
Subtract the shape from the house  
Shade the building



## FROM NOTHING TO SOMETHING



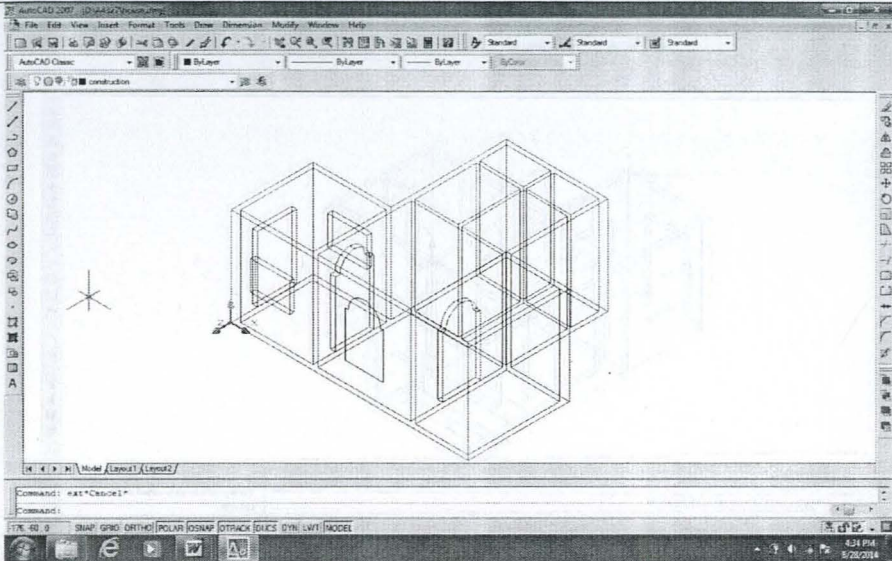
Set UCS base using 3P. Draw shape using previous step. Extrude the shape by -8. Subtract the shape from the building.



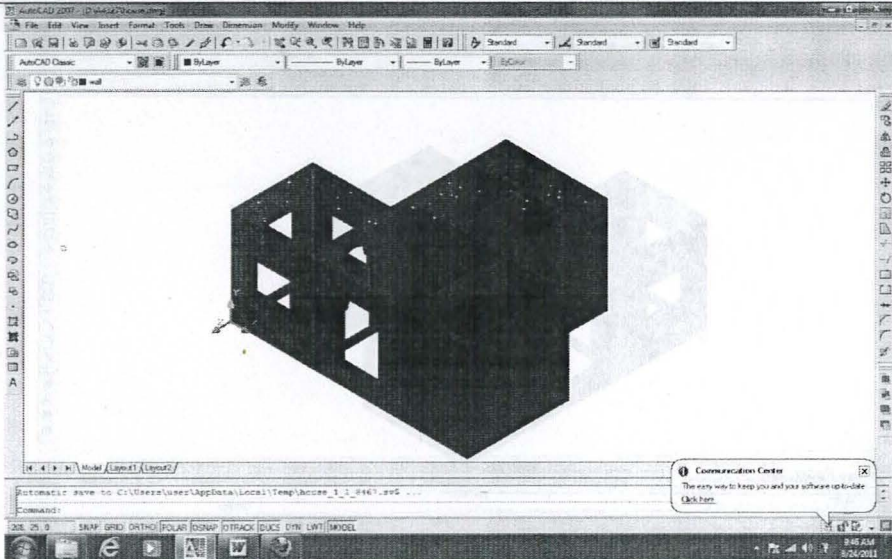
Set view to NE. Set UCS 3p as shown  
Draw line from mid of the top to mid of the bottom  
Use the interior line. Offset the line by 24 both side  
Join both vertical lines. Offset the horizontal line by 24 and 80 consecutively.



## FROM NOTHING TO SOMETHING

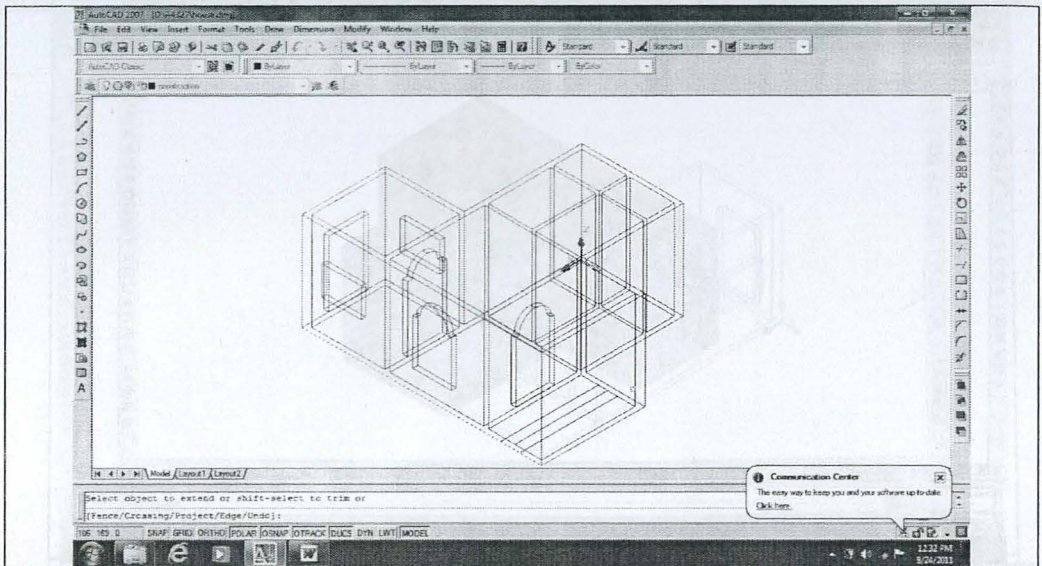


Draw circle with diameter equal to 20  
Trim create the shape as shown.

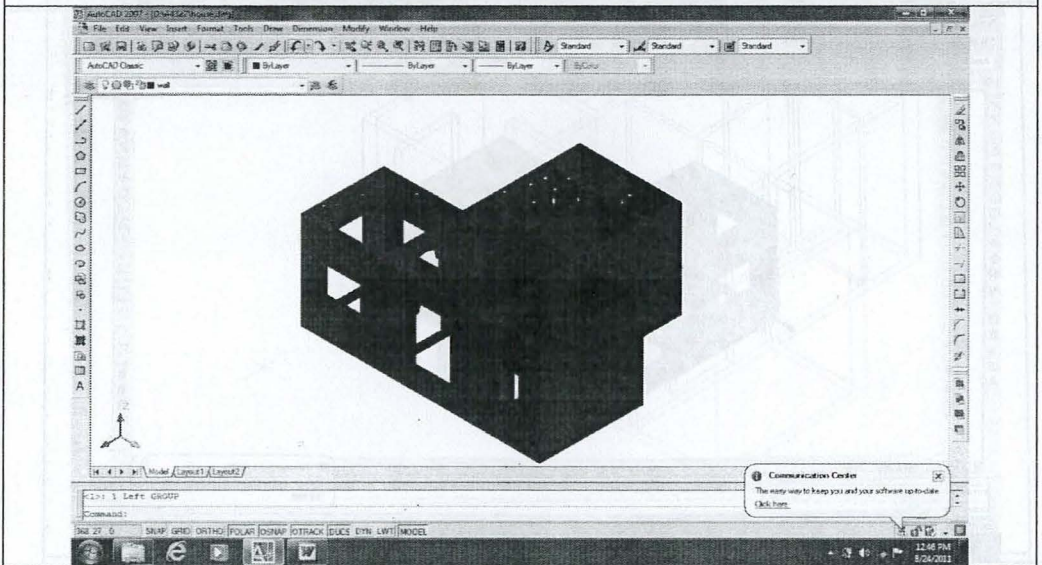


Turn on the wall layer.  
Move the shape by @0,0,10  
Extrude the by -20  
Subtract the shape from the house.  
Shade.

## FROM NOTHING TO SOMETHING

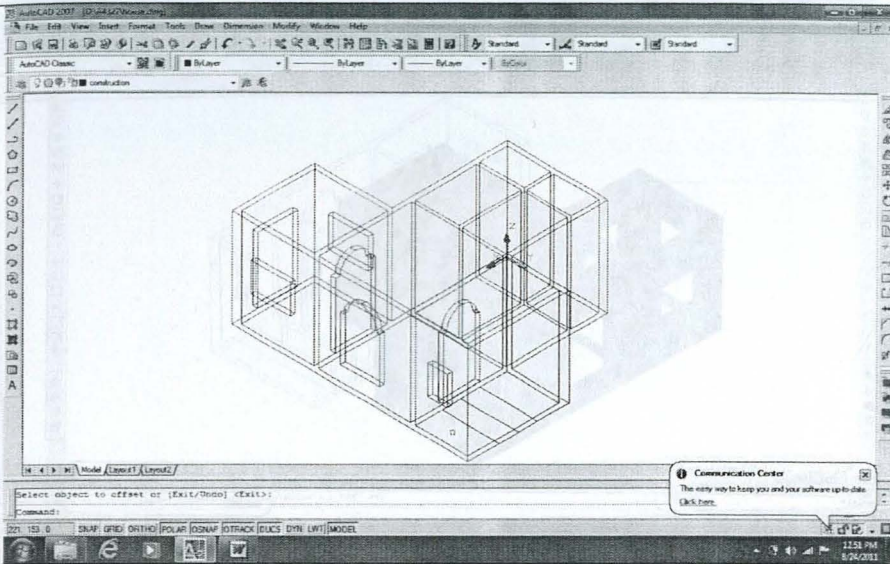


Draw line from the middle of the kitchen area.  
Offset the line by 12 on both side.

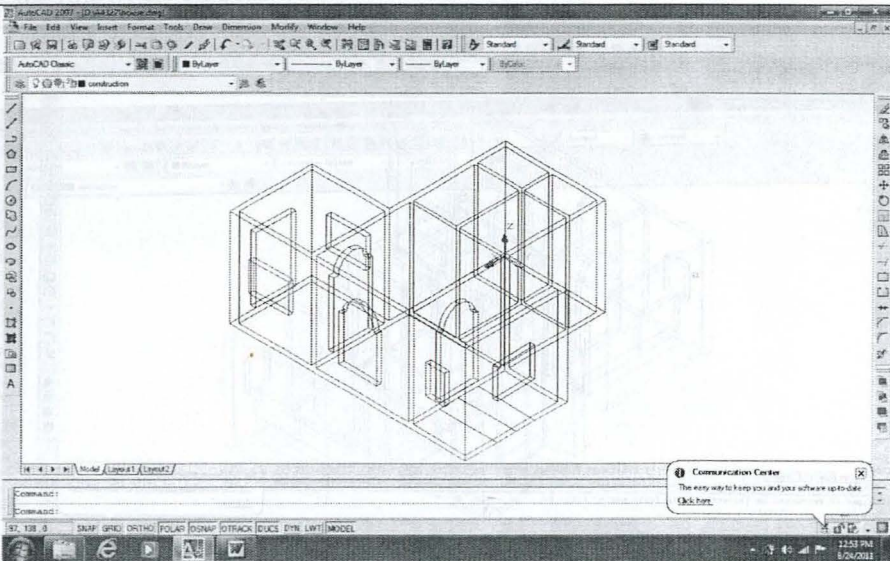


Create rectangle on the line drawn.  
Move the rectangle upward at @0,0,44  
Extrude the rectangle at 36  
Subtract the rectangle from the house  
Shade





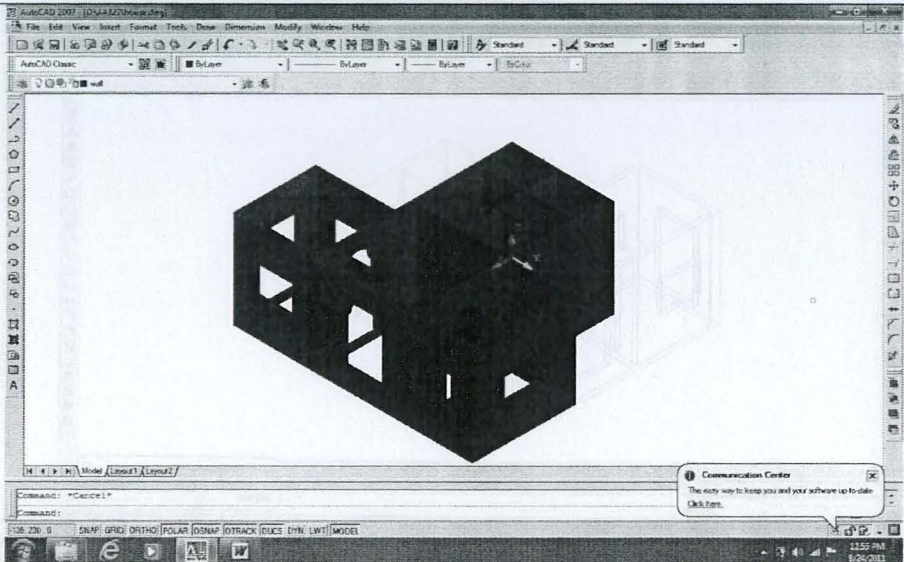
Draw the line as shown.  
Offset the line by 24 on both side.



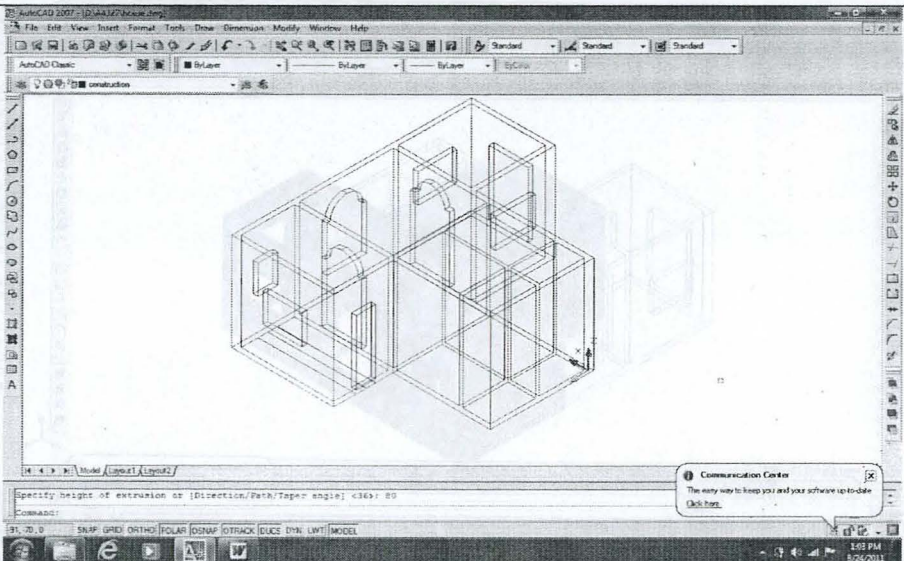
Draw rectangle from line above.  
Move the rectangle upward @0,0,44  
Extrude by 36.



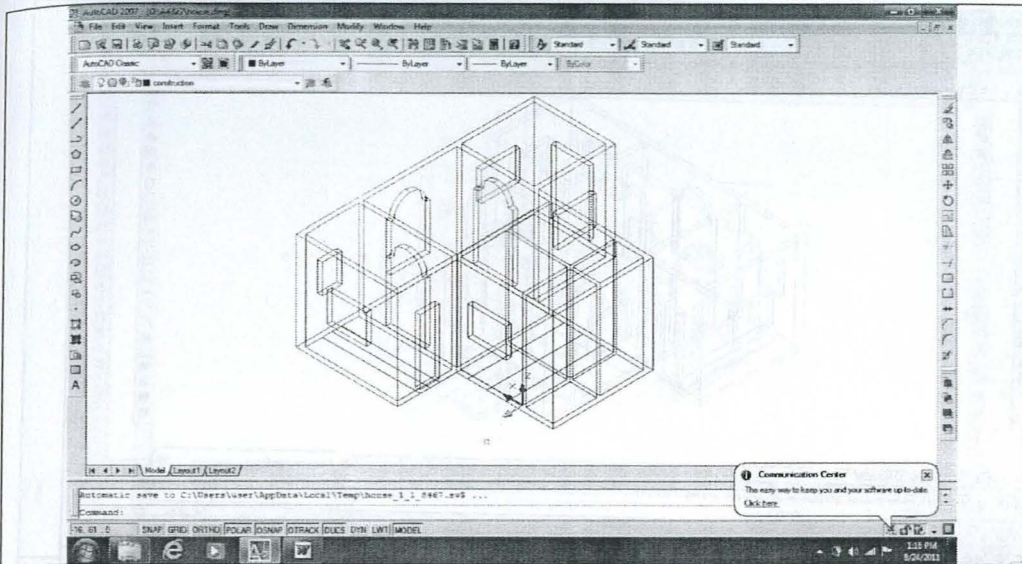
## FROM NOTHING TO SOMETHING



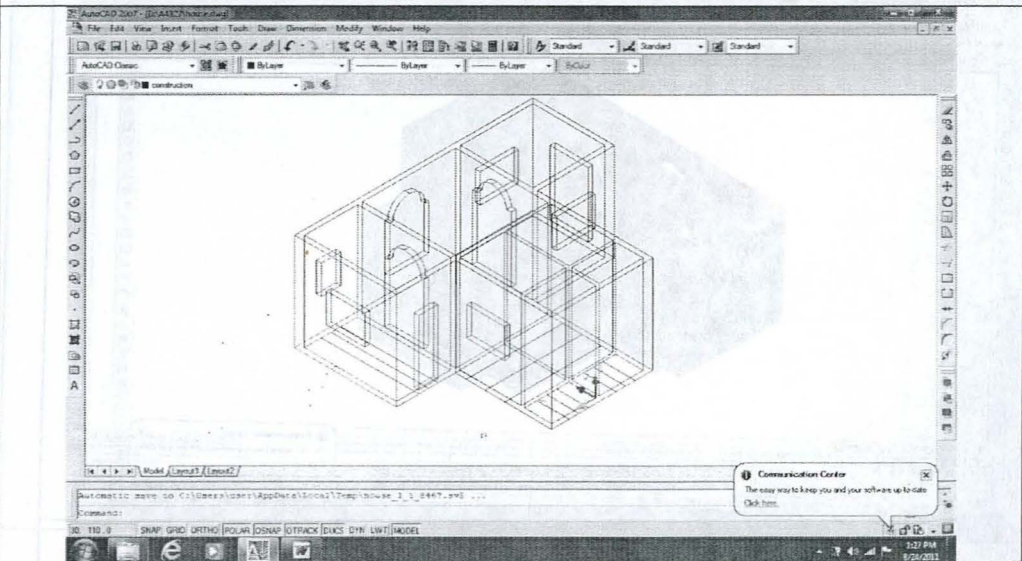
Subtract the rectangle.  
Shade.



Set NW view. Draw the line from the middle of the wall shown.  
Offset line by 12 on both side.  
Draw rectangle on the line.  
Move rectangle upward @0,0,4.  
Extrude the rectangle by 80.



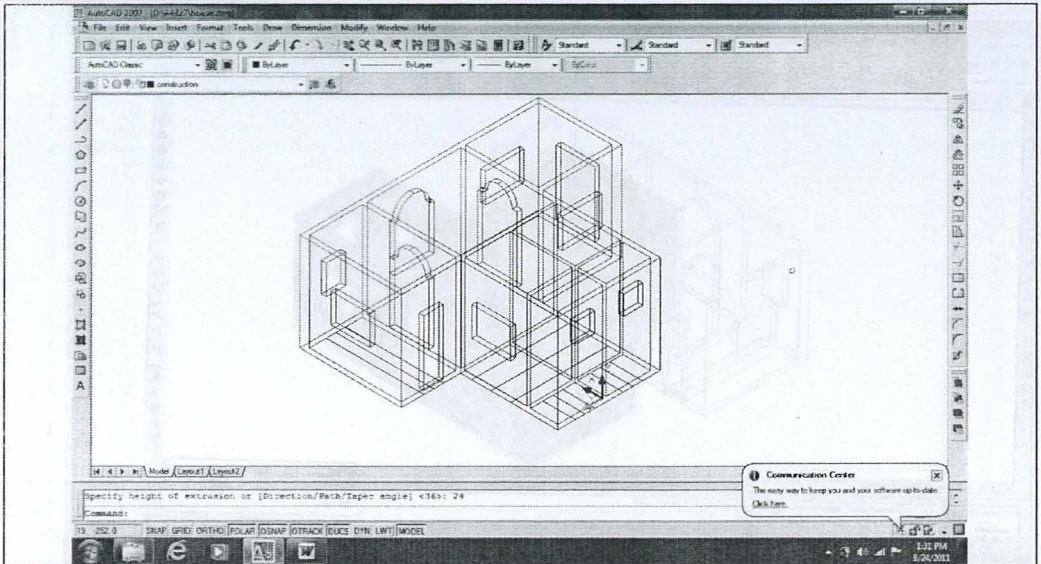
Set the origin of the UCS as shown.  
 Draw the line as shown.  
 Offset the line by 24 on both side.  
 Draw rectangle from line  
 Move the rectangle upward @0,0,44. Extrude by 36.



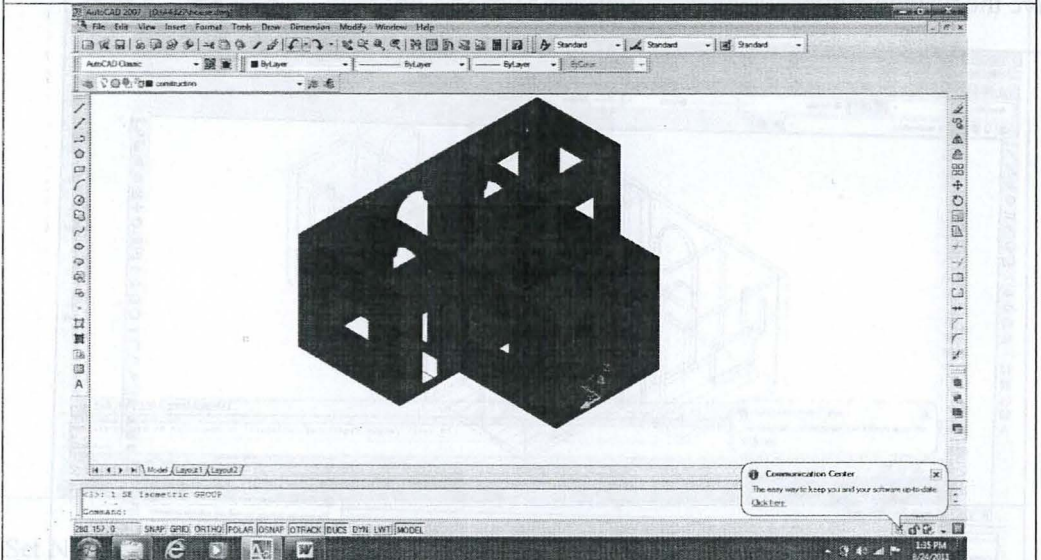
Draw the line as shown  
 Offset the line by 12 on both side.



## FROM NOTHING TO SOMETHING

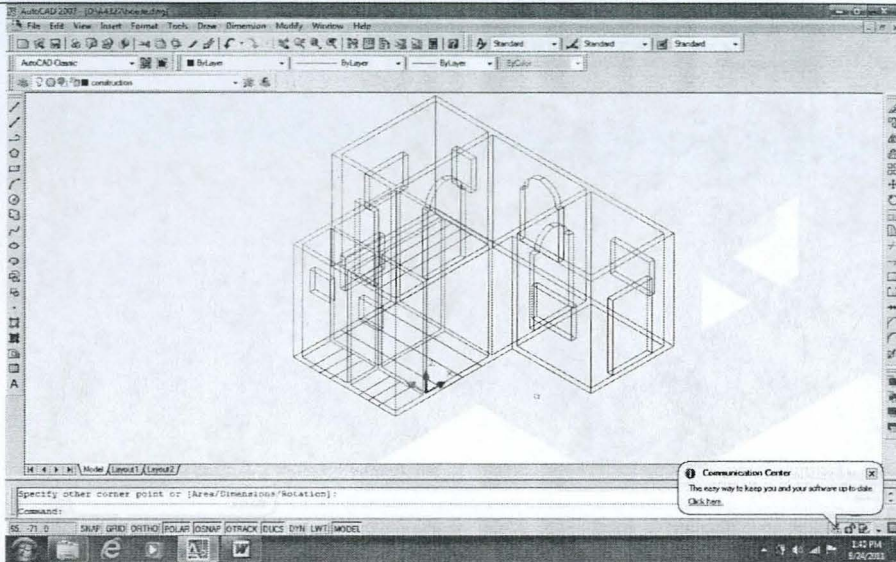


Draw rectangle on the line.  
Move both rectangles.  
Upward @0,0,80.  
Extrude the rectangle by 24.

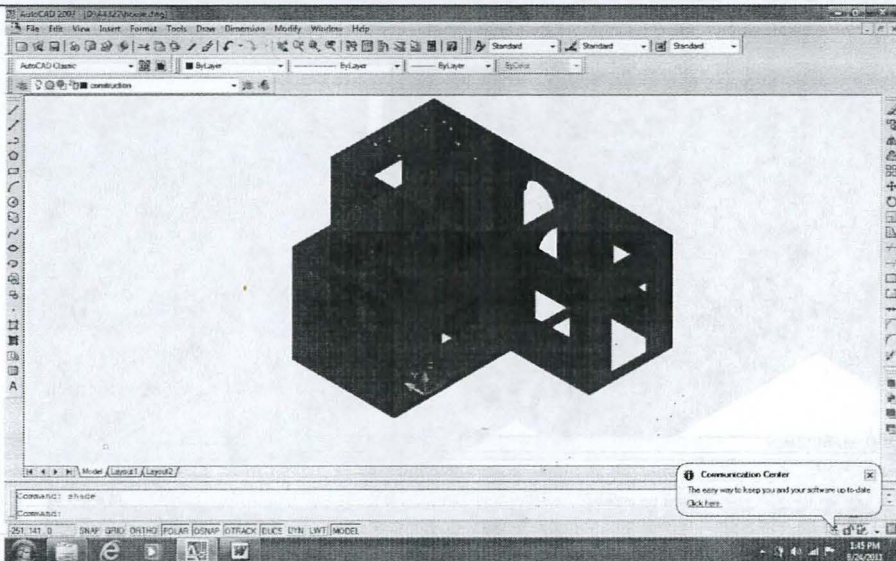


Subtract the rectangle from the house.

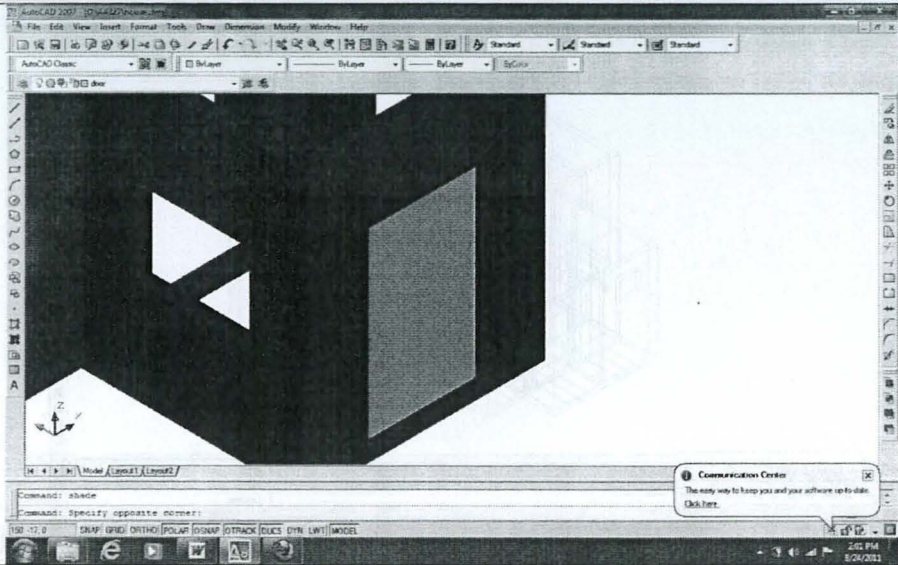




Set the origin of the UCS as shown.  
 Draw the line as shown.  
 Offset the line by 24 on both side.  
 Draw rectangle from line

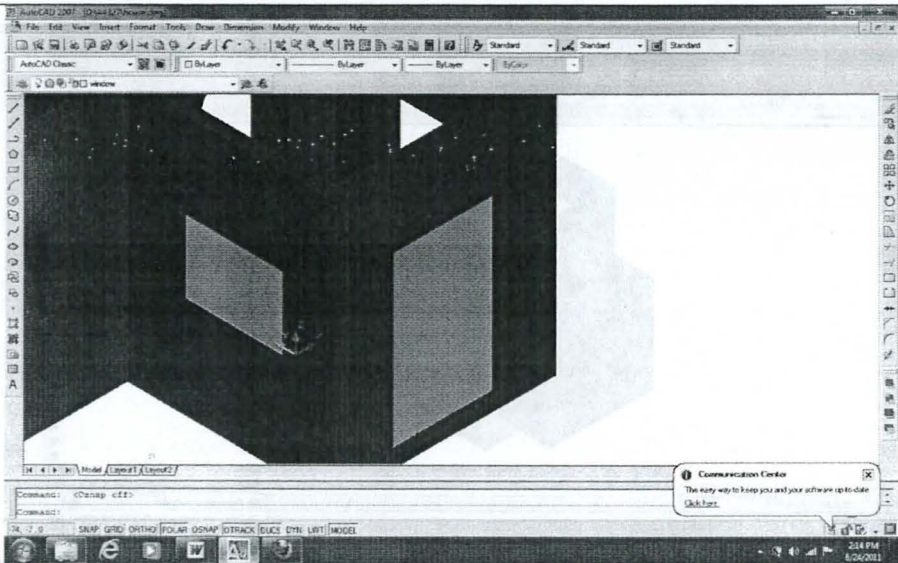


Move the rectangle upward @0,0,44  
 Extrude by 36. Subtract the rectangle  
 Shade



Set door as current layer

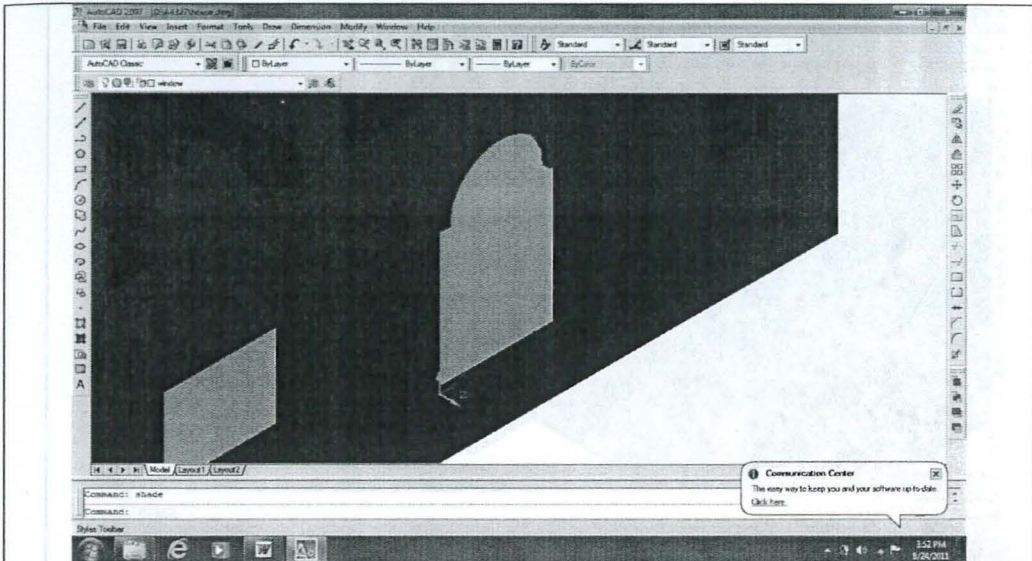
Draw rectangle from the mid of door hole from the side. Extrude the rectangle  
Shade.



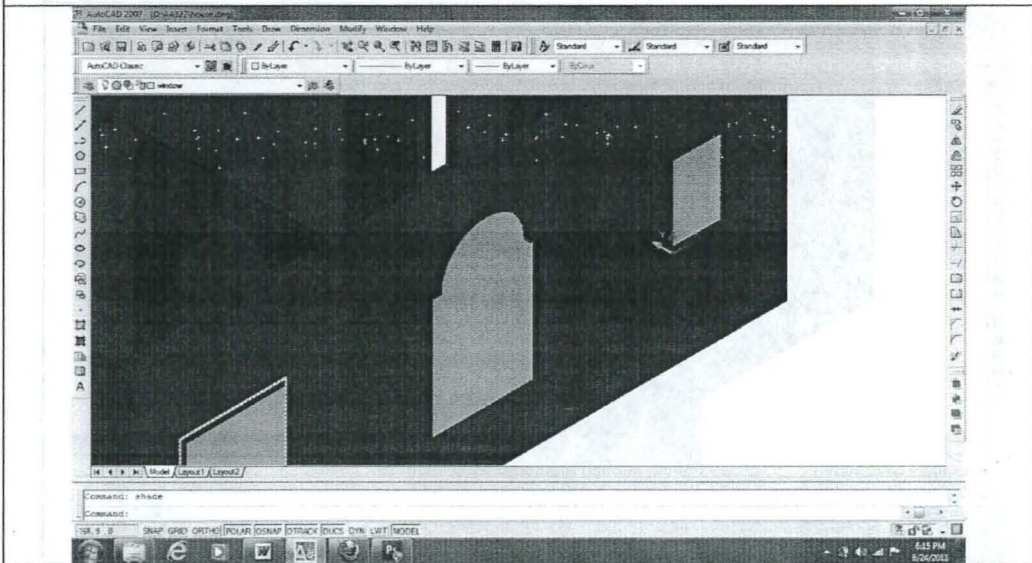
Set window as current layer

Draw rectangle from the mid of window hole from the side. Extrude the rectangle  
Shade.



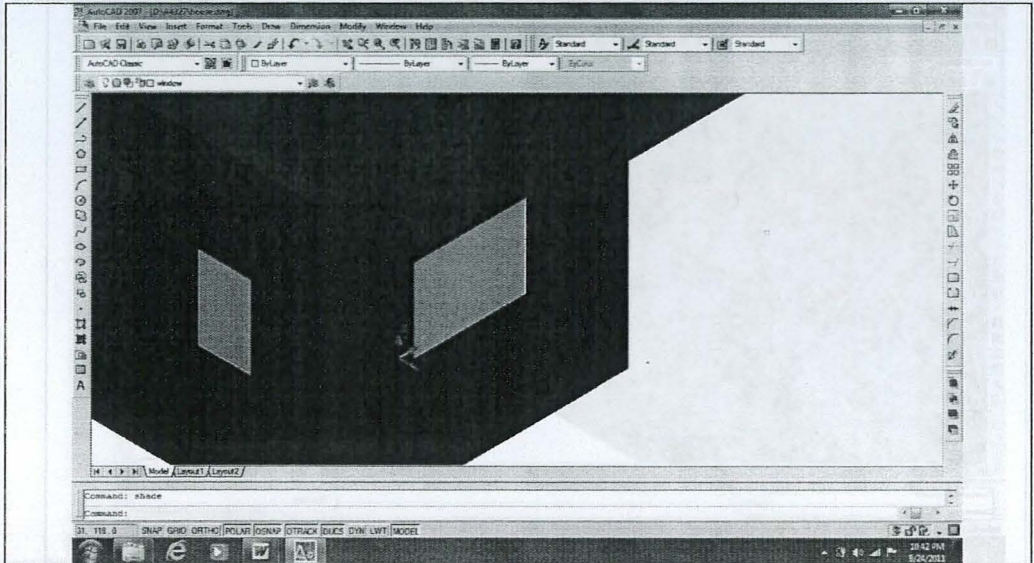


Set UCS origin as shown. Set window as current layer.  
 Zoom to the curve window. Draw the shape of the window.  
 Region the shape to become surface. Extrude the surface by 3  
 Move the surface to the edge of the window hole. Shade.

