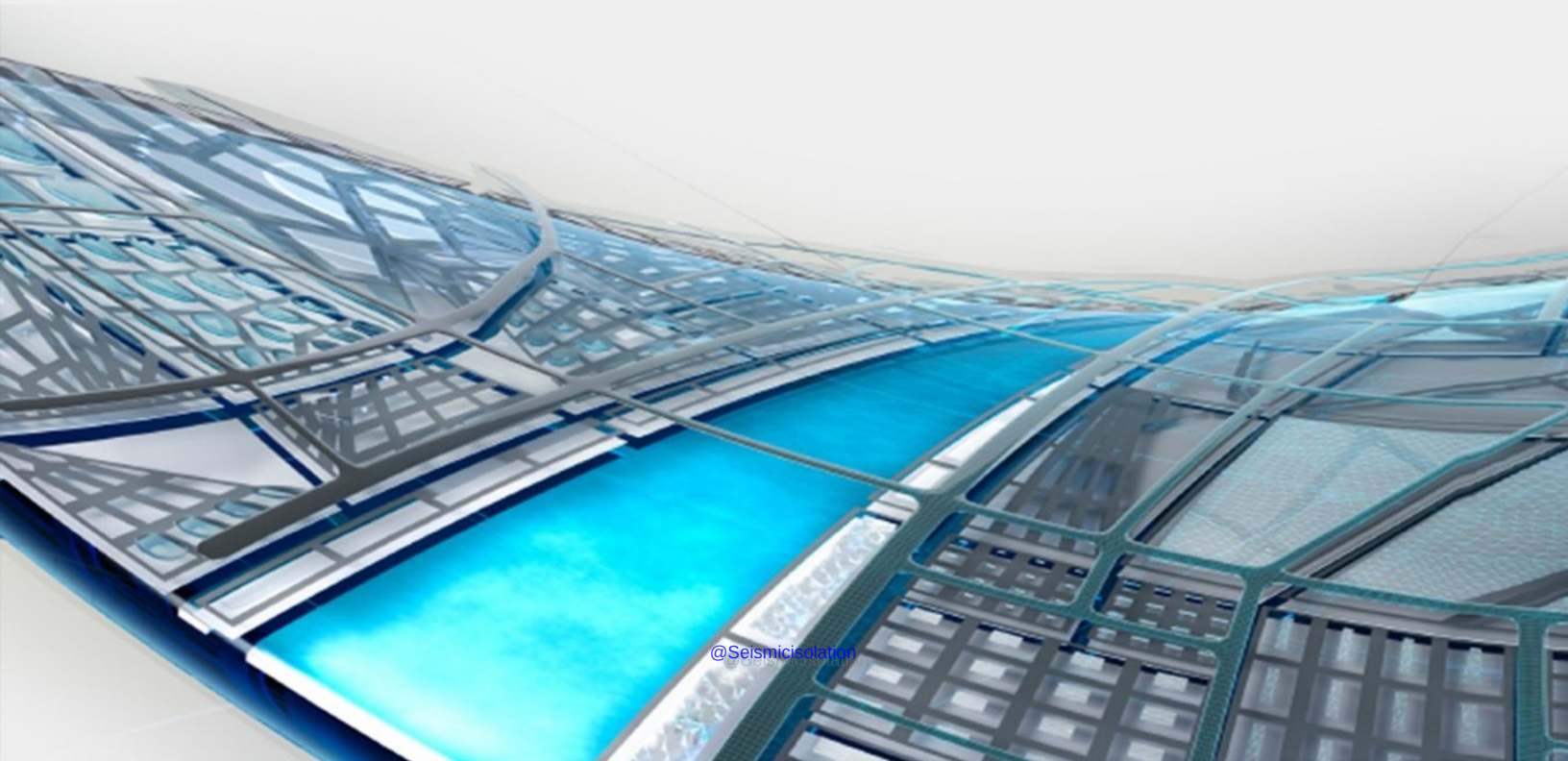
AUTOCAD TUTORIAL BOOK

AutoCAD Civil 3D Book



Divide

Draw an object → provide divide command [DI] → select the object → give a number of segments → object is equidistantly divided.

For example, if a line of 6 cm is taken and divide parameter is given as 3 then the line will be divided into 3 parts of 2 cm each.

The measure (used for divide an object into the desired length)

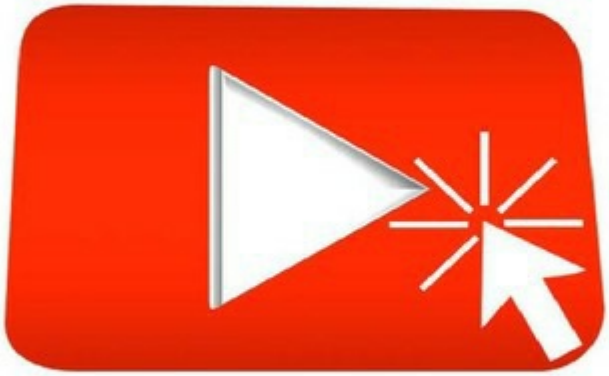
Draw an object → provide measure command

the desired length)

Draw an object → provide measure command [ME] →select the object → give the length of segment → object is divided into multiple segments of given length and last segment length will be of remaining length.

For example, if the total length of a line is 5 cm and divide length is given as 2 cm, then there will be three lines created, 2 for 2 cm each and last for 1 cm.

Have a look at video lecture 26 to learn about text options and examples.



Video 26: Text

10.2 DIMENSION

10.2 DIMENSION

Dimension panel is available in Annotate tab.

Dimension style [D]:

- Press D for dimension style and select 'New' for new dimension style.
- You can define any name for dimension style and provide details like lines, symbols, and arrows, primary unit, text etc.
- Update the style and click on OK.

Refer to *figure 10.4* for dimension style window.

Elevations:

It includes front, rear, and both side views. It is necessary to give the civil structure it's exterior architectural styling.

Figure 1.3: Sample output of an elevation

DYK (Did you know?):

Side views are also called elevations in engineering terms. We use right side view, left side view in lay man terms, just to make it simple to communicate.

Making a Line:

Making orthogonal line

Line command [L]→ switch on ortho mode [F8] → distance → enter →the straight line will be drawn.

Making inclined line

Line command → switch off ortho mode [F8] → provide distance → press tab key → provide angle (anticlockwise measuring from X-axis) →the inclined line will be drawn (*figure 5.2*).

→ provide distance → press tab key → provide angle (anticlockwise measuring from X-axis) →the inclined line will be drawn (*figure 5.2*).

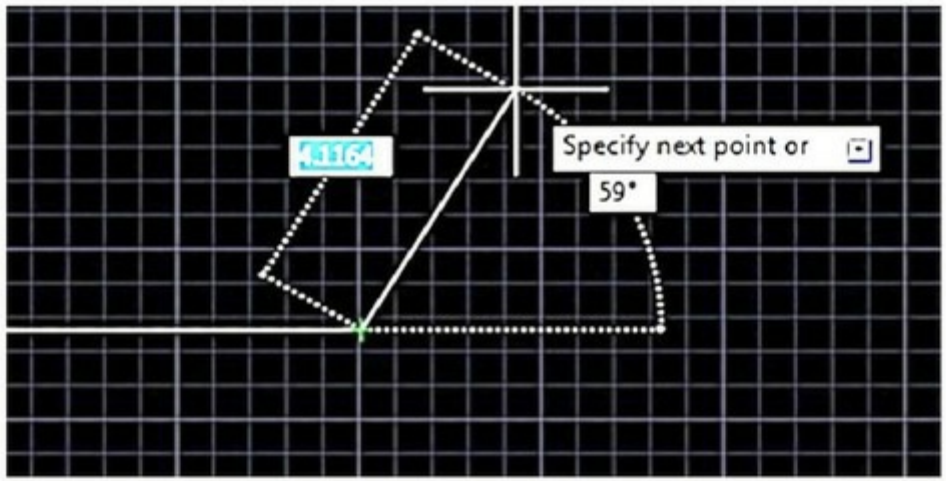
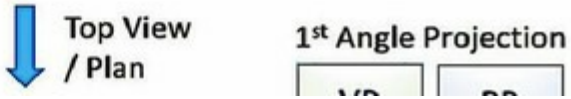


Figure 5.2: Line command

Even if you can, then also read on. It is one of the basic topics of engineering drawing and often asked in job interviews… Read on…

You must be aware about fours quadrants of coordinate system as shown on right side in 2D plane.

Now refer to *figure 1.14*, given below, showing these four quadrants in 3D space. The golden box is placed in 1st quadrant and grey box is placed in 3rd quadrant. The projections made by the object in 1st quadrant are called 1st angle projections or views and for object in 3rd quadrant its projections are called 3rd angle projections or views.



angle projections or views.

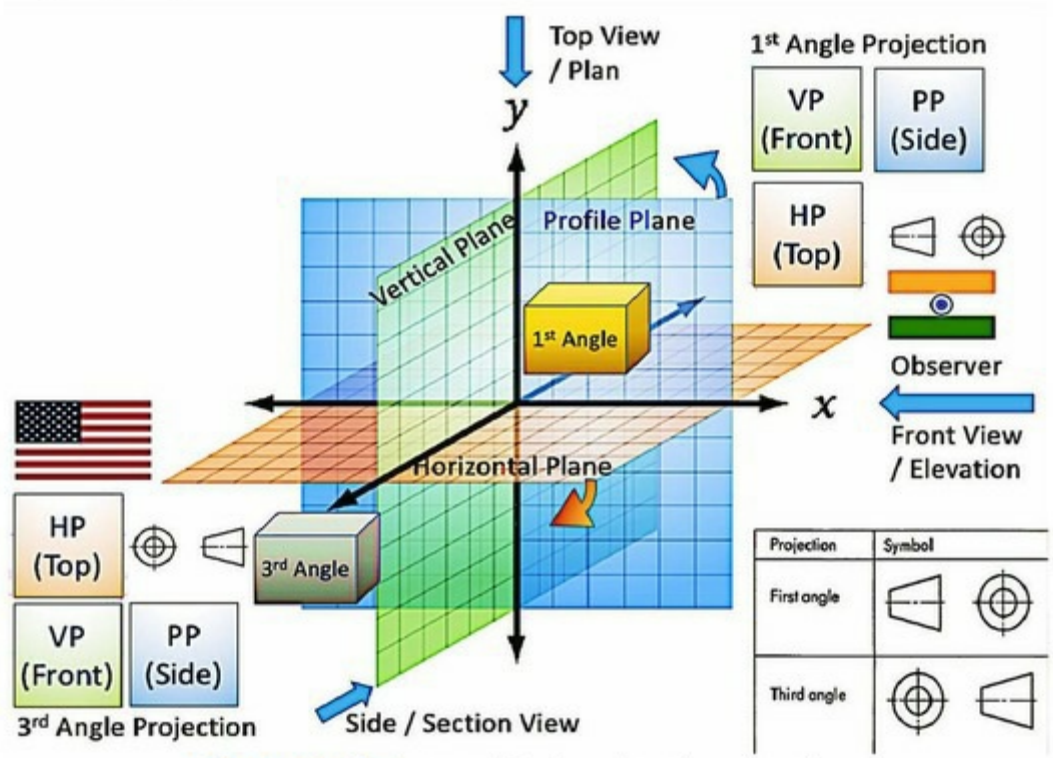


Figure 1.14: 1st and 3rd angle of projection

??? Question Time ???

Why 2nd and 4th angle of projections are not used?

Answer: *In 2nd and 4th quadrants, when we rotate horizontal plane then it overlaps with the vertical plane and hence projection of front view and the top view are merged. Segregated projections will not be available. Therefore these views cannot be used.*

1.5 DIFFERENT PAPER SIZES

In India, we use "ISO A" paper sizes (defined by ISO 216 standard) for drafting and printing. The largest size (A0) measures one square meter. The height/width ratio remains constant (1:1.41 or 1:√2) for all sizes. It means if you double fold A0 along its shortest side, you get A1 and so on. A0 is used for blueprints, A1 for

(A0) measures one square meter. The height/ width ratio remains constant (1:1.41 or 1:√2) for all sizes. It means if you double fold A0 along its shortest side, you get A1 and so on. A0 is used for blueprints, A1 for verification before submission for approvals or for distribution, A2 is used for drafting, A3 is used for quick reference, A4 is used as office document, A5 is used for notepads and A6 is used as postcards. Refer to *figure 1.16* showing different.

Page	Size(mm)	Page	Size(mm)
A0	1189X841	A5	210X148
A1	841X594	A6	148X105
A2	594X420	A7	105X74
A3	420X297	A8	74X52
A4	297X210		

Figure 1.16: Paper sizes and dimensions

6.6 QUIZ

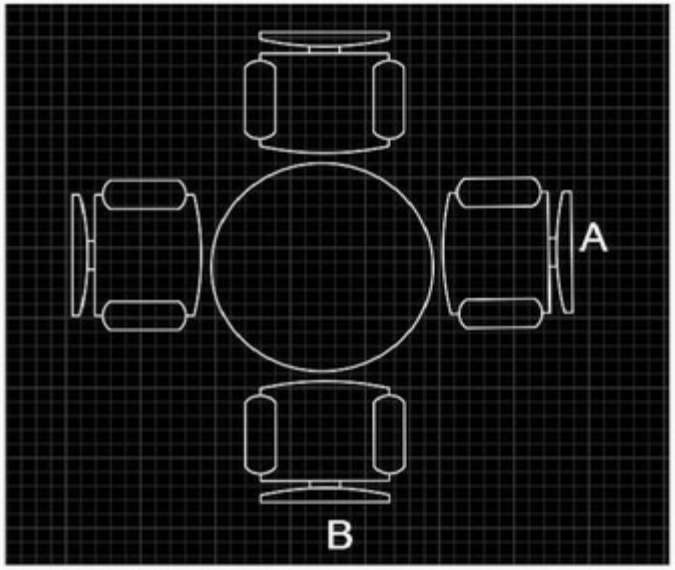
1. With hot grips which of the options can be performed?
   A. Move
   B. Offset
   C. Scale
   D. Rotate

2. What happens if we create fillet with radius zero?
   A. Cannot create a fillet
   B. Sharp corner

A. Cannot create a fillet
B. Sharp corner

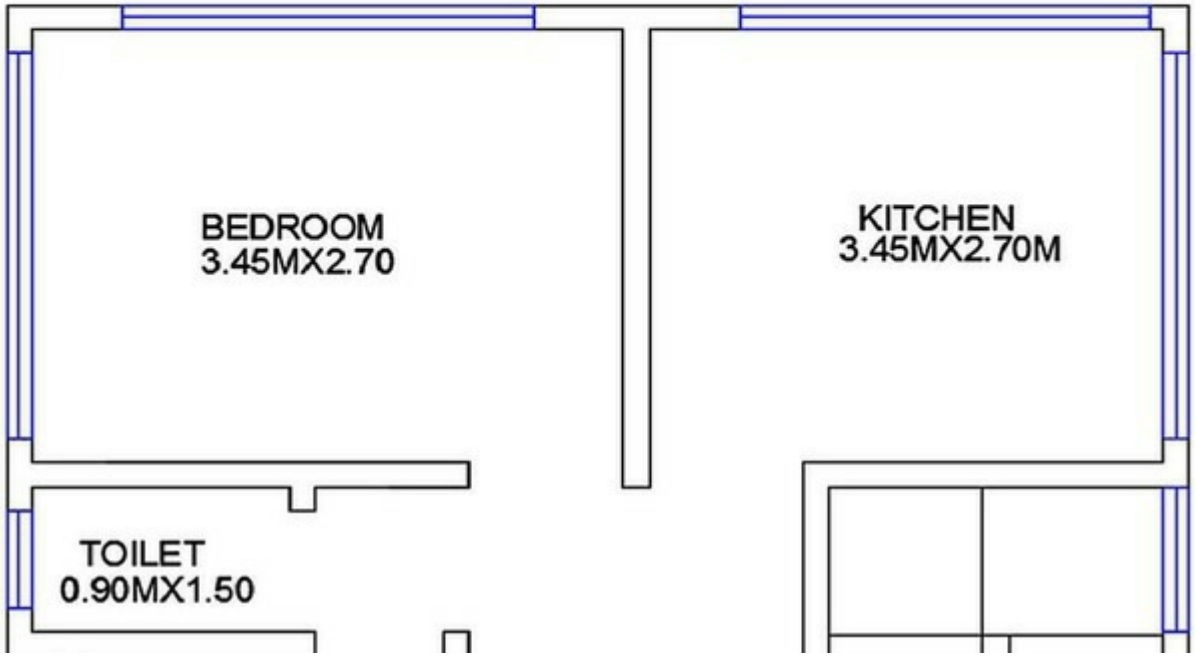
3. What is the angle used to rotate chair from A to B?