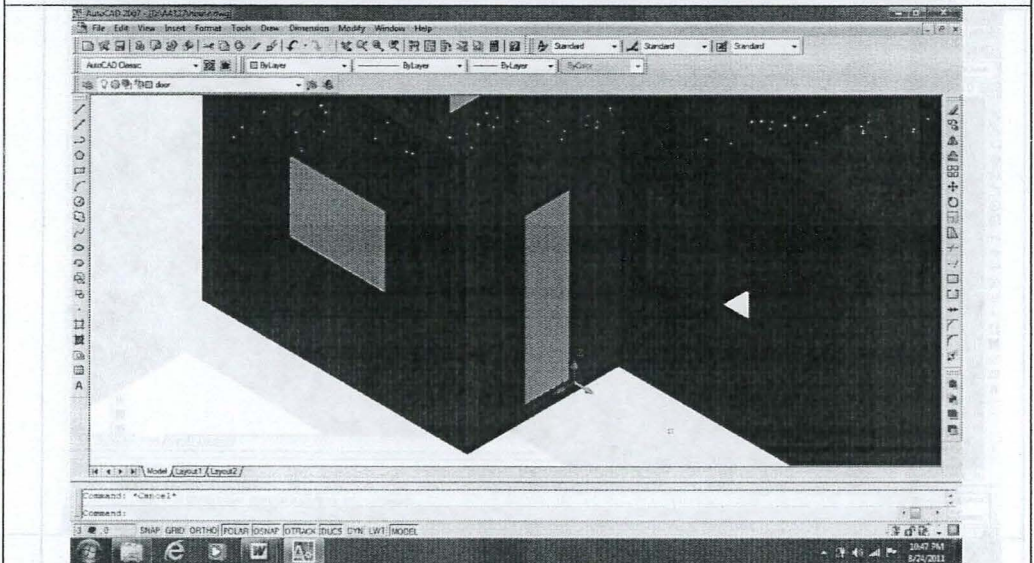


Set UCS origin as shown. Set window as current layer.  
 Zoom to the small window.  
 Draw the rectangle of the window.



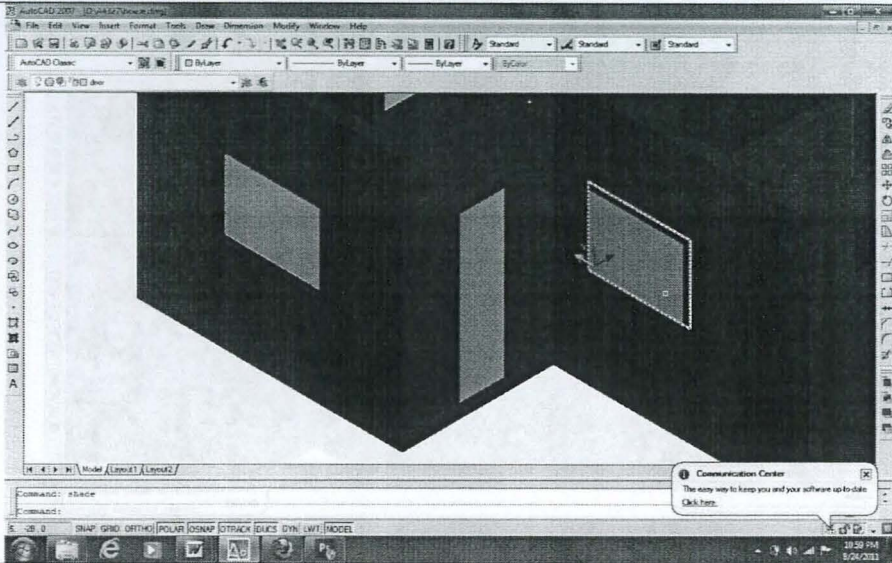


Set UCS origin as shown.  
 Set window as current layer.  
 Zoom to the back window.  
 Draw the rectangle of the window.

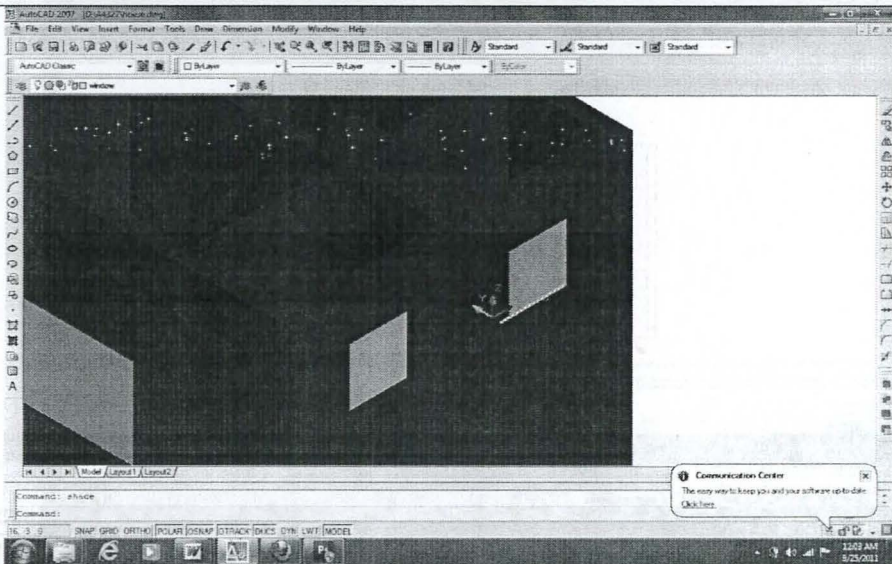


Set window as current layer.  
 Set UCS origin as shown. Set door as current layer.  
 Zoom to the back door.  
 Draw the rectangle of the door. Invoke shade.

## FROM NOTHING TO SOMETHING



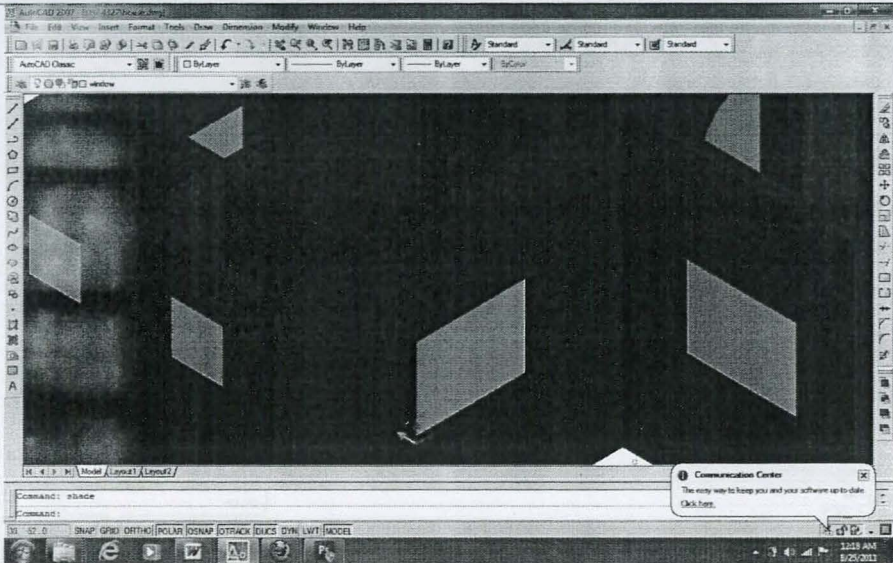
Set UCS origin as shown.  
Set window as current layer.  
Zoom to the back window.  
Draw the rectangle of the window.



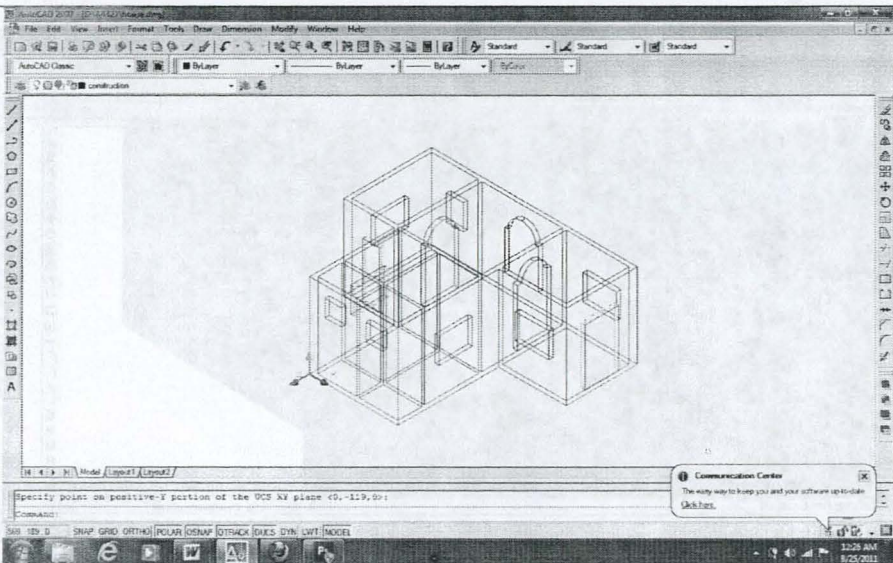
Set UCS origin as shown. Set window as current layer.  
Zoom to the toilet window.  
Draw the rectangle of the window.



## FROM NOTHING TO SOMETHING



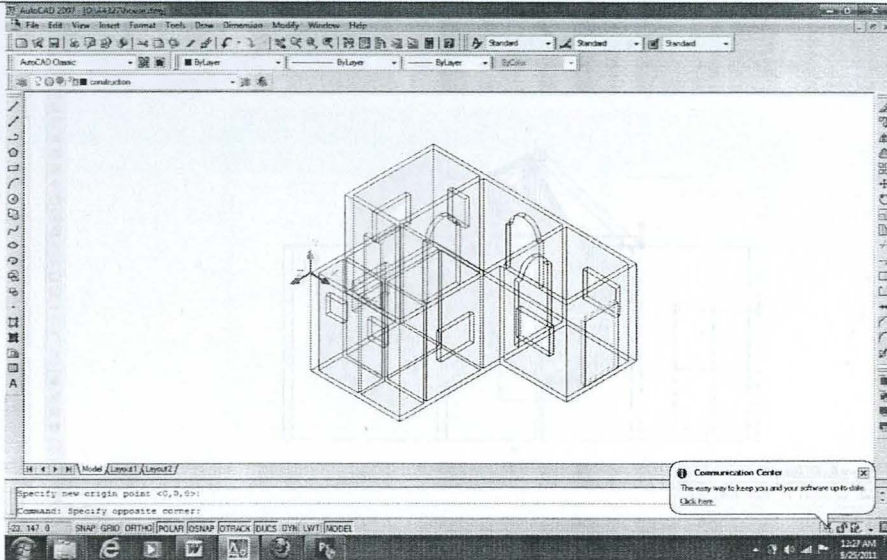
Set UCS origin as shown. Set window as current layer.  
Zoom to the side window.  
Draw the rectangle of the window.



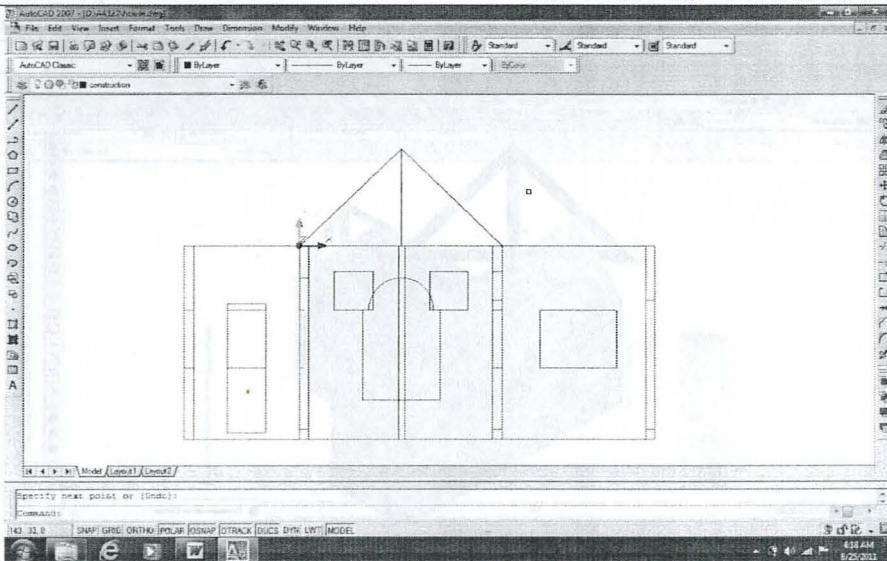
Set UCS use 3point as shown



## FROM NOTHING TO SOMETHING

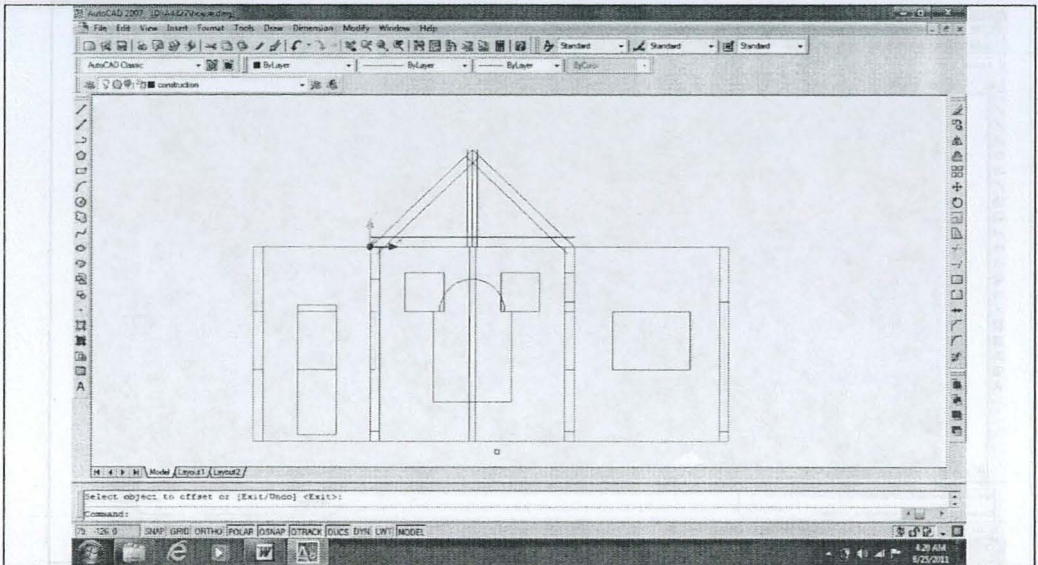


Set UCS and origin at the top as shown

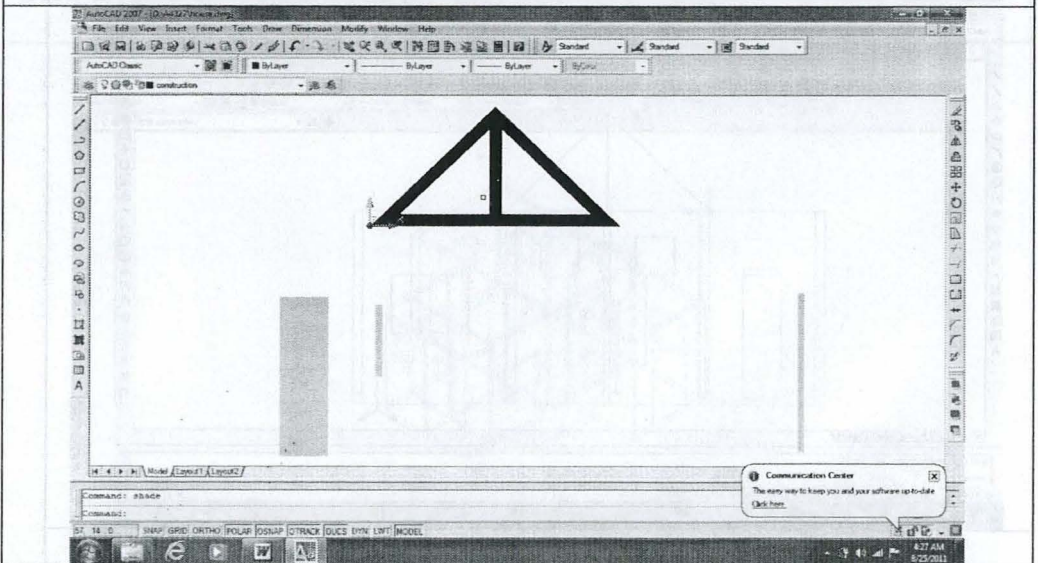


Set construction as current layer.  
Set plan view based on current UCS  
Draw pediment line height equal to 60

## FROM NOTHING TO SOMETHING

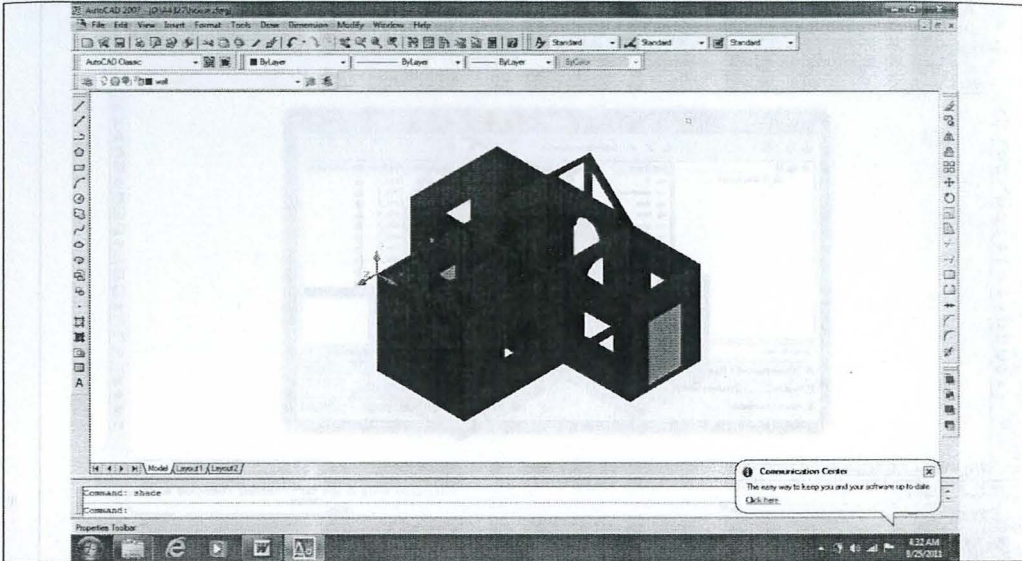


Offset pediment equal to six for all triangle side.  
Offset 3 for both side of the middle line.

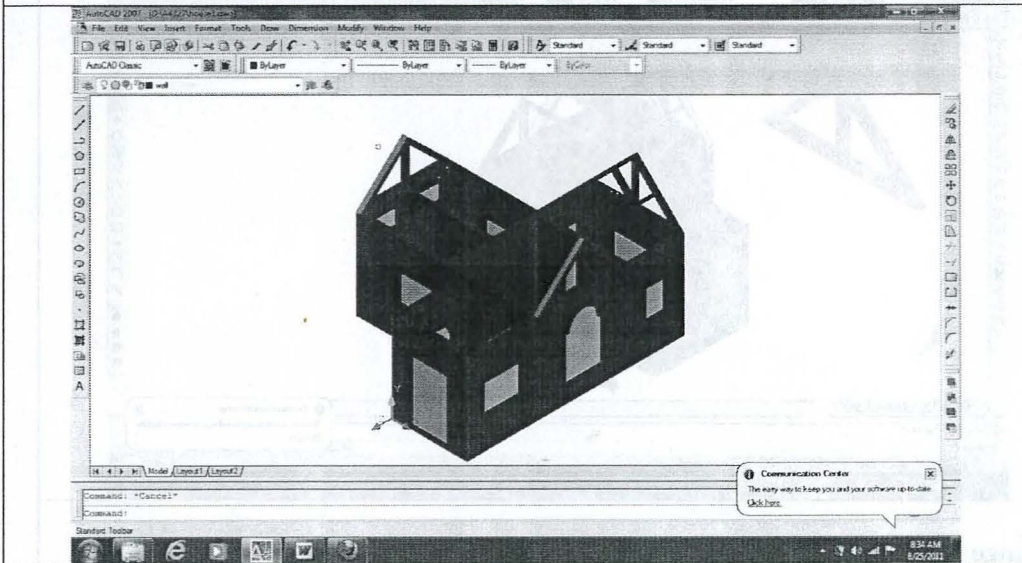


Turn off the wall layer  
Trim and erase to create shape shown.  
Invoke region command  
Subtract two small triangle from the biggest triangle





Set 3D views. Set wall as current layer  
 Extrude the pediment by -6  
 Copy the pediment and move to the wall.



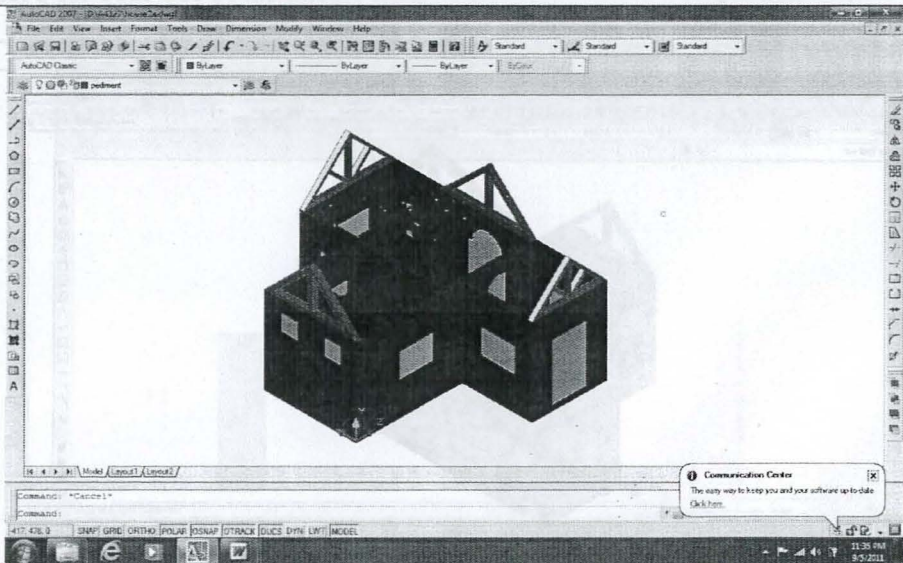
Create all the other pediments using the same technique.  
 Remember the angle must be 45.  
 The other pediment for exterior offset by 4.  
 While interior frame offset by 2 for both side.



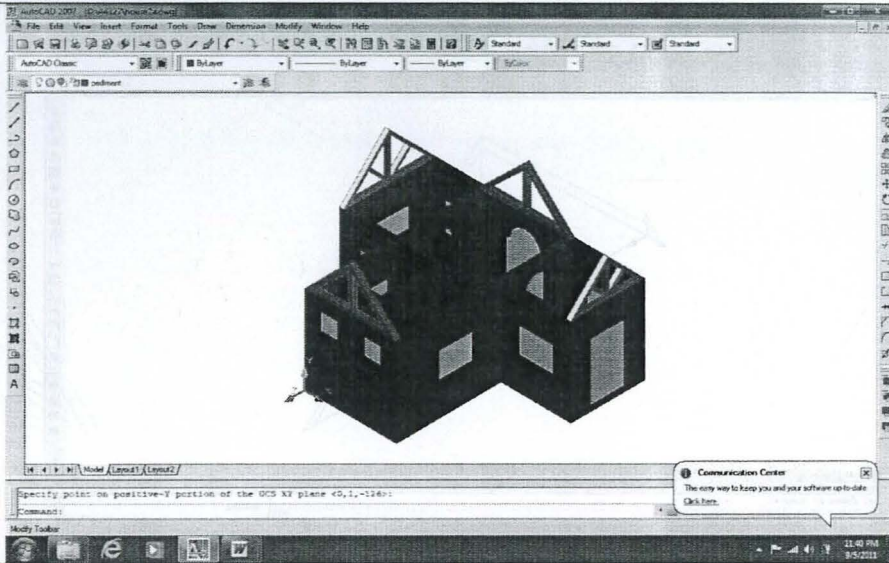
## FROM NOTHING TO SOMETHING



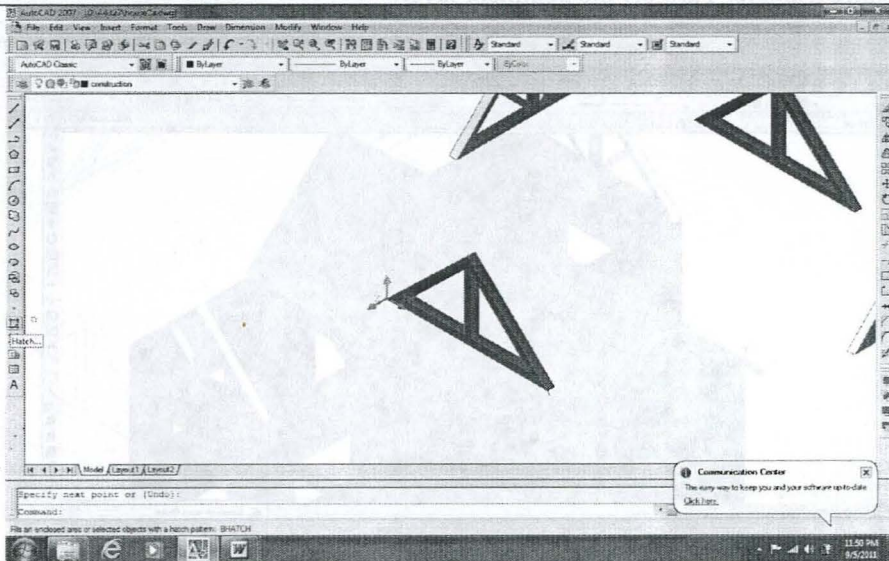
Create layer for pediment and another two layer for roof



Change the pediment to the pediment layer

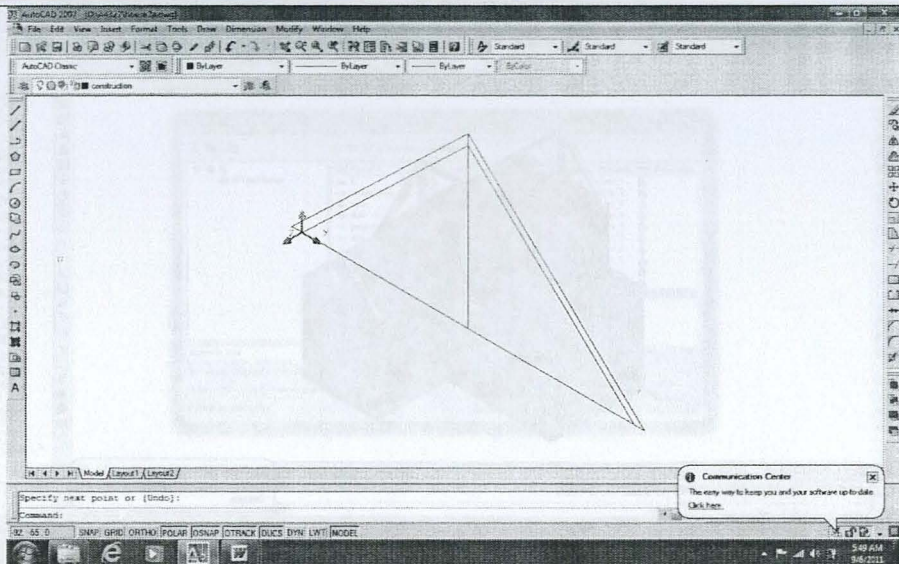


Invoke the SW view.  
Set construction as current layer.  
Use 3p to set UCS as shown.



Turn off other layer  
Turn on the pediment layer as current layer.  
Draw line on the top of the pediment shown



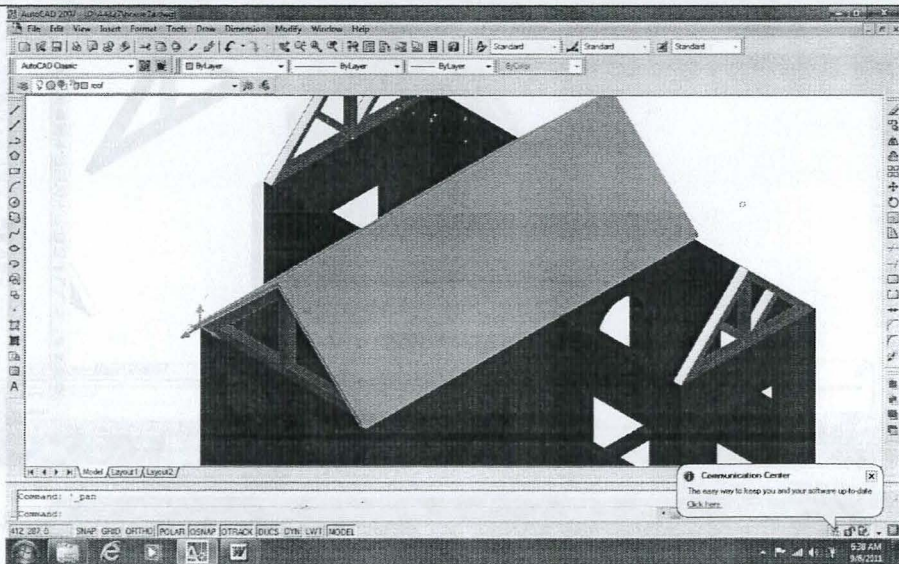


Zoom to one pediment. Use construction as current layer.

Draw line at the bottom. Extend both line by 4 at each end using @4<0 and @4<180.

Draw vertical line from mid of horizontal at the bottom with height of @64<90

Join the entire triangle. Turn off the pediment layer.

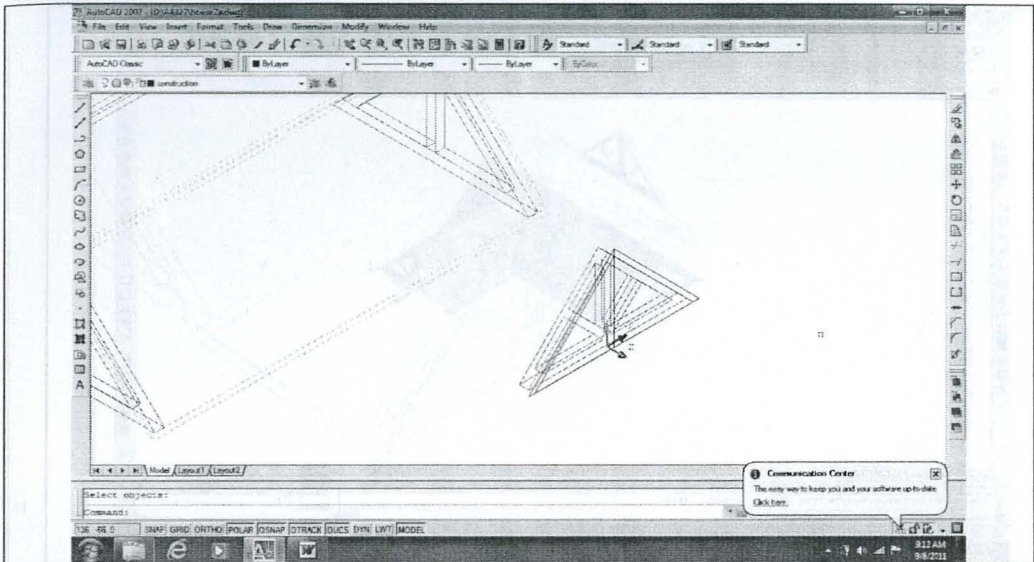


Erase the vertical and the bottom line. Set roof as current layer.

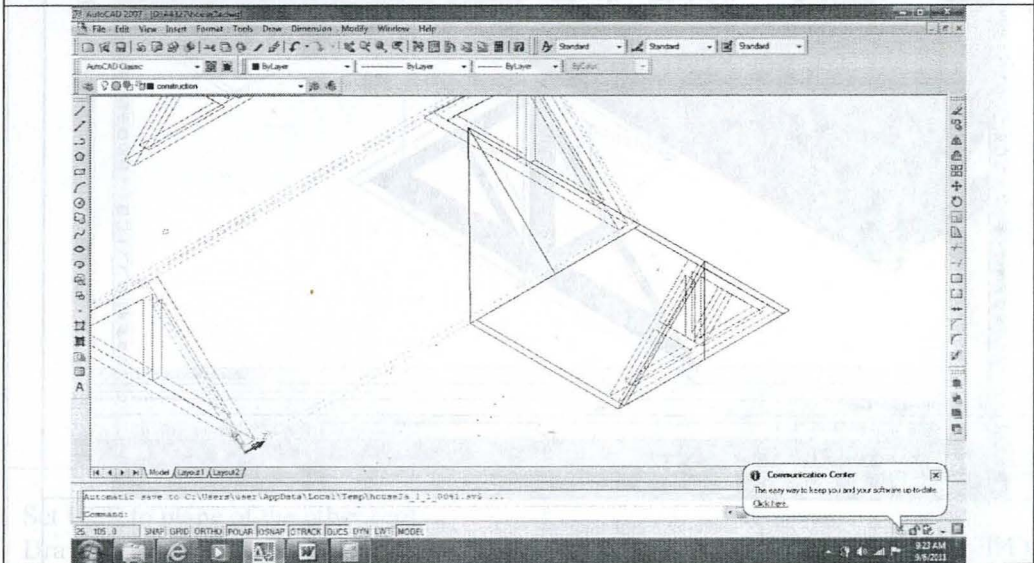
Invoke region command. Move the roof plane @0,0,4.

Turn on the pediment and wall layer. Apply extrude with the height of -(254)

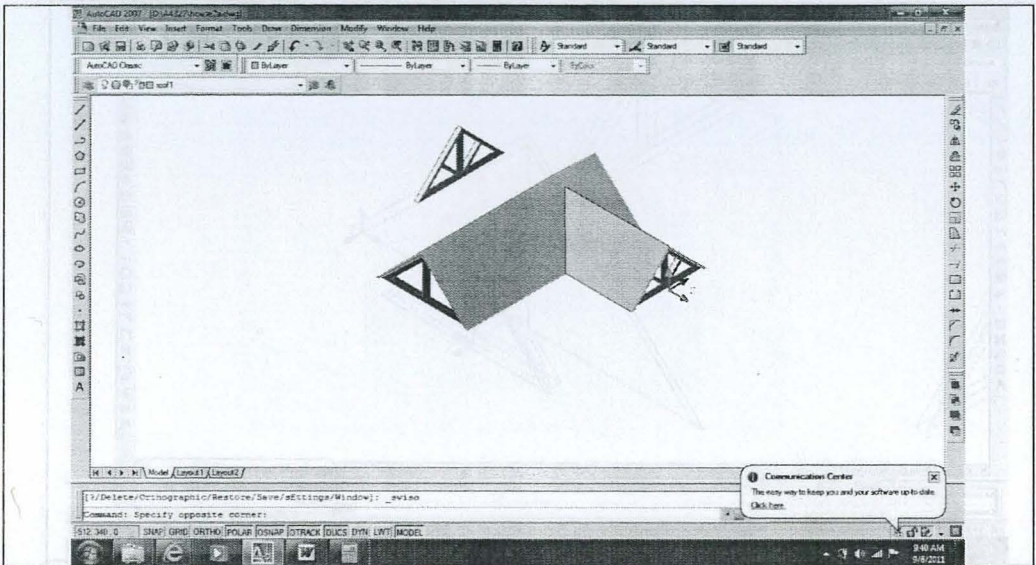




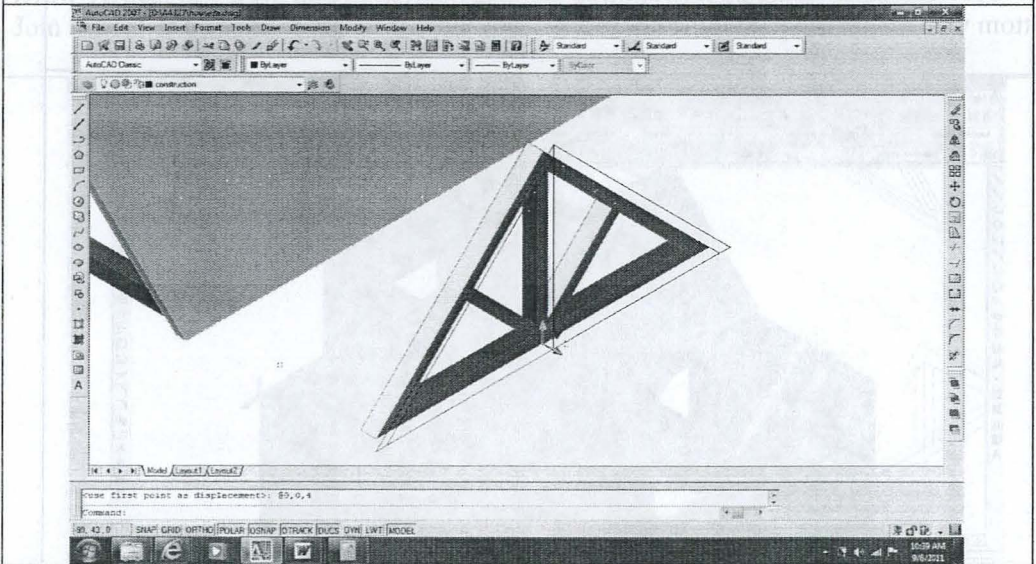
Zoom toward the pediment. Turn off the wall layer. Set construction as current. Draw on all edge of pediment. Extend both line by 4 at each end using  $@4<0$  and  $@4<180$ . Move the line by  $@0, 0, 4$ . Draw vertical line from mid of horizontal at the bottom with height of  $@55<90$ . Join the entire triangle.



Set UCS use 3p on the plane of the other roof as shown. Set visual style as 3D wireframe. Draw line from the mid of the other line lay on the roof  $@78<90$ . Connect both horizontal lines on the end. Connect all the line as shown.

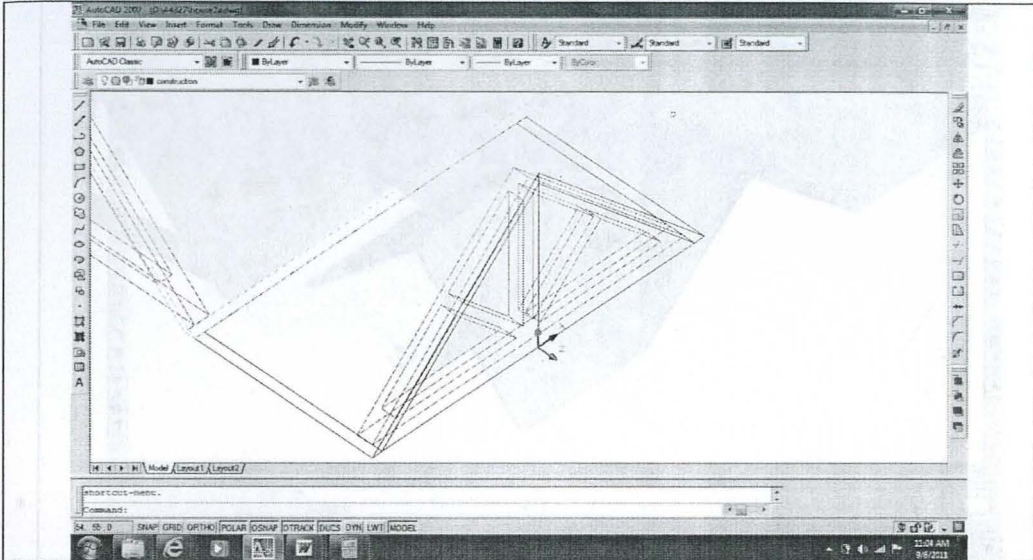


Set UCS at the plane of the pediment. Apply region to the roof plane at the pediment. Invoke 3D Face at the other part of the roof. Shade the roof.

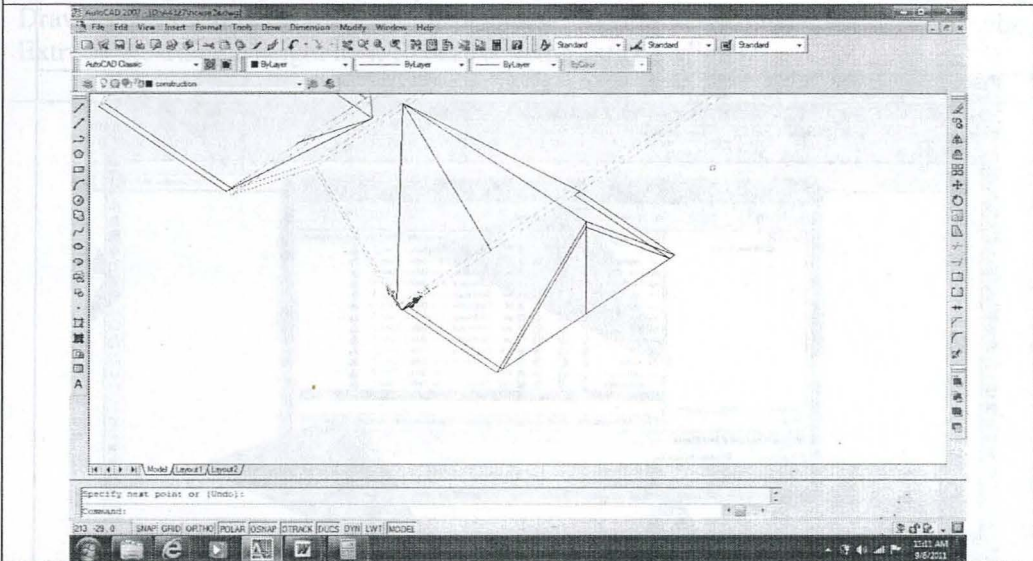


Set NE view. Set construction as current layer.  
 Zoom toward the pediment. Draw on all edge of pediment.  
 Extend both line by 4 at each end using @4<0 and @4<180.  
 Draw vertical line from mid of horizontal at the bottom with height of @67<90  
 Join the entire triangle. Move the line by @0,0,4.





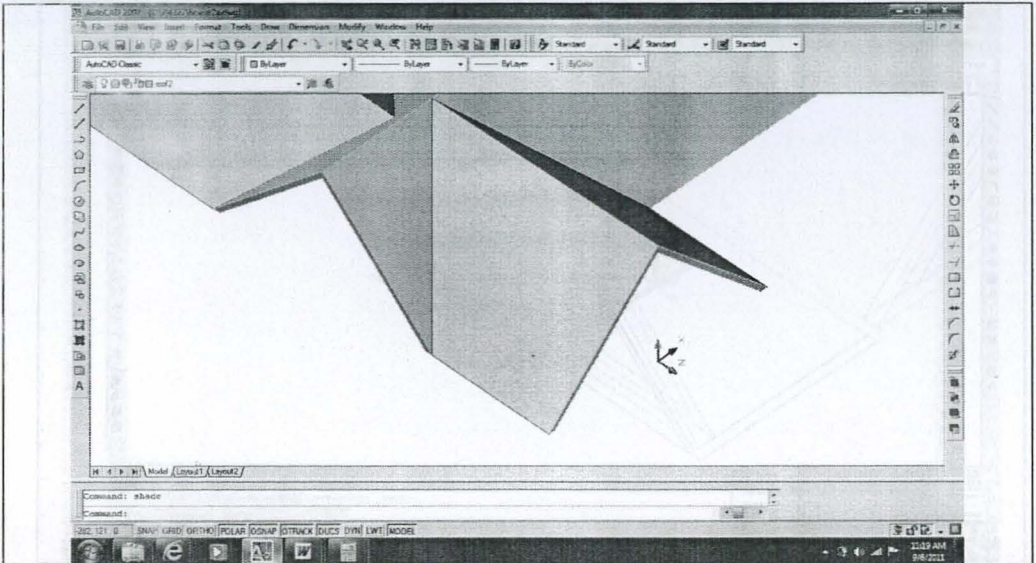
Connect the line as shown.



Set UCS to plane of the other roof.  
 Draw line from the mid of the bottom to the ridge of the roof.  
 Connect all the line.



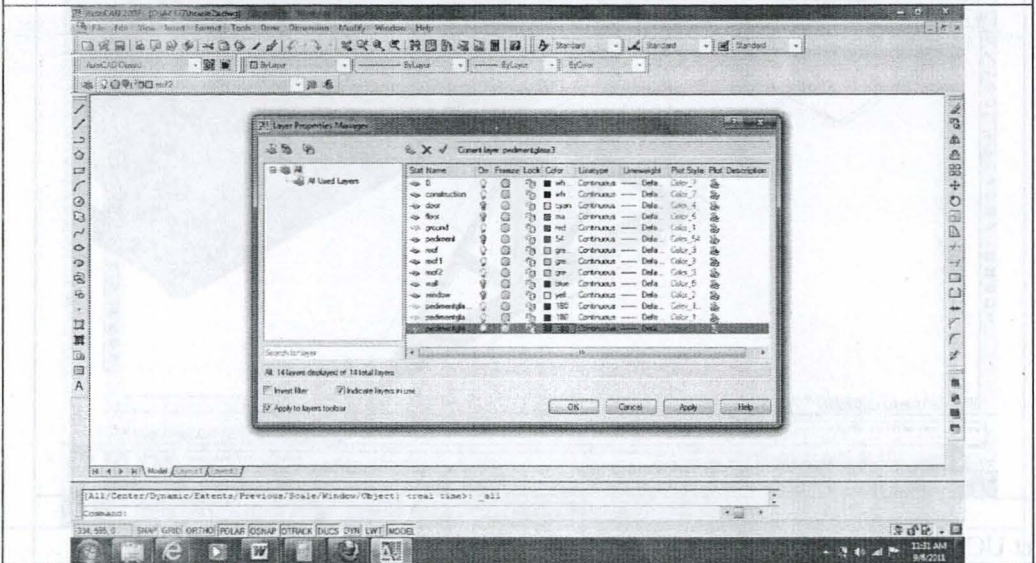
## FROM NOTHING TO SOMETHING



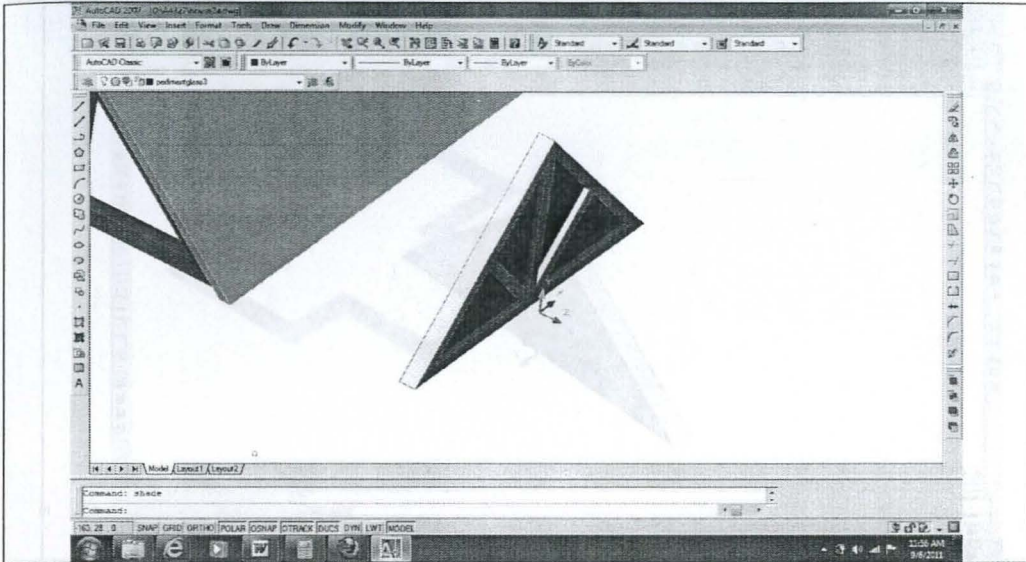
Set roof2 as current layer.

Apply 3Dface.

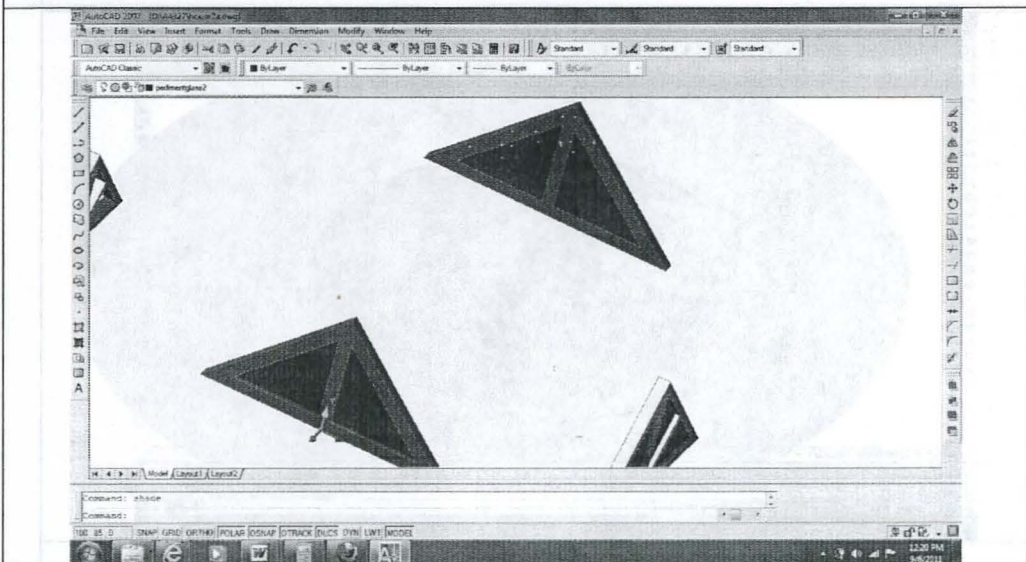
Shade.



Add 3 more layers which are pedimentglass, pedimentglass1 and pedimentglass2

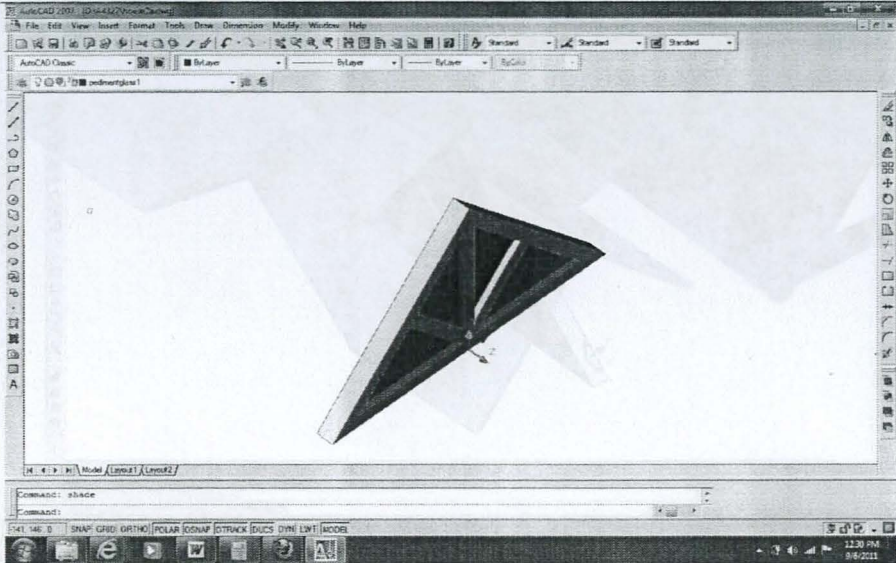


Set pedimentglass2 as current layer. Set NE view. Turn off the roof2 layer. Zoom to the pediment. Set view style as 3D wireframe. Draw triangle within each hole in the pediment. Region the pediment glass. Extrude the triangle height to 4. Repeat with the entire pediment.

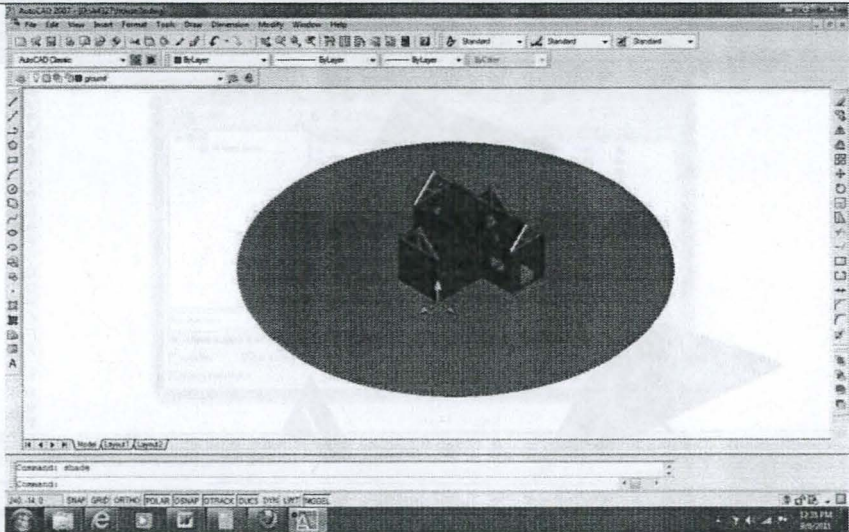


Set UCS as shown. Turn off the entire roof layer. Set pedimentglass1 as current layer. Draw triangle within hole. Invoke region command. Extrude the glass to 4





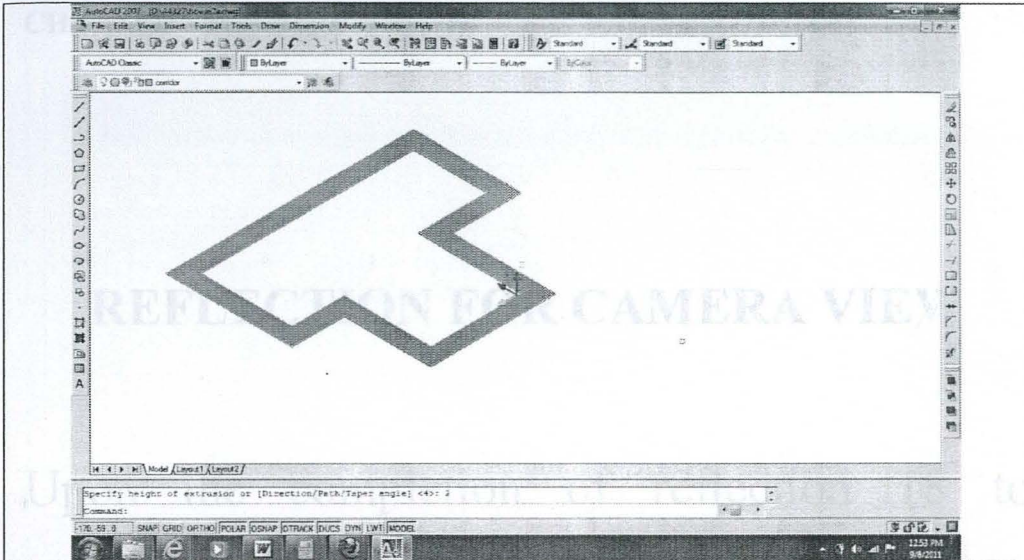
Set UCS as shown. Set SE view.  
 Zoom to the pediment. Set pedimentglass as current layer.  
 Draw triangle within hole. Invoke region command.  
 Extrude the glass to 4



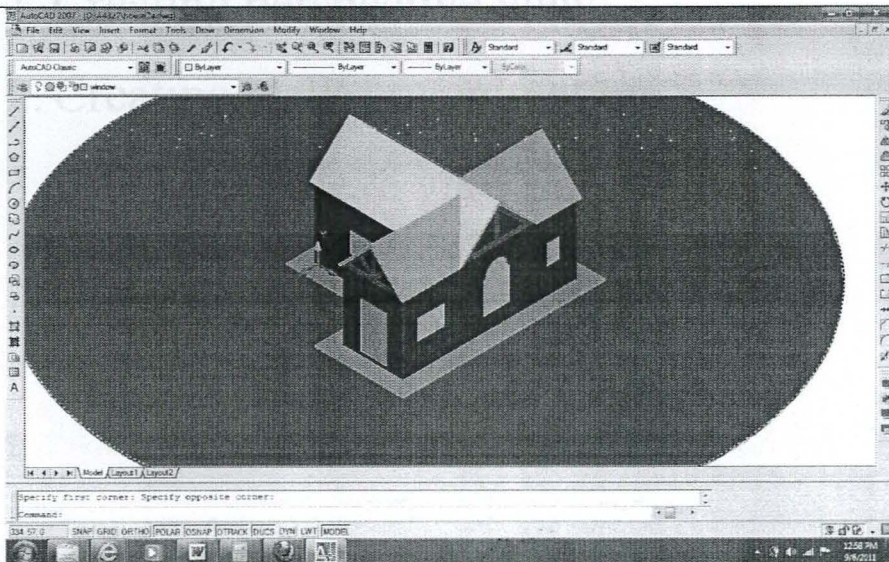
Set UCS to world.  
 Set ground as current layer.  
 Draw circle radius equal to 50.  
 Extrude the circle by -4.



## FROM NOTHING TO SOMETHING



Off the entire layer except ground. Create and set corridor as current layer.  
Draw line around the wall. Set the wall layer off.  
Offset the line by 24. Connect the lines. Invoke region command.  
Subtract interior from outer line. Extrude the corridor by 2



Invoke the SE view.  
Zoom into the house.





## CHAPTER SIX

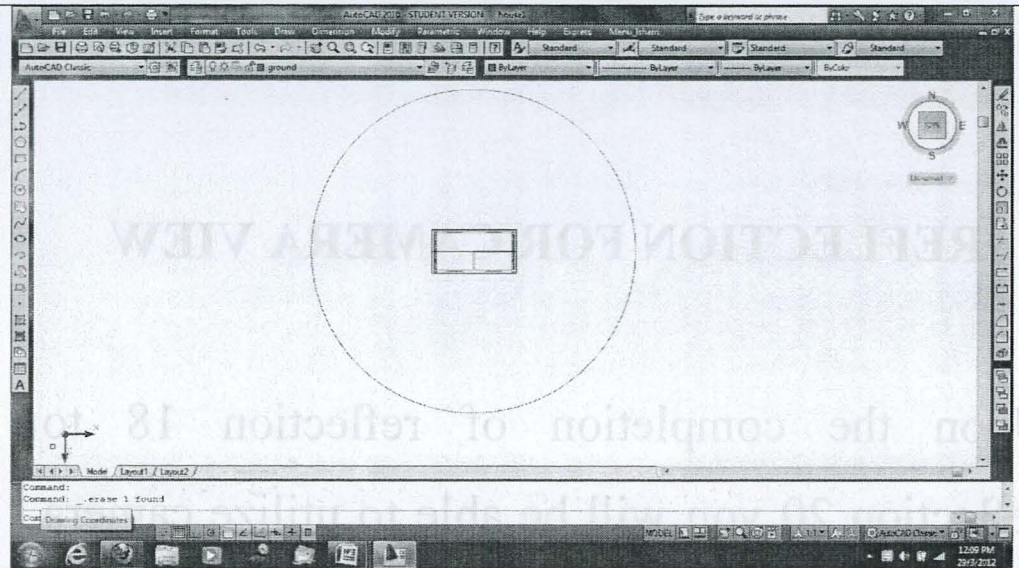
# REFLECTION FOR CAMERA VIEW

Upon the completion of reflection 18 to reflection 20 you will be able to utilize camera tool in AutoCAD on

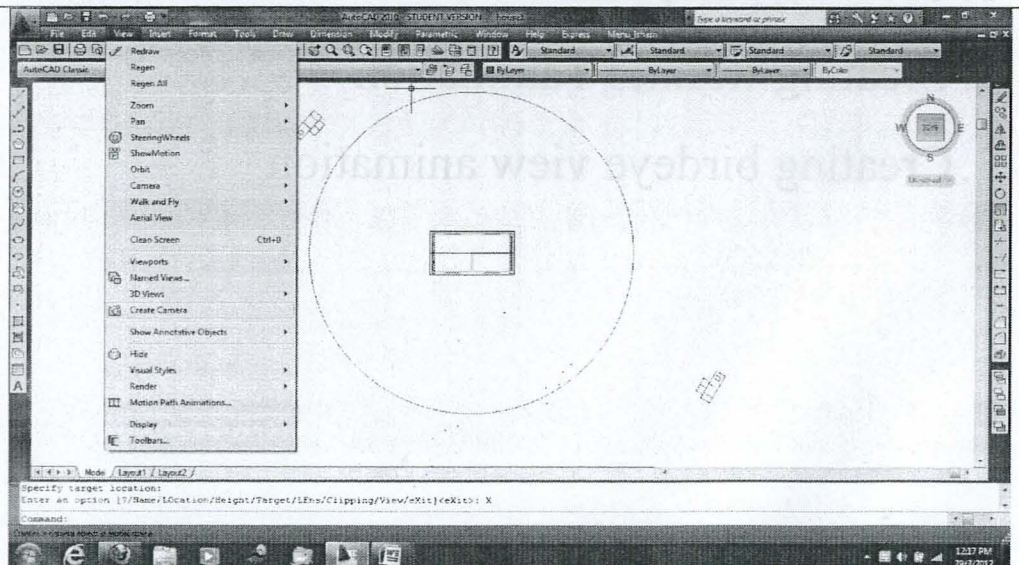
1. Creating perspective view
2. Creating walkthru animation
3. Creating birdeye view animation



## Reflection 18 – Creating view using camera in AutoCAD

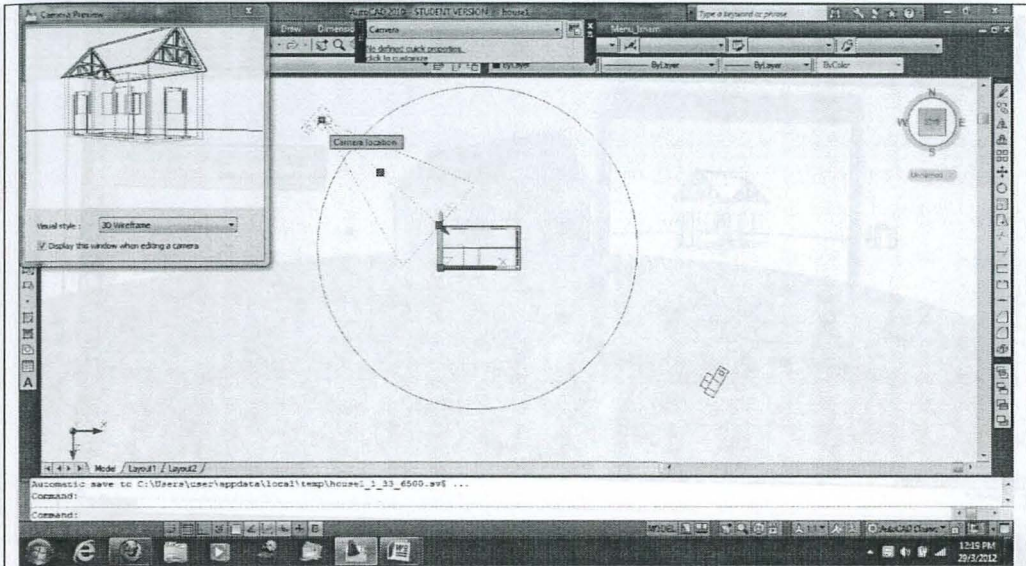


Open the house from reflection 16  
Set the view to floor plan view based on WCS

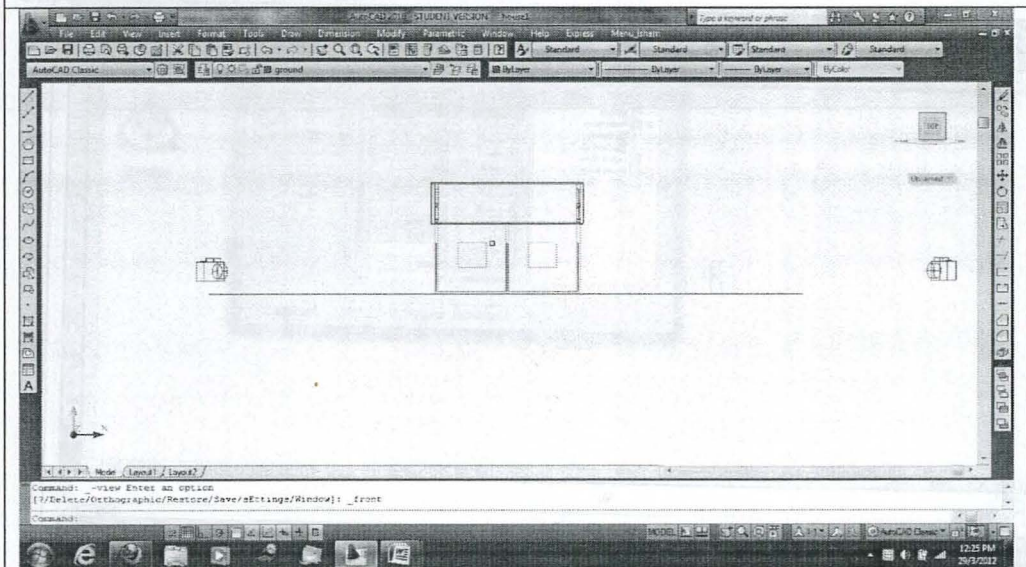


Set two cameras on the plan view.

## FROM NOTHING TO SOMETHING



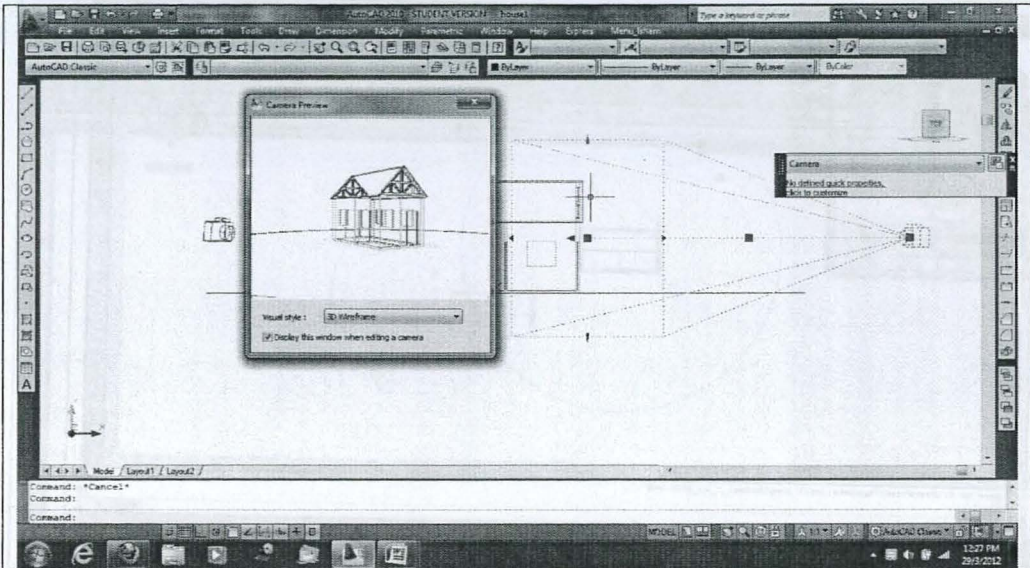
Click the camera the camera preview will be shown.



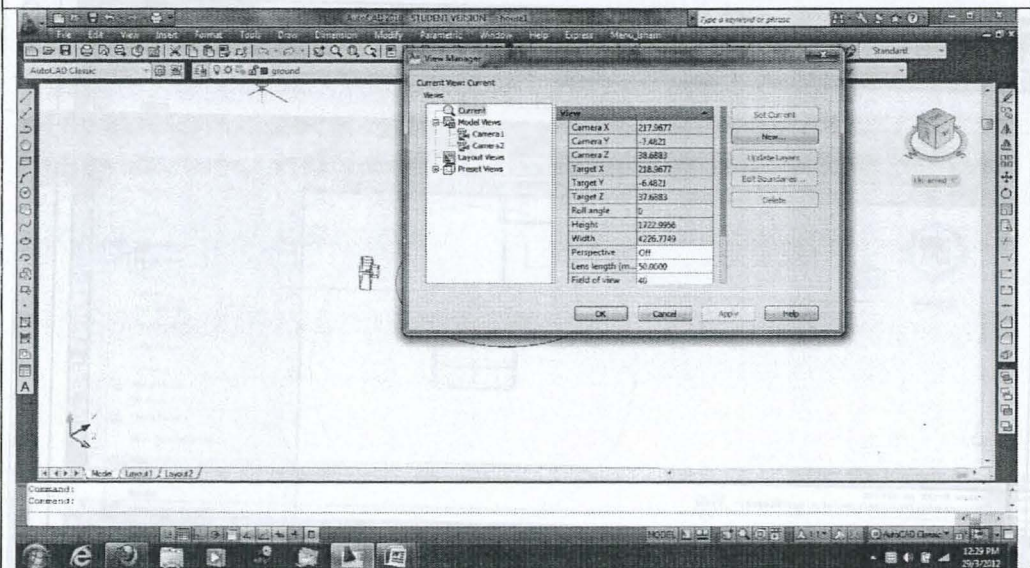
Set the view to elevation view



## FROM NOTHING TO SOMETHING



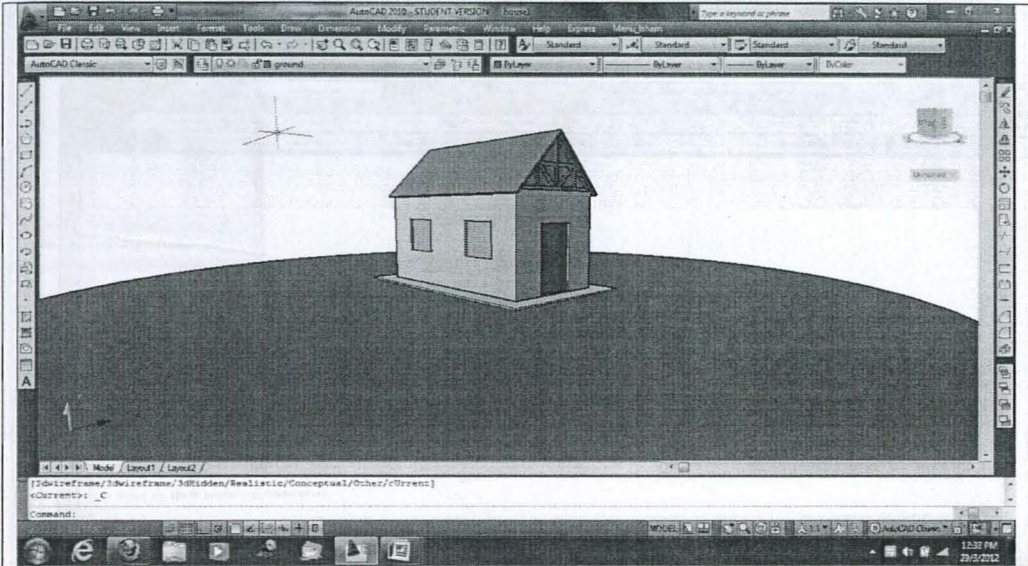
Adjust the camera on the elevation views



Set the view as 3D SW view.  
Click view>name view.  
View Manager dialog box will occur.