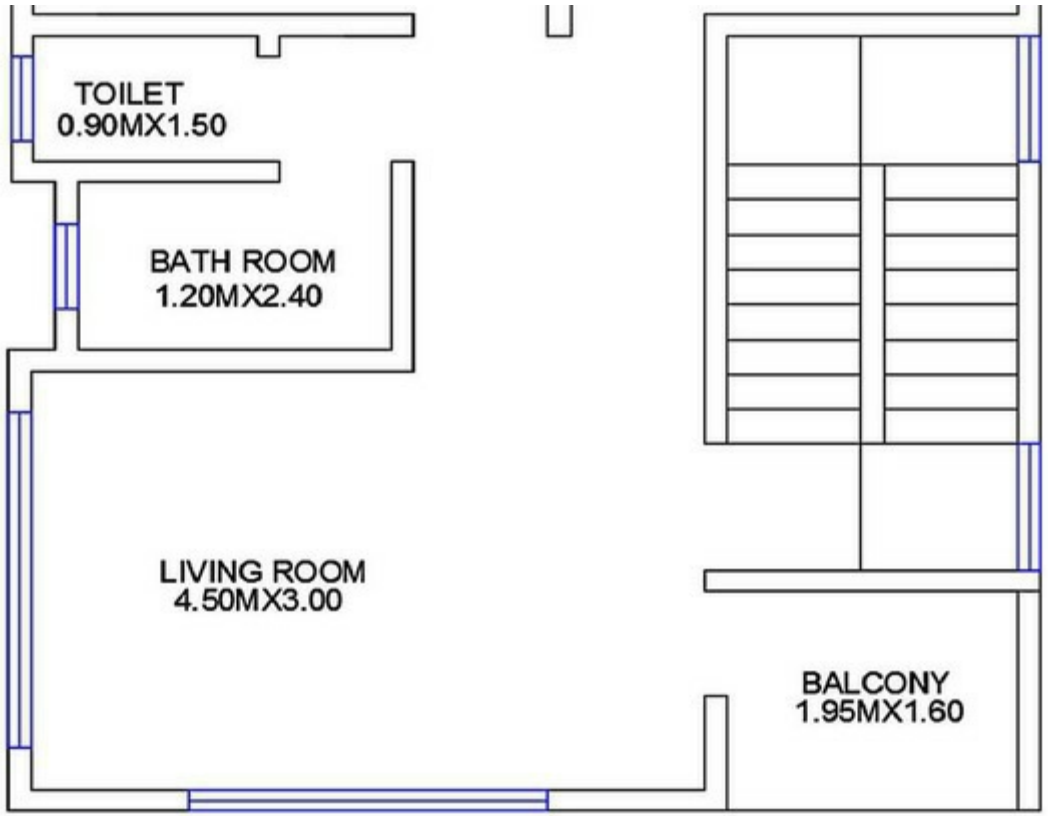
A. 90
B. 270
C. -90
D. 180



7.1 EXERCISES

Exercise7.1: Estimated duration: 30 minutes





Step 2: Editing basic shapes

The basic component can be modified by using move, copy, mirror, trim, etc. command which also enhances drafting speed. (We will learn about these steps in detail). The same hall is edited and doors are added to *figure 2.5*:

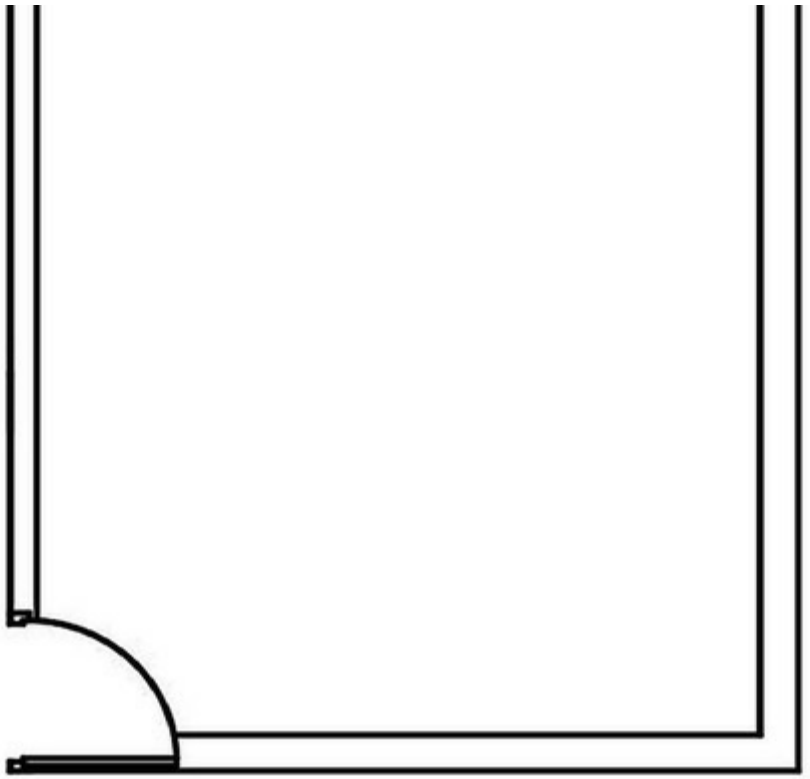


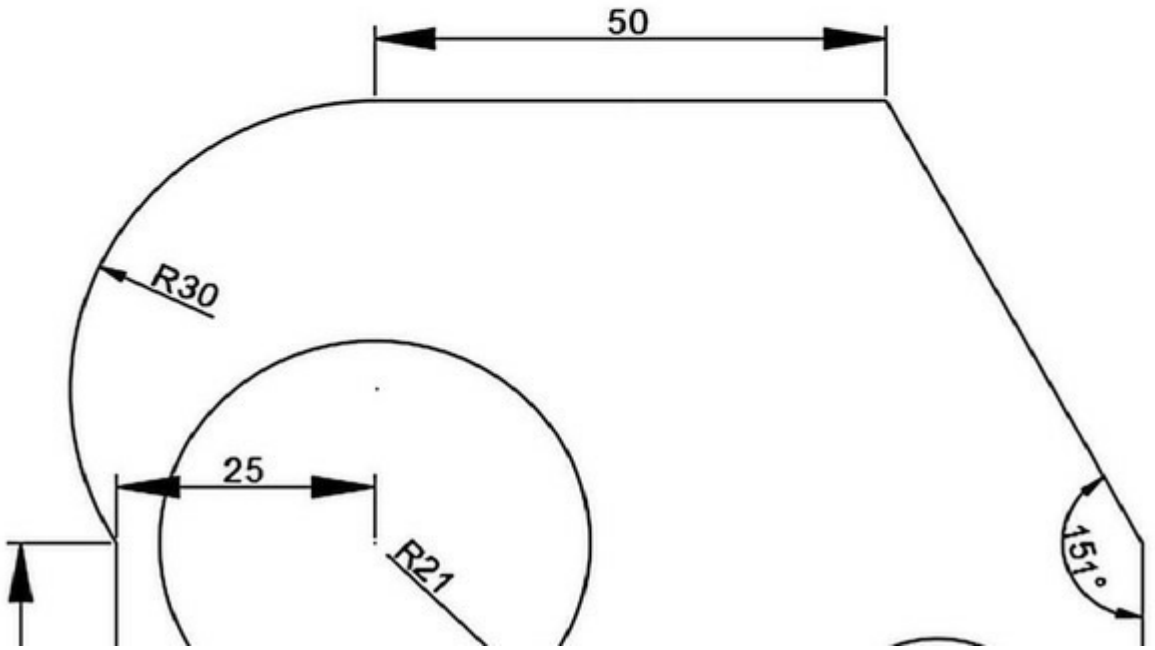
Figure 2.5: Editing hall

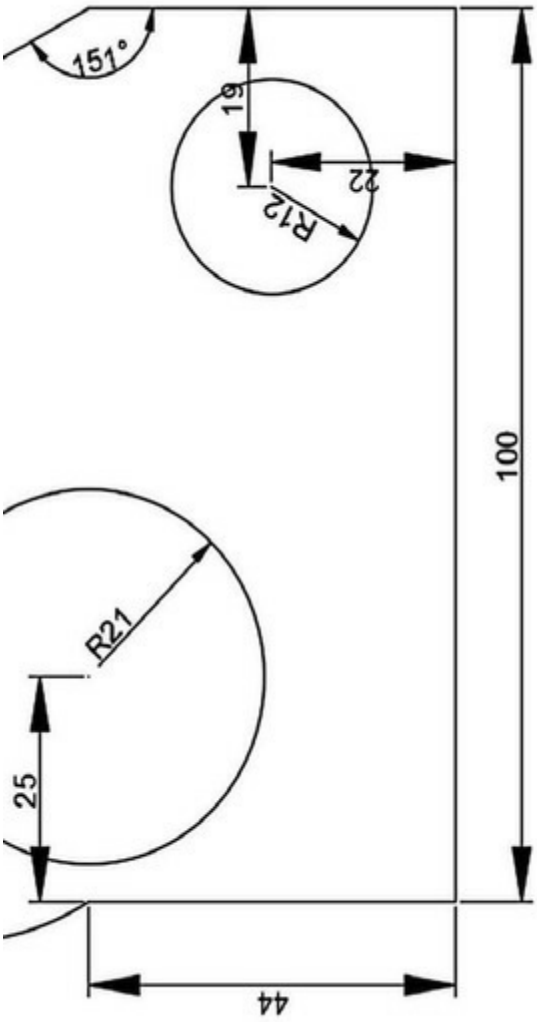
Floor Plan:

A floor plan is a drawing to scale, showing a view from the top, of the relationships between rooms, spaces and other features at one level of a structure.

Figure 1.2: Sample output of a floor plan

Exercise 5.4: Estimated duration: 15 minutes





1.2 CIVIL INDUSTRY WORKFLOW

Below is the work sequence followed by Civil Industry.

Figure 1.5: Hand sketching

Hand Sketching: It is the starting point for most of the project to start giving it. After a few iterations when the idea takes shape then drafting work starts on software.

Drafting: Drafting is essential for communicating ideas in engineering. To make the drawings easier to understand, people use most widely used symbols, units of measurement, notation systems, visual styles, and page layout. Together, such conventions constitute a visual language and help to ensure that the drawing is unambiguous and relatively easy to understand

of measurement, notation systems, visual styles, and page layout. Together, such conventions constitute a visual language and help to ensure that the drawing is unambiguous and relatively easy to understand.

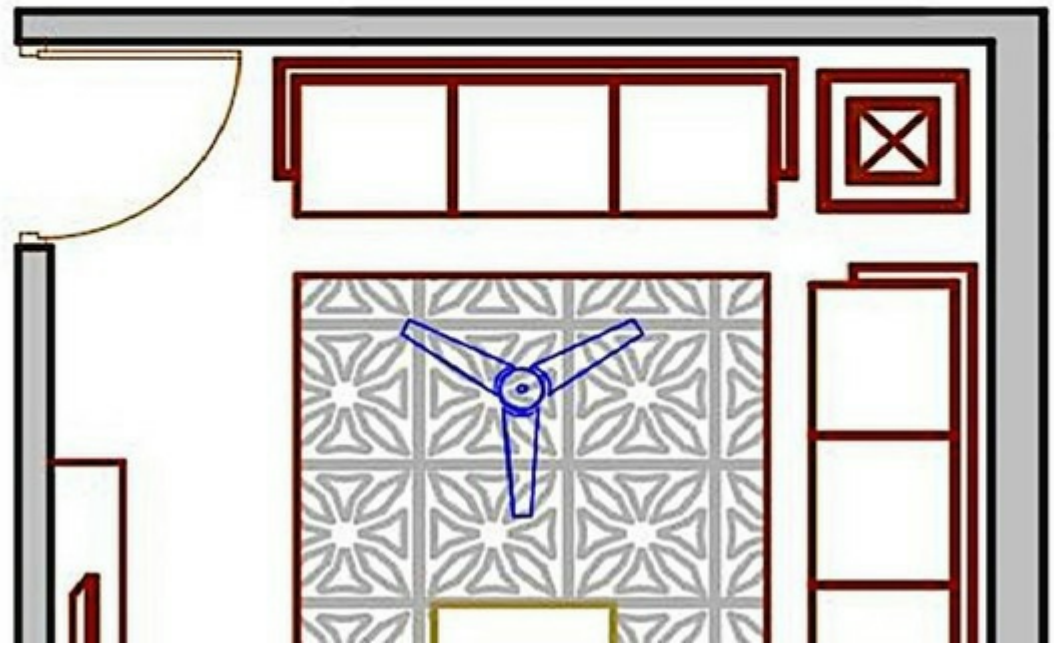
Modeling: Modelling is used for 3D visualization and construction. There are two types of modeling:

1. Handmade: For example, township or building model with an interior view
2. Computer-aided; For example, bungalow model made in CAD software

Software used for modeling: Revit Architecture and **3DS-Max** are the two most widely used software for modeling. Apart from creating 3D models for easy visualization, it provides features of adding different types of materials, lighting, furnishing, furniture,

Step 4: Presentation

By using hatch, layers, line weight, line type simple drafting can be artfully presented.



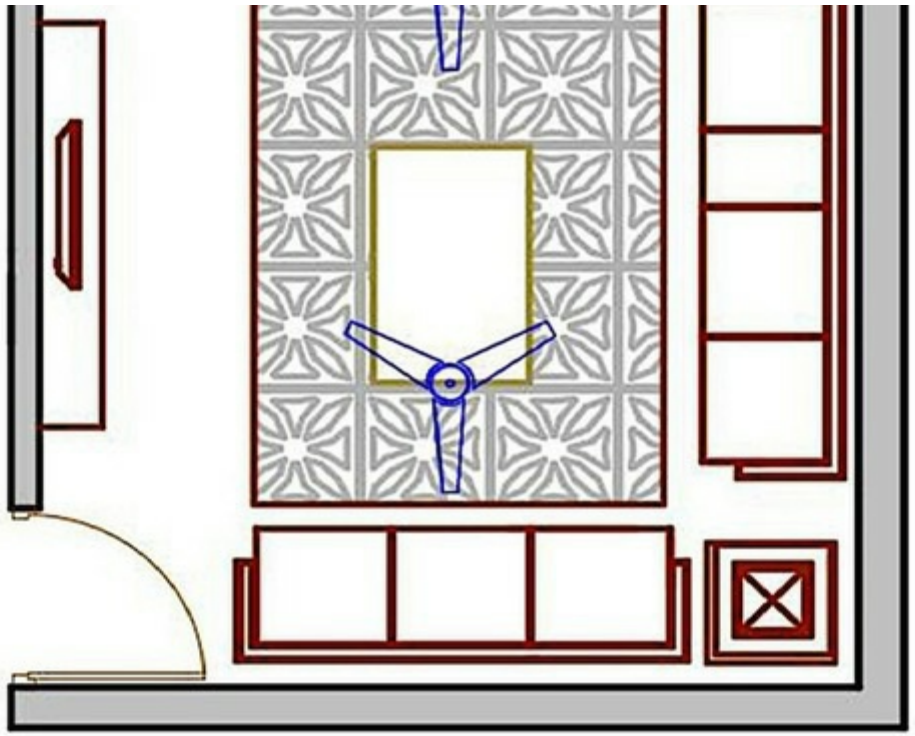


Figure 2.7: Presentation of the hall

7. Why should companies use templates?
   A. To save drafters time
   B. Drawing is consistent
   C. To make it easy for an employee to work on other files
   D. All of the above.

8. What can be contained in a template drawing?
   A. Layers
   B. Text Style
   C. Dimension Style
   D. All of the above

9. Which file type is used for publishing on the

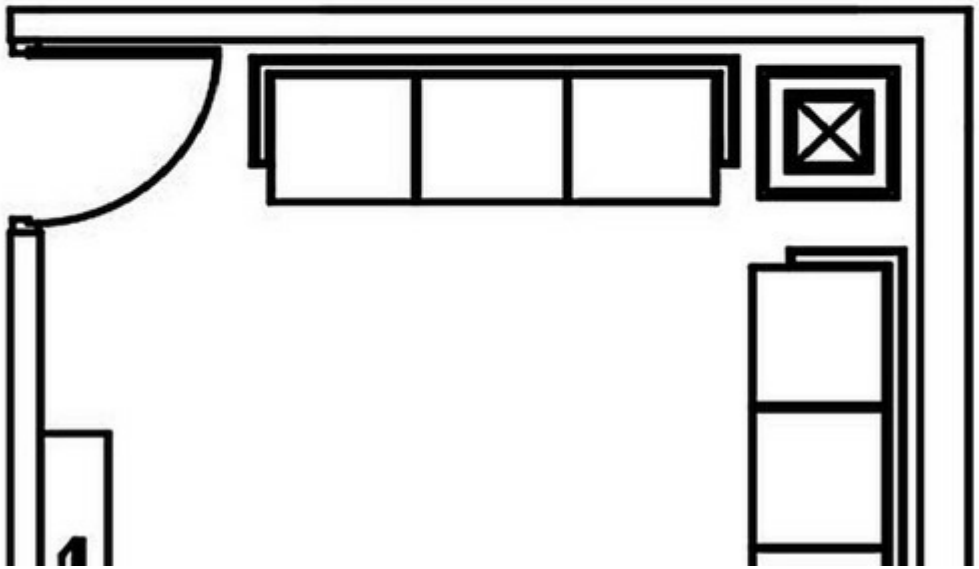
D. All of the above

9. Which file type is used for publishing on the web?
   A. DWG
   B. DWF
   C. DXF
   D. WMF

10. Which is a shortcut for dynamic input?
   A. F8
   B. F7
   C. F12
   D. F3

Step 3: Adding 'Blocks'

Blocks are a united object which are re-used, for example, sofa, chair, dining, microwave etc. In hall sofa, T.V box, side table is added by block concept.