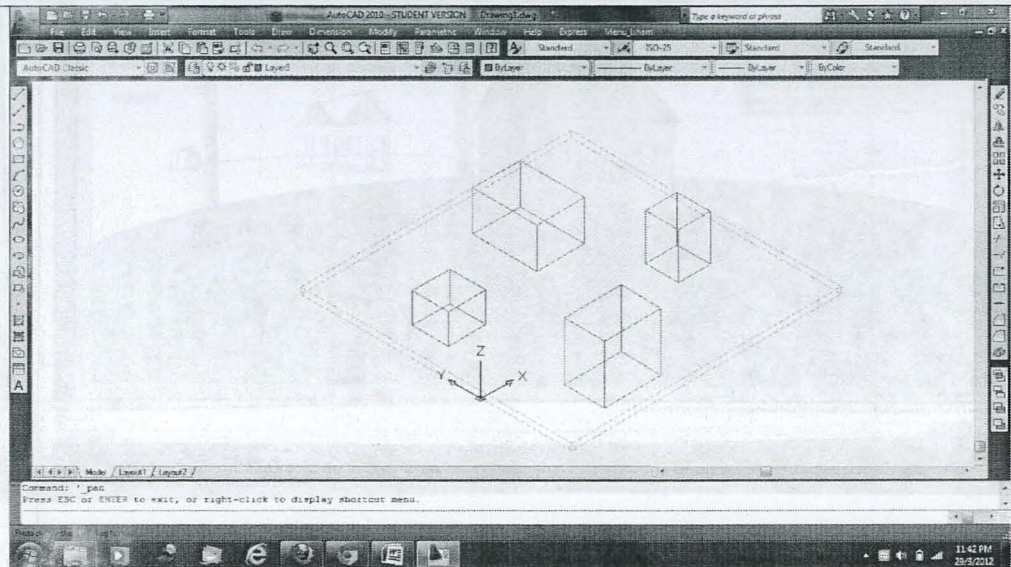


## FROM NOTHING TO SOMETHING



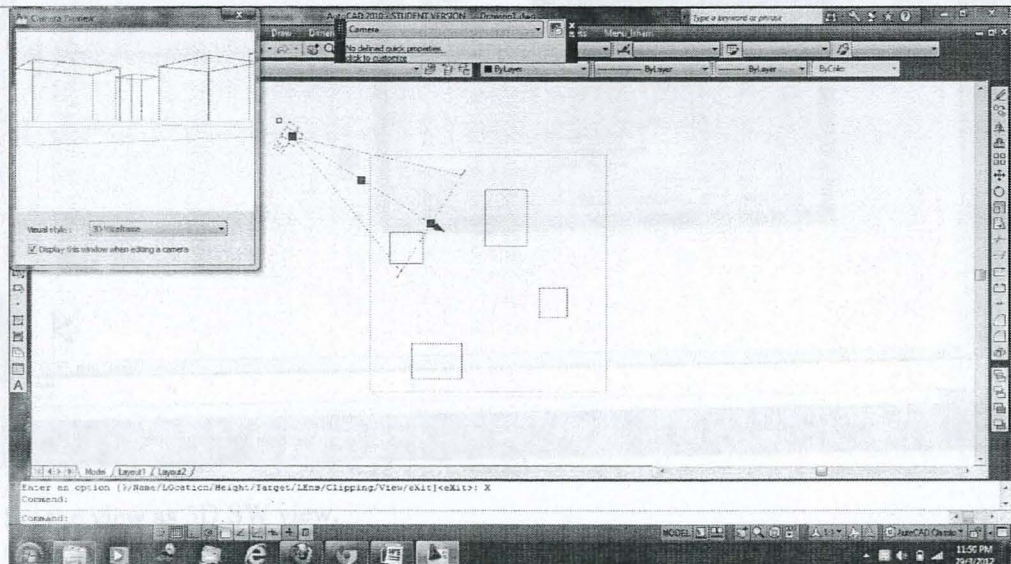
In the view manager dialog box select camera 1 as current.  
Click applies in view manager.  
Invoke shade command  
Camera view is shown

## Reflection 19 – Utilizing camera for walk thru animation



Invoke SW Isometric view

Set 4 layers and draw object as shown. Estimate the height and size

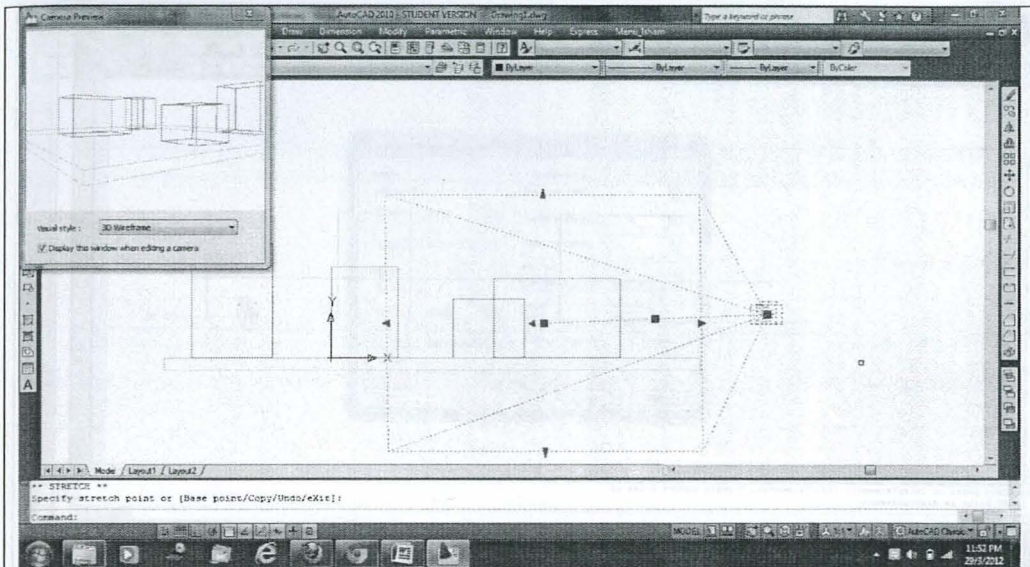


Set plan view in the current UCS

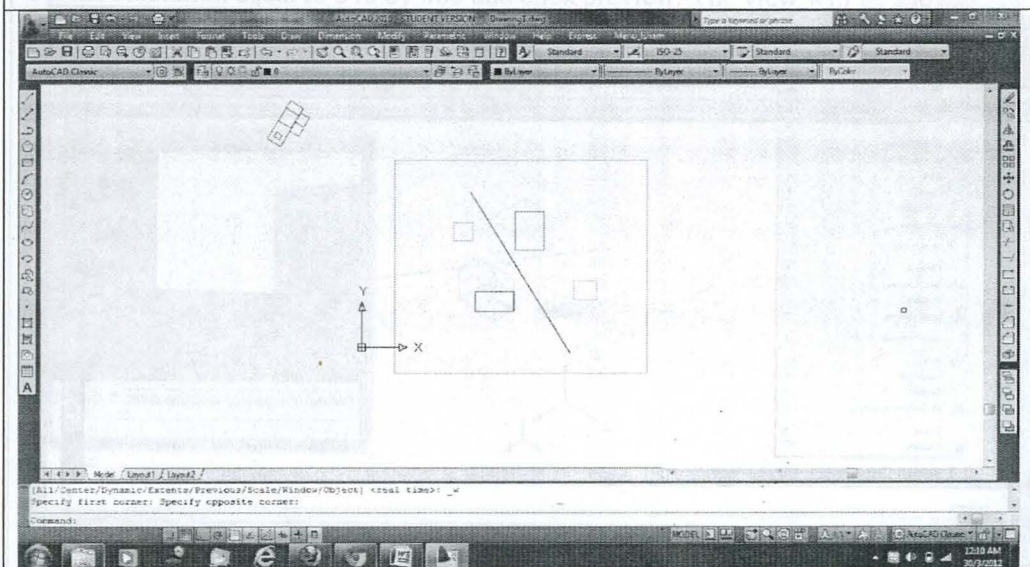
Create one camera

Adjust the camera's position.



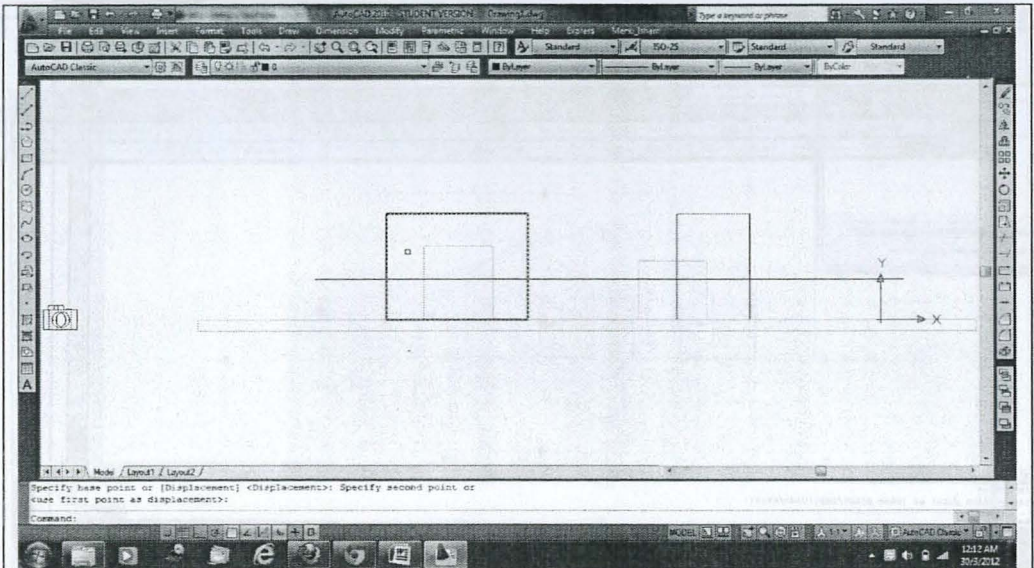


Set the elevation view  
Adjust the camera in elevation view including the field of view

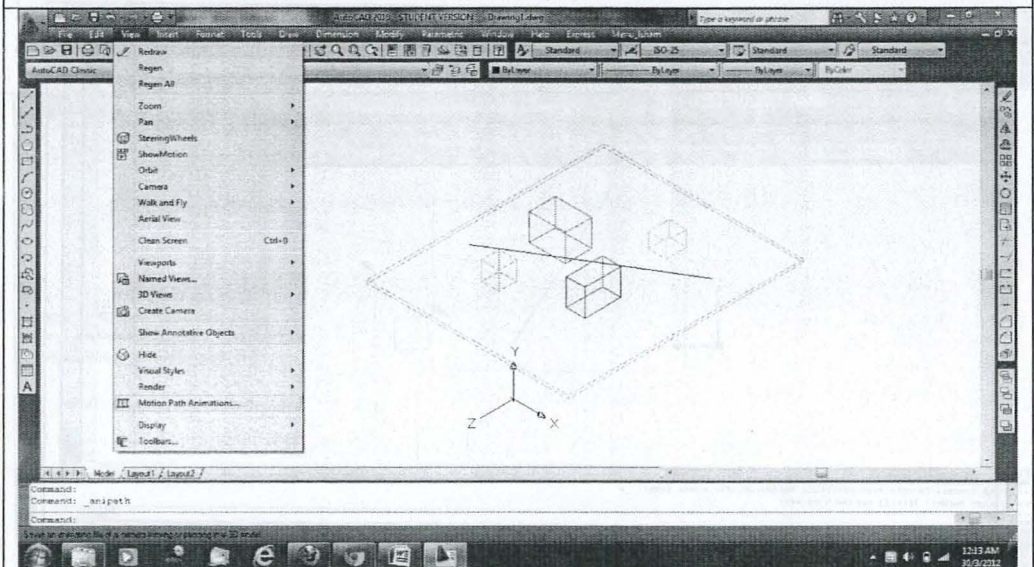


Set plan view. Set construction as current layer.  
Draw straight line between objects as shown.



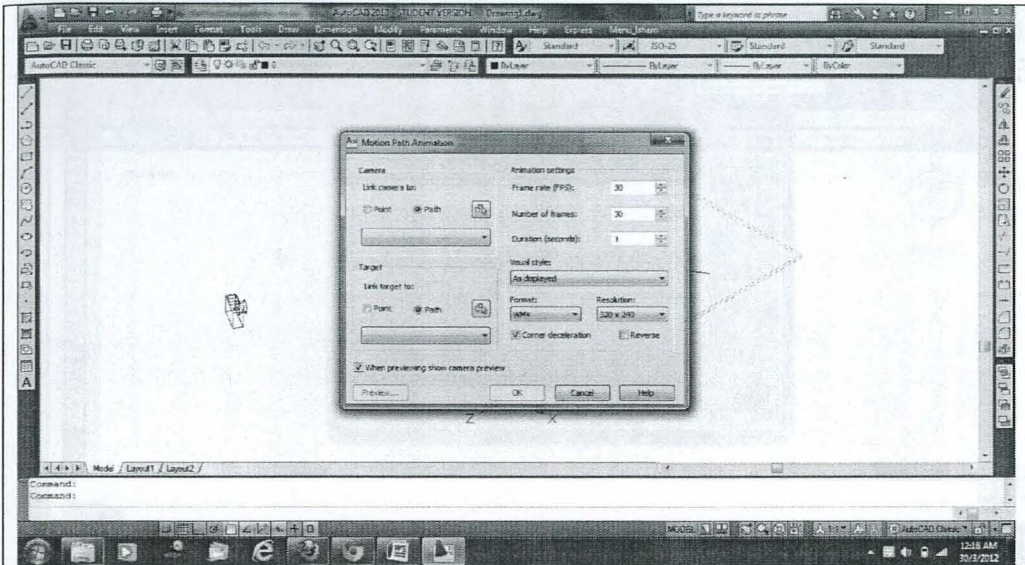


Set elevation view.  
Move the line to the height as shown



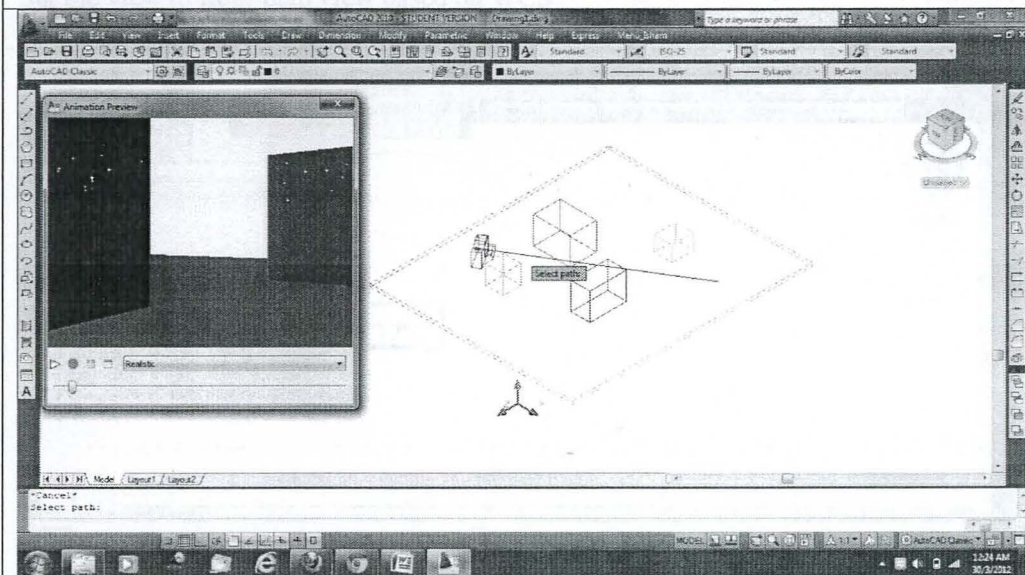
Click motion path animation in the view pull down menu.  
Motion path animation dialog box will occur

## FROM NOTHING TO SOMETHING



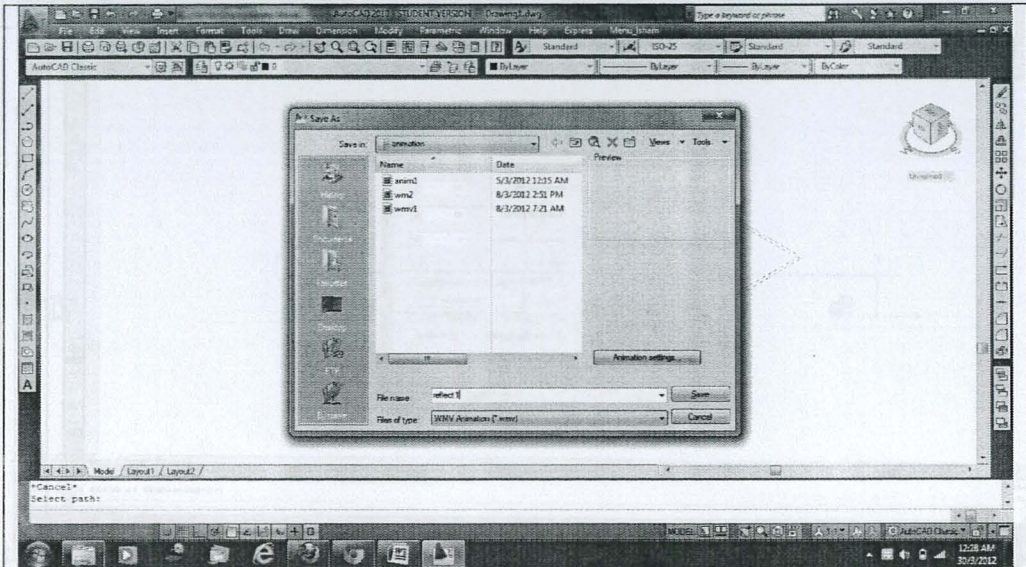
Select the line as path and the line as target

Set the frame rate to 25 and time is equal to 10 seconds. Set visual style to conceptual  
Set the resolution equal to 640 by 480 and click preview. The view will be shown.

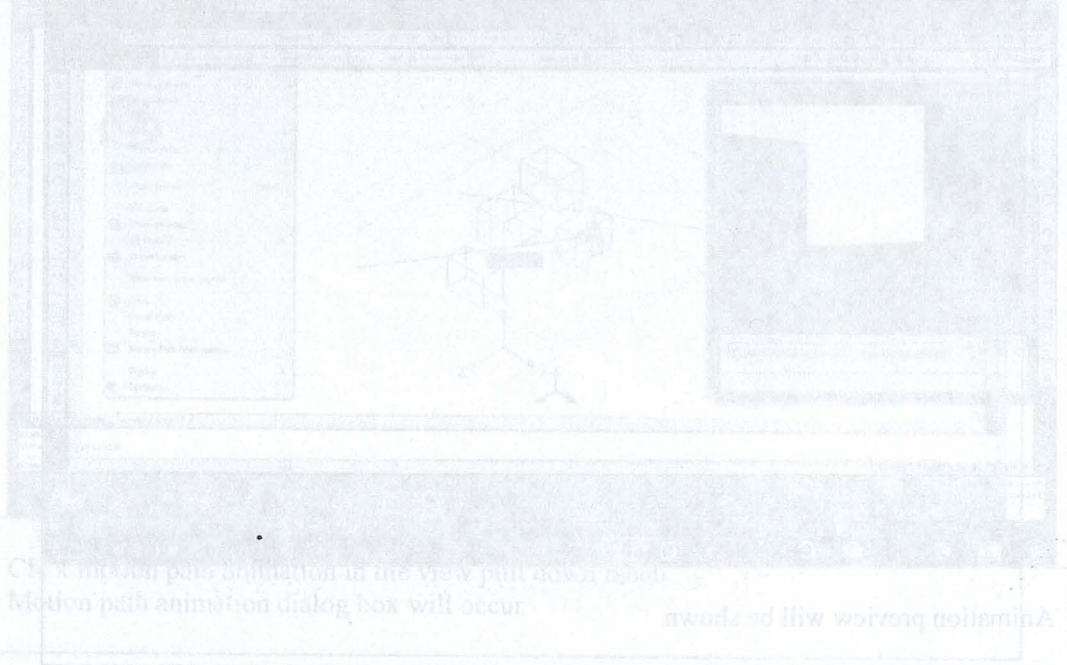


Animation preview will be shown



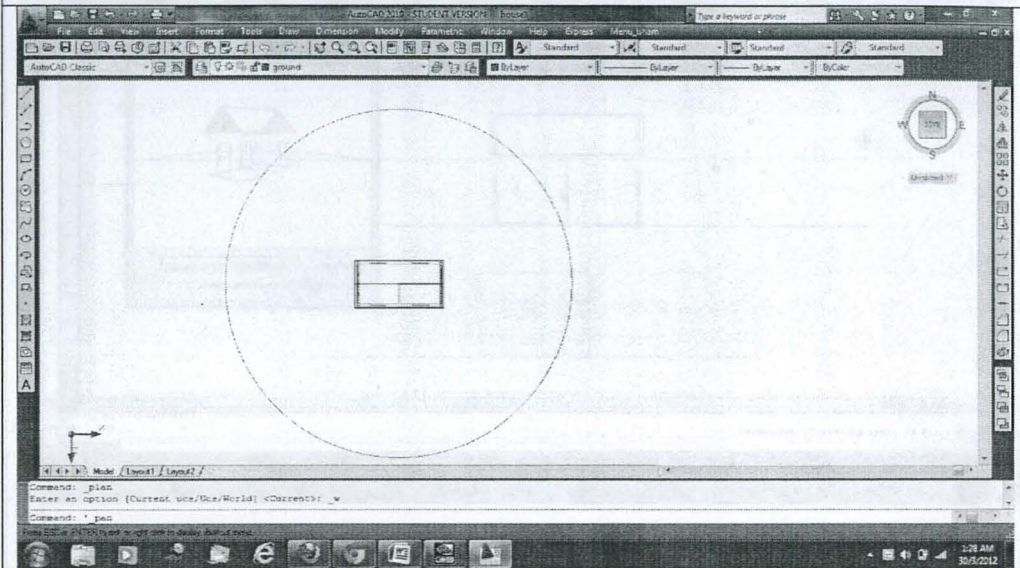


When we click in dialog box the saving display will occur  
 Animation can be saved either in wmv or mpeg or avi format  
 For this reflection the walkthrough animation is considered done

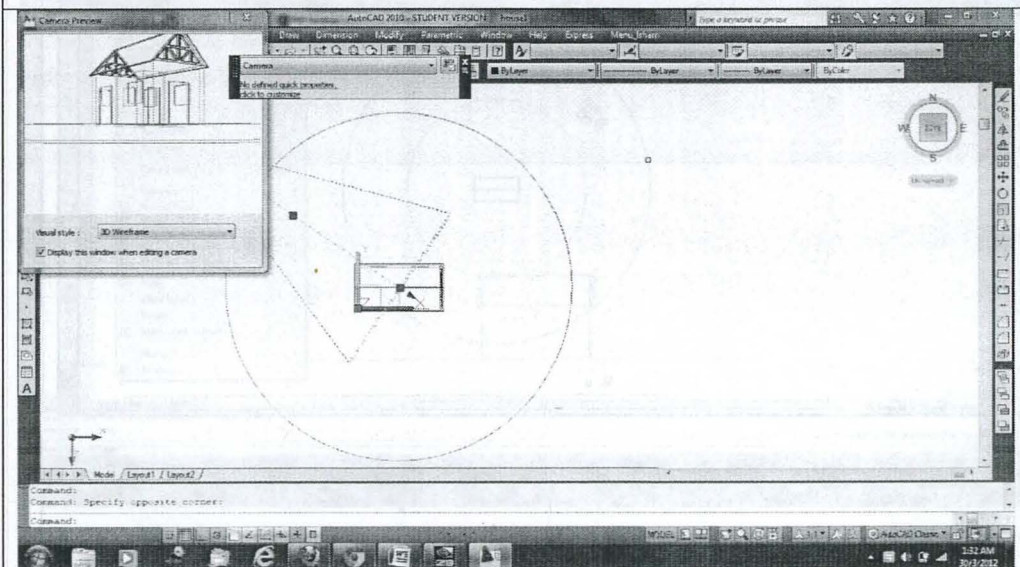




## Reflection 20 – Utilizing camera for bird eye animation

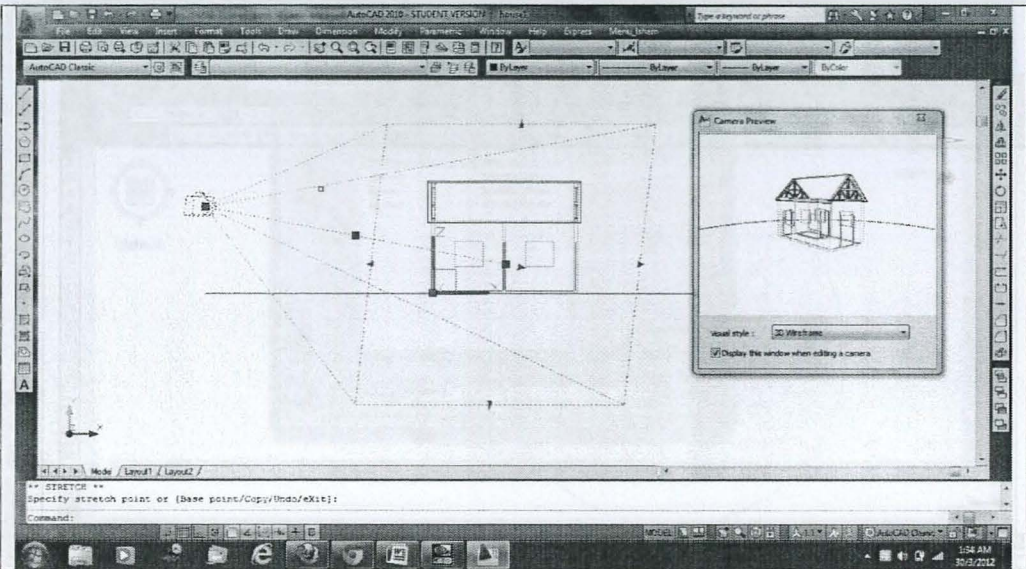


Open the house from reflection 16  
Set the view to floor plan view based on WCS

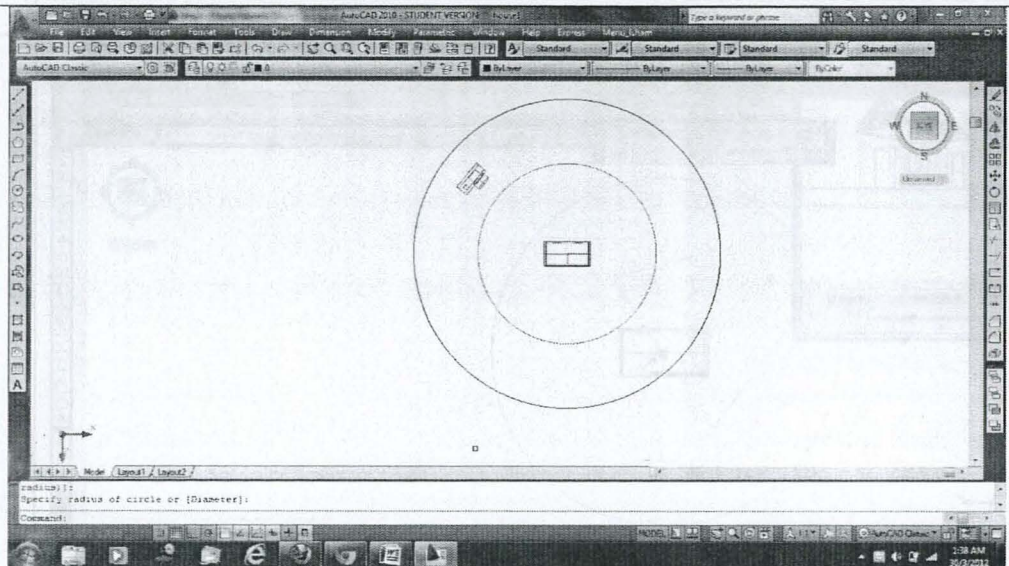


Create a camera in a plan view  
Adjust the camera

## FROM NOTHING TO SOMETHING



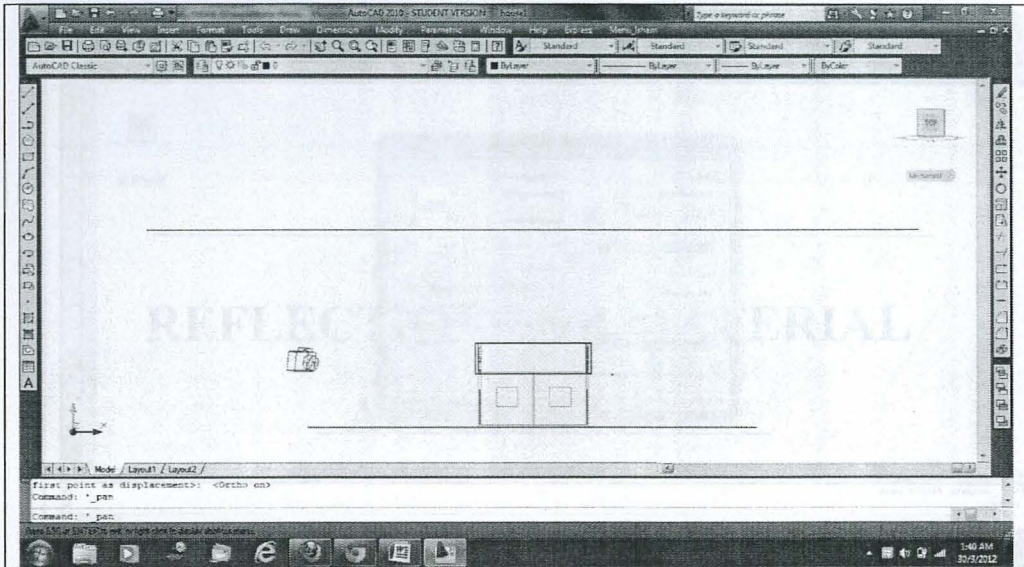
Set the camera in the elevation view  
Adjust the field of view



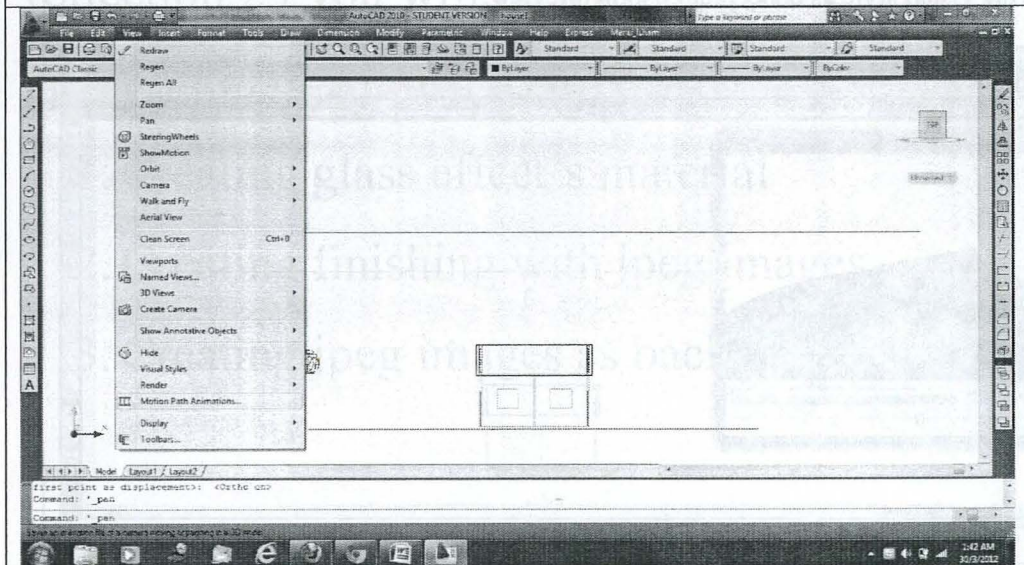
Set the object in plan view and draw big circle as shown  
Use construction as current layer



## FROM NOTHING TO SOMETHING



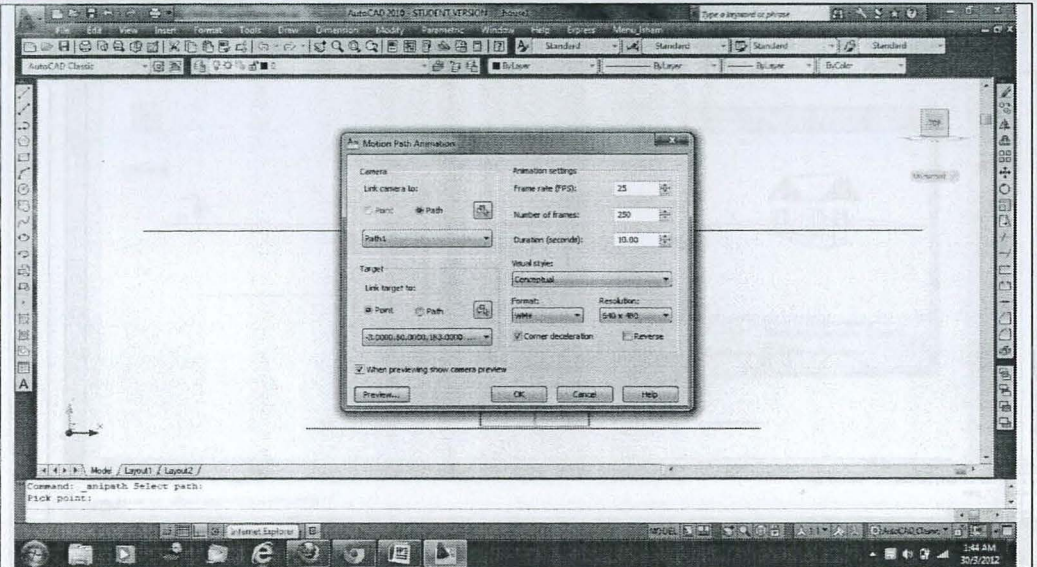
Set the view in elevation  
Move the construction line upward above the house



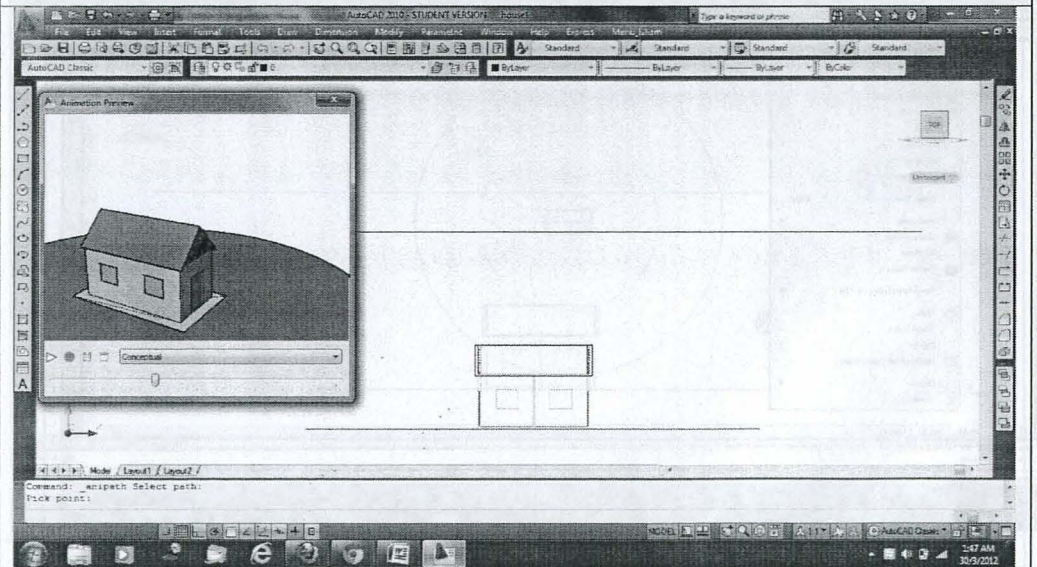
Invoke the motion path animation dialog box



## FROM NOTHING TO SOMETHING



Motion path animation dialog box will be shown. Select big circle as path. Select one point on the roof as target. Set the frame rate to 25. Set the time to 12. Set the visual style as conceptual. Apply preview.