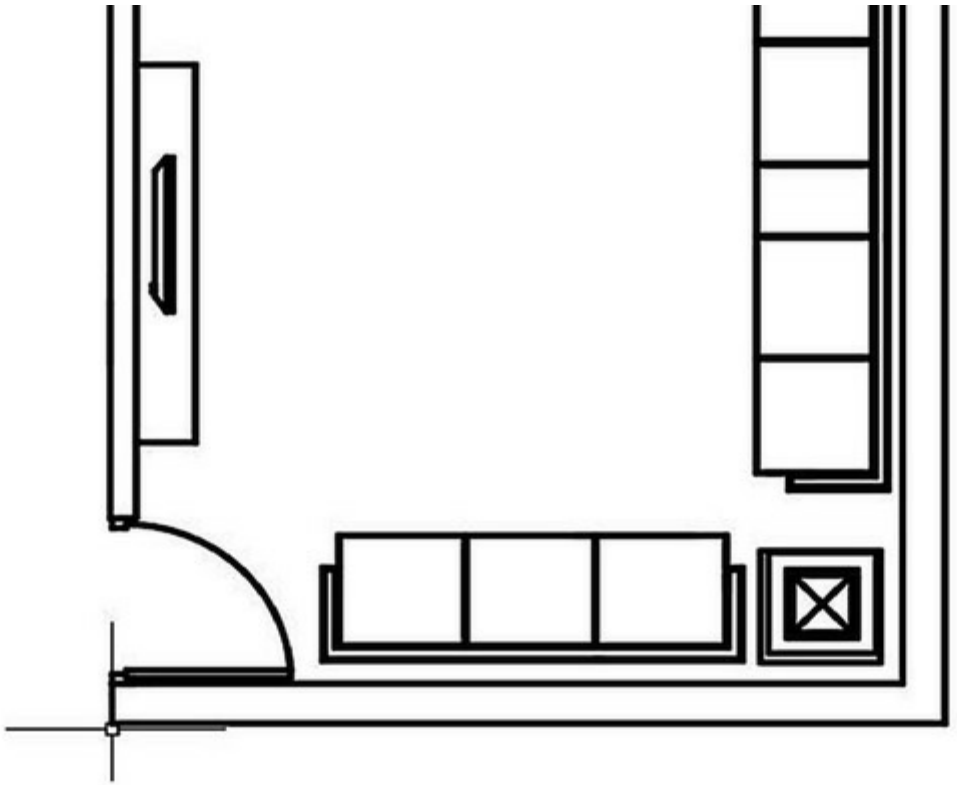
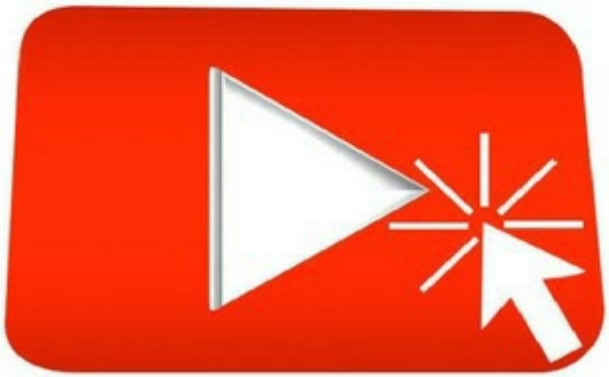


Figure 2.6: Adding blocks

- **Snap** – To restrict curser at particular corners [F9]
- **Quick Property** – To show the property of selected drawing [QP]

Look at video lecture 8 for ortho and dynamic input.



Video 8: Ortho and Dynamic input

Video 8: Ortho and Dynamic input

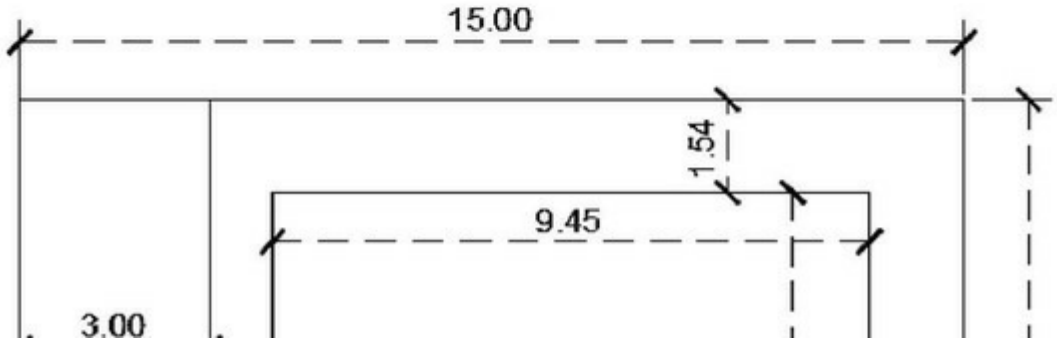
Look at video lecture 9 for Snap, Quick Property, and Line weight.

Video 9: Snap, Quick Property, and Line weight

7. DRAFTING FLOOR PLAN

In approval sheet/sanction sheet, we have Floor Plan, Elevations, Section, Site plan and details of Schedule, Area statement, etc.

Site Plan: is an architecture, engineering drawing shows building, utility runs and position of a road as shown in *figure 7.1*.



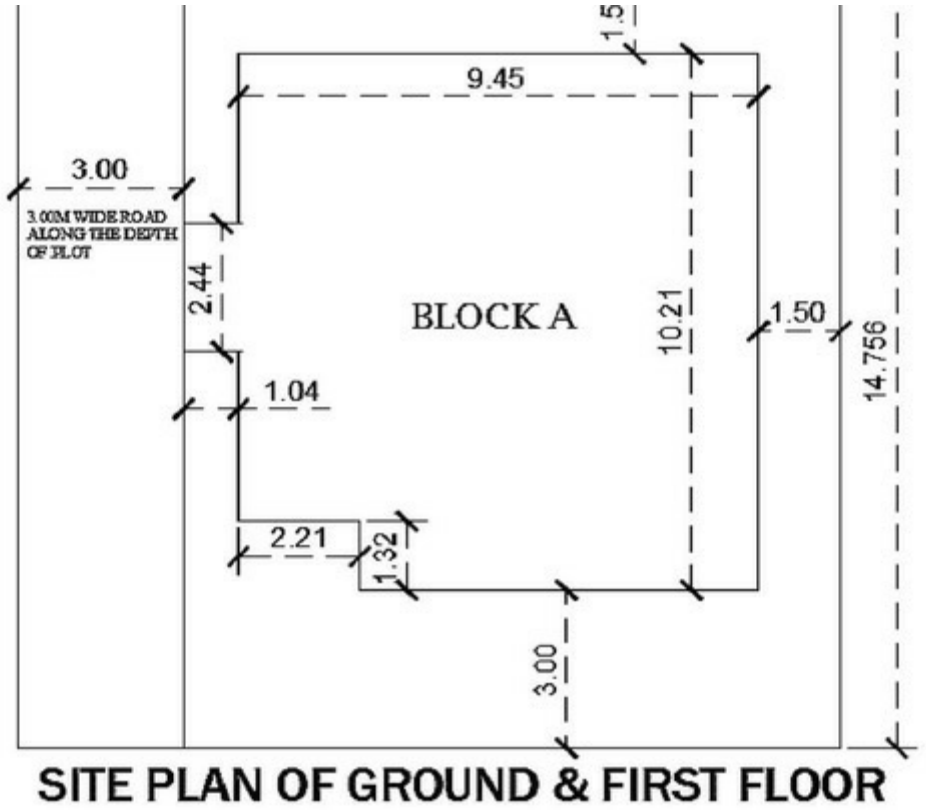


Figure 7.1: Site plan

Angular Dimension: gives an angle between lines

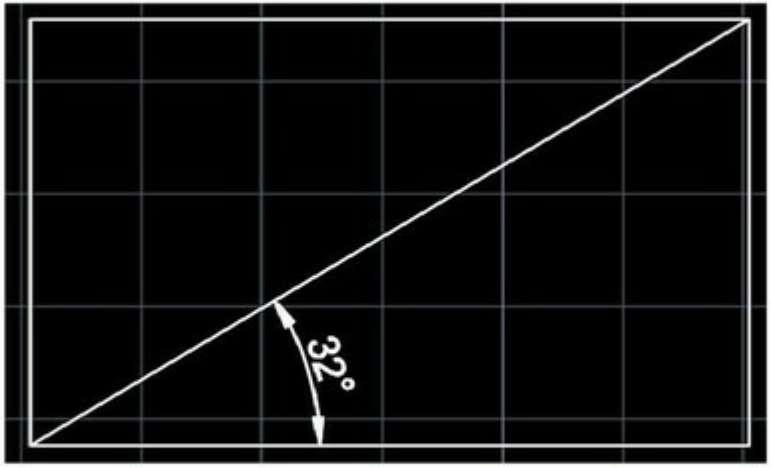


Figure 10.8: Angular dimension

Radius Dimension: gives the radius of circle or arc.

Radius Dimension: gives the radius of circle or arc.

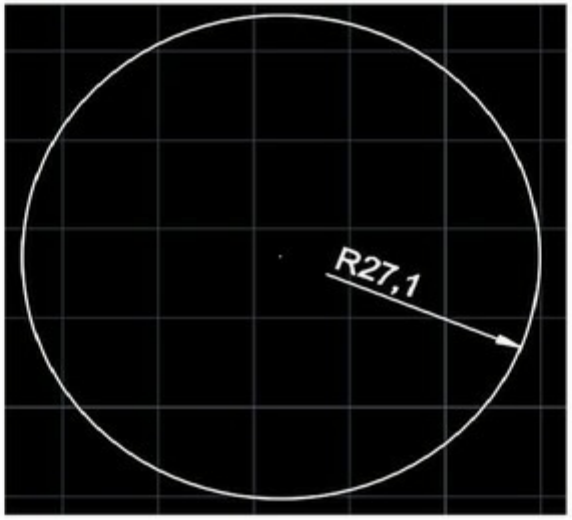


Figure 10.9: Radius dimension

Current Layer

All new objects are drawn on the current layer. The green check mark on the Layer Properties Manager indicates the current layer. A layer cannot be the current layer if:

- The layer is frozen
- The layer is part of an external reference

Turning layer on or off

Turning off layer will hide the object on the layer. Turning on will show it again.

Turning off layer will hide the object on the layer. Turning on will show it again.

Freeze of a layer

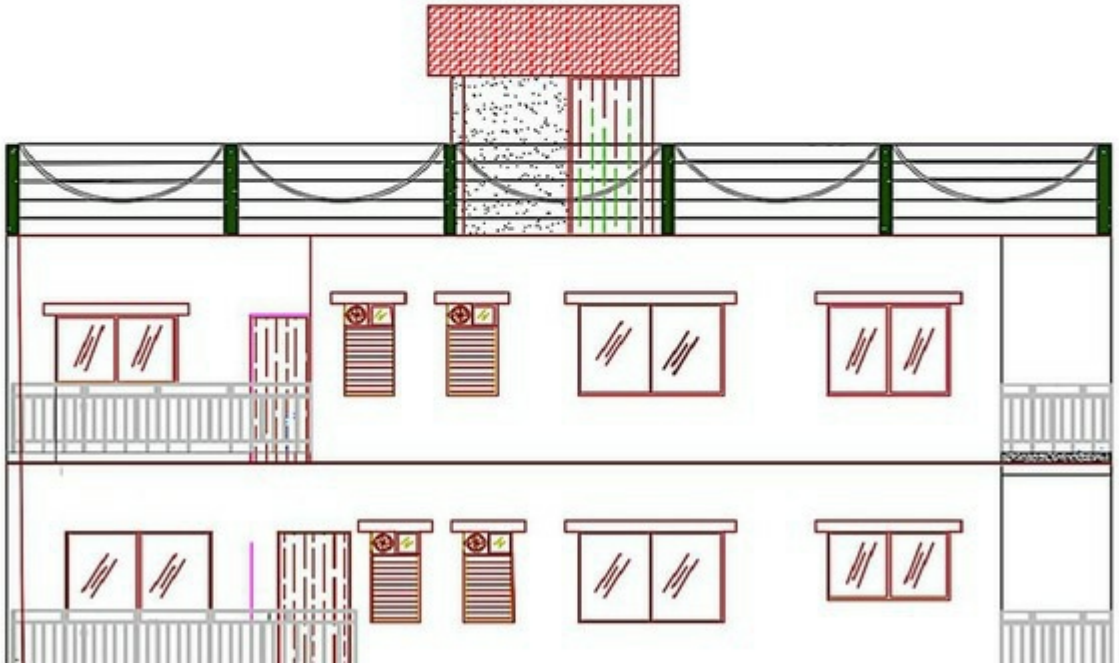
It will hide the object on the layer but it cannot be used for current layer.

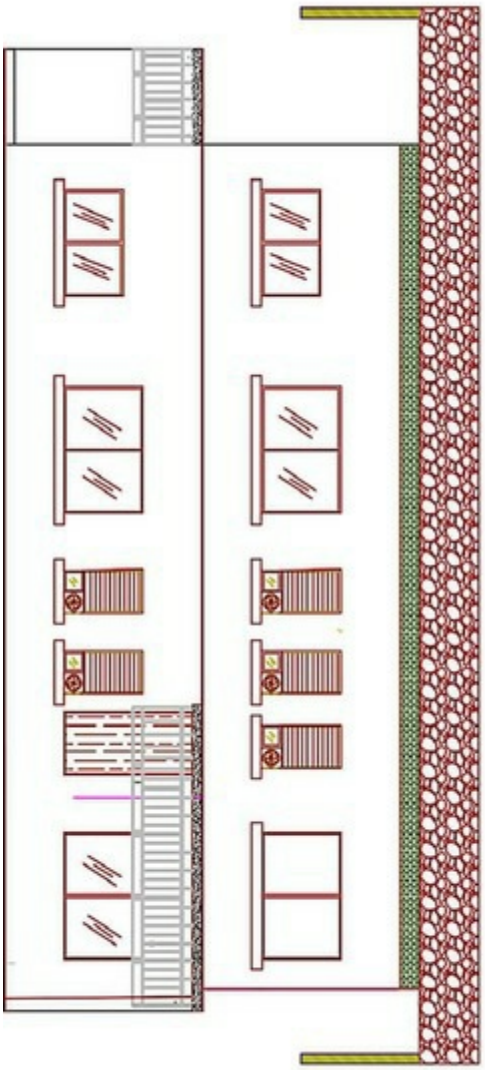
Locking of layers

It sets whether the layer is locked against editing, for example, line weight cannot be changed, any modifying command cannot be used.

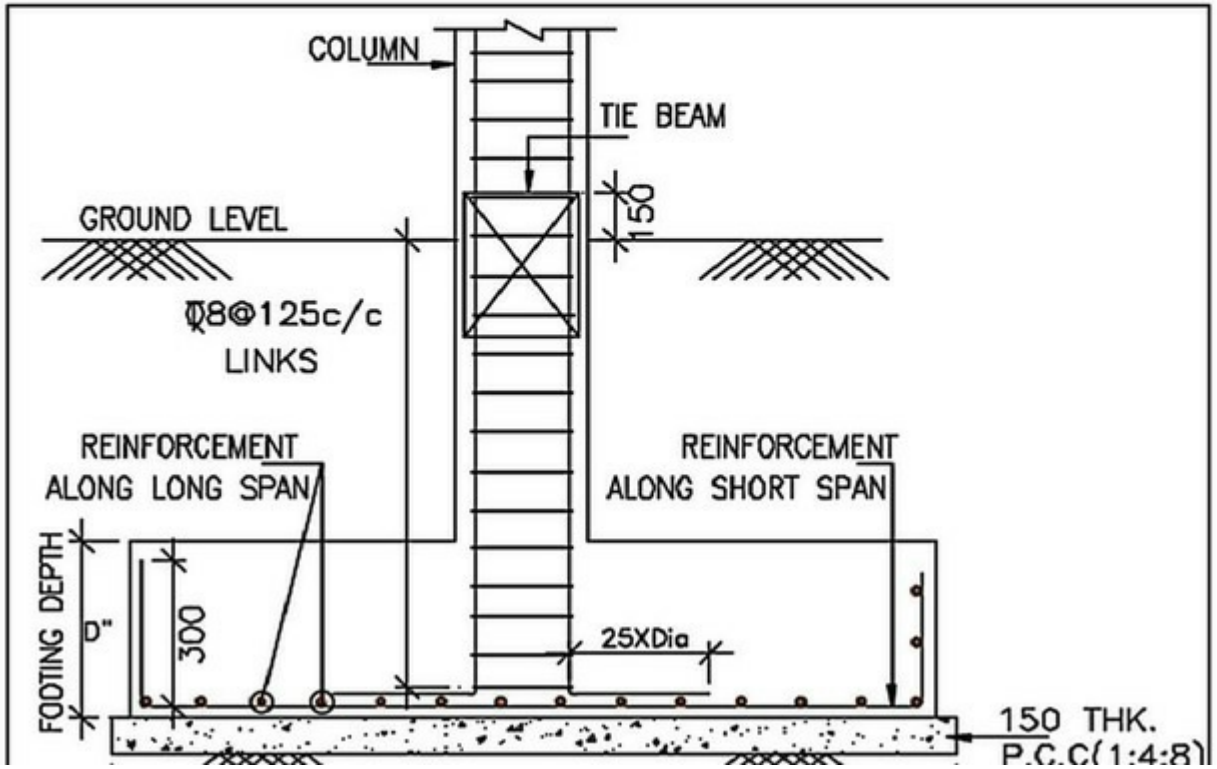
Exercise 9.5: Estimated duration: 30 minutes

Draw following elevations and apply hatch.





12.6 TYPICAL DETAIL OF BOX FOOTING



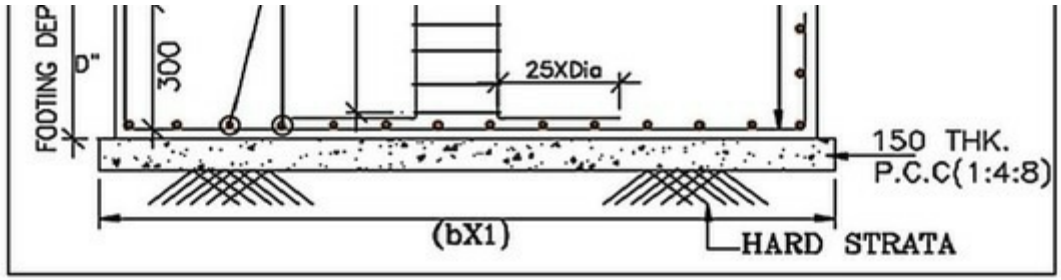


Figure 12.6: Box footing

Have a look at video lecture 34 for details.

Video 34: Foundation-Box footing

Answers:

1 – D

2 – B

3 – B

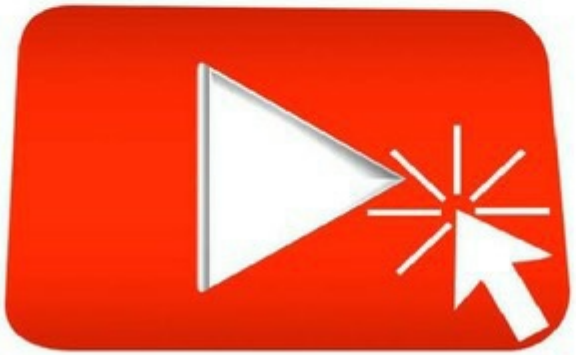
4 – B

5 – B

CONTENT

13.3 COMPLETE STRUCTURAL DESIGN OF STRUCTURAL AND FOUNDATION PLAN

Have a look at video lecture 38 to visualize complete structural design sheet with structural & foundation plan:



Video 38: Complete structural plan

Video 38: Complete structural plan

13.4 CONVERSION OF DRAWING TO PDF

Have a look at video lecture 39 to convert foundation plan sheet in PDF:

Video 39: Conversion to PDF

Answers:

1 – D

2 – D

3 – A

4 – C

5 – D

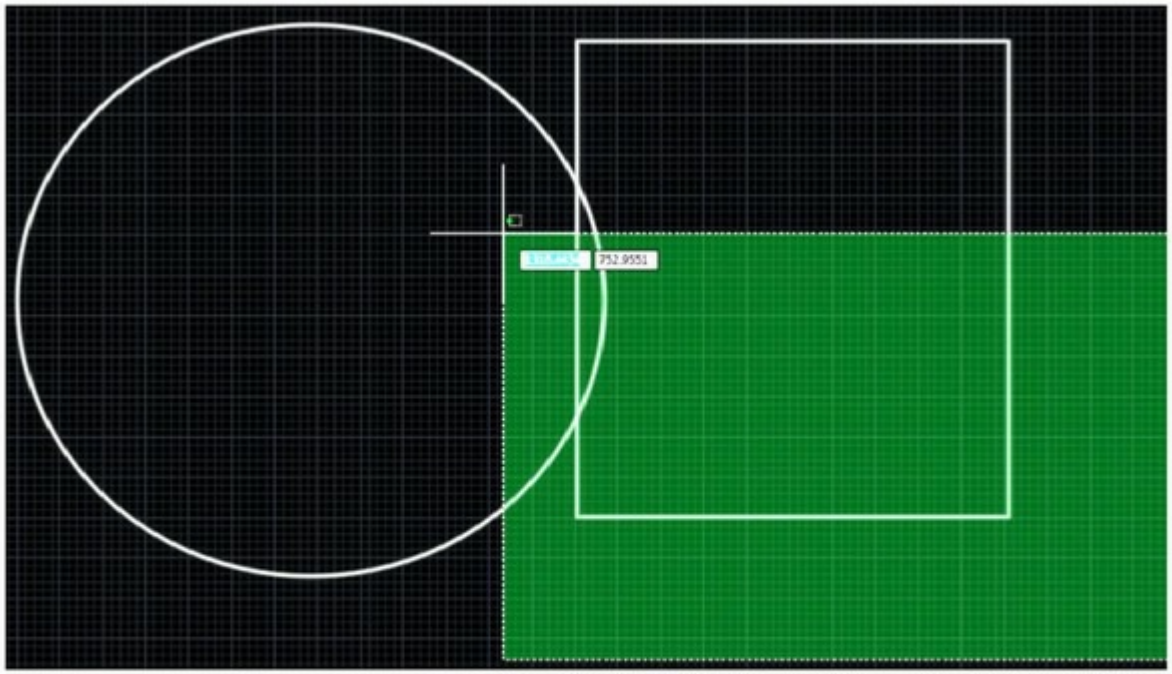


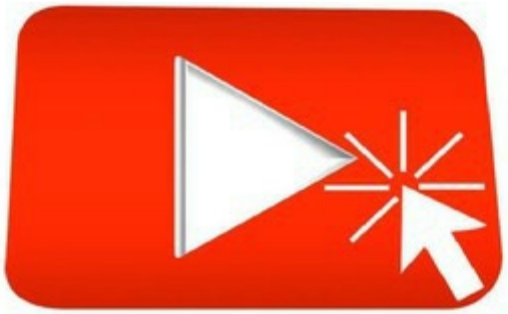
Figure 4.3: Green selection window

Deselection: In case you want to deselect any particular element from the selection set, then

Figure 4.3: Green selection window

Deselection: In case you want to deselect any particular element from the selection set, then you simply press the shift key and click on the element to deselect and it will be deselected.

Now, look at video lecture 7 for selection set.



Video 7: Selection set

Blend curve

Provide blend curve command → select start point → select endpoint

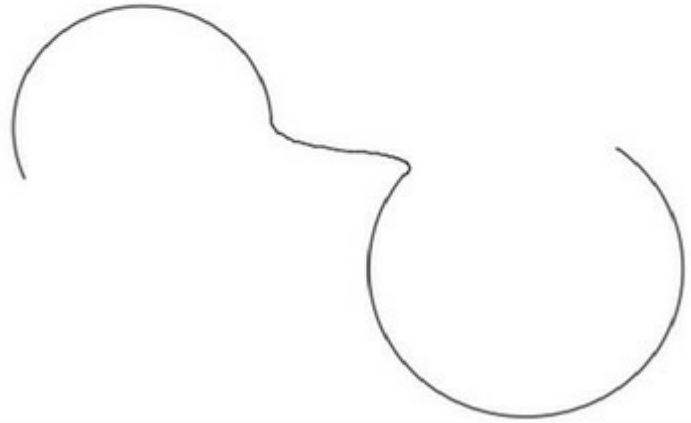


Figure A8: Blend curve

Figure A8: Blend curve

Break

Select line → Provide Break command [BR] →
→ break at a single point or with a gap.

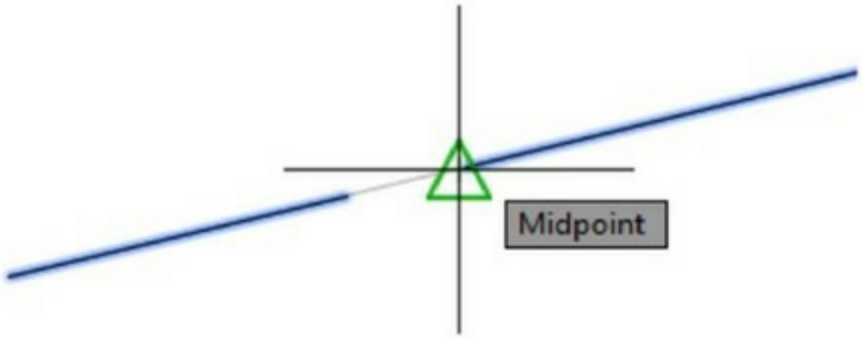


Figure A9: Break

4.3 DRAFTING SETTINGS

To increase the drafting efficiency, there are multiple drafting settings available at **Status Bar → Drafting setting tools**. These are:

- **Orthomode** [Shortcut F8] – To restrict cursor movement only in the orthogonal direction (horizontally or vertically).
- **Dynamic Input** [F12] – To show following details on the cursor, of the current command, while drawing:
  - **Cursor,** as a pointer
  - **Dimensions**
  - **Prompt:** it is different for different commands for example you will get

- **Cursor,** as a pointer
- **Dimensions**
- **Prompt:** it is different for different commands, for example, you will get prompt for NEXT to provide next point, for a rectangle you will get prompt for first corner point, second corner point.

- **Line weight** – To show the increased line thickness in drawing
- **Polar tracking** – To restrict line at a particular angle [F10]
- **Object Snap** – To snap curser at particular reference point [F3]
- **Grid** – Used to show a drawing grid [F7]

2.2 AUTOCAD WORKFLOW

In AutoCAD workflow, we will cover steps used to create a plan. We will start by creating basic shapes and reach up to making final output.

Step 1: Drawing basic shapes

By using a line, polyline, circle, arc, rectangle etc. we can draw any basic component. Simple example of a hall is shown in *figure 2.4*:

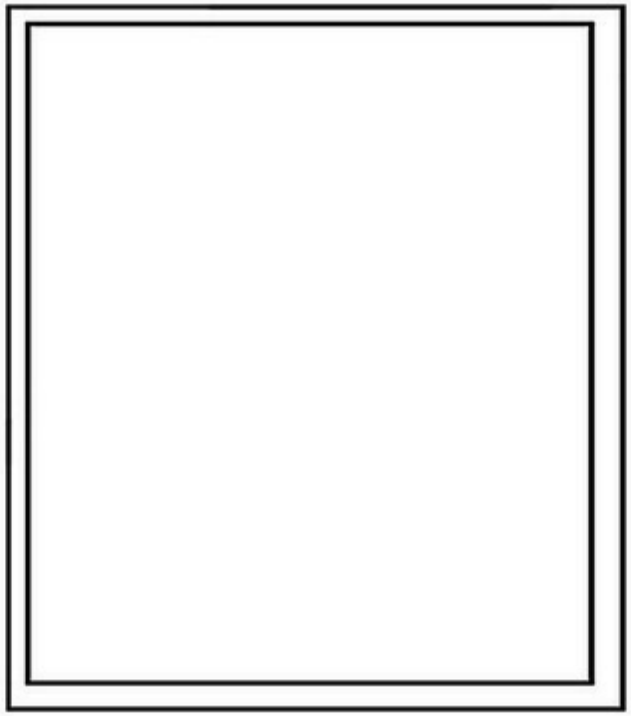


Figure 2.4: Simple sketch of a hall

Creating new text style:

Open text style window → click on New button → enter the style name → select a font → enter text height in height field in drawing units → Under Effects, enter an angle between -85 and 85 in the Oblique Angle box (A positive value slants text to the right and negative value slants to the left) → set Character spacing by entering a value in the Width Factor field (value less than 1.0 condenses the text and value greater than 1.0 expands it).

entering a value in the Width Factor field (value less than 1.0 condenses the text and value greater than 1.0 expands it).

You may use Annotative option so that any text using this style displays uniformly at the same size or scale regardless of the scale of the drawing.

To save the changes click Apply → Click Close.

3.4 RIBBON AND DRAWING WINDOW

Ribbons and panels are a most extensive place for most of the tabs such as home, insert, annotate, view, manage, draw, modify, blocks, dimensions, etc., as shown in *figure 3.5*.

Figure 3.5: Ribbon

Drawing window is the area where we work and make sketches. Drawing title shows versions of AutoCAD and drawing sheet name. Look at video

Figure 3.3: Ribbon

Drawing window is the area where we work and make sketches. Drawing title shows versions of AutoCAD and drawing sheet name. Look at video lecture 4 to get familiar with ribbons and drawing window.

Video 4: Ribbon and drawing window

3. Choose AutoCAD 2017 and other options matching your computer's configuration

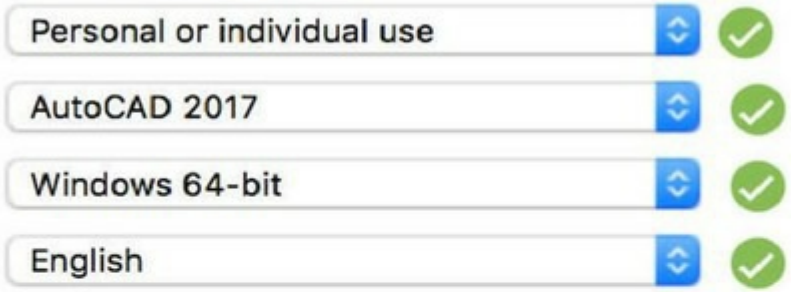


Figure 2.2: Options to be provided to get AutoCAD

4. Immediately you will get serial number and product key to be used for activation. Same information will also be sent to your registered email address.
5. Simply download the software, install it, activate it with given serial number and product key, and start using it.

5. Simply download the software, install it, activate it with given serial number and product key, and start using it.

Hurray! Now you have your own AutoCAD!

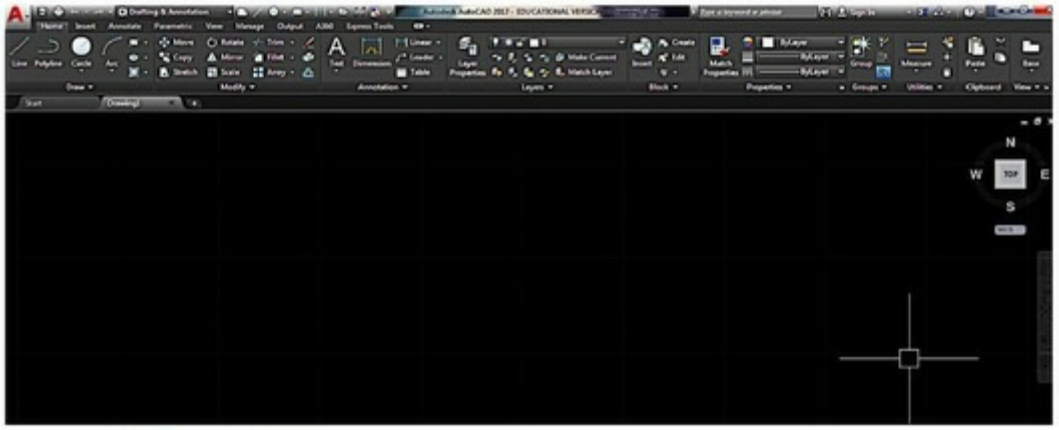


Figure 2.3: Opening first screen of AutoCAD

Excited to start working on it? Go through steps in next section, soon after it, we will start…

APPENDIX A- INTRODUCTION TO ADVANCED TOPICS

The appendix contains multiple useful commands which were not used during our exercises of creating floor plans and structural plans. Consider it as a glossary for further study to cover other useful commands.

A1 ADDITOINAL SHAPE OPTIONS

A1 ADDITOINAL SHAPE OPTIONS

Line types

There are different types of line, frequently used are listed below:

- **Construction line** – It is the line having infinite length. Command XL → give directions.
- **Ray line** – It is the line having only one direction with infinite length. Command: RAY → Provide point of direction.

1.3 BASICS OF DRAWING AND VIEWS

Drafting is the first step for any Civil Engineering work. It is 2D drawing of entire structure with all details to facilitate construction. A draft should include details of dimensions, notes, schedule of doors, windows and ventilators, area statement, scale, direction, and everything else needed to construct the entire civil structure. Below are few types of 2D drawings:

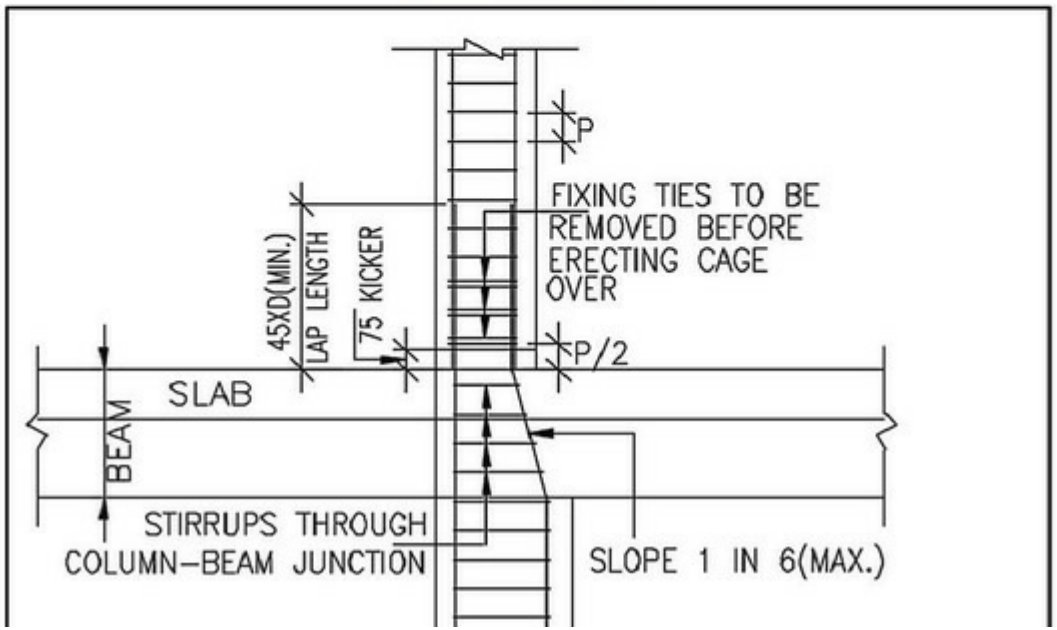
Isometric view

Civil structures are three-dimensional objects. We are able to visualize three-dimensional view in isometric views as shown in *figure 1.6*, given below:

views as shown in *figure 1.6*, given below:

Figure 1.6: Isometric view

12.7 TYPICAL DETAIL OF SPLICING COLUMN BARS AT THE INTERMEDIATE FLOOR



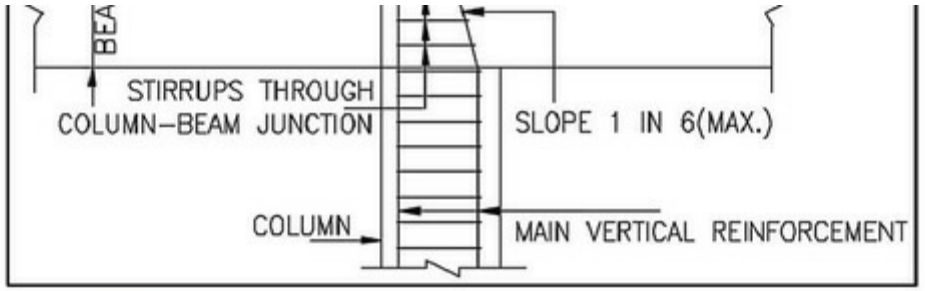


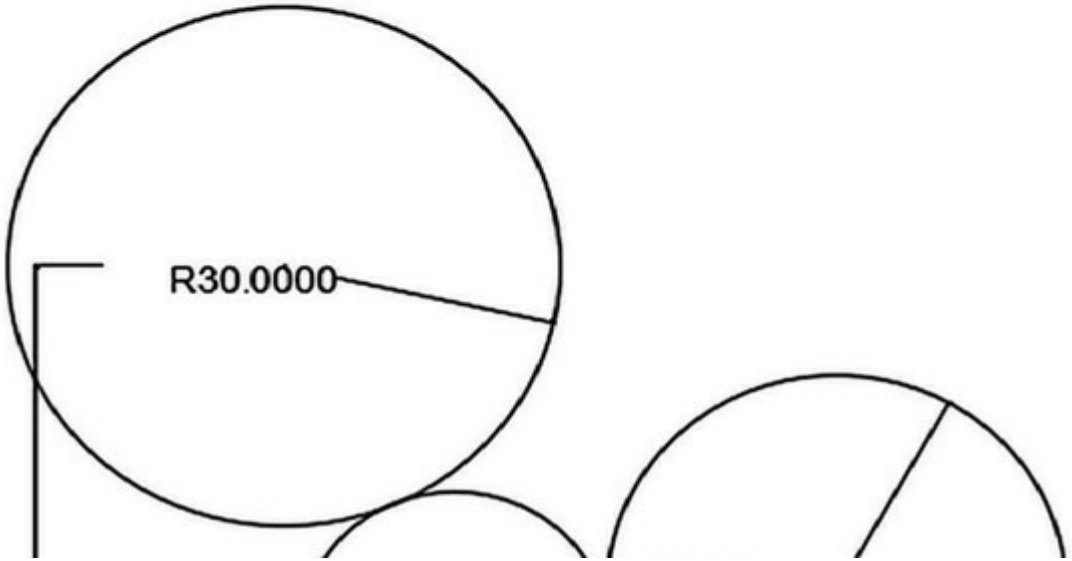
Figure 12.7: Splicing column bars at intermediate floor

Have a look at video lecture 35 for details.