When previewed being applied, animation preview dialog box is shown. Save the file in wmv format. The bird eye animation task is considered done.

CHAPTER SEVEN

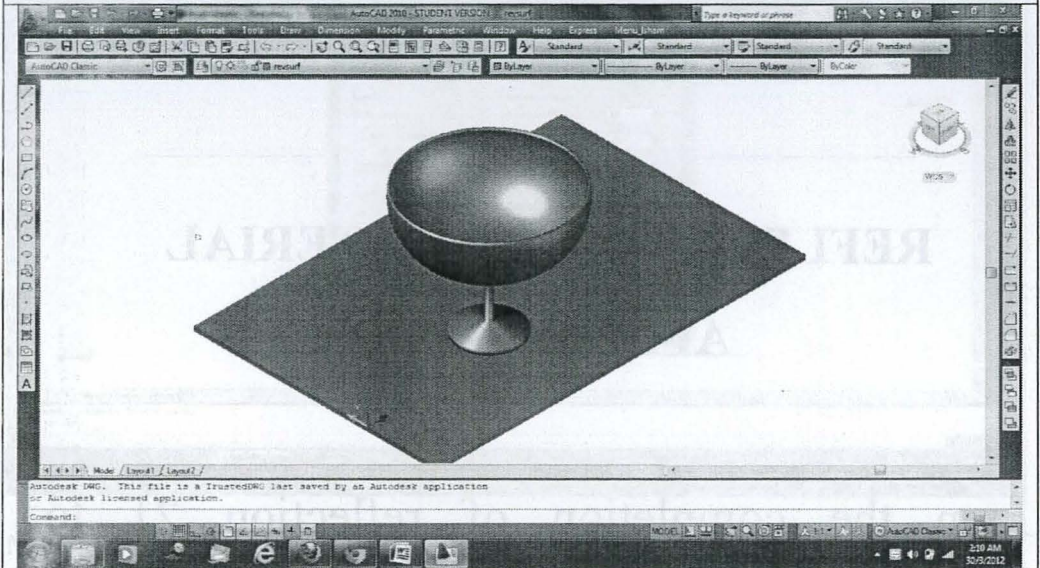
## **REFLECTION FOR MATERIAL APPLICATION**

Upon the completion of reflection 21 to reflection 23 you will be able to utilize material application in AutoCAD on

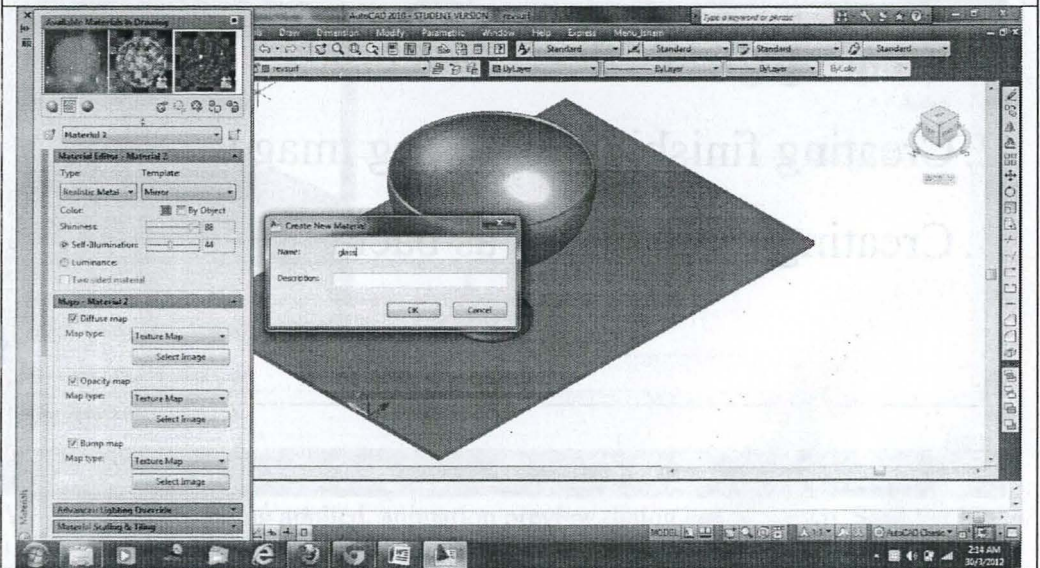
1. Creating glass effect's material
2. Creating finishing with jpeg images
3. Creating jpeg images as background



## Reflection 21 – Material application with glass effect



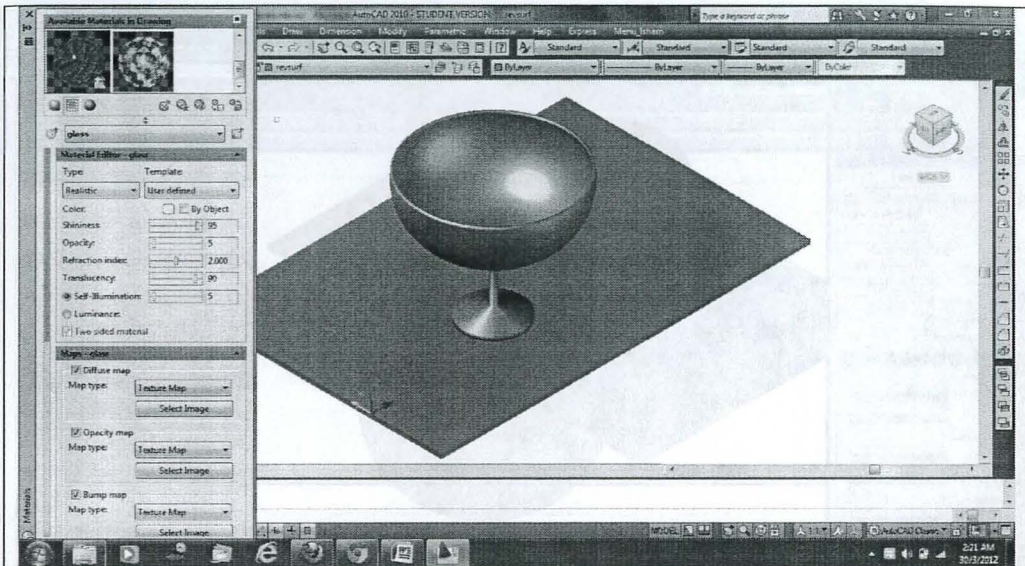
Open the drawing created from reflection 5  
 Create a rectangular base with estimated size and thickness  
 Invoke the SW Isometric view.



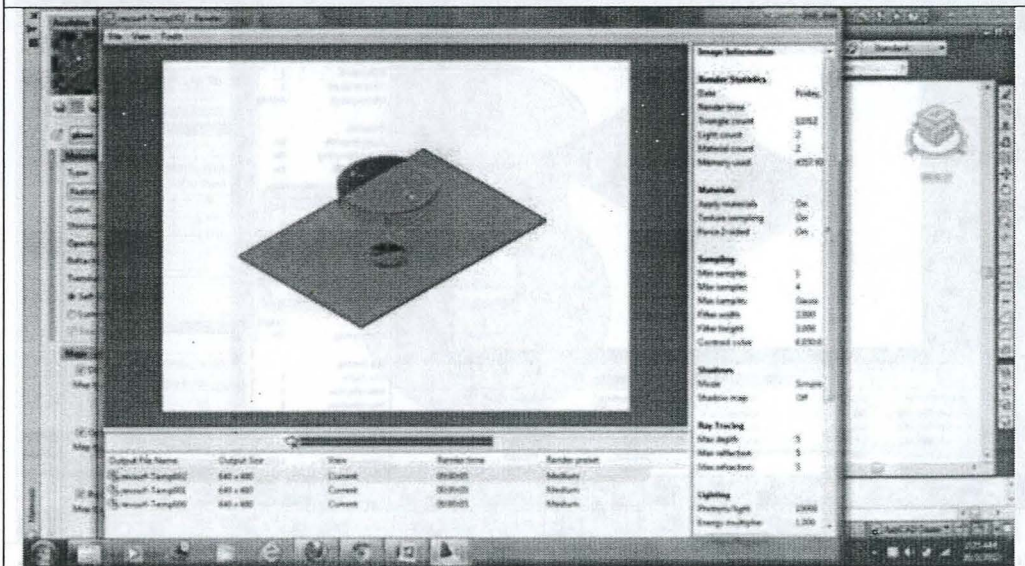
Invoke material dialog box by typing rmat.  
 Create new material and name it glass



## FROM NOTHING TO SOMETHING



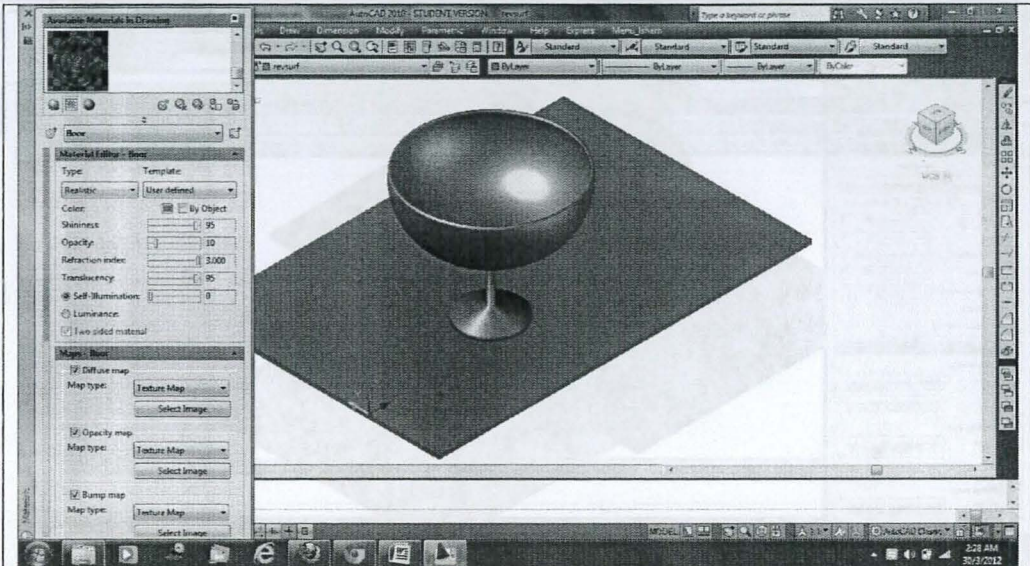
Select light yellow as color to the glass. Set the opacity value to 5. Opacity is main value to be controlled in order to get glass effect material; the lower value the high quality of glass effect will be shown. Set the shininess to 95, refraction index to 2, translucency to 90 and self illumination to 5.



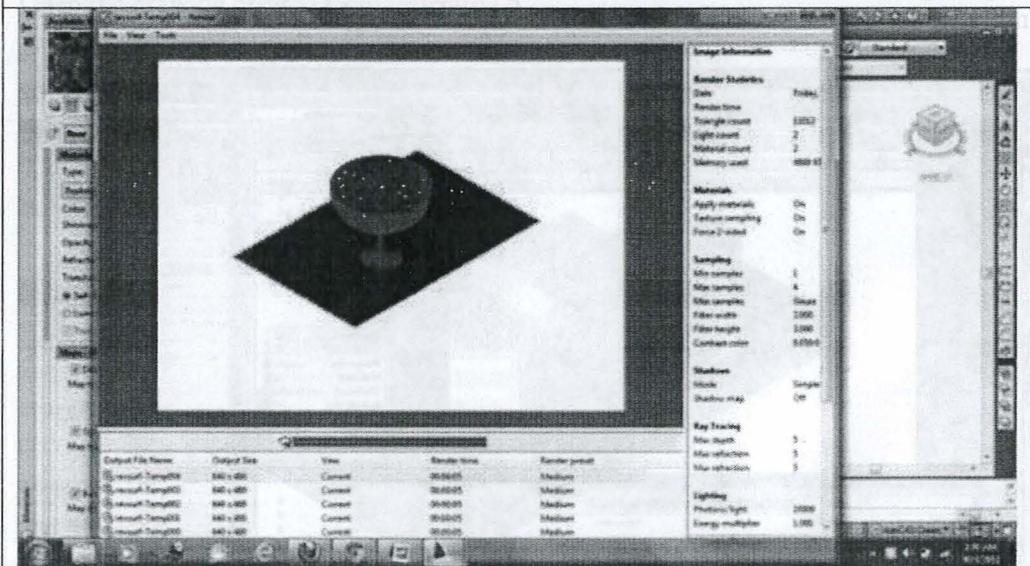
Invoke render and glass effect material will be exposed.



## FROM NOTHING TO SOMETHING

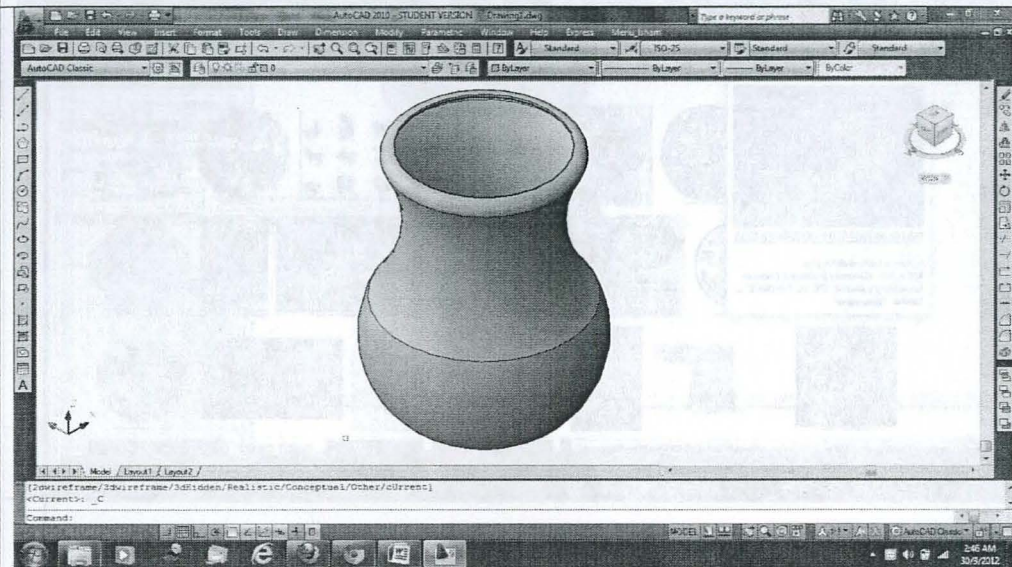


Create another new material name it floor. Set the material entity as follow shininess 95, opacity 10, refraction index 3.00 and translucency 95

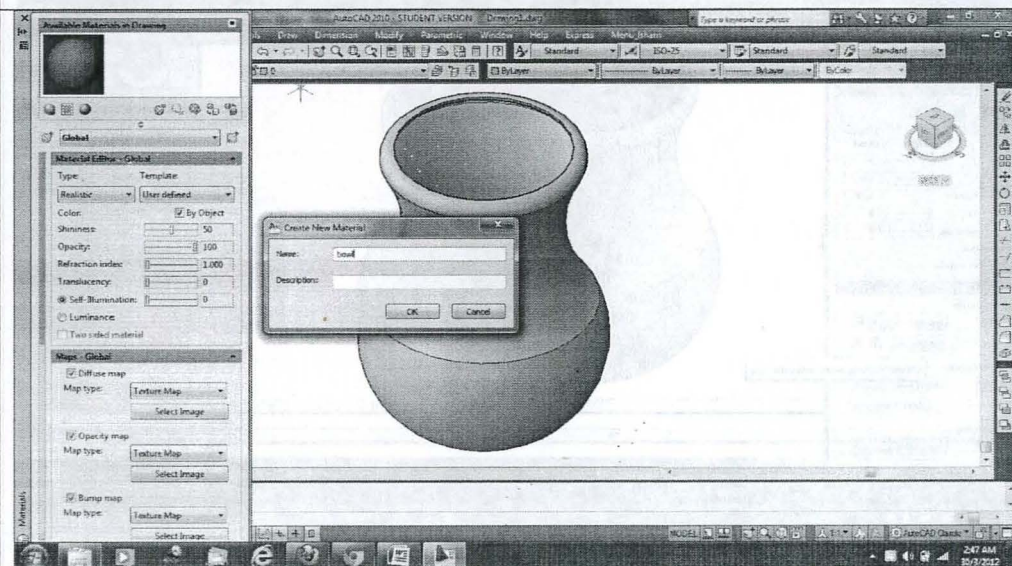


Invoke render and the glass effect material exposed on the glass and floor.

## Reflection 22 – Material application with jpeg image from Internet



Create object with estimated size using revolve technique. Invoke SW Isometric view.



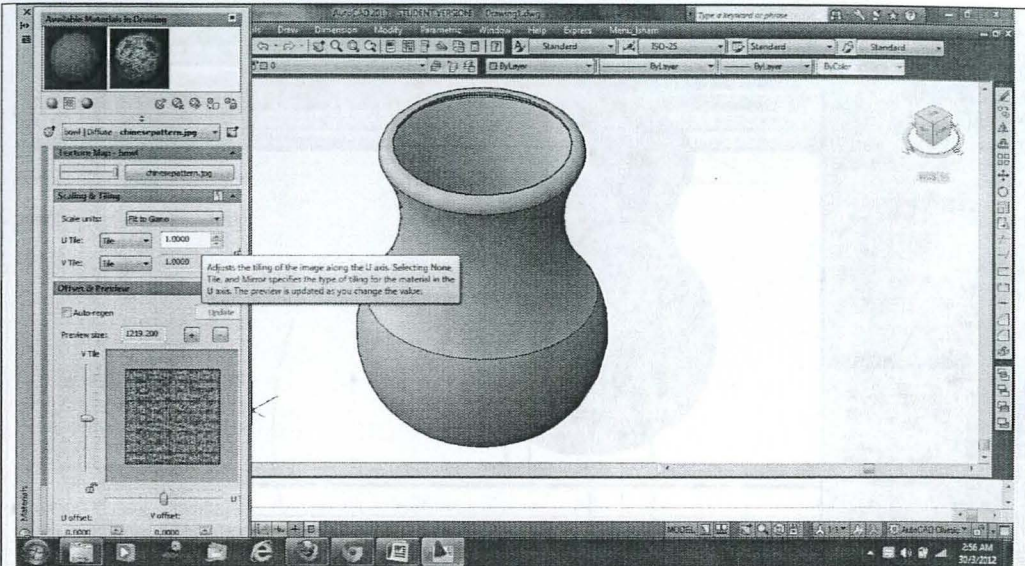
Invoke rmat command to get the material dialog box. Create new material name it bowl.



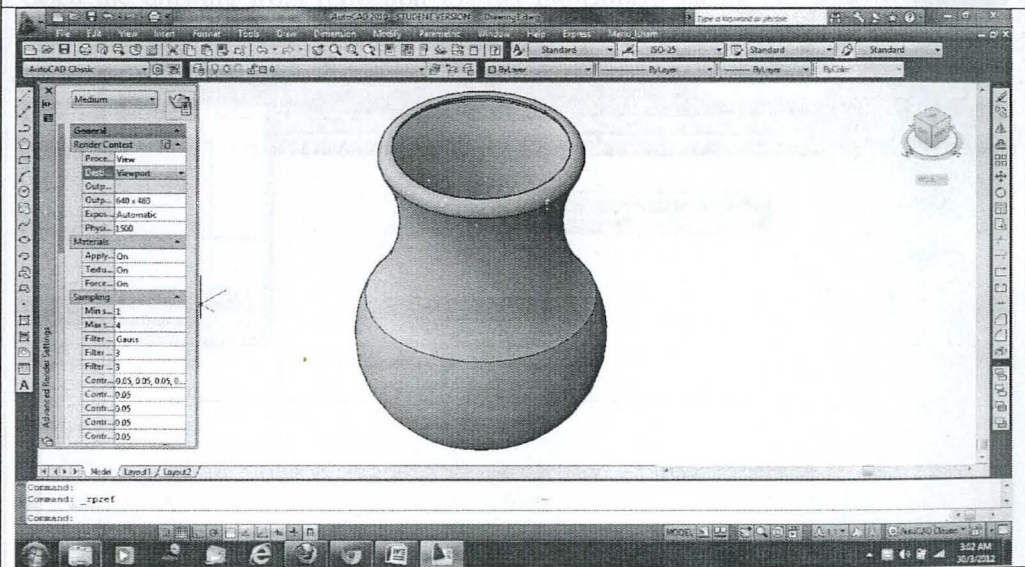




## FROM NOTHING TO SOMETHING

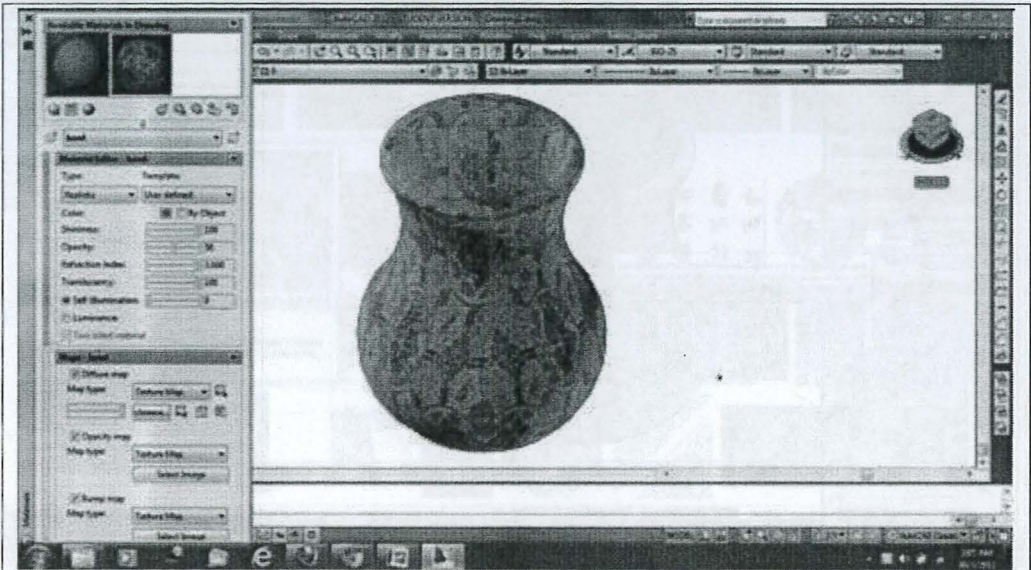


Set at scaling and tiling using scale units fit to gizmo. Use U-Tile and V-Tile equal to 1.



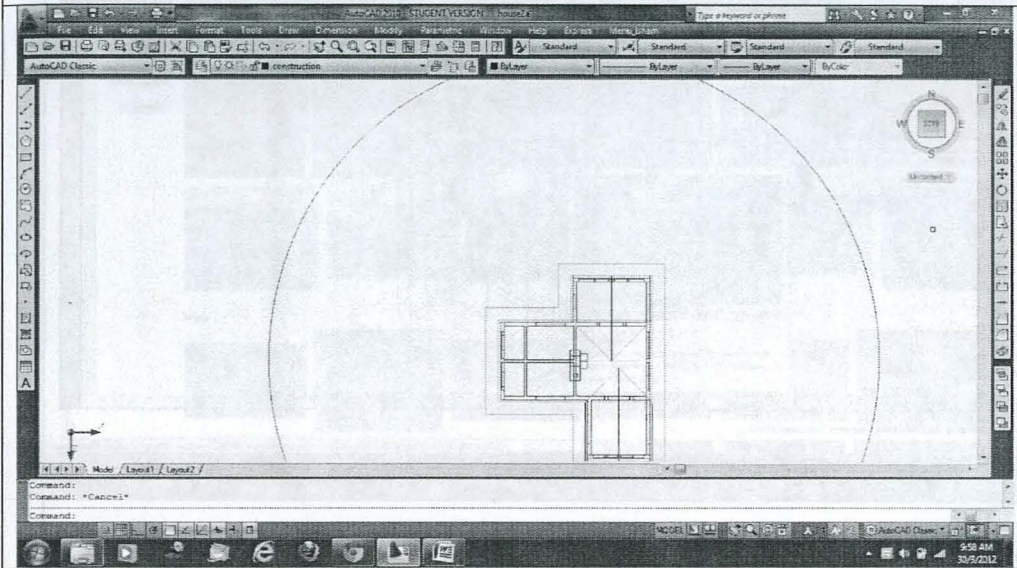
Apply material to the object. Invoke advanced render setting dialog box by typing rpref. Set the destination of render to viewport.



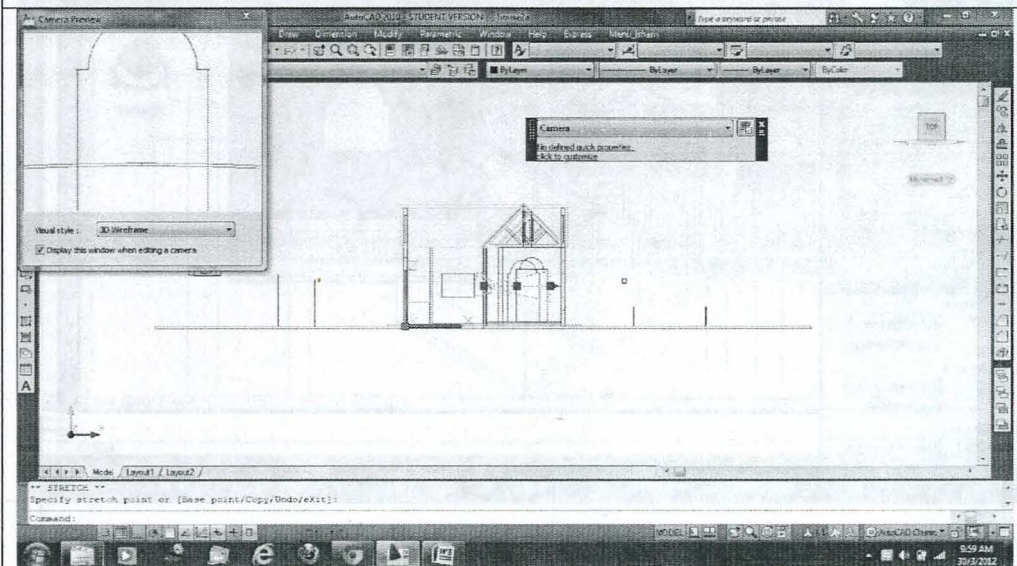


Invoke material dialog box. Set the values as shown shininess 100, opacity 50, refraction index 3.00 and translucency 100. Invoke render. Rendered object shown on the viewport.

## Reflection 23 – Material application with jpeg image as background

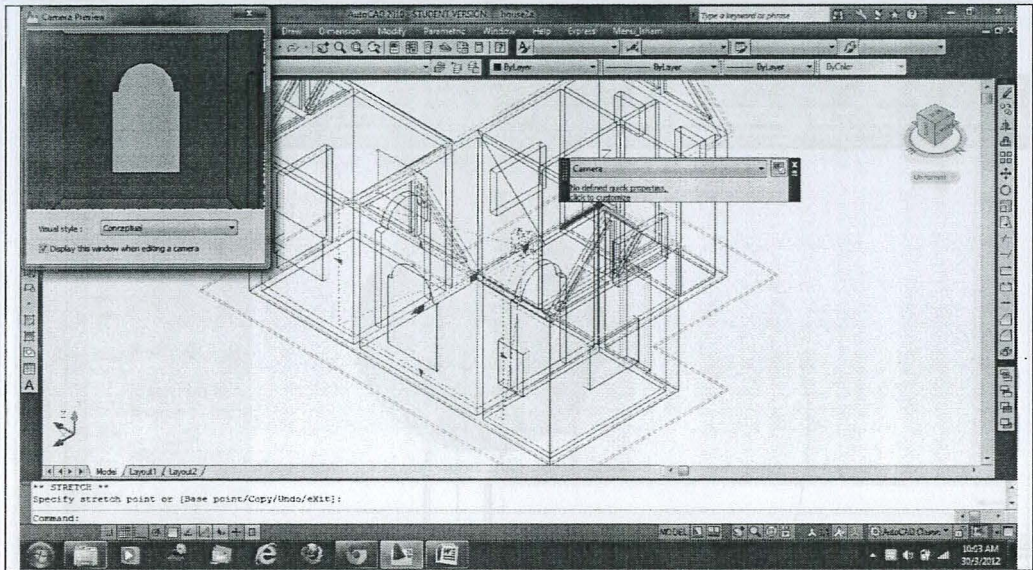


Open the drawing from reflection 17. Set the camera facing the window outward. Adjust the position of the camera.

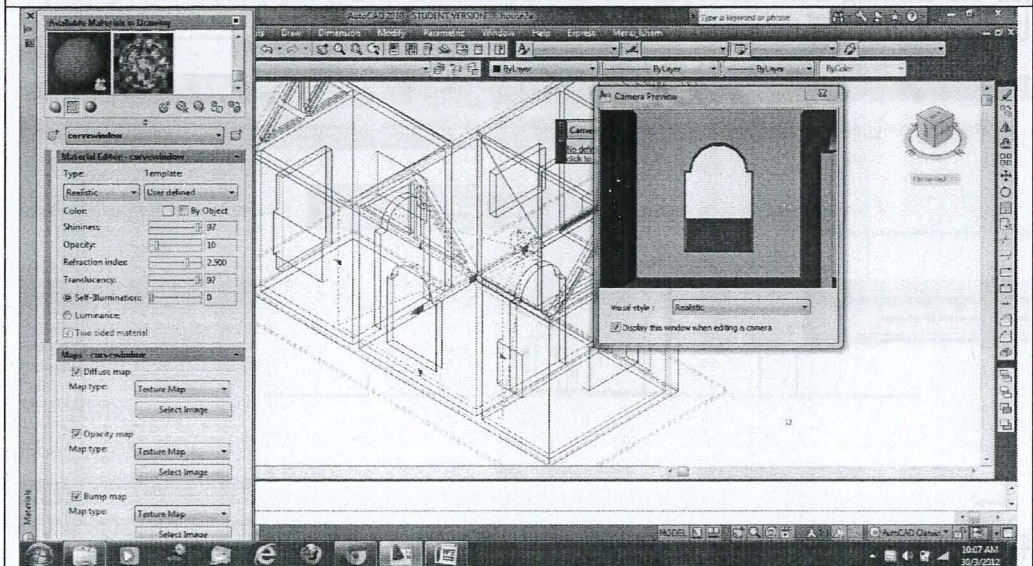


Adjust position of the camera in elevation view so that it will be exactly facing the window.





Adjust the position of the camera and its field of view in NW Isometric position. Set the view style in preview window as conceptual style.

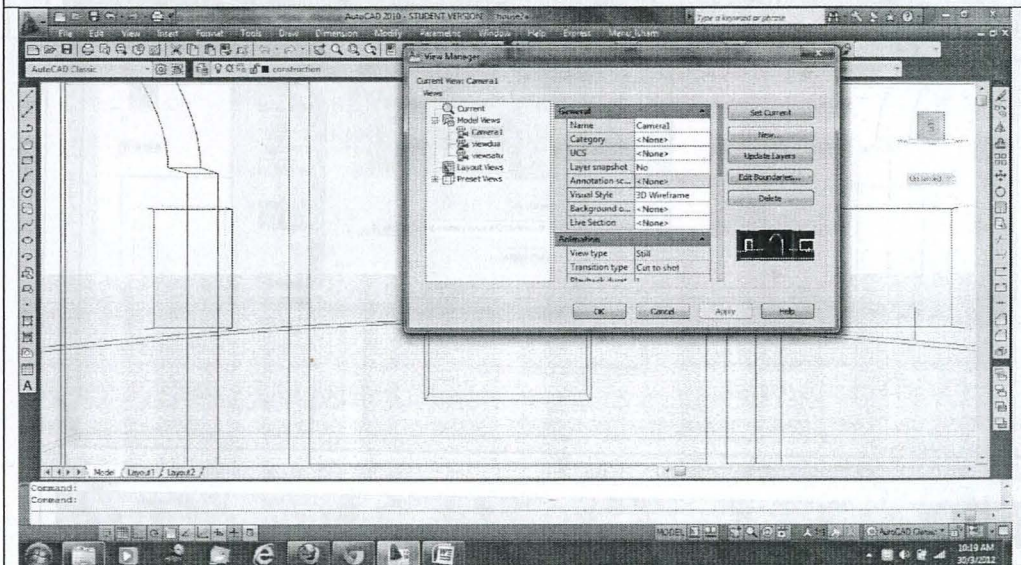


Invoke RMAT set the material for window glass with values as follow shininess 97, opacity 10, refraction index 2.5 and translucency 97. Apply the material to the glass. Preview it in the camera preview window.



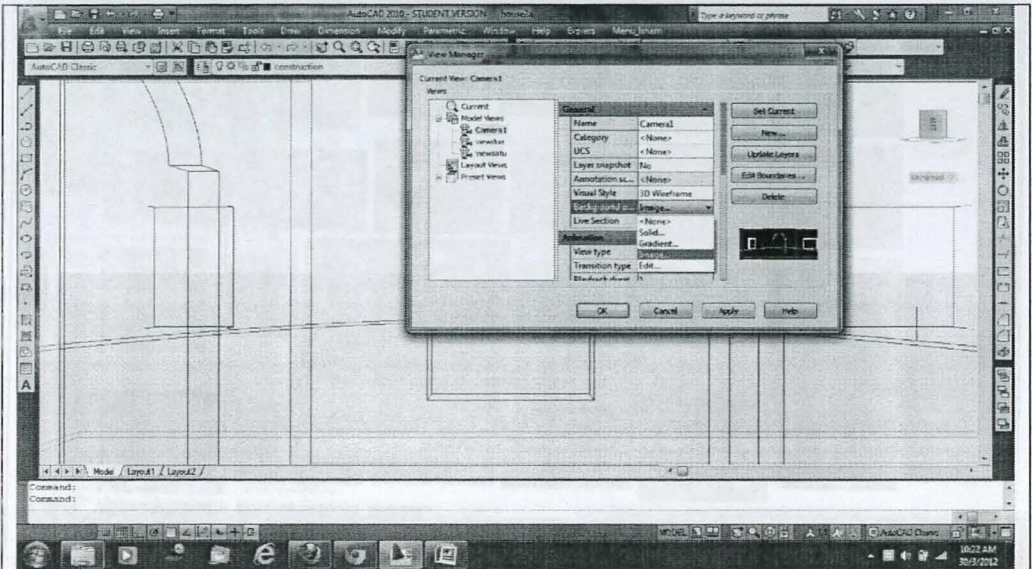


Get nature scenery from the Internet's google search. Save the selected scenery in jpeg format.