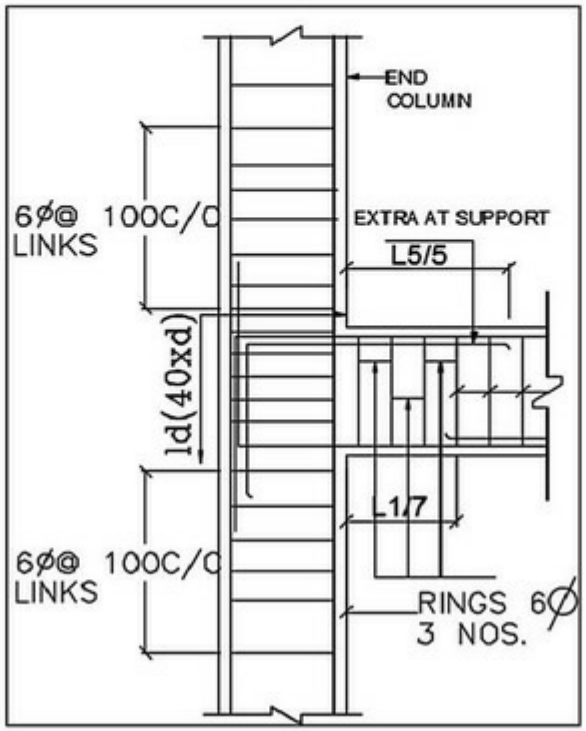
Video 35: Foundation-Splicing column

5.4 EXERCISES

Exercise 5.3: Estimated duration: 15 minutes



12.3 TYPICAL DETAIL OF BEAM AND COLUMN JUNCTION AT THE END



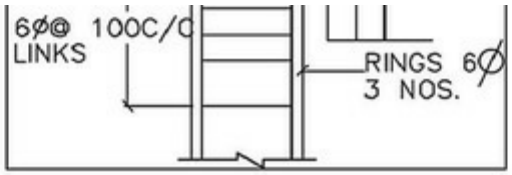


Figure 12.3: Column and beam junction

Have a look at video lecture 31 for details.

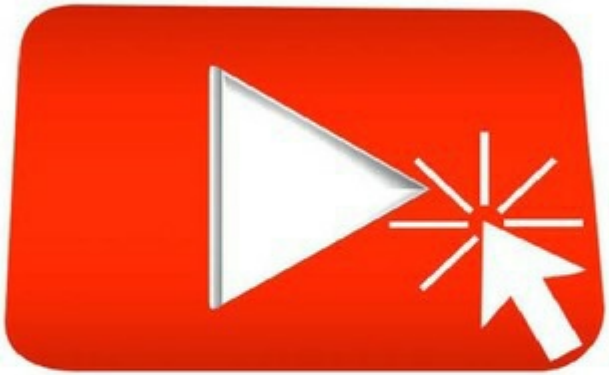
Video 31: Structure-beam and column junction at the end

- Click on Hatch → Hatch Creation tab will open → Go to its Properties panel and choose the Hatch type that you want to insert. Choose from Solid, Gradient, Pattern or User Defined. Specify the pattern on the Pattern panel.
  - Choose "Pick Points" to determine a boundary around the specified point, or
  - Choose "Select Boundary Objects" to manually select the boundaries of the area to be hatched.
- Color, Angle, and Scale can be set according to the choice

area to be hatched.

- Color, Angle, and Scale can be set according to the choice
- In options panel, switch on creating separate hatches while giving hatching pattern to the object.
- In options panel, gap tolerance can be given if there is an open loop in order to fill entity.
- After filling the area, press enters to apply the hatch.

Look at video lecture 10 for line and polyline



Video 10: Line and Polyline

Refer to video lecture 11 to look at interesting applications of the lines.

Refer to video lecture 11 to look at interesting applications of the lines.

Video 11: Application of Line command

After going through these lectures, you attempt exercises 5.1 and 5.2 and attain the efficiency needed. Practice is the key factor of success.

Block Attributes

This is a very useful feature where you can define multiple attributes (like text) of a block and manage it as well.

Dynamic Block

Dynamic blocks can change shape, size, or configuration. It helps to avoid making multiple static blocks. This is done in block editor. It contains flexibility to reuse in multiple variations.

contains flexibility to reuse in multiple variations.

A4 USING MULTILEADER

A multileader object typically consists of multiple arrowheads, a horizontal landing, a leader line or curve, and text. It is used to point to multiple objects having same or similar information.

Navigation: Annotate tab → Leader panel → Multileader option, as shown in figure A13.

Answers:

1 – B

2 – A

3 – D

4 – A

5 – A

APPENDIX

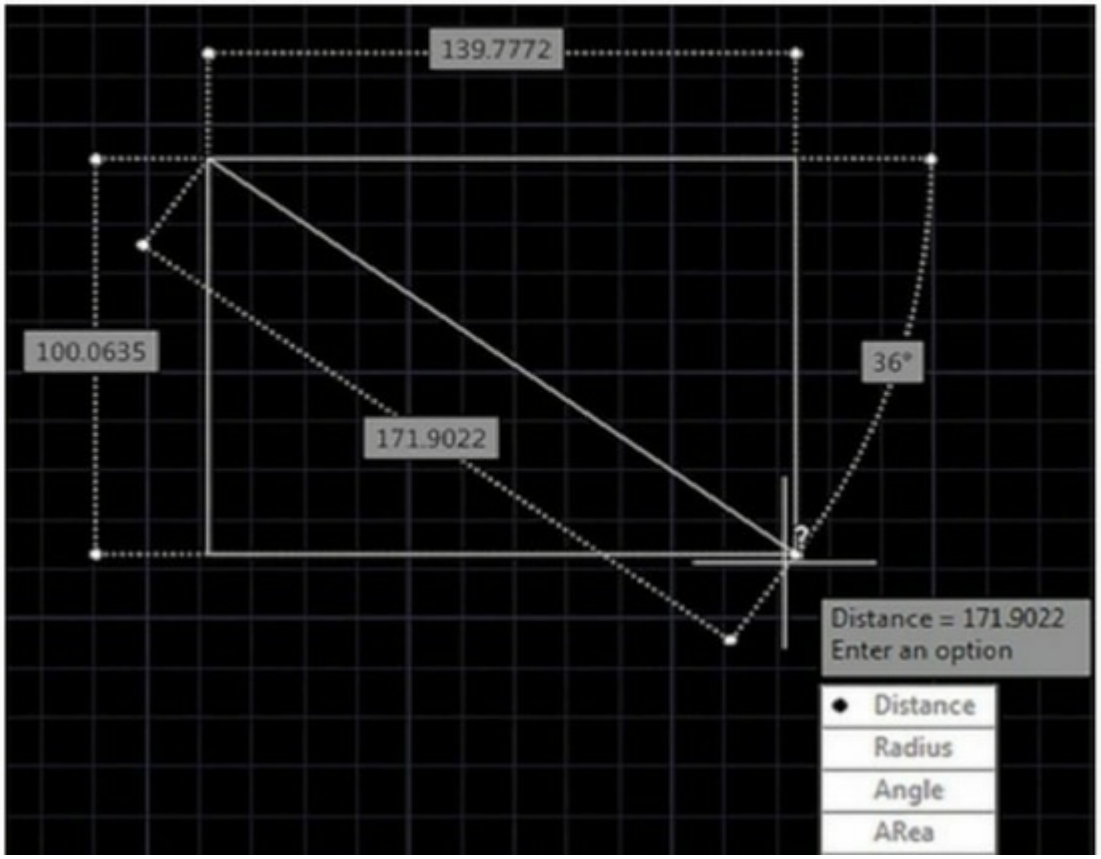
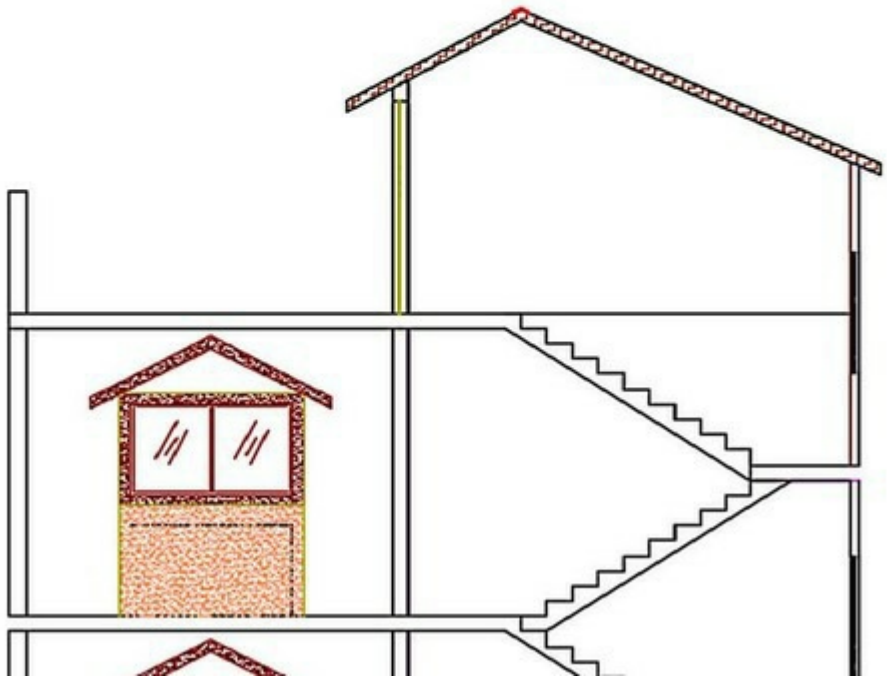


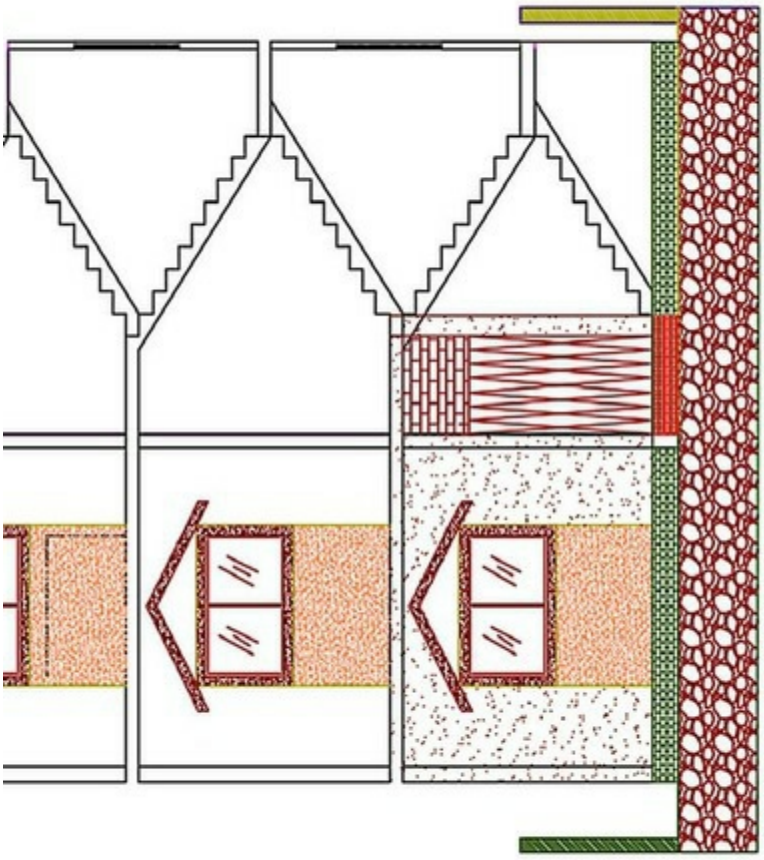
Figure A18: Measure sample

The dimensions shown above is used for information gathering purpose only. These will not stay with the drawing.

Exercise 9.6: Estimated duration: 30 minutes

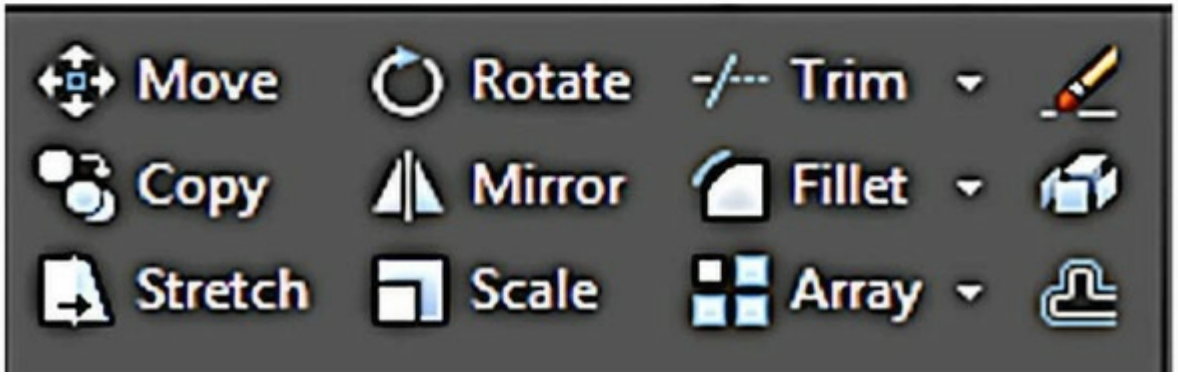
Draw the following section and apply hatch on it.





6. MODIFYING BASIC SHAPES

After creating basic shapes, we can modify it to give the desired shape by using modify tools as shown in *figure 6.1*, given below:



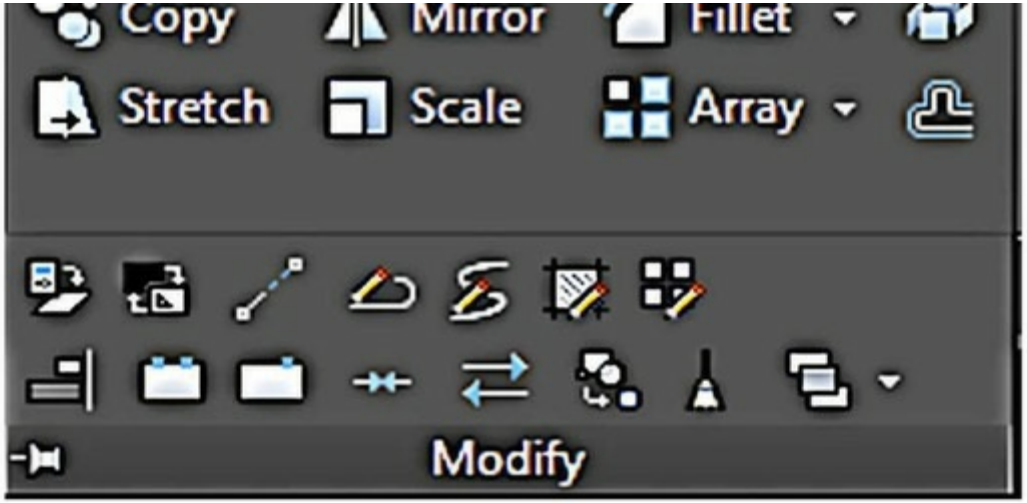
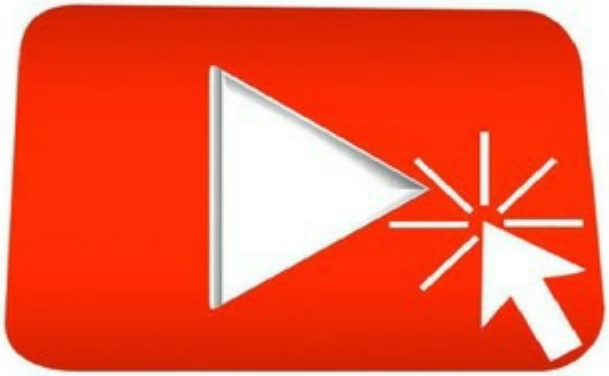


Figure 6.1: Modifying commands

Modify panel is available in home tab.

Have a look at video lecture 24 to learn about layer concept.



Video 24: Layers

4. CONFIGURING AUTOCAD

In this chapter, we will learn about configuring the AutoCAD. Its like configuring your TV for brightness, sound level, favorite etc. Similarly, we can configure AutoCAD. It is basically you ask AutoCAD to behave in a particular manner.

When you work in any organization then you would find everyone following the same setup. In other words, they all use the same configuration as required by the organization. It is used to ensure consistency in work and standardization. For

other words, they all use the same configuration as required by the organization. It is used to ensure consistency in work and standardization. For example, the organization needs everyone to follow metric system for units then it would preconfigure AutoCAD in the same manner.

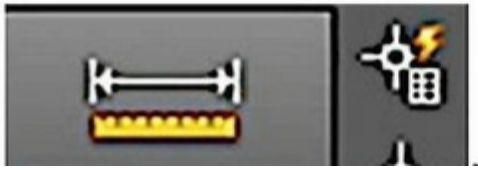
In case you are a fresher and work in such streamlined environment then sometime you would feel the configuration to be global configuration but that is not the case. You can change it. In this chapter, we will learn such configurations.

5. Are blocks defined as?
   A. United complex object
   B. Repetitively used objects
   C. It is added to the library to be accessible to others
   D. All of the above

A6 USING MEASURE OPITONS

These options are used to measure the distance between any points or find properties, like layer assigned, the geometry of an object.

Navigation: Home tab → Utilities panel → Measure command



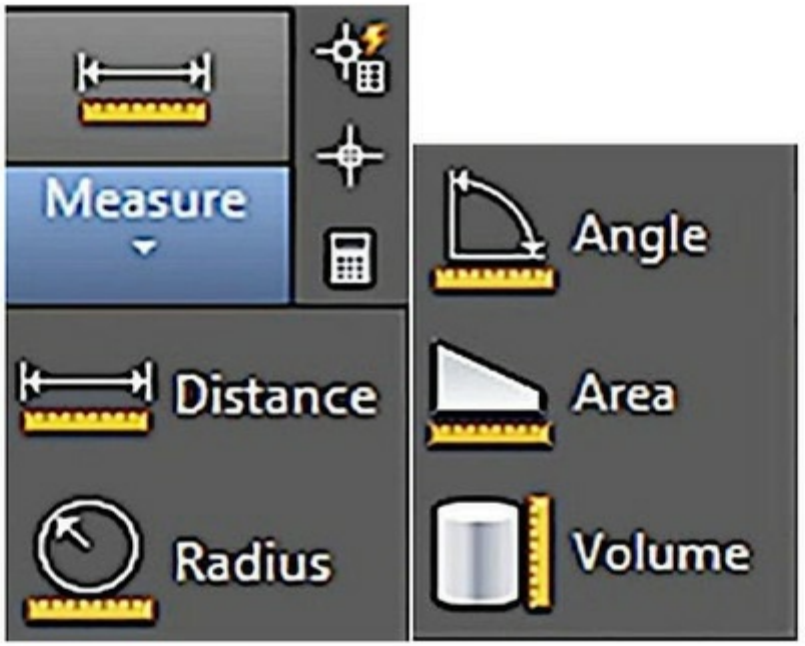


Figure A17: Measure

3.5 COMMAND BAR, STATUS BAR, ZOOM, AND PAN

Command bar is an area in which we work with help of commands and parameters to work on sketches. The status bar is a setup area in which you perform setup such as ortho, snap, isometric view, etc. as shown in *figure 3.6*. The navigation bar is a placeholder of zoom and pan (to move view area in screen).

Figure 3.6: Status bar

in screen).

Figure 3.6: Status bar

Watch video lecture 5 to learn about these useful options and practice as much as you can.

Video 5: Command bar, Pan, and Zoom

Procedure:

Click on single line text → specify the insertion point → enter a height or use cursor to specify the height of the text → Enter an angle value or use cursor to specify the rotation angle → type the text → click outside to exit the command.

Text Style

You may set the font, style, height, width etc. of the text in text style window, shown below:

the text in text style window, shown below:

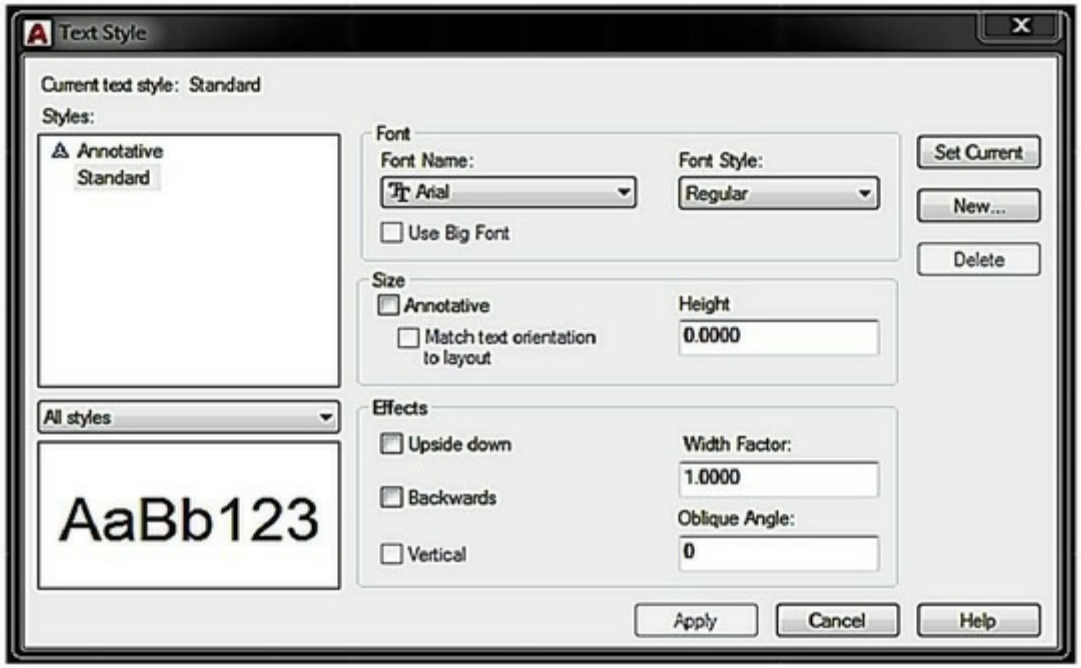
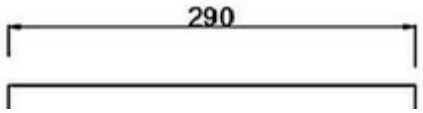


Figure 10.3: Text style window

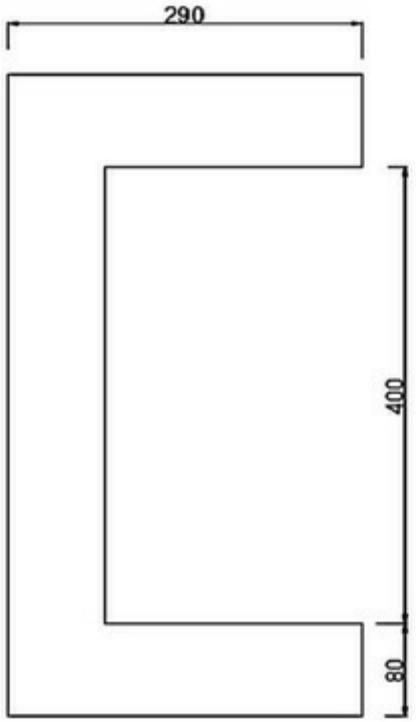
4.4 EXERCISES

Now your AutoCAD is configured and you are aware of multiple commands to start actual work on AutoCAD. We will begin with simpler exercises. Every exercise has estimated duration expected from you to complete the exercise. As a beginner, you should be able to complete it within given duration. Faster is better.

Exercise 4.1: Estimated time: 15 minutes



Exercise 4.1: Estimated time: 15 minutes



Polyline

Polyline is made by multiple lines, either with making lines in ortho mode or without it (inclined lines), as given below:

Polyline command [Pl] → switch on ortho mode [F8] → distance → enter →the straight line will be drawn.

Polyline command [Pl] → switch off ortho mode [F8] → provide distance → press tab key → provide angle (anticlockwise measuring

mode [F8] → provide distance → press tab key → provide angle (anticlockwise measuring from X-axis) → Polyline will be drawn as shown in *figure 5.3*.

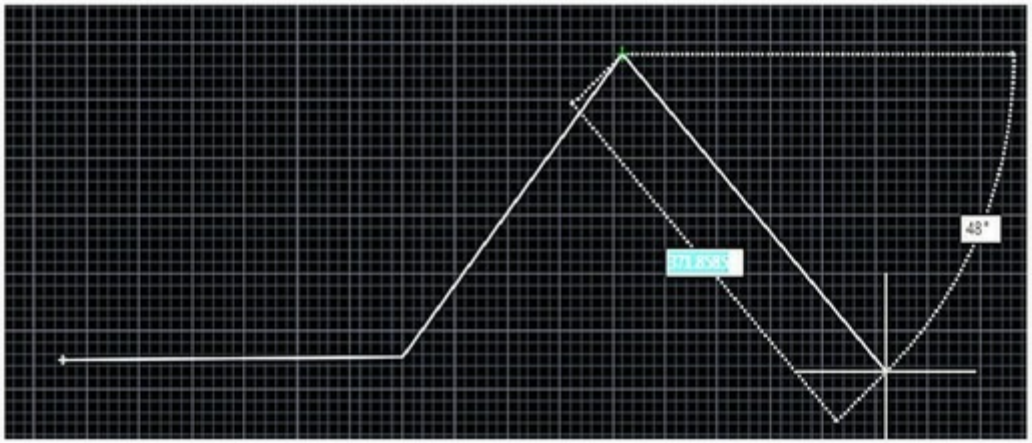


Figure 5.3: Polyline command

1.4 1ST & 3RD ANGLE OF PROJECTIONS

As a civil engineer, you must mention:

1. North direction symbol
2. Angle of projection symbol

on your drawing sheets to avoid any mistake of assumption.

Figure 1.12: North Symbols

Just imagine, you didn't mention the north direction on a drawing sheet of a house, and you are not available for confirmation. What could happen? You would allow the builder to build the house in any direction which she/he would feel to be appropriate. If any wrong assumption is made by the builder, then you will be responsible for same, not the builder.

Similarly, you need to mention one of the following

feel to be appropriate. If any wrong assumption is made by the builder, then you will be responsible for same, not the builder.

Similarly, you need to mention one of the following symbols on the drawing sheets:

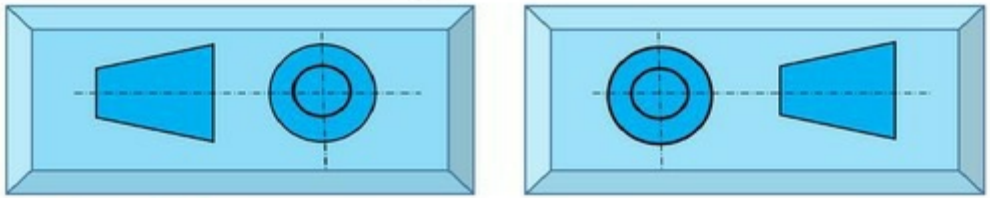
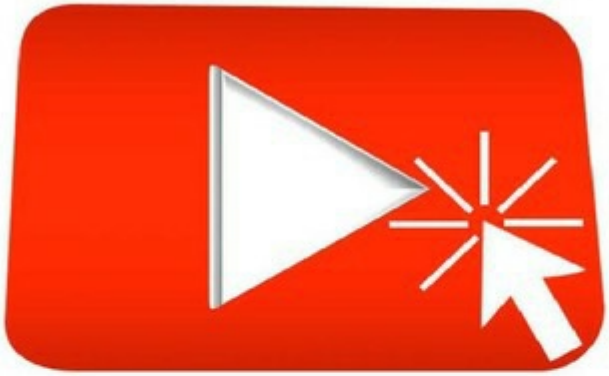


Figure 1.13: Symbols of 1st angle and 3rd angle of projection

??? Question Time ???

- Which one is to use, and why?
- Just know which one to put in drawing?
- How does it make a difference?
- Can you answer above questions?

Look at video lecture 6 for unit setup.



Video 6: Unit setup

4.2 SELECTION SET

Selection set is a group of one or more selected objects. It is helpful when you want to perform same operation on all objects in a selection set. For

Selection set is a group of one or more selected objects. It is helpful when you want to perform same operation on all objects in a selection set. For example, you may copy, paste, delete, move, rotate, etc. all objects in a single command rather than doing it independently. It helps to save time.

You can save your selection set by making a group of it and giving it a name. Just type GROUP after you select object and press Enter.

There are many ways to create selection set. Following two options are commonly used:

Option 1: Window Selection. It is done by dragging the cursor from upper left to lower right corner. It will make a blue window. If an element

Rectangle with chamfer corners

Rectangle command [Rec] → Choose chamfer from command bar → Provide distances of meeting points from the corner (d1 and d2) → Specify 1st corner point (x,y) of the rectangle → Specify 2nd corner point (x,y) of the rectangle → Rectangle with chamfer will be drawn.

Making a Polygon

Making a Polygon

Polygon command [Pol] → Enter no. of sides → Specify polygon type (Inscribed in center of polygon or Circumscribed about circle) (to make polygon inside a circle or outside a circle, respectively) → Provide Radius.

Look at *figure 5.8* to draw a polygon by using the option1, that is, inscribed in a circle.

Figure 5.9 shows the option 2 output.

5.5 QUIZ

1. What is the shortcut for units?

   A. UN B. U
   C. UNI D. UNIT

2. What command do you use for edit polyline?

   A. Pol B. Poly
   C. Poledit D. Pedit

3. Which object doesn't have an endpoint?

   A. Line B. Rectangle

3. Which object doesn't have an endpoint?
   A. Line B. Rectangle
   C. Circle D. Arc

4. What is the color of hot grip?
   A. Blue
   B. Red

5. Which key do you press to cycle through available snap points?
   A. Tab B. Ctrl
   C. Alt D. Shift

4. What is the shortcut of extent command?
   A. E
   B. X
   C. Ext
   D. Ex

5. Trim need which condition?
   A. Boundaries
   B. Intersection
   C. Cutting edge
   D. All of the above

B. Intersection
C. Cutting edge
D. All of the above

2. INTRODUCTION TO AUTOCAD

We said, **AutoCAD is world leader** in drafting tools. Want to know **why**? We will soon find it, before that, let's have a quick glance at few facts of the AutoCAD:

- First version was released in December 1982
- As of now (May 2018)
  - Latest version is 2019 (released in May 2018)
  - Version 2017 is most widely used in Industry
- This AppBook is also based on version 2017

Now, let's look at important features of AutoCAD which makes it a world leader! if you don't understand any point then also don't bother we will cover in detail

Now, let's look at important features of AutoCAD which makes it a world leader! if you don't understand any point then also don't bother, we will cover in detail.

- It enables us to **draw various geometrical shapes** like lines, circles, polygons, multiple parallel lines, and curves, to make any kind of design.
- Various **modifying tools** like move, rotate, fillet, chamfer to increase the speed of drafting. We don't have to draw everything from primitive shapes.
- It also provides a feature of **snap** to automatically locate an exact position to create particular geometry. For example, with the snap feature you can locate exact mid-point of a line, intersection of two line and many such options soon we will learn. It helps in accurate positioning of our work.

Transparency of a layer

It controls the transparency of all objects on a layer. Zero '0' is used for maximum visibility and 90 is used for no visibility.

Controlling plotting/printing of objects

It controls whether objects on the layer are plotted / printing or not.

Delete Layer

It deletes the layer only. Following layers cannot be deleted:

Delete Layer

It deletes the layer only. Following layers cannot be deleted:

- Current layer
- Zero layer
- Layers containing the object(s)
- External reference layer

Assigning layers to objects

Select objects, select layer from drop-down menu in layer panel, the object will be assigned to the selected layer.

Double click on the block → insert window will open → provide desired details → block will be inserted into the drawing.

Have a look at video lecture 23 to learn tool palette and design center.

Video 23: Tool palette and design center

Next window (shown in figure A20) opens when you select .DWG option. Here you provide insertion point, scale, etc. option to attach the drawing file in current file.

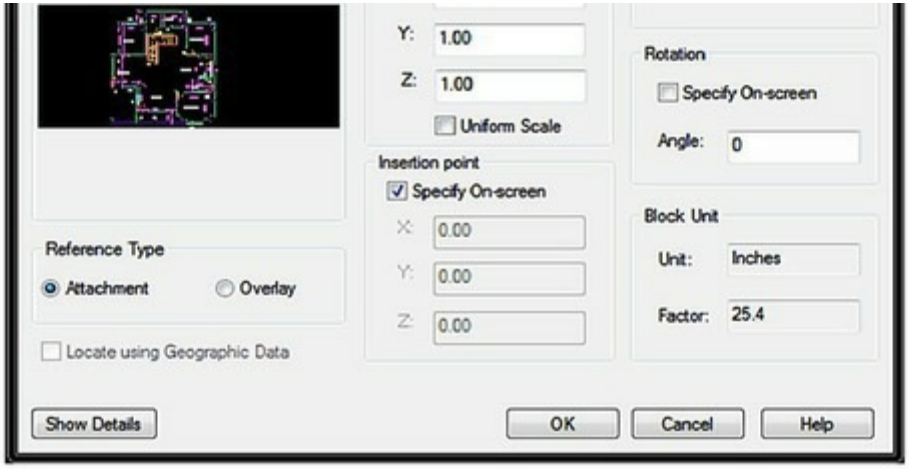
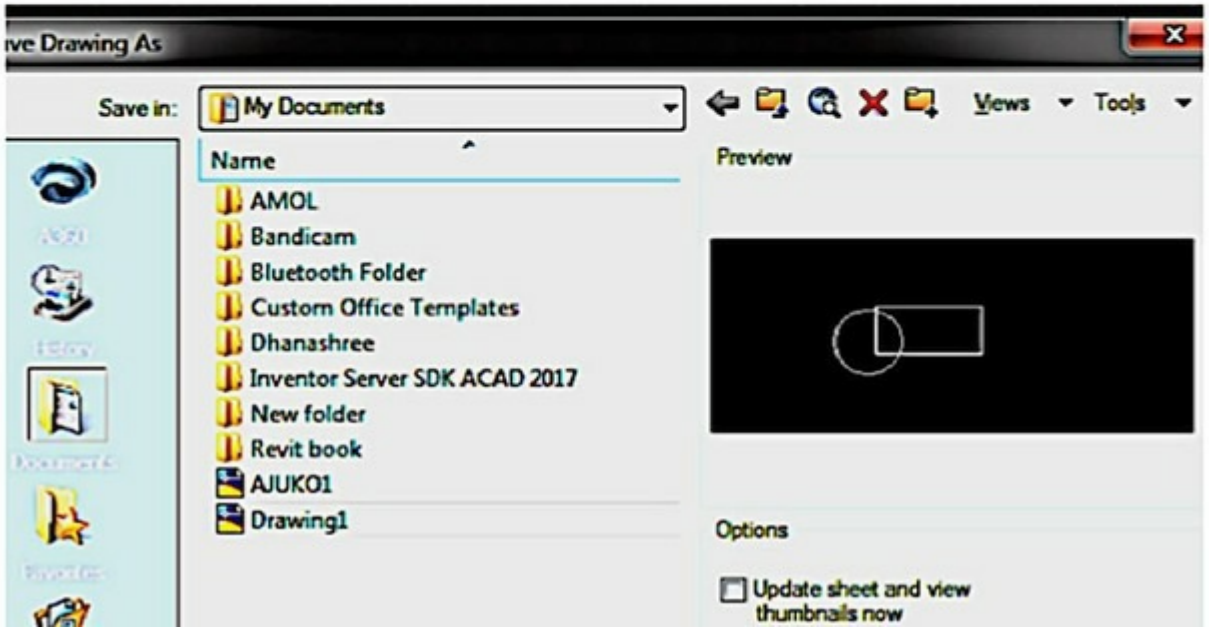


Figure A20: Attach external reference

Note: If the hyperlink is used in the drawing to be imported then you should use the option of **Attachment** to keeps the hyperlink information. If you use Overlay then hyperlink information will be lost.