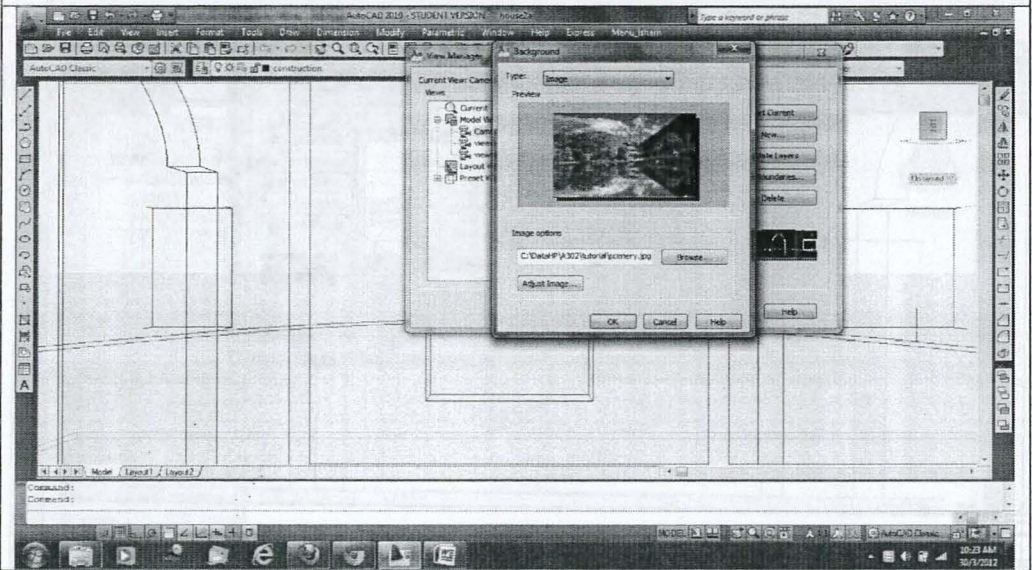


Open the view manager and set camera 1 as current view. The view will appear in viewport.





In view manager dialog box set the image for the background.



et the scenery selected as the background of the camera view.



Invoke render command and background images shown on the window glass as this is the environment of the building. The process to set the scenery as the background of the building is done.

1. Creating sunlight's effect
2. Creating spotlight's effect
3. Creating point light's effect





## CHAPTER EIGHT

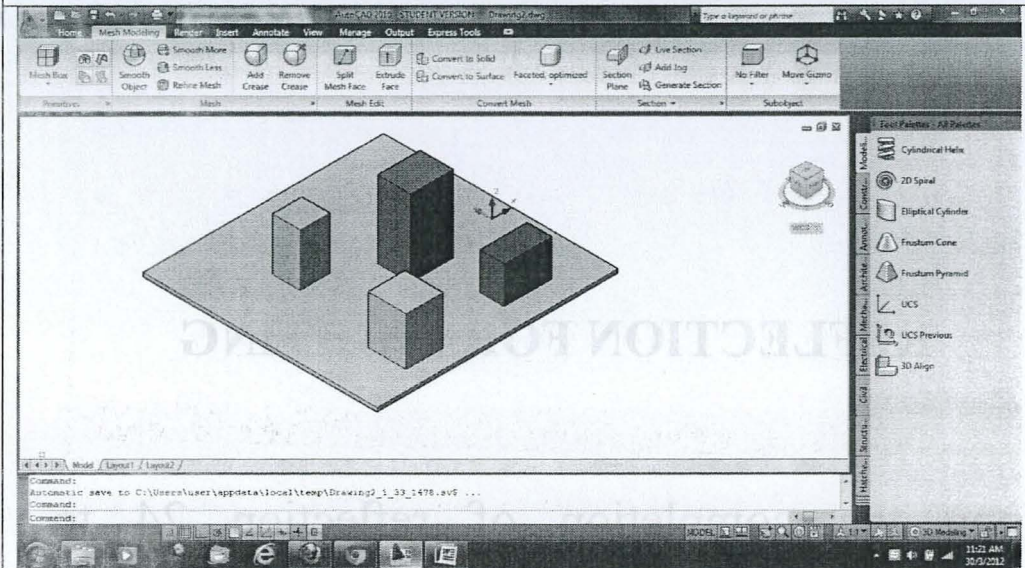
# REFLECTION FOR LIGHTING

Upon the completion of reflection 24 to reflection 26 you will be able to utilize lighting application in AutoCAD on

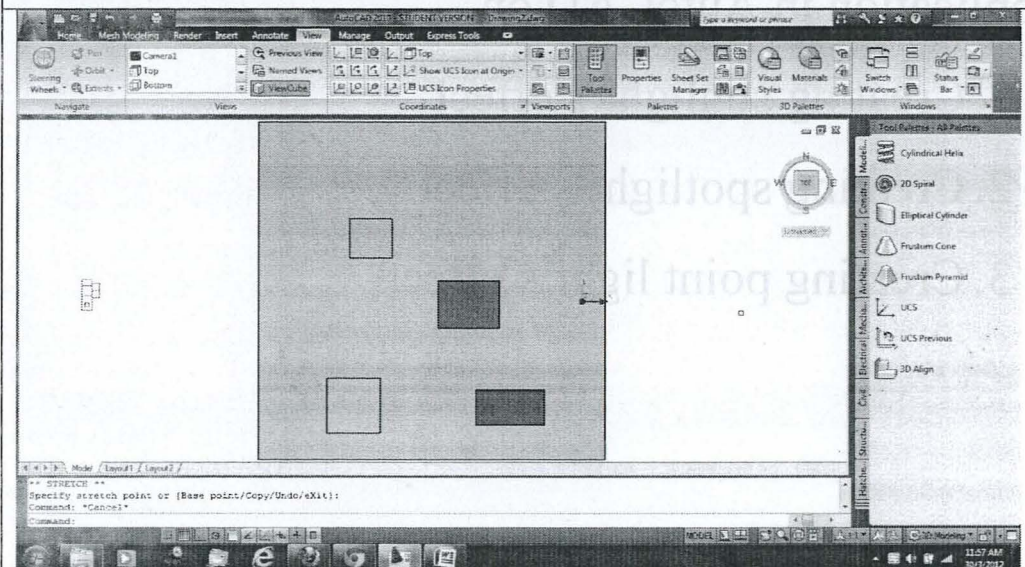
1. Creating sunlight's effect
2. Creating spotlight's effect
3. Creating point light's effect



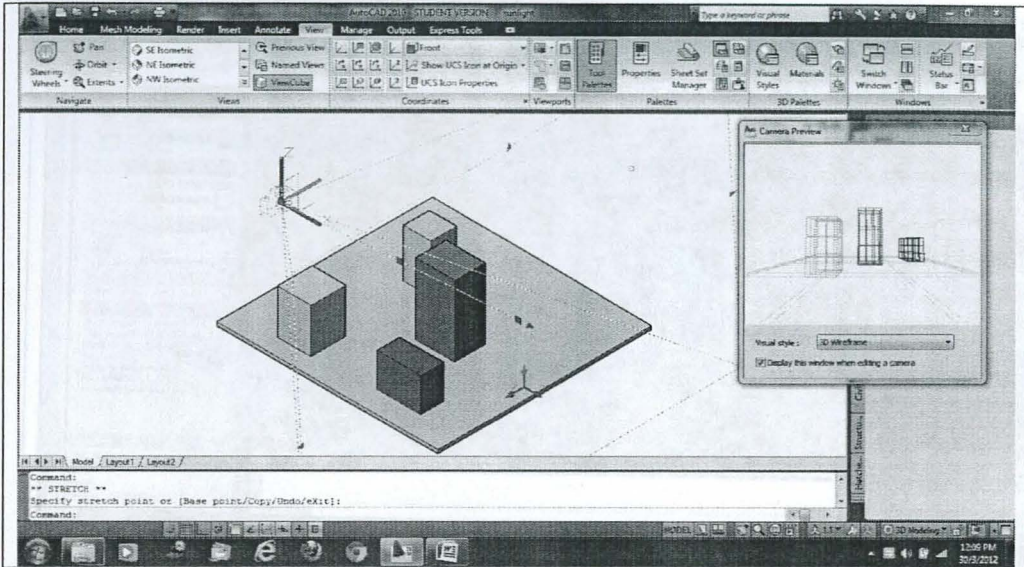
## Reflection 24 – Creating sunlight's effect



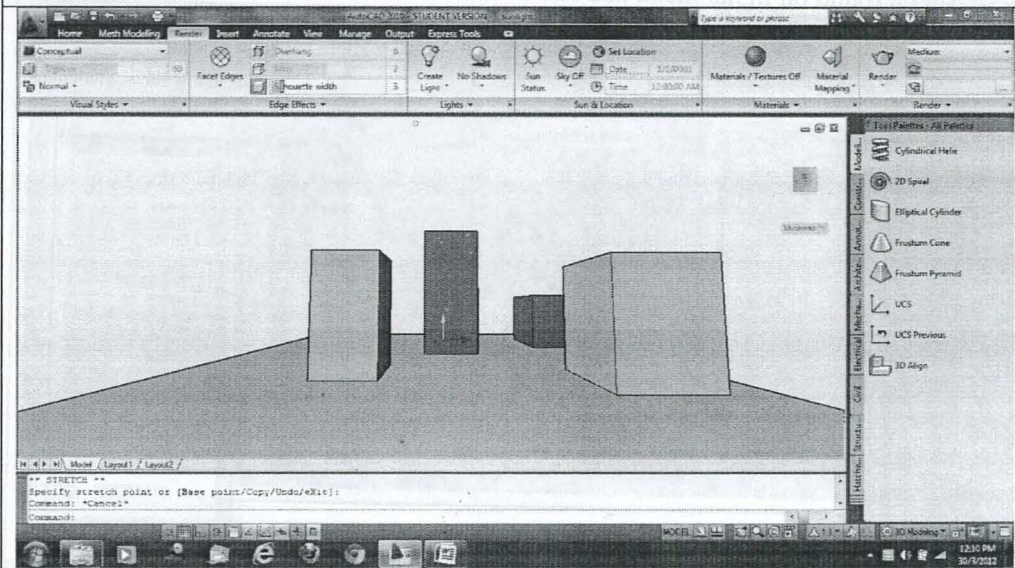
Set the modeling environment. Set 4 different layers. Construct objects shown. Estimate the height and size of the objects constructed.



Set the camera on the plan view.



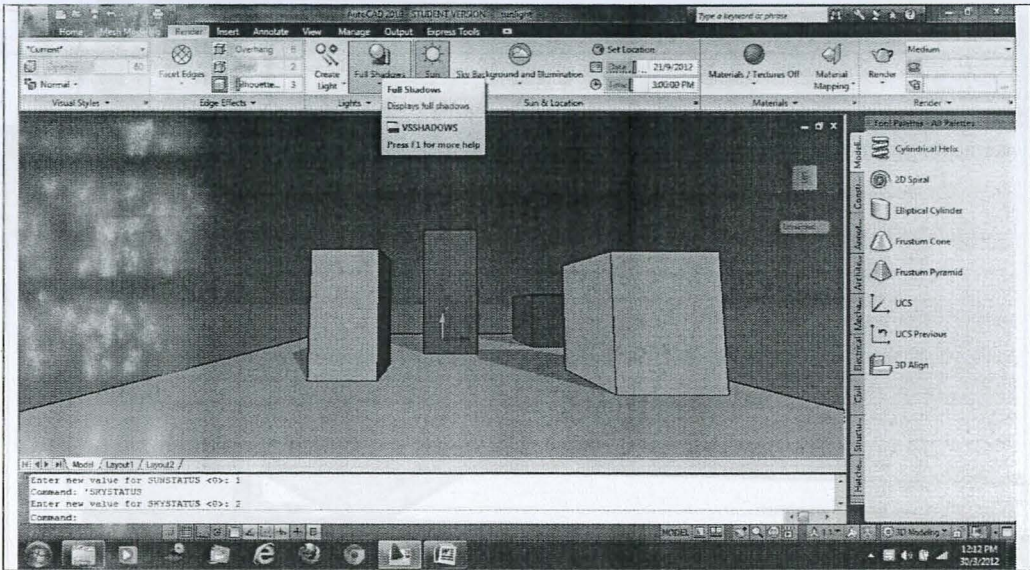
Adjust the camera position and its field of view in isometric view



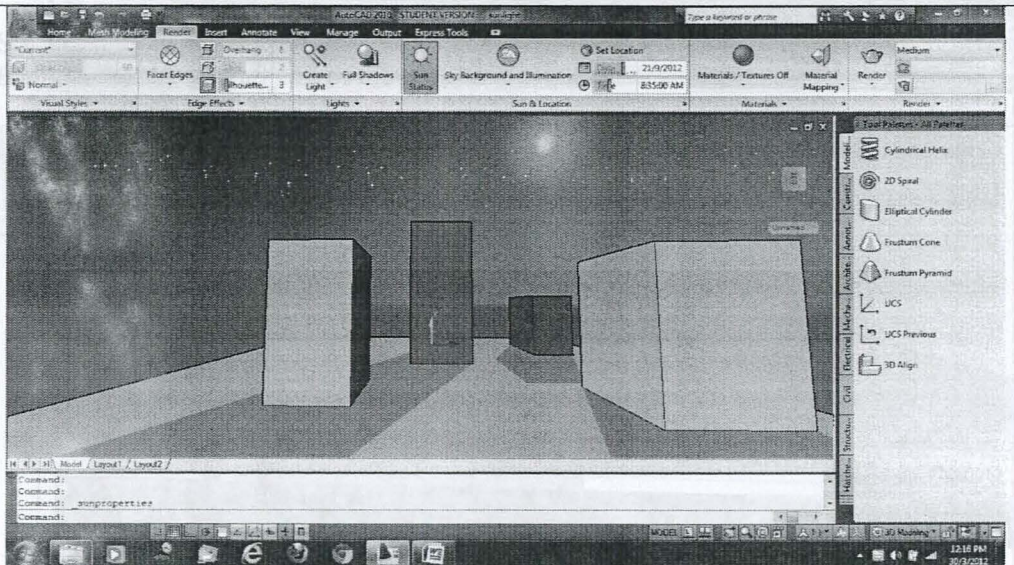
Set the camera view as current view and click at render pull down menu.



## FROM NOTHING TO SOMETHING



Set the sun status on then set full shadow and set sky background and illumination. All these can be found on lights menu and sun & location menu.

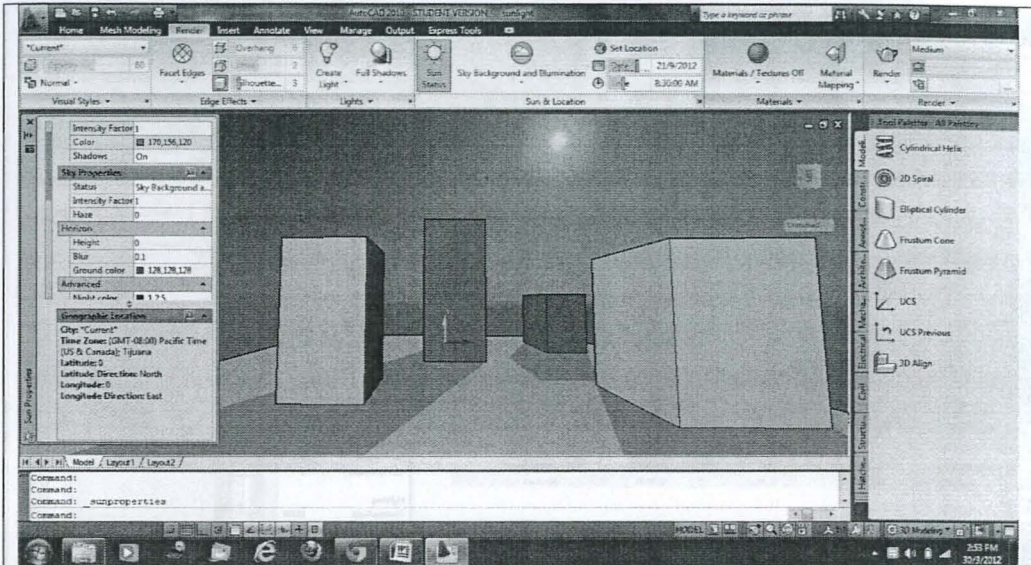


Set the time in the morning to get the sun effect.

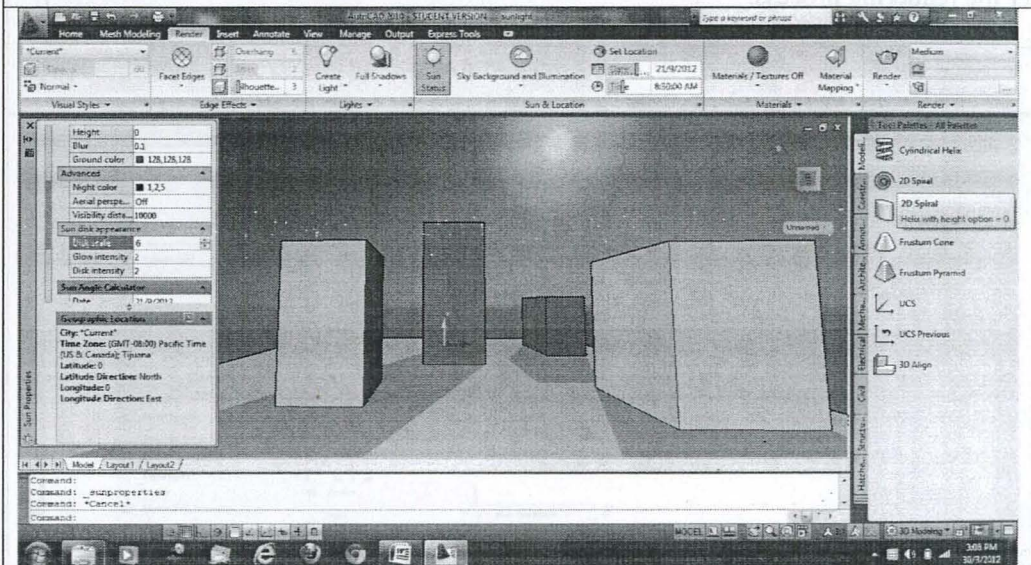
Set the camera on the plan view.



## FROM NOTHING TO SOMETHING

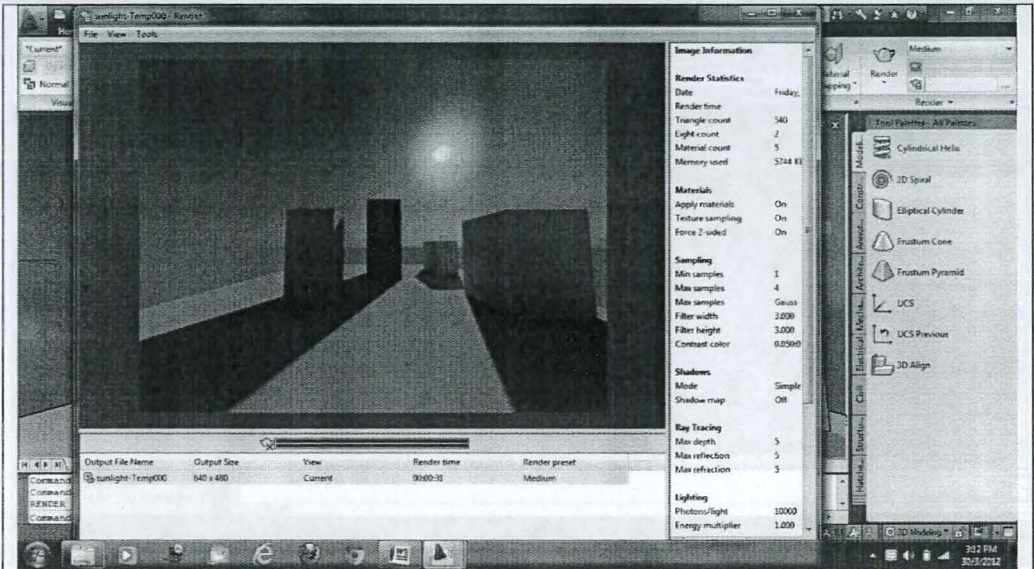


Click on arrow at sun & location, sun properties dialog box will occur.



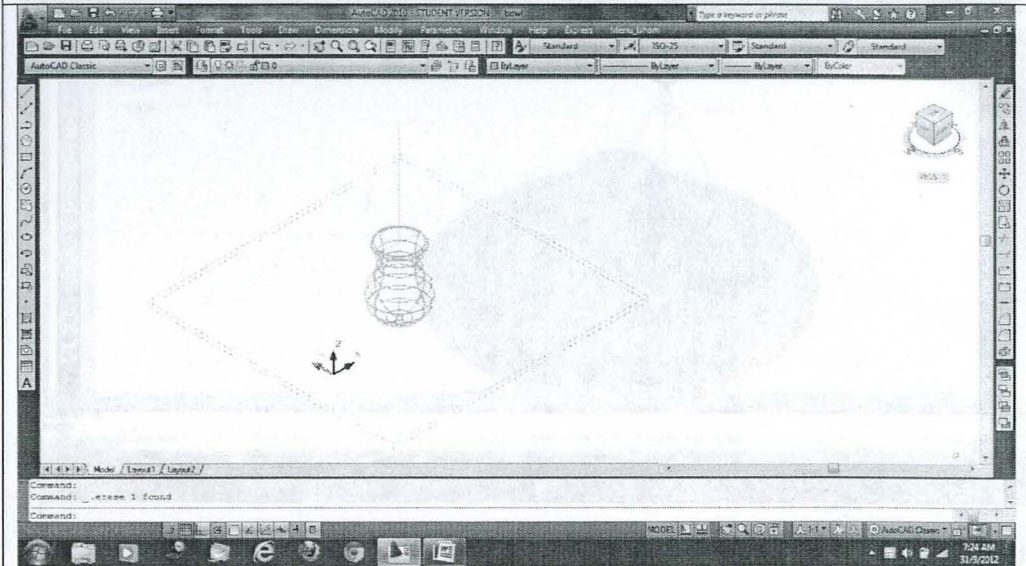
In the sun properties dialog box change the value in sun disk appearance to change appearance of the sun. Change the value of disk scale to 6, glow intensity to 2 and disk intensity to 2. The change will occur on sun appearance.



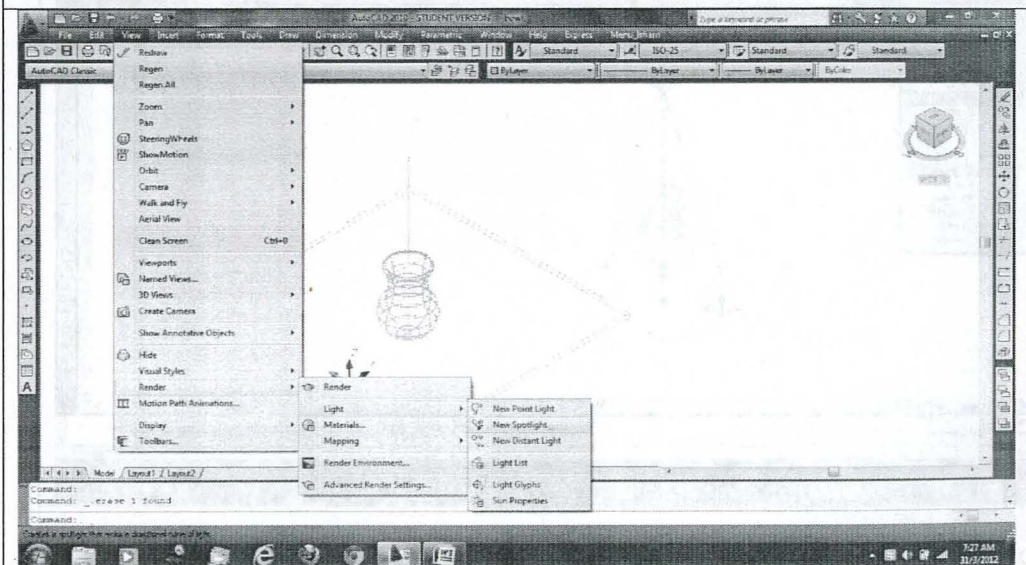


Invoke the render command. The sunlight effect, shadows and sun appearance occur after the rendering process.

## Reflection 25 – Creating spotlight

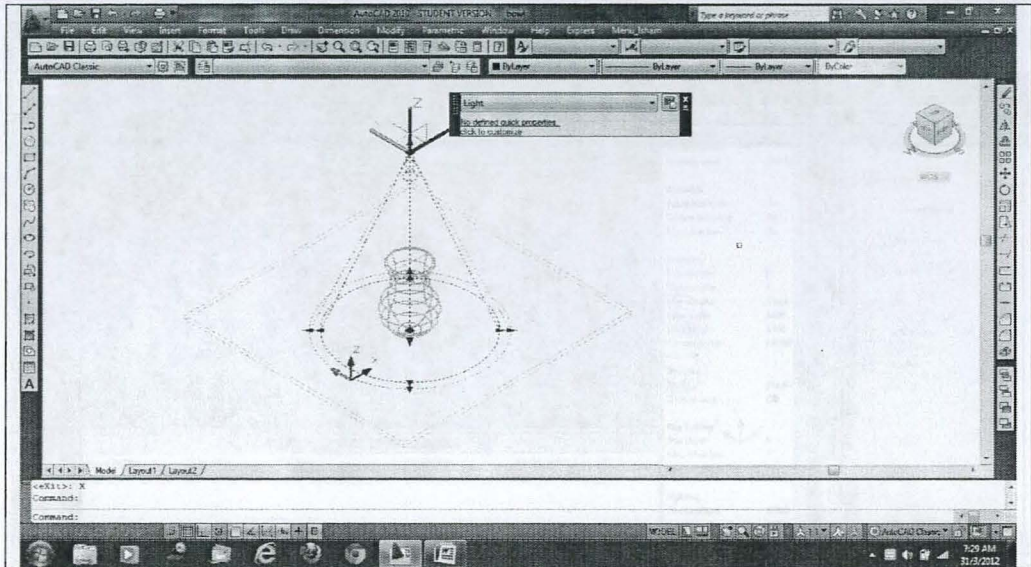


Open the drawing produced from reflection 22. Draw horizontal rectangle as a floor. Draw a vertical line with estimated height from center of the bowl.

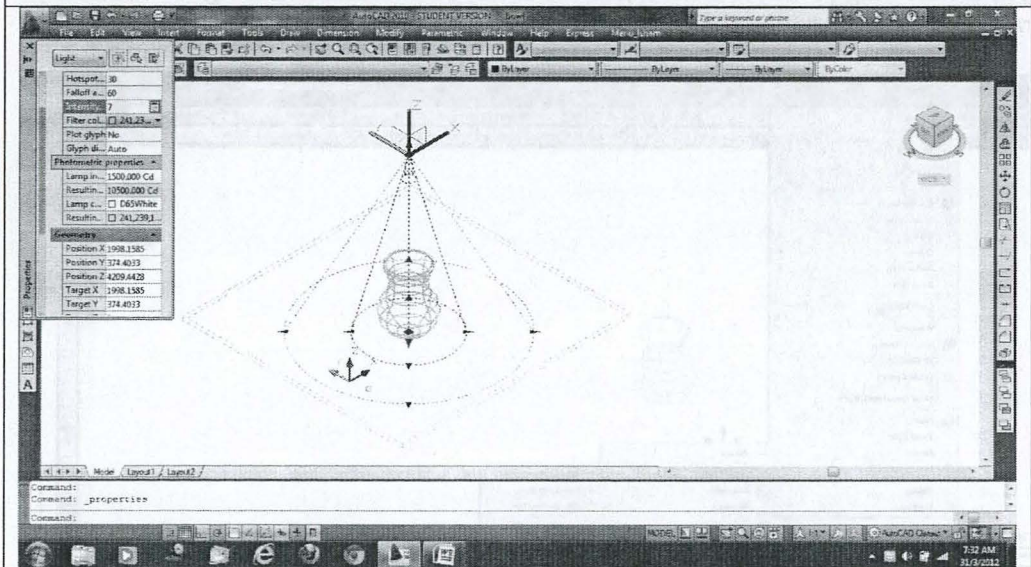


From the view pull down click the new spotlight. The new spotlight will be inserted.

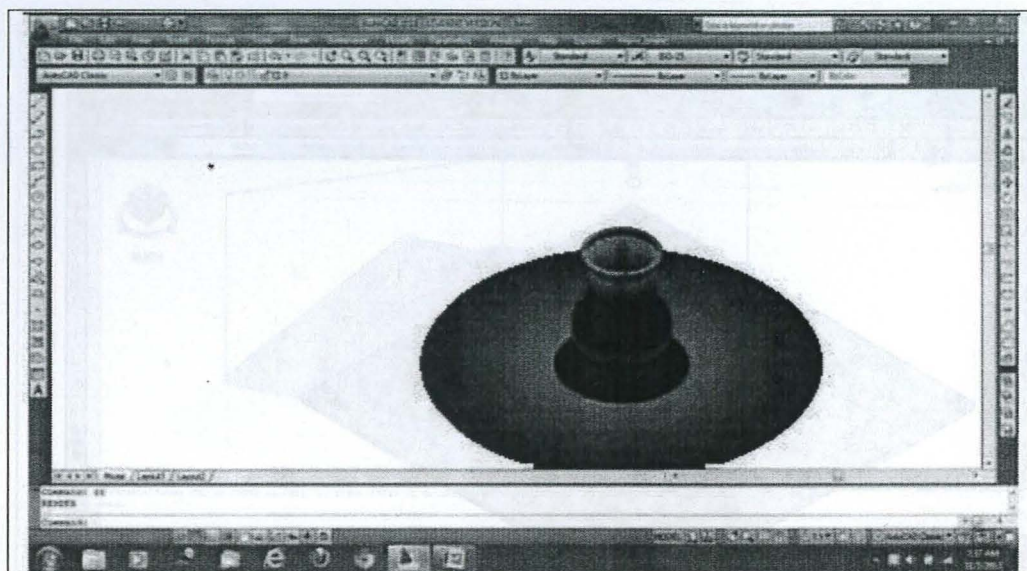




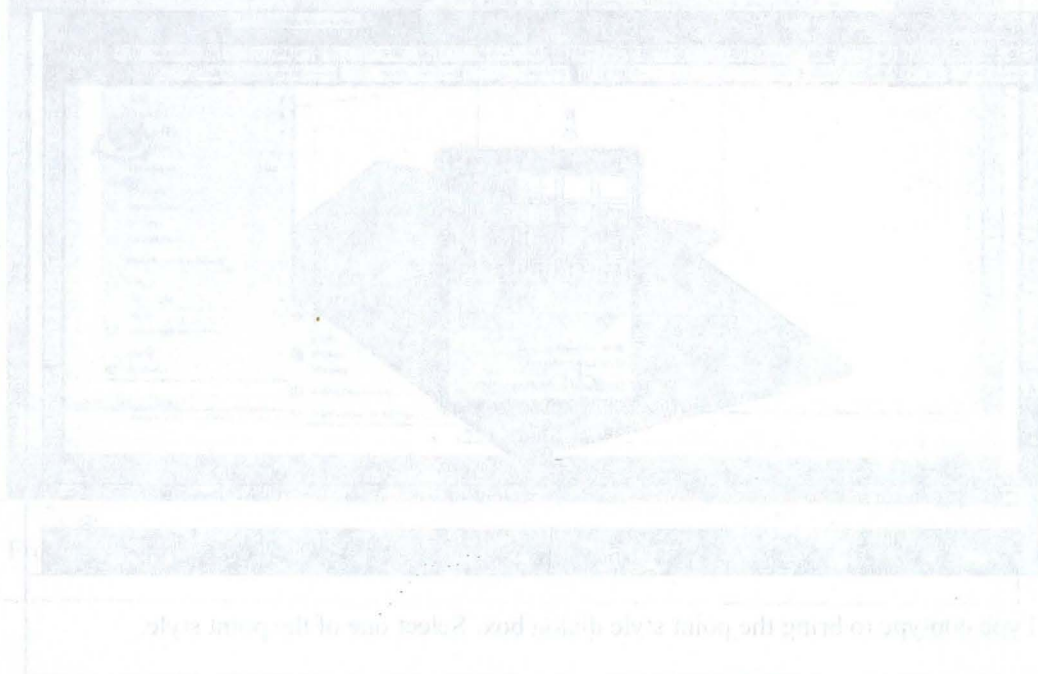
Set the position of the spotlight as shown by selecting the position of the spotlight at the top of the line and its target at the bottom of the vertical line.



Double click at the spotlight symbol and the light properties box will occur. Change the light intensity to 7, hotspot to 30, falloff to 60, shadow map to 1024, shadow type to map and its softness to 5.

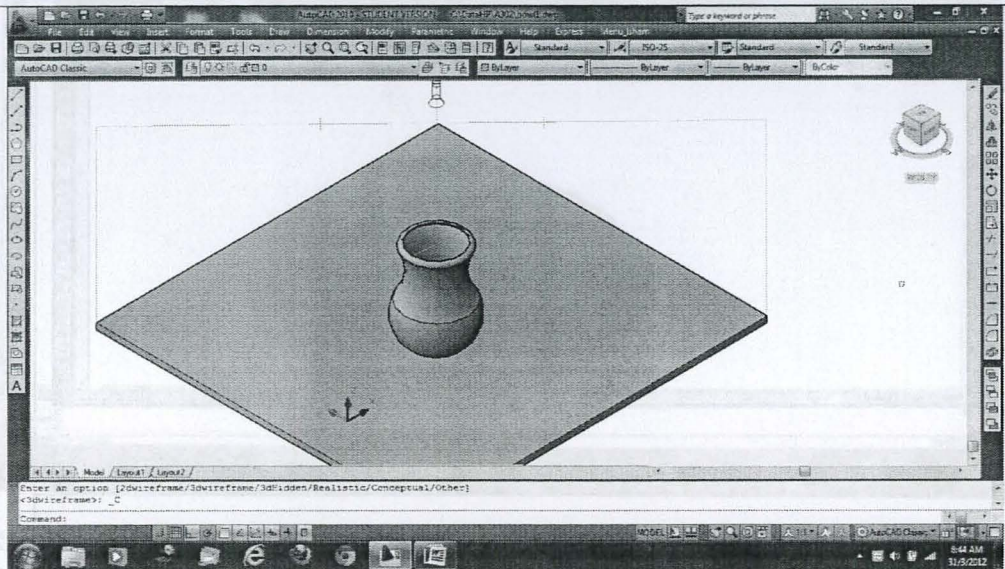


Invoke render and the effect will be as shown above. You are done with spotlight.