We begin with **Templates**. The file type of template is .dwt. Open the template and save it (Ctrl+S) as shown in *figure 3.2*:



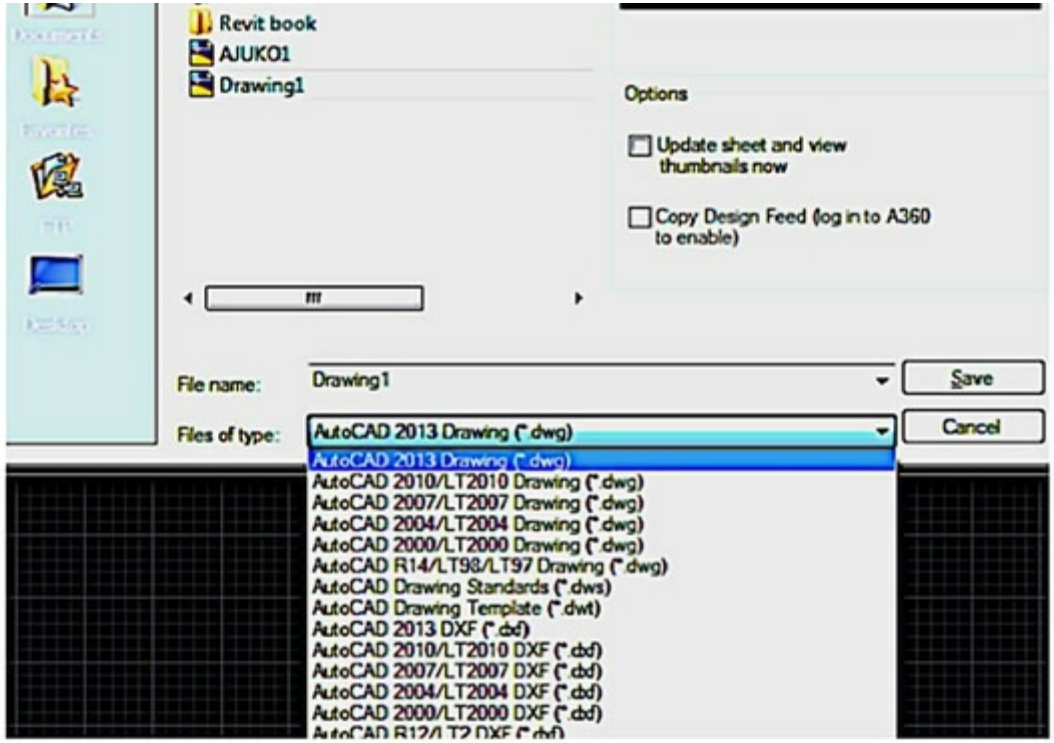


Figure 3.2: File types

The orthographic projections are initially drawn on three mutually perpendicular planes. Further, one plane is kept as it and remaining two planes are rotated to bring them in same plane as of first plane, such that entire drawing can be shown in single 2D plane. Notice the direction of rotation of planes in *figure 1.14*:

- The green Vertical Plane (VP) is kept as it is.
- The orange Horizontal Plane (HP) is rotated clockwise if seen from the front.
- The blue Profile Plane (PP) is rotated in anticlockwise direction when seen from top.

In India we use 1st angle of projection, however, in the USA, we use 3rd angle of projection. *Figure 1.15* shows the difference in places of different views depending of

In India we use 1st angle of projection, however, in the USA, we use 3rd angle of projection. *Figure 1.15* shows the difference in places of different views depending of selection of angle of projection.

Figure 1.15: illustration of drawing sheet and places of different views in 1st angle (left side) and 3rd angle (right side) of projections

Making an Arc

Arc command [A] → Select first point → Select second point → Third point → Enter

Look at *figure 5.7* to find other options, which are also explained in video lecture ahead.

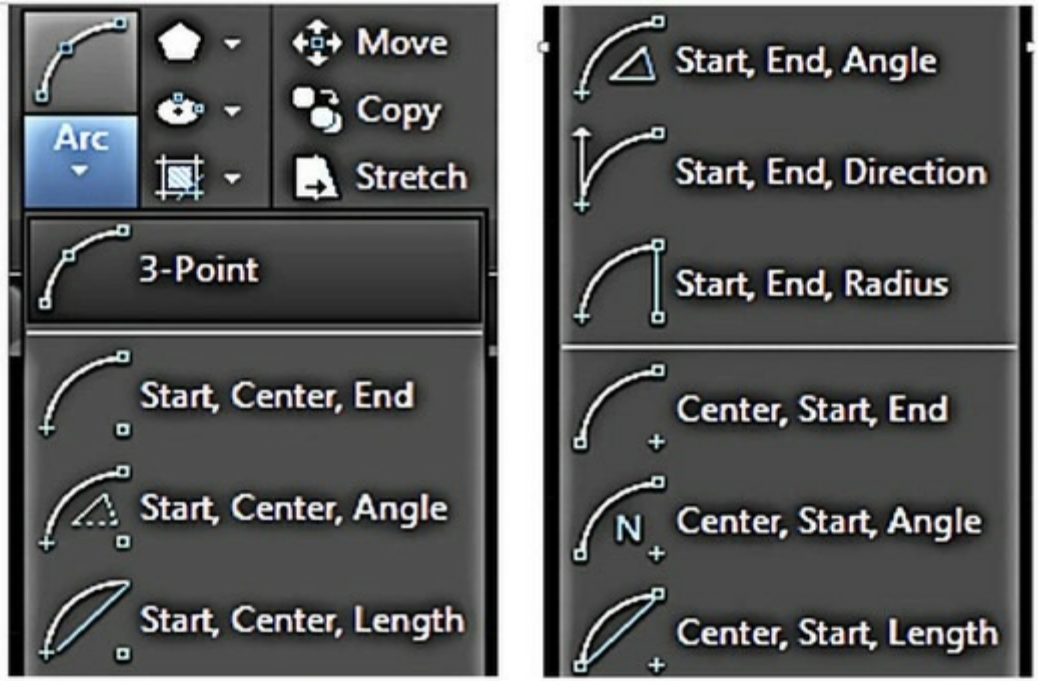


Figure 5.1: Types of arc

- Filling areas with different color and pattern is a requirement in artwork and presentation, wide range of option for which is provided in AutoCAD.
- The feature of zoom-in/zoom-out is a great asset while drawing to the minutest level with accuracy.
- Multiple types of text and dimension styles are also pre-built to make a professional class output. In fact you can import your own styles.

Excited to start working on AutoCAD?
O'khai, Let's get the beast first...

2.1 GETTING AUTOCAD

Autodesk is our true friend. They provide free software to students. Jump to www.autodesk.com, register yourself and put request for AutoCAD free license.

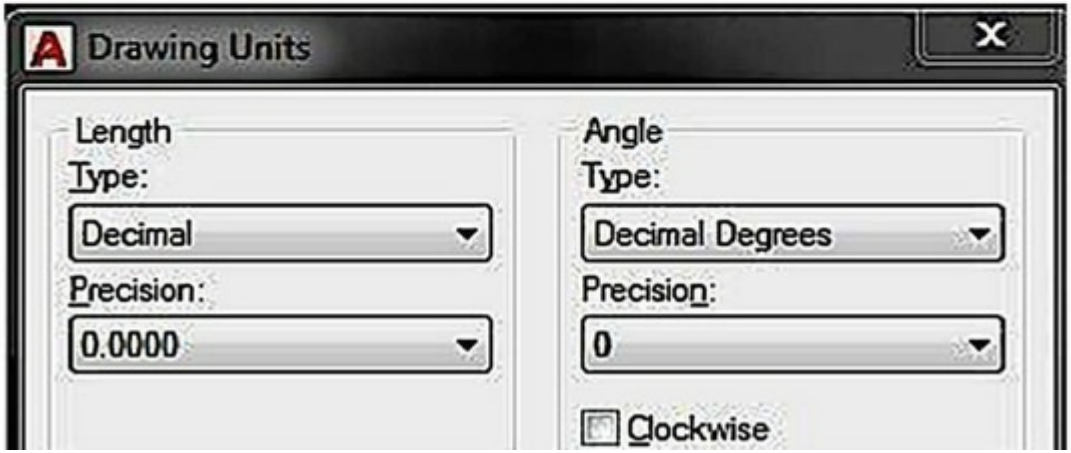
Autodesk is our true friend. They provide free software to students. Jump to www.autodesk.com, register yourself and put request for AutoCAD free license. Within couple hours, you will have your own AutoCAD with a license in your own name. Its simple, still steps are given for guidance.

1. Go to Autodesk website (autodesk.com) and search for Free software download for students. You will ask to sign in/up.
2. If you don't have an account, then click on CREATE ACCOUNT, else SIGN IN

Figure 2.1: Creating or using autodesk.com account to get AutoCAD

4.1 UNITS

For the architectural plan, length type should be Architecture and Units in feet or inches. For Engineering plan, Length type should be Decimal and Units in meter, centimeter or millimeter. *Figure 4.1* shows the drawing units setup window. Shortcut for the unit is UN.



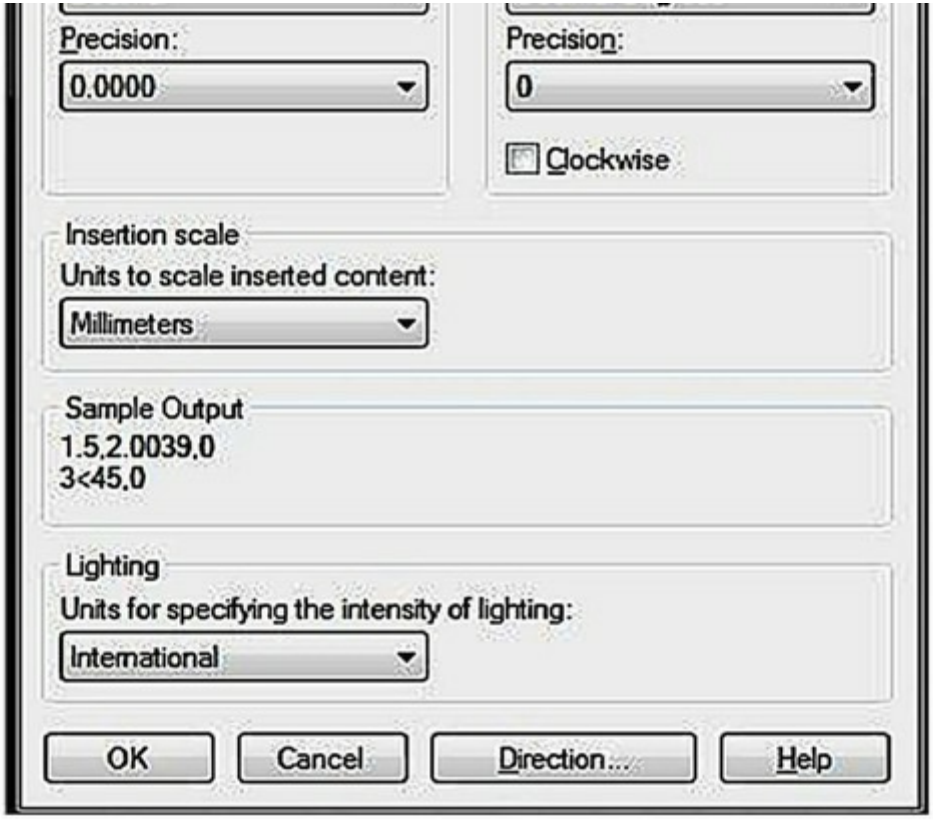
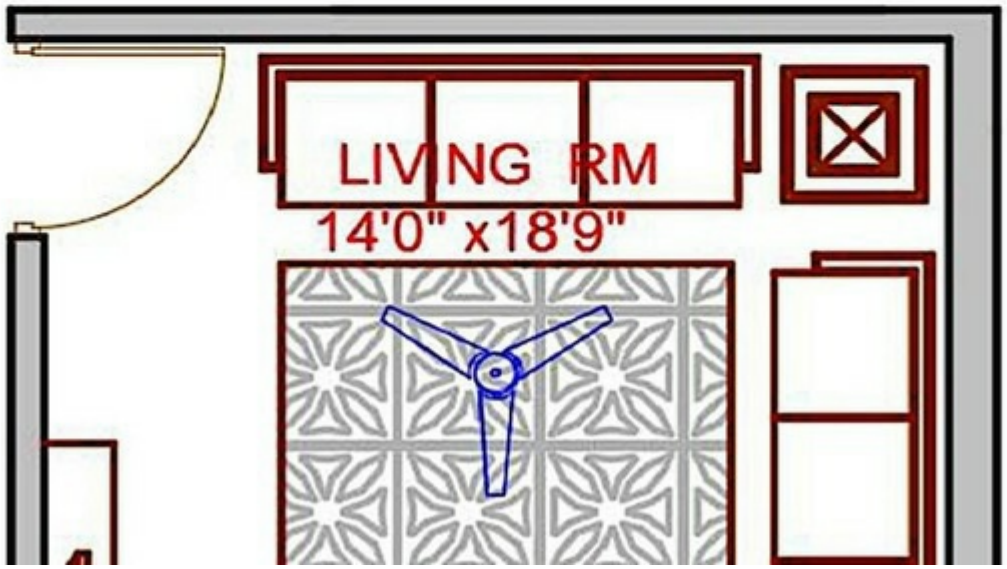


Figure 4.1: Unit setup window

Step 5: Detailing

By using text and dimension styles, important description and measurement can be shown. Dimension for the hall is given in *figure 2.8*:



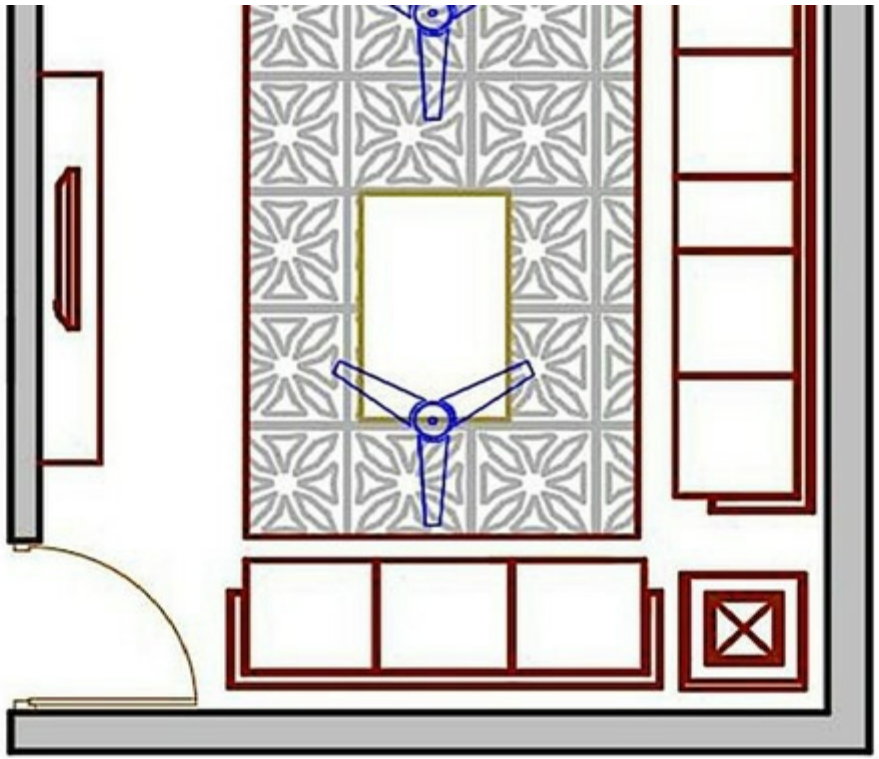
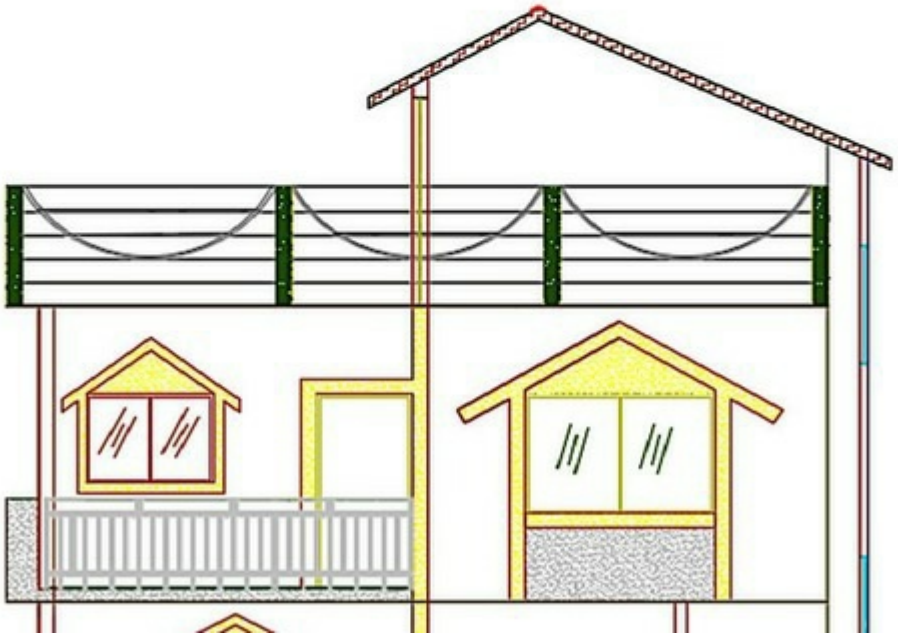