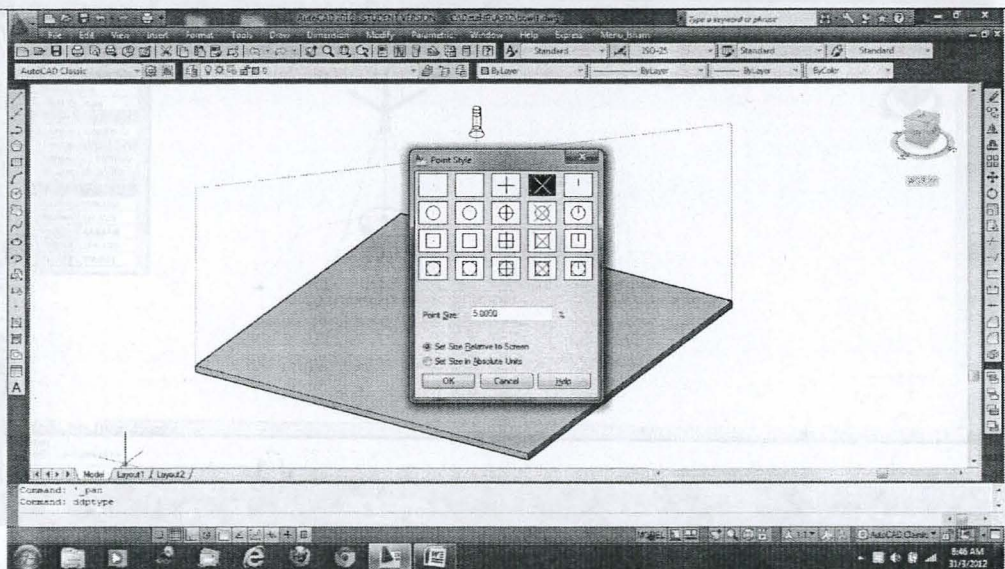




## Reflection 26 – Creating point light

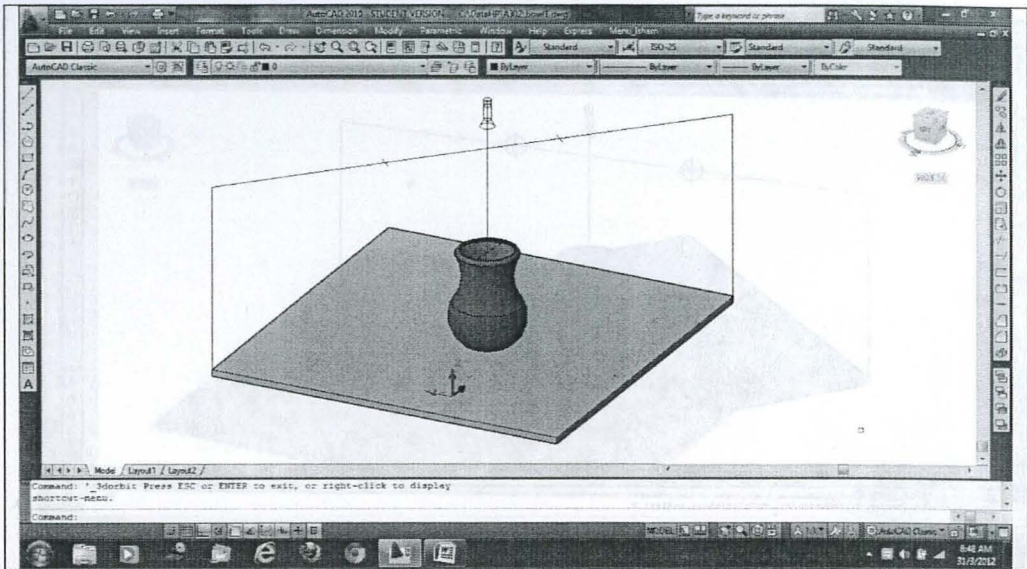


Open the drawing produced from reflection 25. Draw the line as shown.

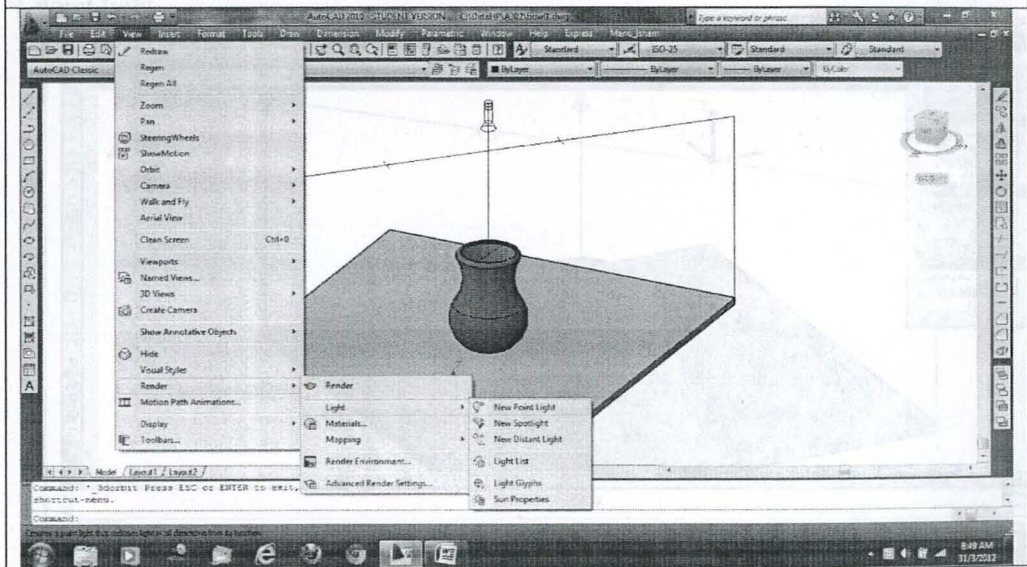


Type ddptype to bring the point style dialog box. Select one of the point style.

## FROM NOTHING TO SOMETHING



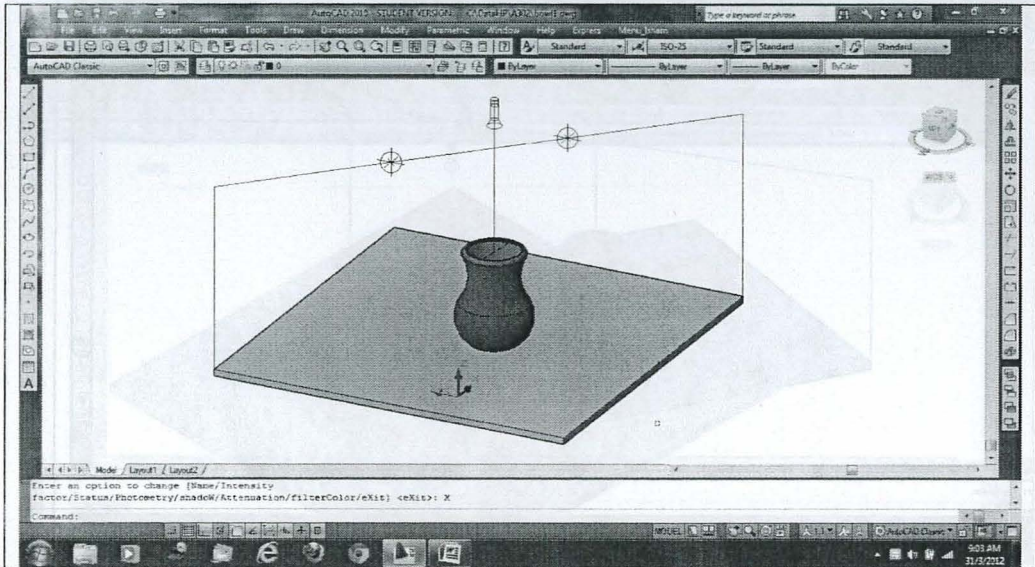
Divide the horizontal line into three segments. Two division point will be shown.



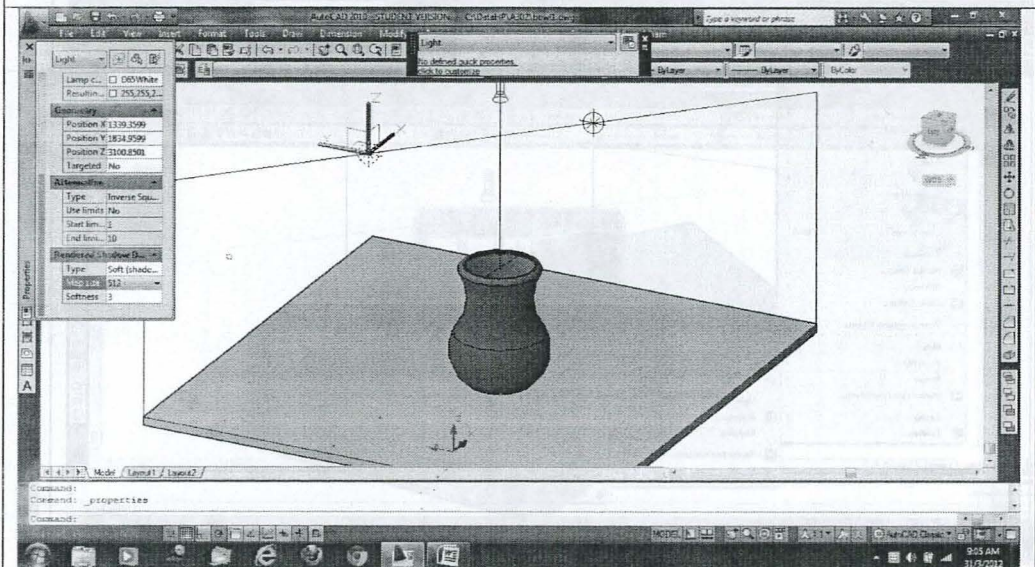
From view pull down menu select new point light



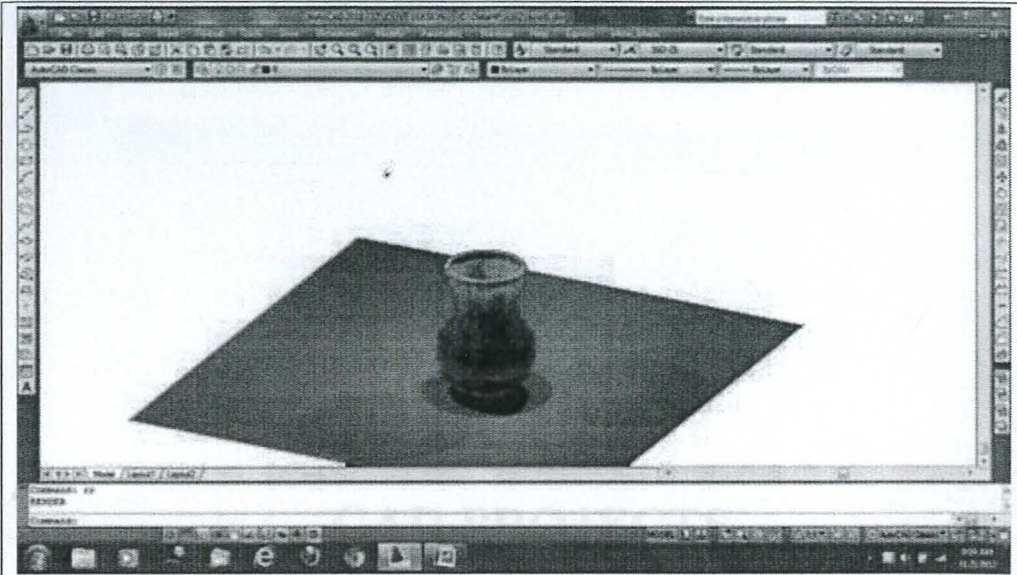
## FROM NOTHING TO SOMETHING



Select the point light and put it on the division point.



Double click at the spotlight symbol and the light properties box will occur. Change the light intensity to 2, shadow map to 512, shadow type to map and its softness to 3. Same amount apply to the other light.



Invoke render and the effect of the point light will as shown above. You are done with point light.



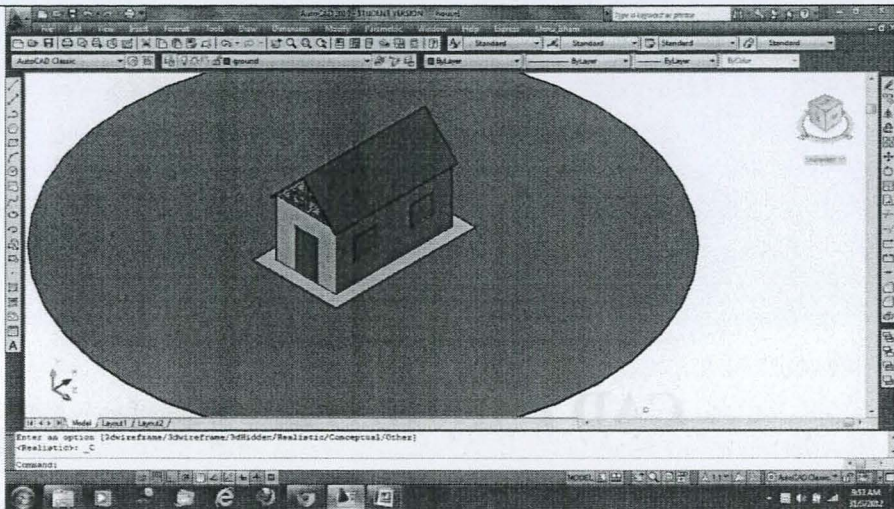


## CAD PROJECTS

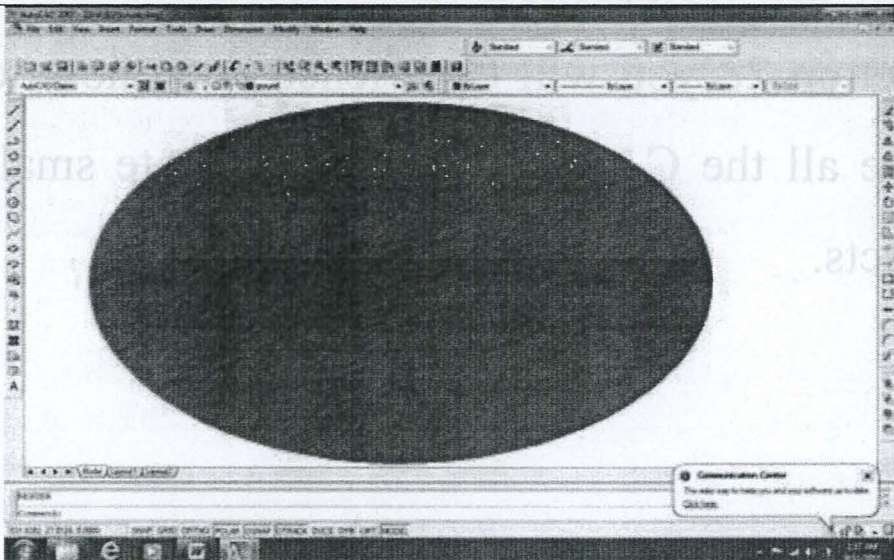
Upon the completion of reflection 27 to reflection 28 you will experience upon how to utilize all the CAD commands to create small projects.



## Reflection 27 – Simple Project



Open the drawing product from reflection 16.



### Creating The Ground Material

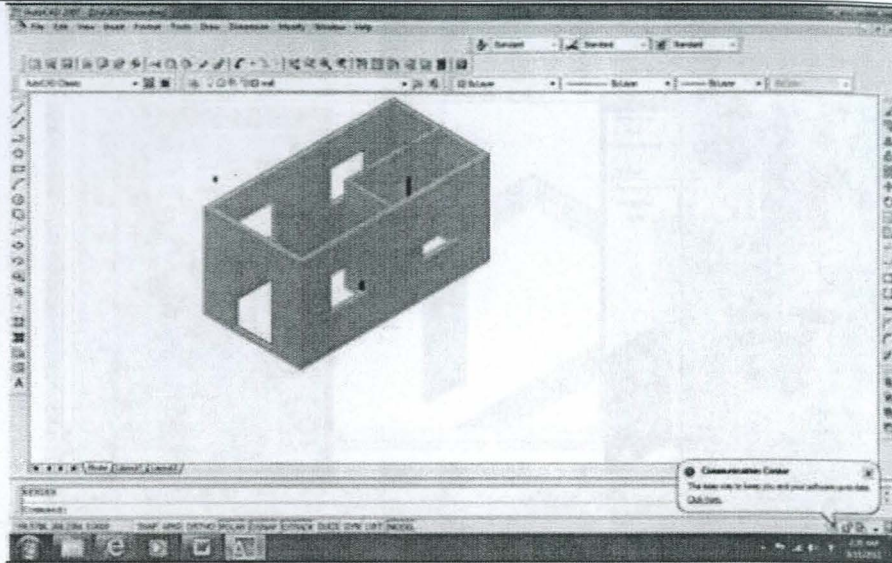
Set view to 3D SW. Turn off the other layer and turn on only ground layer.

Type RMAT. Select texture map grass.

Set the bitmap scale fit to gizmo.

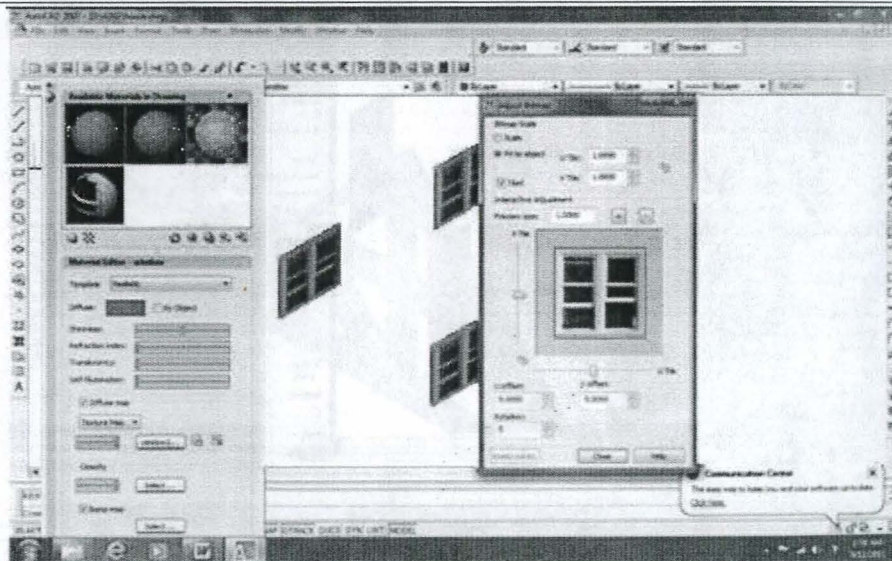
Set the U and the V tile to 2. Apply material to the ground.





### Creating The Wall Material

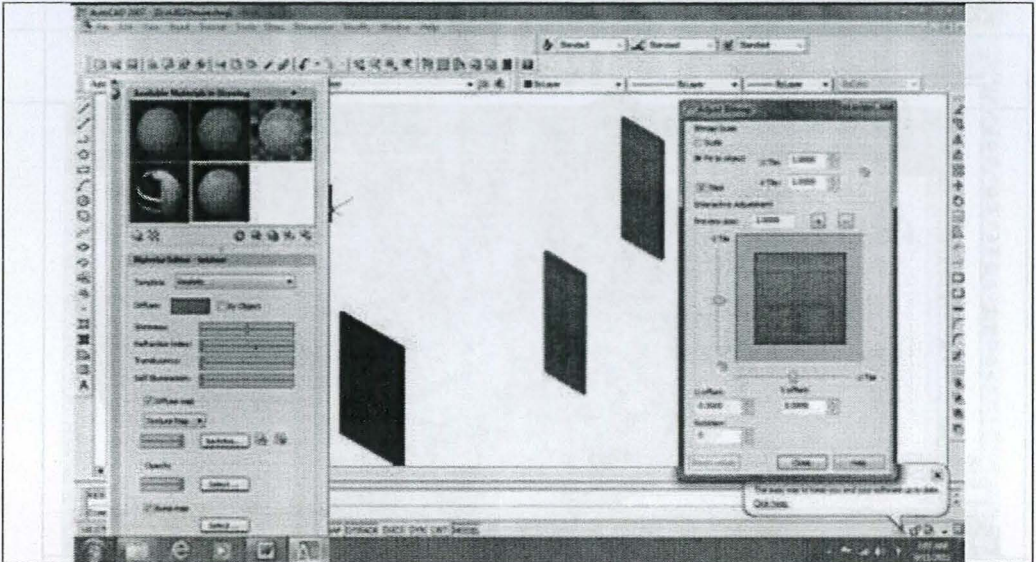
Set view to 3D SW. Turn on only wall layer  
Type RMAT. Select texture map concrete  
Set the bitmap scale fit to gizmo. Apply material to the wall.



### Creating The Window Material

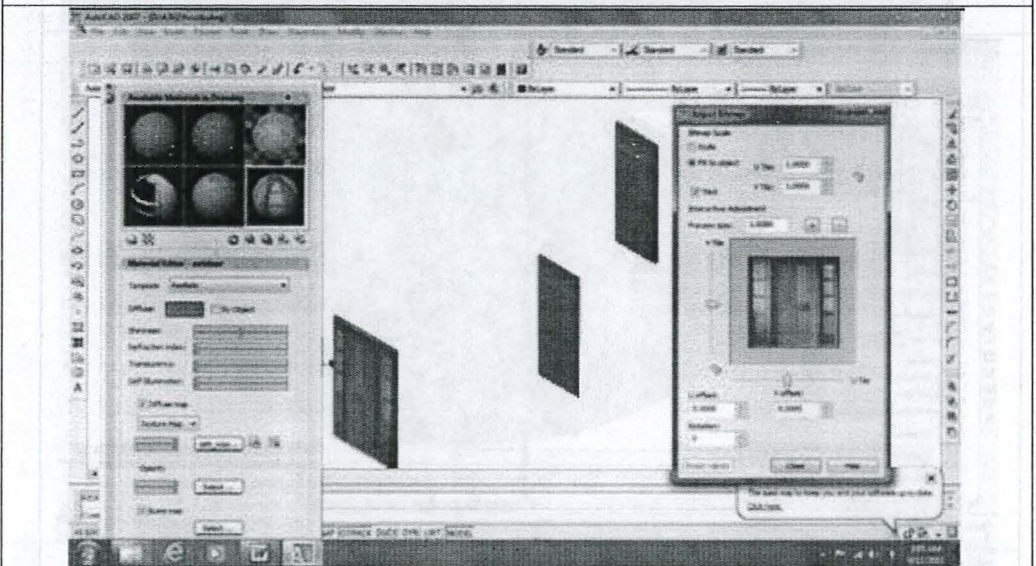
Set view to 3D SW. Turn on only window layer. Type RMAT. Select texture map window. Set the bitmap scale fit to gizmo. Apply material to the window.





### Creating The Interior Door Material

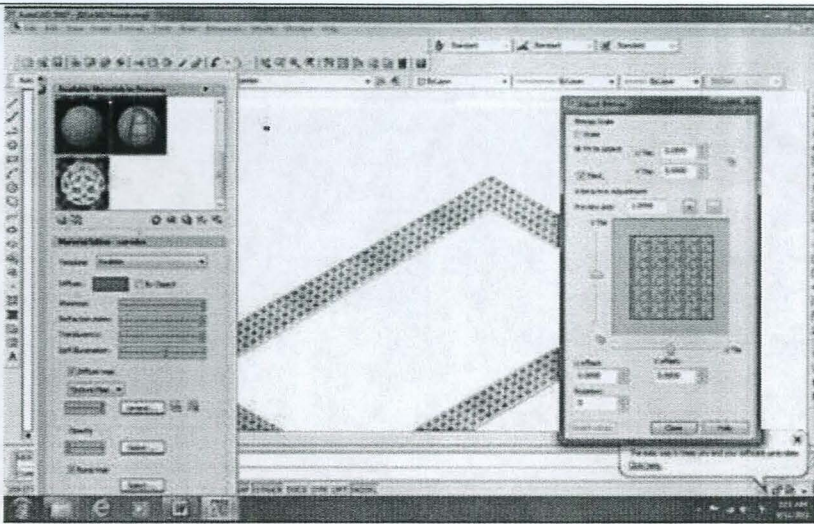
Set view to 3D SW. Turn on only door layer. Type RMAT. Select texture map interior door. Set the bitmap scale fit to gizmo. Apply material to the interior door.



### Creating The Exterior Door Material

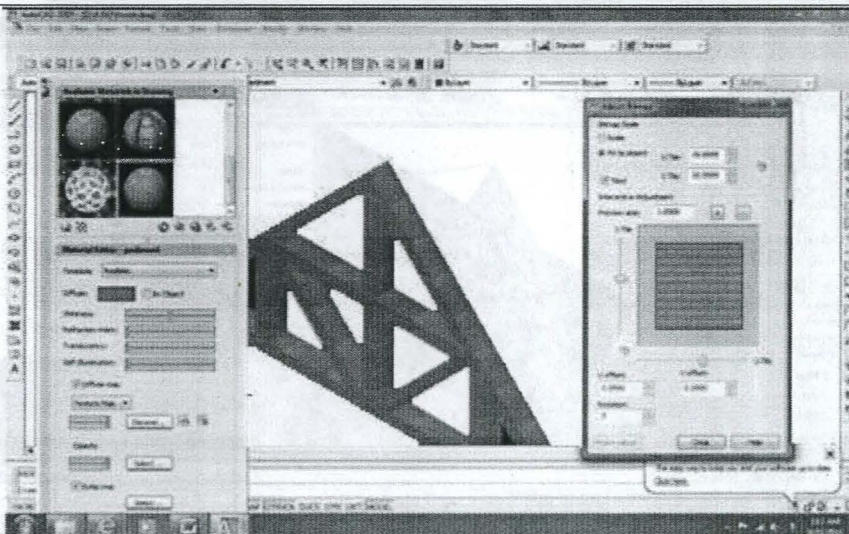
Set view to 3D SW. Turn on only door layer  
Type RMAT. Select texture map exterior door  
Set the bitmap scale fit to gizmo. Apply material to the exterior door.





### Creating The Corridor Material

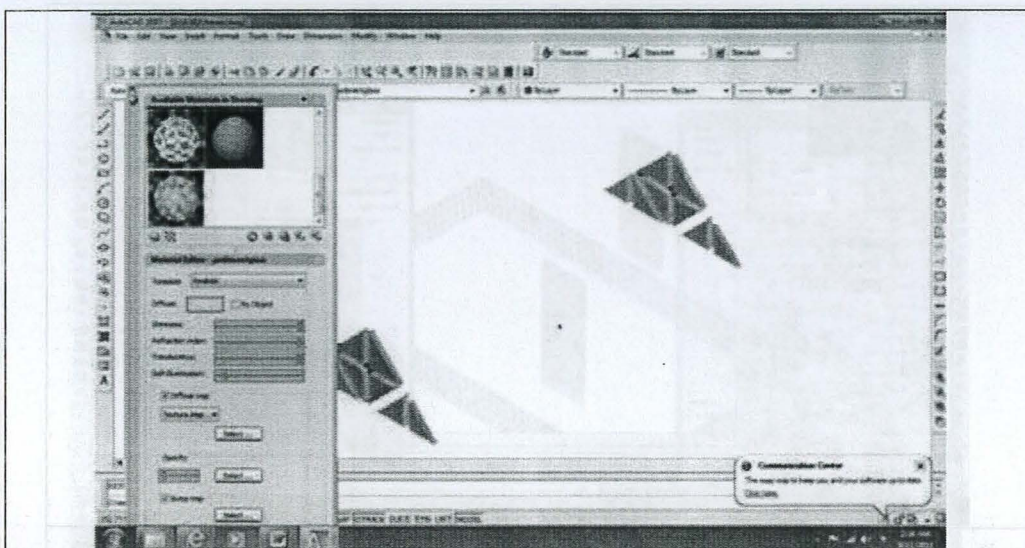
Set view to 3D SW. Turn on only corridor layer. Type RMAT. Select texture map corridor. Set the bitmap scale fit to gizmo. Set the U and the V tile to 5. Set shininess, refraction, translucency, self illuminate and opacity as shown. Apply material to the corridor.



### Creating The Pediment Material

Set view to 3D SW. Turn on only pediment layer. Type RMAT. Select texture map pediment. Set the bitmap scale fit to gizmo. Set the U and the V tile to 10. Apply material to the pediment.

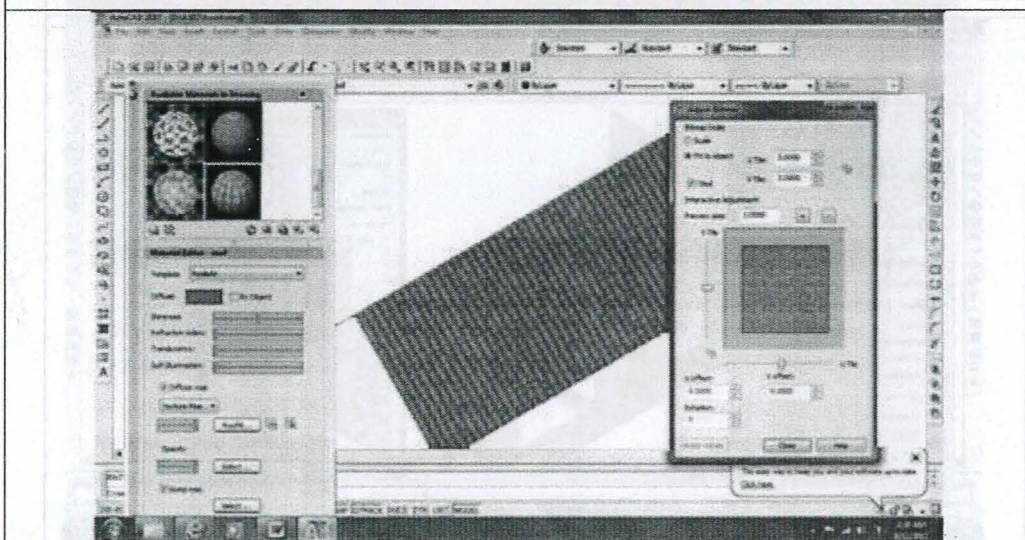




### Creating The Glass Pediment Material

Set view to 3D SW. Turn on only wall layer. Type RMAT

Change the diffuse color to yellow. Set shininess, refraction, translucency, self illuminate and opacity as shown. Apply material to the glass pediment.

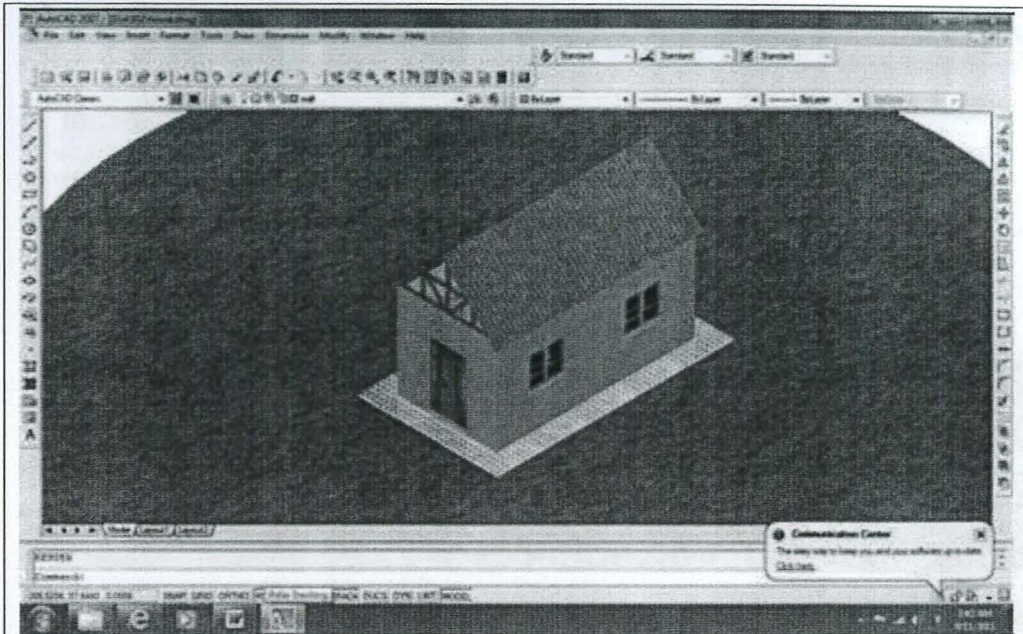


### Creating The Roof Material

Set view to 3D SW. Turn on only roof layer. Type RMAT. Select texture map roof

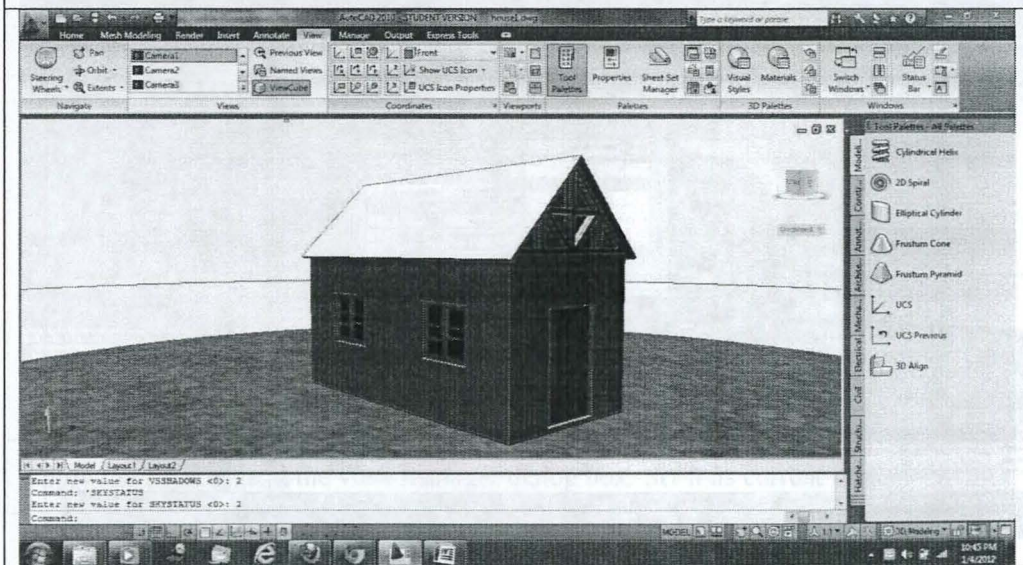
Set the bitmap scale fit to gizmo. Set the U and the V tile to 3. Apply material to the roof.





## The Product

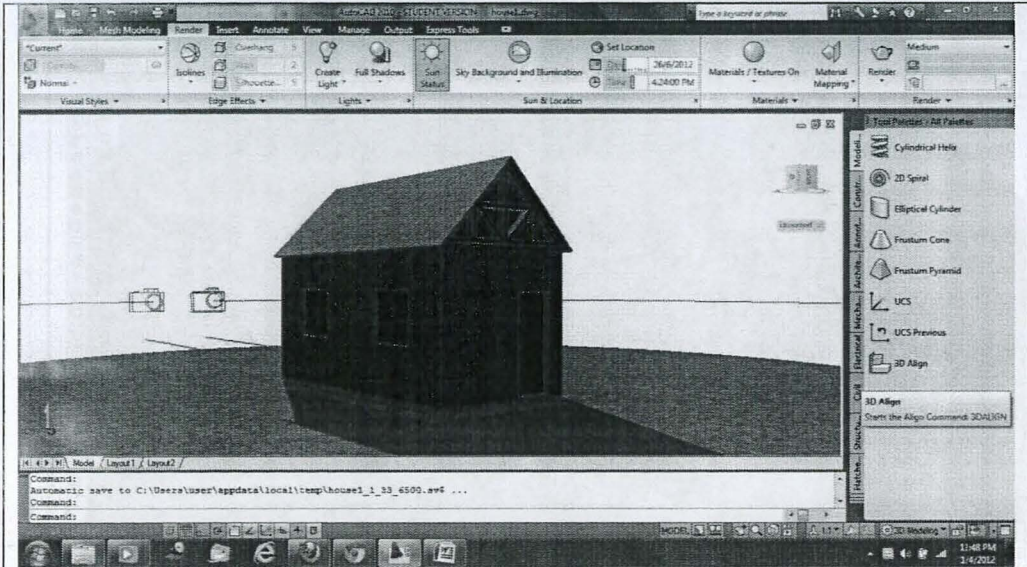
Turn on the entire layer. Render.



## The Camera

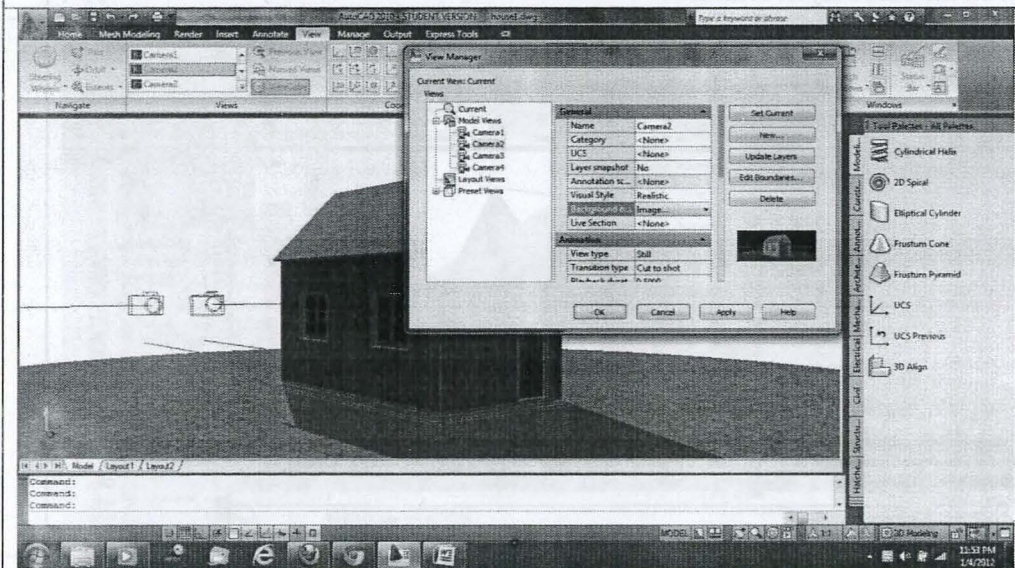
Be in the 3D modeling environment. Set the camera in plan view. Adjust the camera. Click to desire camera's view





## The Sun

Set the shadow and sun at the light, sun and location properties. Set the proper time and date.



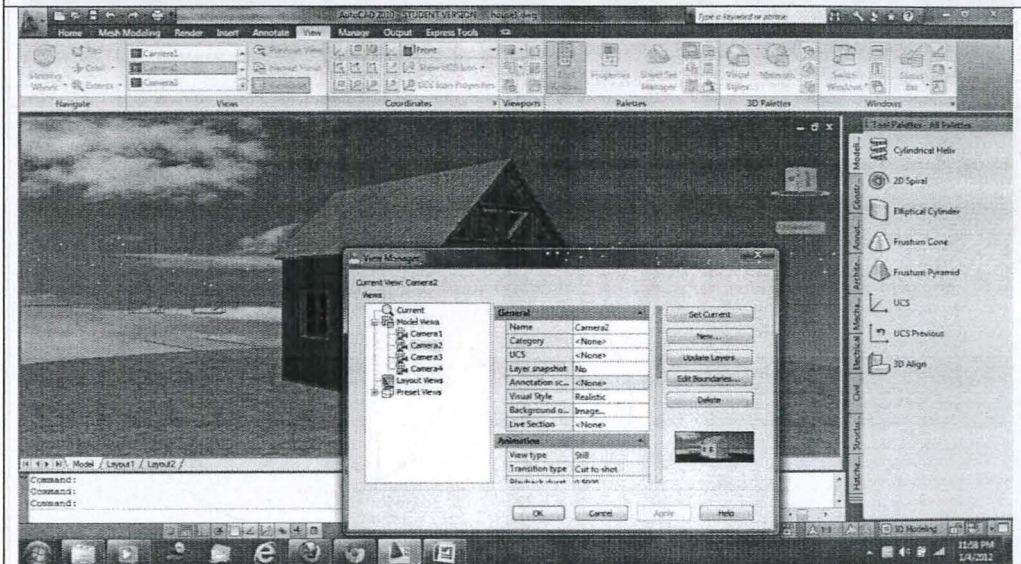
## The Sky

Click the view pull down menu. Click the name view and select the camera we want to use as current view. Go to the background.



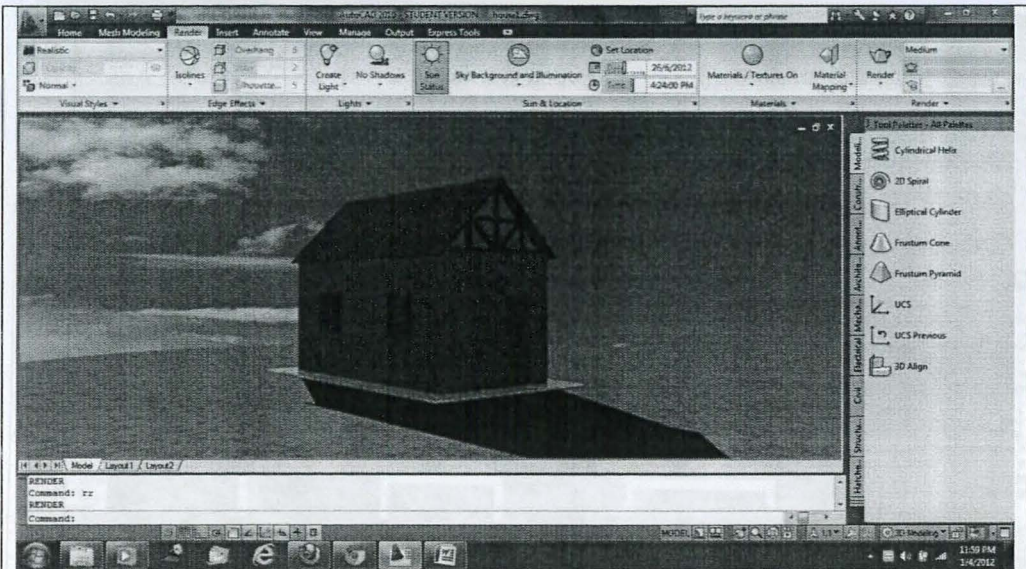


Get the sky image from google in jpeg format.



Apply the sky image at the view manager dialog box. Set it as current image.





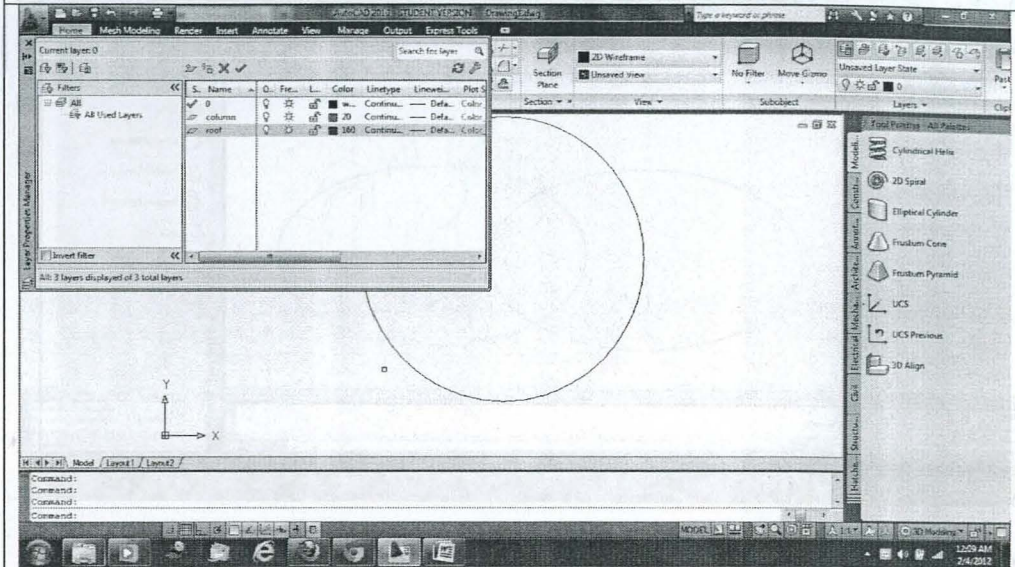
### The Final Product

Invoke render the final product is shown.

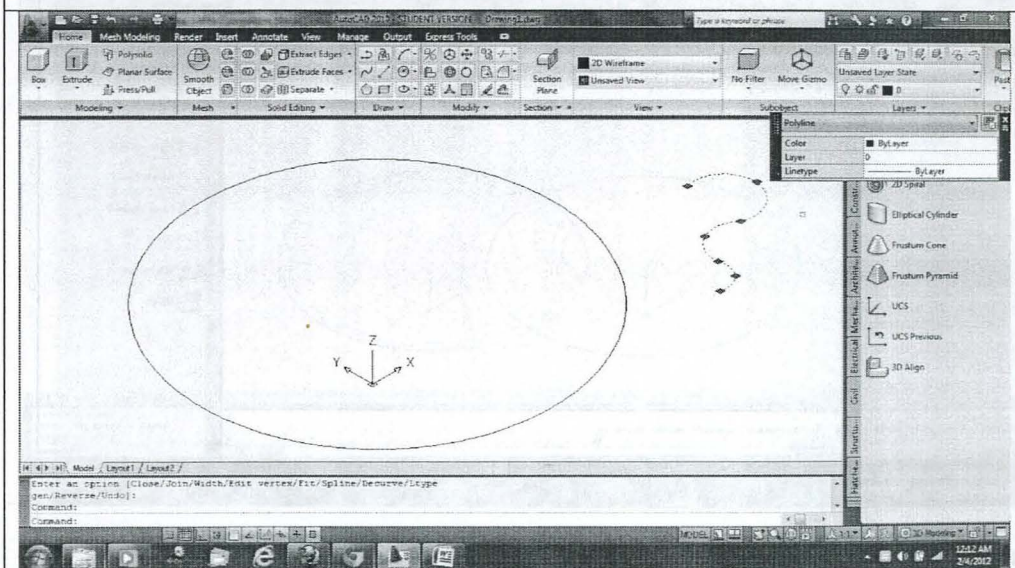
### The Sky

Click the view pull down menu. Click the name view and select the camera we want to use as current view. Go to the background.

## Reflection 28 – Creating Stadium's Roof Project



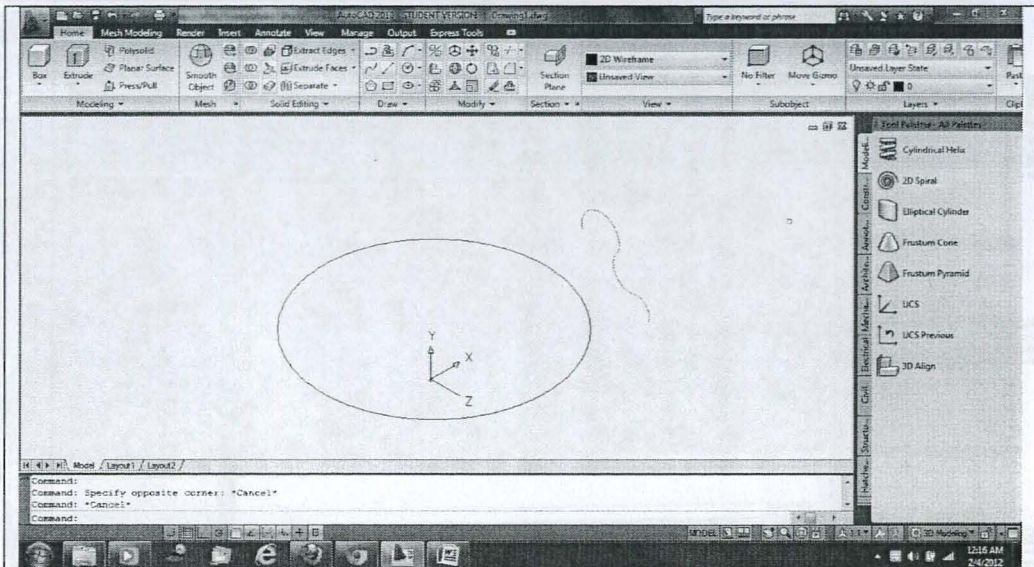
Create two layers roof and column. Set big circle in construction layer.



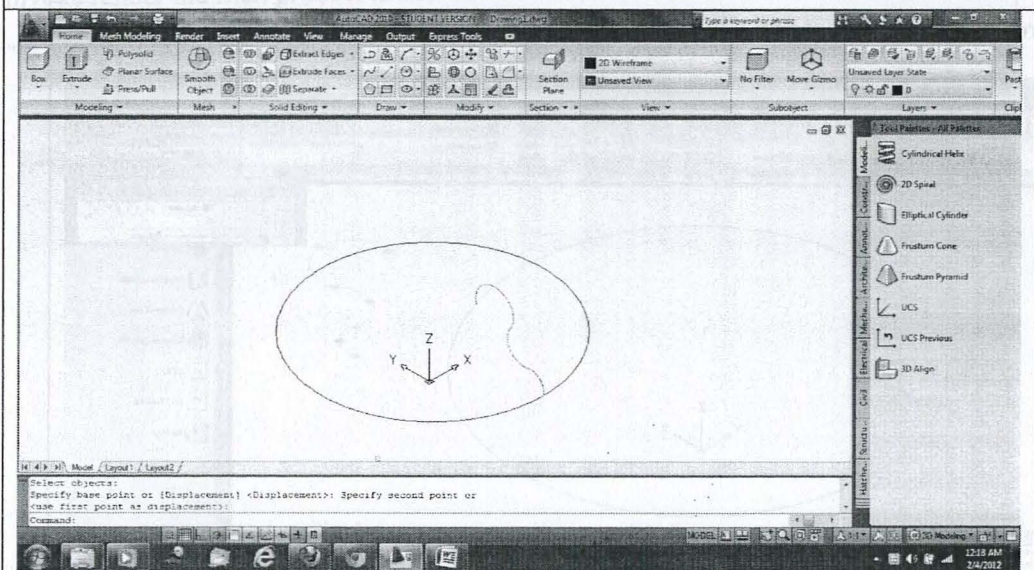
Draw the line using 3p arch. Joint the lines to be one entity.



## FROM NOTHING TO SOMETHING

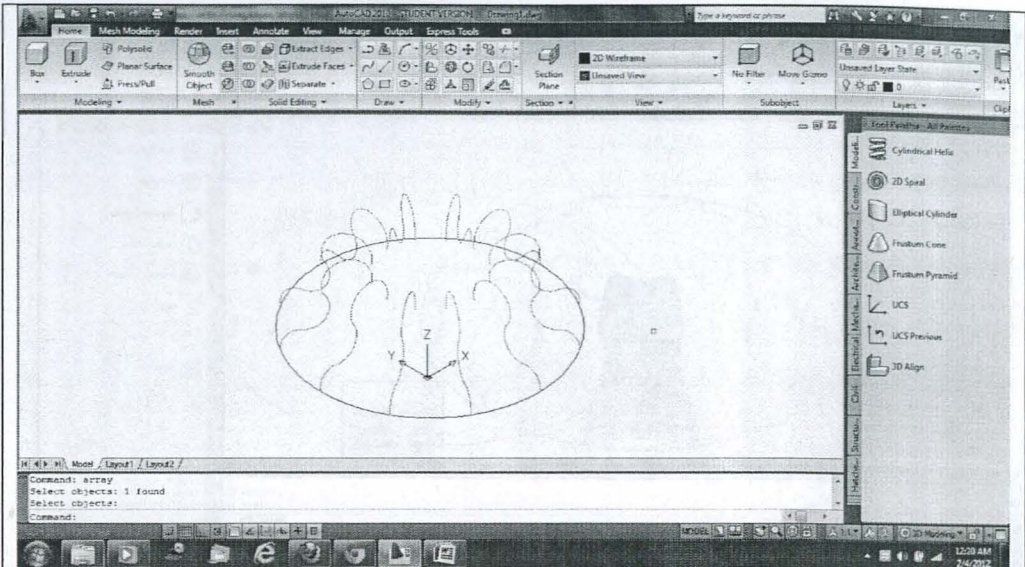


Rotate the UCS at X axis by 90 degree. Rotate the object by 90 degrees.

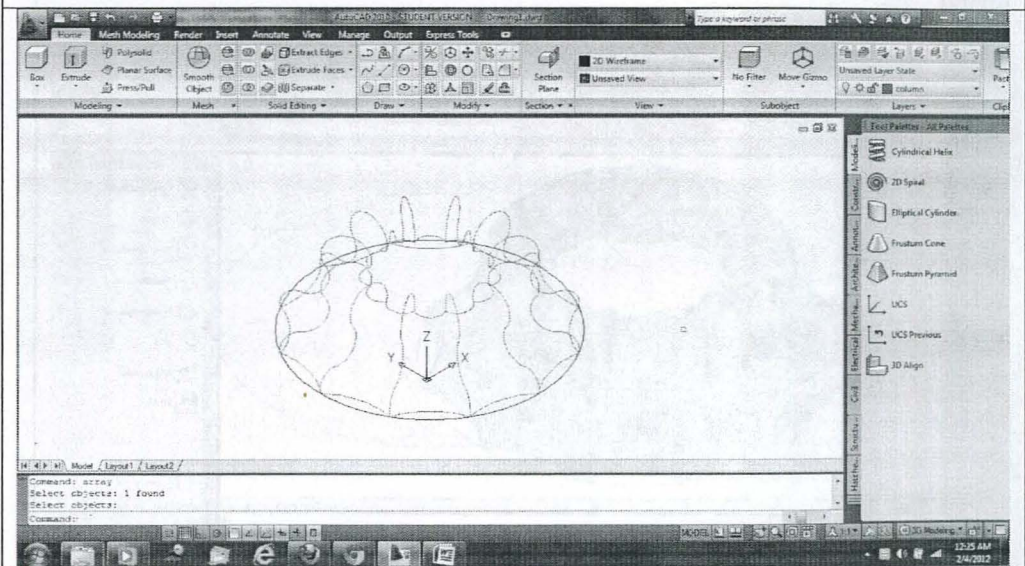


Change UCS to WCS. Move the line to the quadrant of the circle.

## FROM NOTHING TO SOMETHING

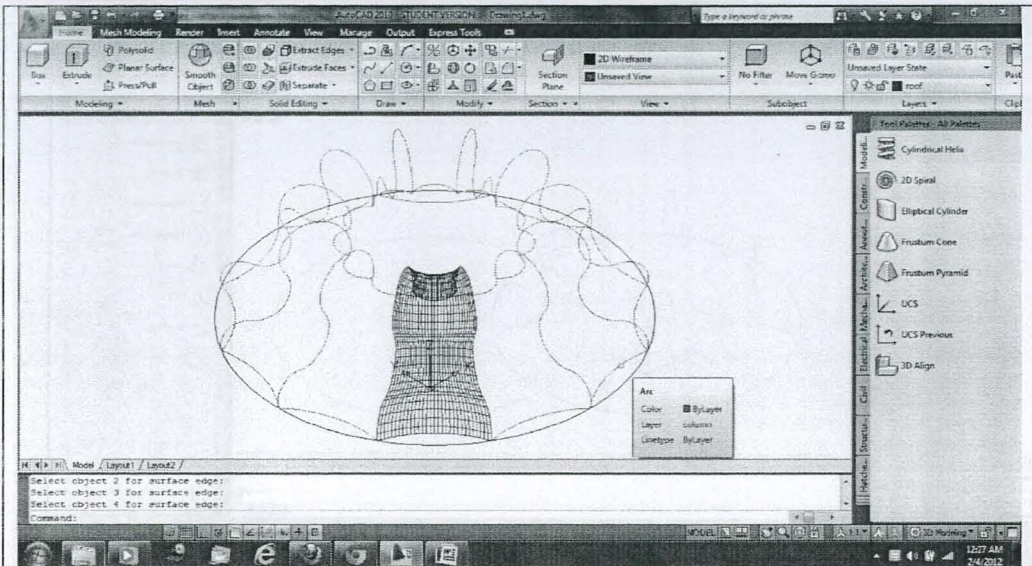


Array the line using polar array to the amount of 12.

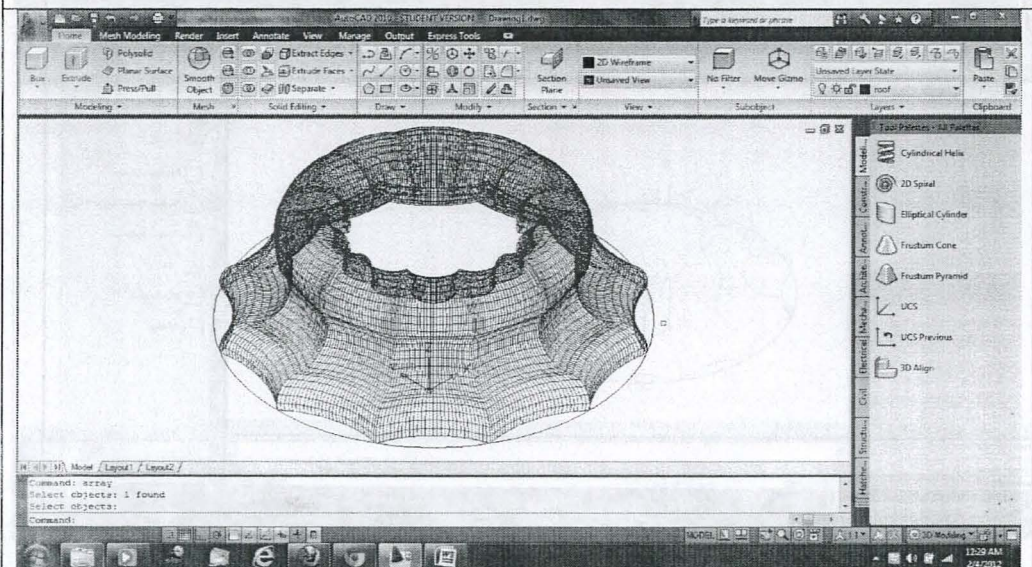


Draw the line at the top and bottom of the roof. Array both line using polar array.



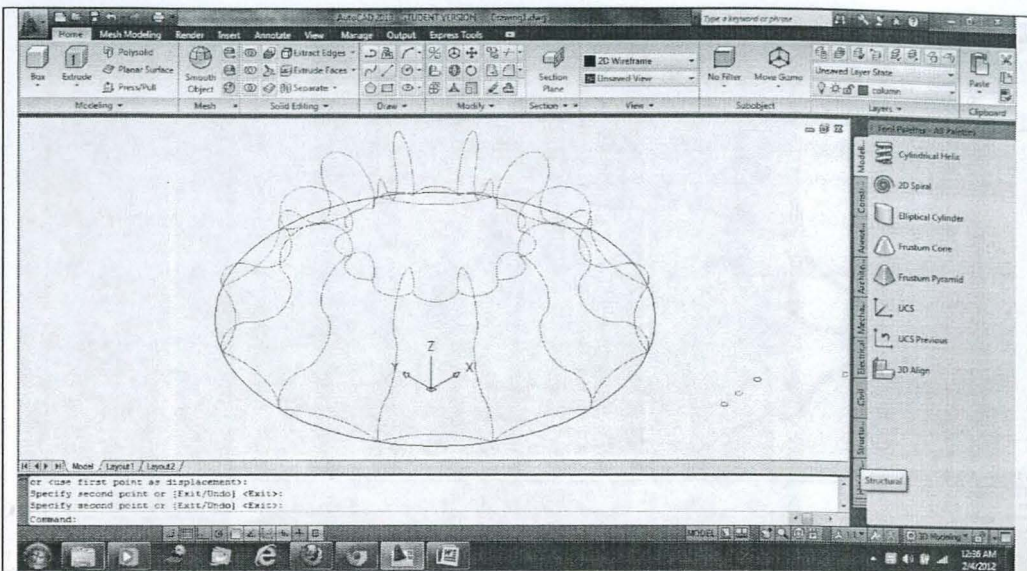


Set the surfab1 and surfab2 equal to 30. Set roof as current layer. Invoke edgesurf command.

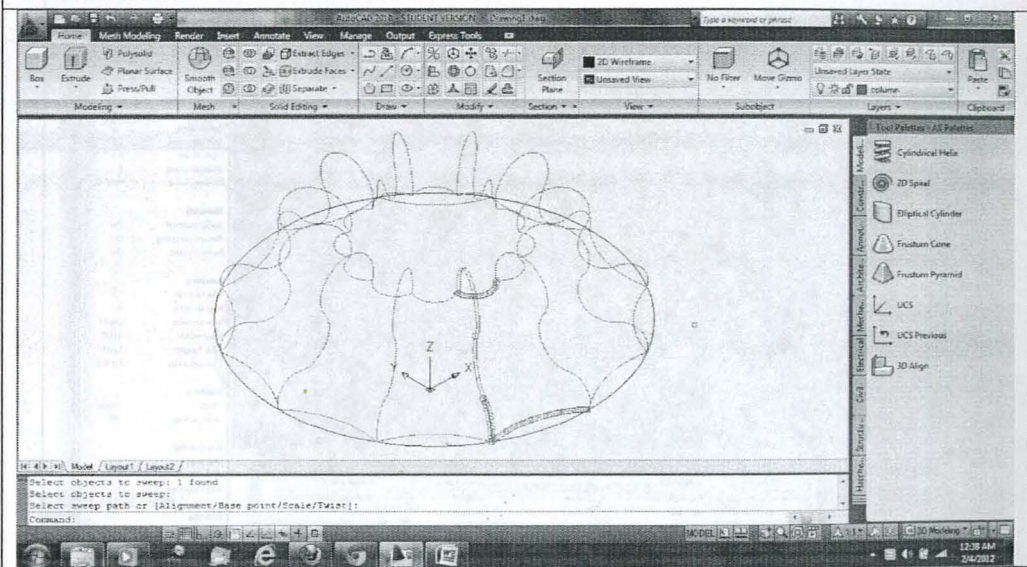


Array the roof using polar array command





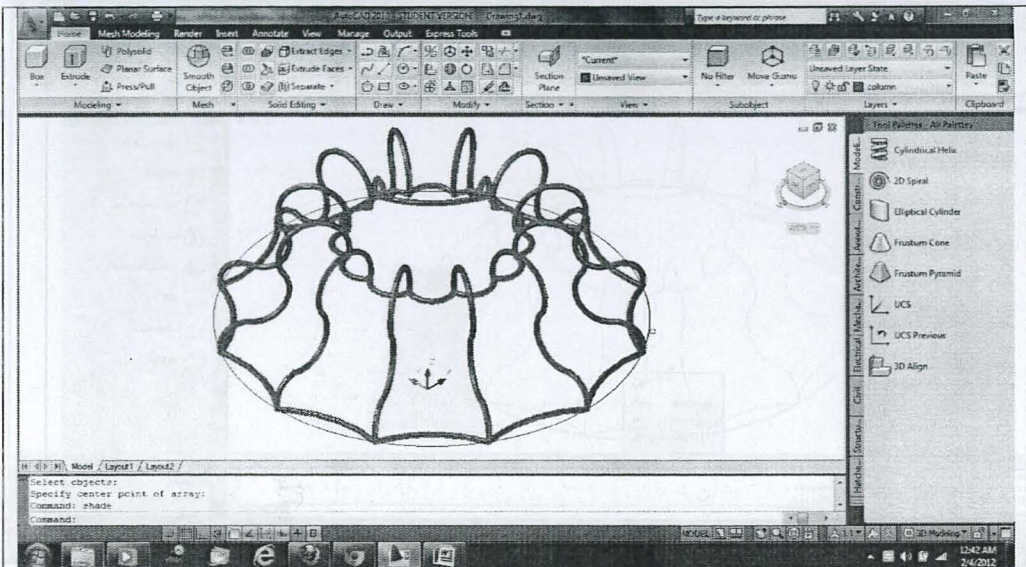
Draw three small circles diameter equal to 75.



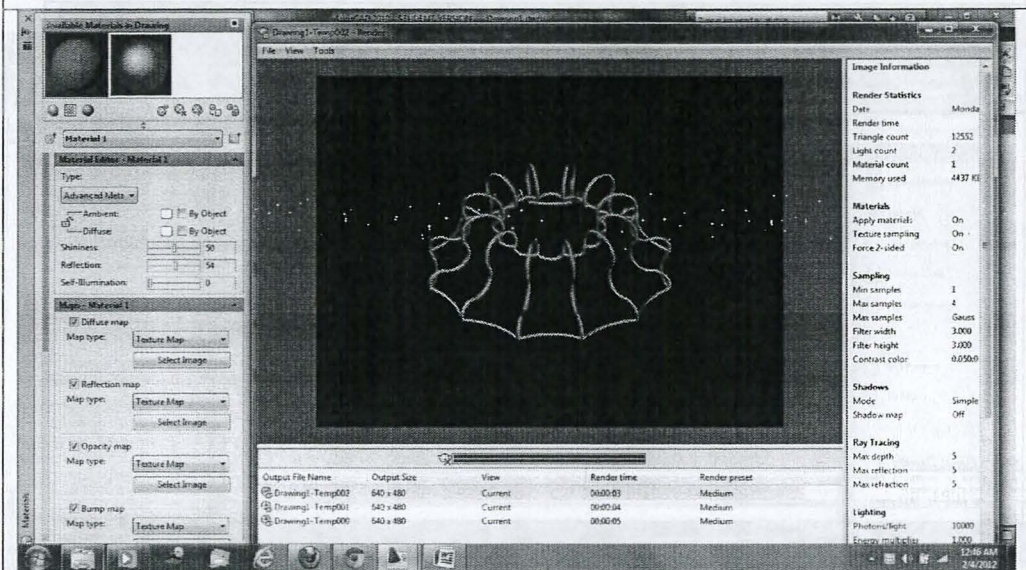
Use sweep command to get the structure as shown. Select the small circle as object and line as path.



## FROM NOTHING TO SOMETHING

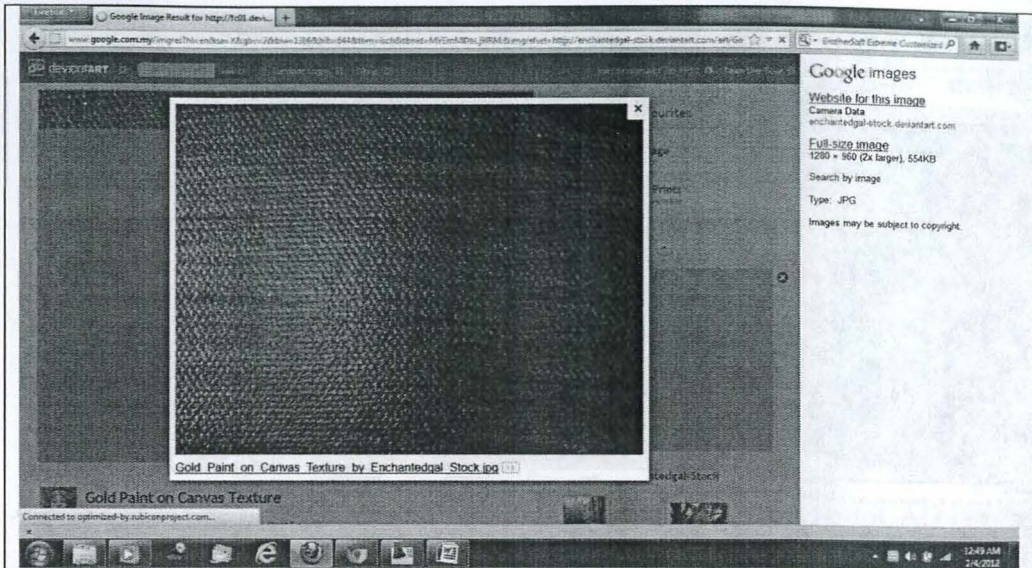


Array the column line using polar array. Invoke shade.

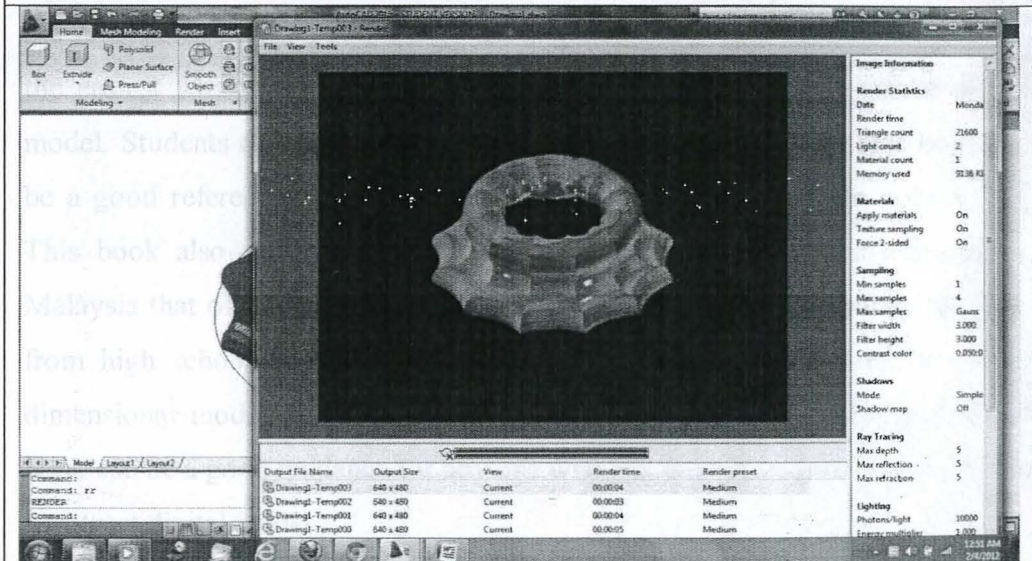


Create advanced material using material editor. Apply material to the column.





Set roof as current layer. Turn off the column layer. Select the roof canvas material from Internet.



Apply the material to the roof. Invoke render.





Turn on the entire layer. Adjust the camera. Set the condition of the shadows and sun view. Invoke the the render command. The stadium roof's is done.

Digital models represent a three dimensional object using a collection of points in three dimensional space, connected by various geometric entities such as triangles, lines and curved surfaces. Digital models are used in a wide variety of fields. In architecture three dimensional models can be a final product of the design ideas. There are three types of digital models which are wireframe model, surface model and solid model. There are many types of software available today that can be used to construct a digital model. This book gives some tips upon how AutoCAD can be used to construct a digital model. The approach of this book is understood by practice. Step by step approaches being presented in this book in order for us to understand upon how AutoCAD can be used to construct a digital model. The writer had used this approach when he taught 3D AutoCAD to polytechnic students for the past 10 years. The reflections used in this book for every topic being arranged from the easiest to the most difficult task. From the past experiences this approach offers one of the easiest ways for the students to understand on how to construct digital model. Students can learn by themselves when using this book. This book can be a good reference for architecture and mechanical students in polytechnic. This book also can be a good reference for any high level institutions in Malaysia that offer architecture, mechanical or product based course. Students from high schools also can use this book to help them construct the three dimensional model that they design in rekacipta class. The writer hopes this book can be a good guidance for any one who has interest in using AutoCAD to construct digital model.



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**TARIKH DIPULANGKAN  
(DATE DUE)**

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