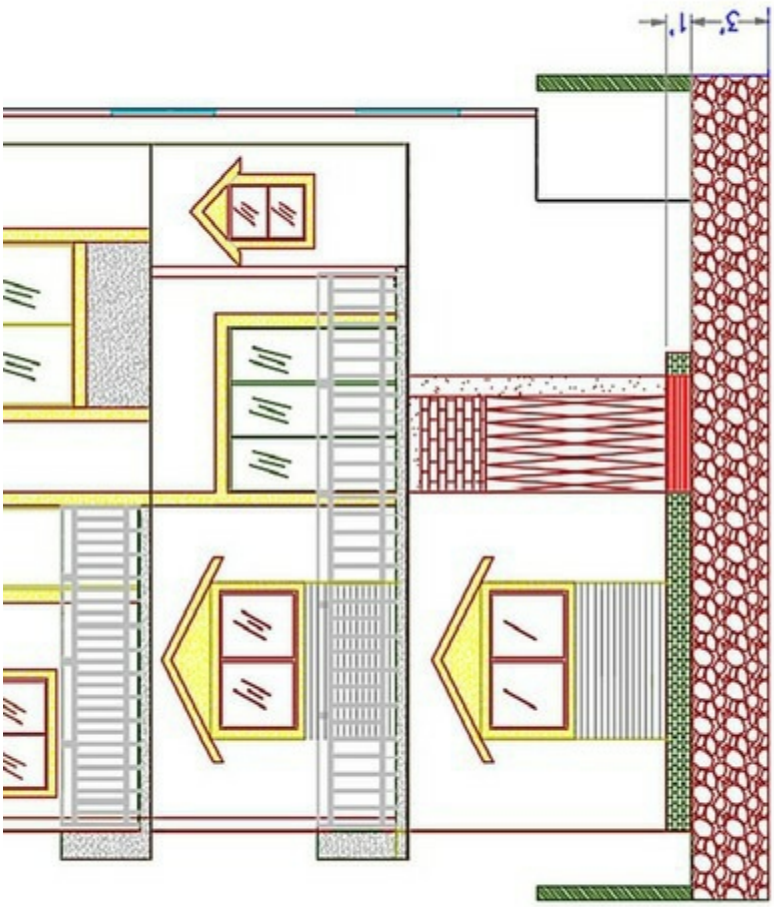
Figure 2.8: Detailing of the hall

9.4 EXERCISES

Exercise 9.4: Estimated duration: 30 minutes

Draw following elevations apply hatch on it





14. CONCLUDING NOTES

So? How was the journey?

- Feeling good?
- Feeling incomplete? Need to learn more?

I am happy if your answer is second answer, because you are realizing there is lot more to learn in AutoCAD. Remember, this AppBook is created to elevate skills of new learners from almost starting point to a good level of exposure to appear for job interviews and tool tests. It will help you to begin your career as a

almost starting point to a good level of exposure to appear for job interviews and tool tests. It will help you to begin your career as a fresher. Definitely there would be a journey to move from fresher to expert? Right? How would be reach there? It has two components:

1. Working exposure in industry and domain, which will make you an expert.
2. Learning more advanced features of AutoCAD to increase your efficiency.

First point is time and opportunity dependent, however we can have a plan to address second point. In order to support you for advanced

Command: Spline/SPL → Select 1st point → provide random points or specific Distance & Angle → press Enter

Helix

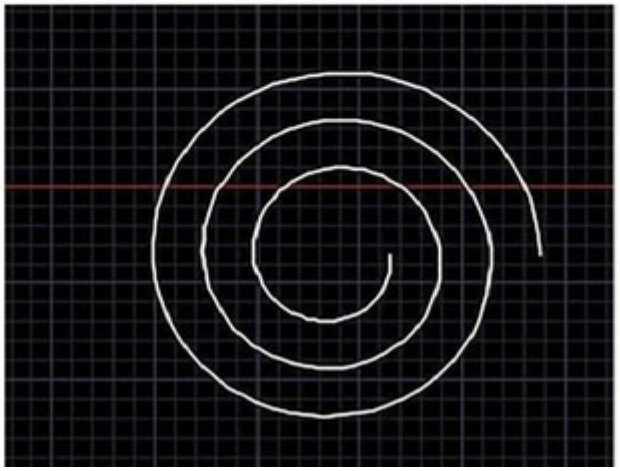


Figure A2: Helix sample

Command: Helix/HE → Specify center point → provide base radius → provide top radius → provide height.

Donut

Command: Donut / DO → Specify inside diameter → specify outer diameter → place the donut.

6.4 TRIM AND EXTEND

Trim

Give trim command [Tr] → press enter twice → Click on a portion of the element or object to be trimmed.

Look at *figure 6.3* in which upper portion of the vertical line will be trimmed.

Figure 6.3: Trim

Extend (used for extending lines)

Using extend command:

Give extend command [Ex] → press enter twice → select object to extend

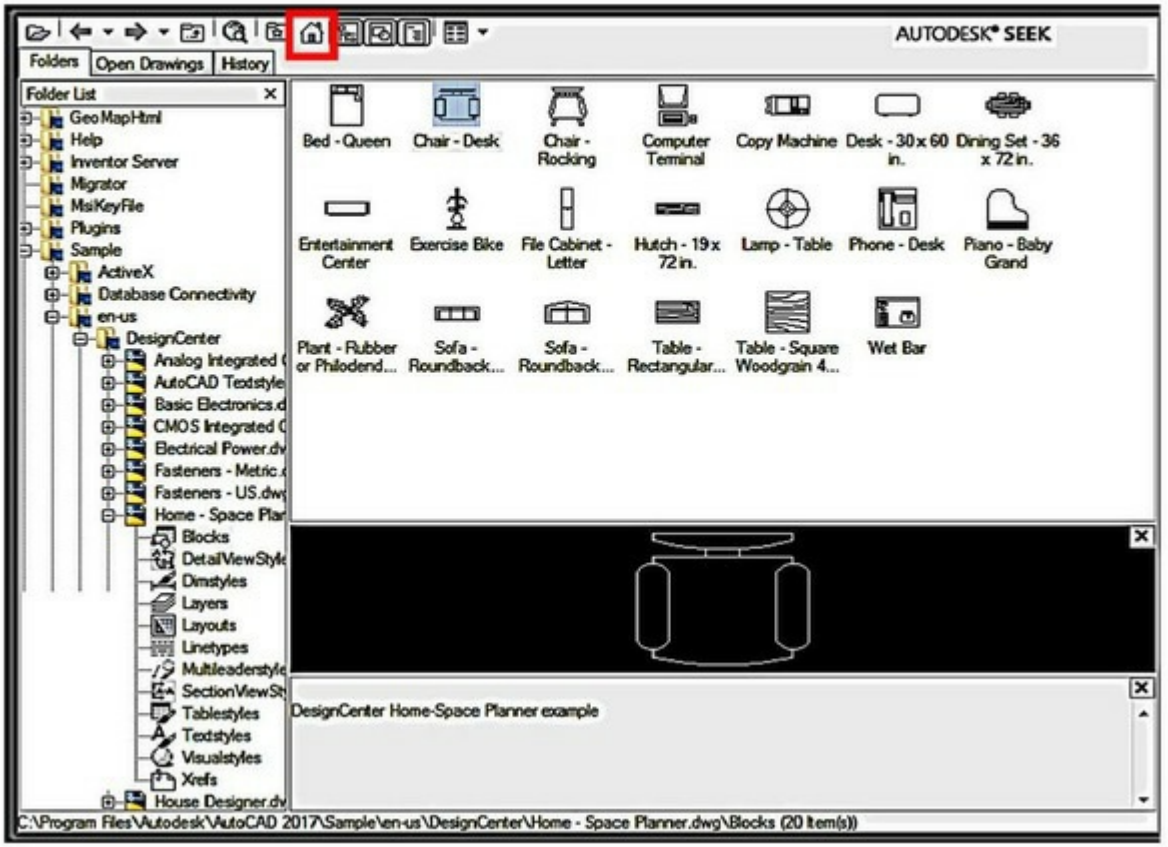


Figure 8.6: Blocks in the design center

Click on the Design Center toolbar and select block using any option given below:

Option1: Folders → Design center → Select drawing that contains the block to insert.

Option 2: Click on the home icon as highlighted inside the red rectangle → en-us → design center

10.4 QUIZ

1. Which is the by default dimension style?
   A. Standard
   B. ISO 25
2. What is the by default break size?
   A. 3.75
   B. 2.75
   C. 2
   D. 3
3. Text alignment has which options?
   A. Horizontal
   B. Aligned with the dimension line
   C. ISO Standard

A. Horizontal
B. Aligned with the dimension line
C. ISO Standard
D. ALL of the above

4. Can we import different text font into AutoCAD?
   A. Yes
   B. No
5. The multiline text contains?
   A. Paragraph
   B. Single entity

You must have found these to be simple. You might have faced some difficulties, which is okay at this stage. In case you are able to beat the duration given then you are awesome. If not then try to make similar shapes at a faster speed. It will help.

As you go along, you should check your learning progress and effectiveness. Attempt following questions and write answers on a paper.

4.5 QUIZ

1. By default, AutoCAD has the following workspaces?

4.5 QUIZ

1. By default, AutoCAD has the following workspaces?
   A. 2D Drafting and Annotation
   B. 3D modeling
   C. My workspace
   D. AutoCAD classic

2. One of the following options is wrong about unit length type?
   A. Architectural
   B. Fraction
   C. Decimal
   D. Millimeter

Answers:

1: A

2: D

3: A

4: A

5: A

6: D

7: D

8: D

6: D

7: D

8: D

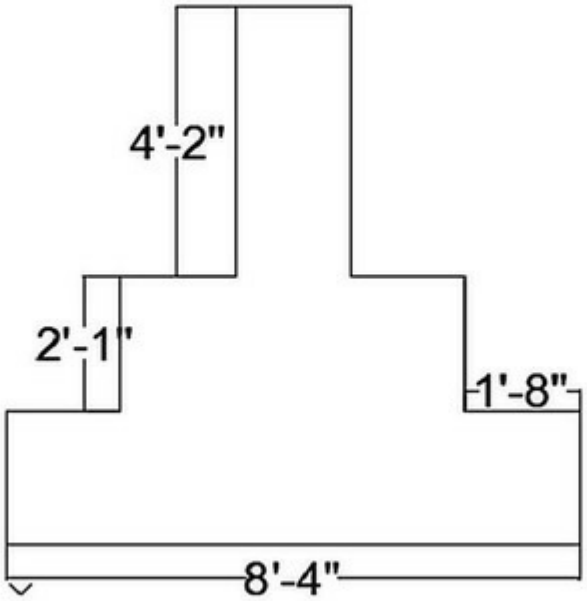
9: B

10: C

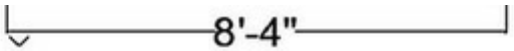
Your performance and next steps

If 7 or more were correct answers then you may proceed to further activities, else revise on chapter 4 and 5 content and rework on more exercises.

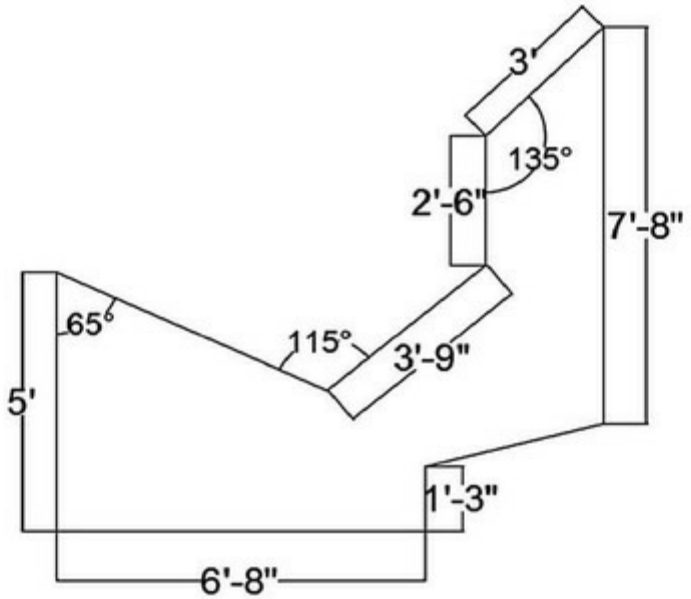
Exercise 5.1: Estimated duration: 10 minutes



Exercise 5.2: Estimated duration: 30 minutes



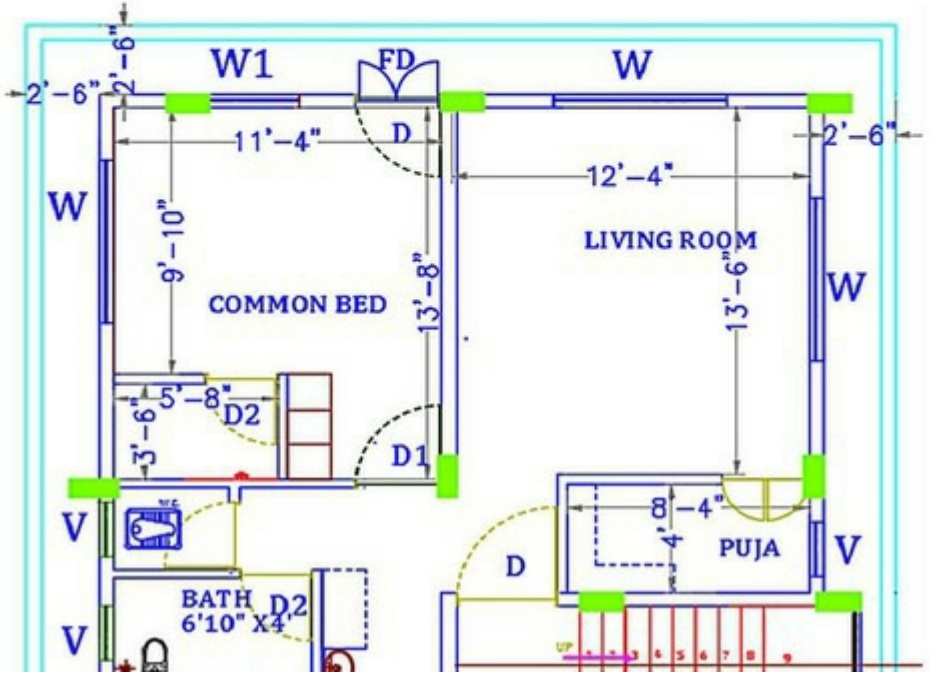
Exercise 5.2: Estimated duration: 30 minutes



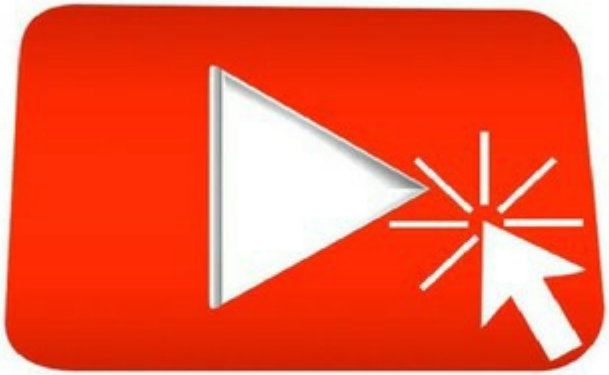
9.2 EXERCISES

Exercise 9.1: Estimated duration: 15 minutes

Draw following plans and apply layers on it



Have a look at video lecture 25 to learn about hatch concept and applications.



Video 25: Hatch

decoration and many different objects and facilities to have a realistic appearance. Do plan to learn these.

Structural analysis: Once the structure is designed then it needs to undergo analysis which is actually the testing of the structure under different load conditions. There are two dimensions of Analysis:

1. Structural design – It includes RCC, steel, timber, etc.
2. Loads – It includes dead, live, wind, seismic load, etc.

Once structure and loads are defined in analysis software then it provides output like deflection, distortion, shear force, bending moment, response to the earthquake, etc. **Staad.Pro** and **EATBs** are most widely used software. You plan to learn these them.

Overall, to build a super career, you should plan to study following software, while covering fundamentals

the earthquake, etc. **Staad.Pro** and **ETABS** are most widely used software. You plan to learn these them.

Overall, to build a super career, you should plan to study following software, while covering fundamentals.

3D Modeling

Design and Analysis

8. BLOCKS

Block is a collection of objects that form an entity representing an object in real world, e.g. door, window, sofa, bed etc.

Advantages of Block

- Blocks are a single entity which can be edited easily and used repetitively (re-use).
- We can build a library of blocks to reuse it by multiple drafters.
- Internet hyperlink can be added to it.

- We can build a library of blocks to reuse it by multiple drafters.
- Internet hyperlink can be added to it.
- Block can contain text information called an attribute.

Block panel is available in Home tab, as shown below in *figure 8.1*:

Figure 8.1: Block panel

Wblock

Used to insert the block into another file.

Select Wblock command [WB] → select object → give a name → select base point → provide unit → Browse the location to which you want to save the block → press ok

Block Editor

Right-click on the block to open the Block editor. You may add, remove or change the

Block Editor

Right-click on the block to open the Block editor. You may add, remove or change the composition of the block.

Redefine block

Here you make a copy of an existing block explode the copied block, make desired changes and save the copied block with the same name as that of the original block. Changes will be visible in all blocks wherever this block is used.

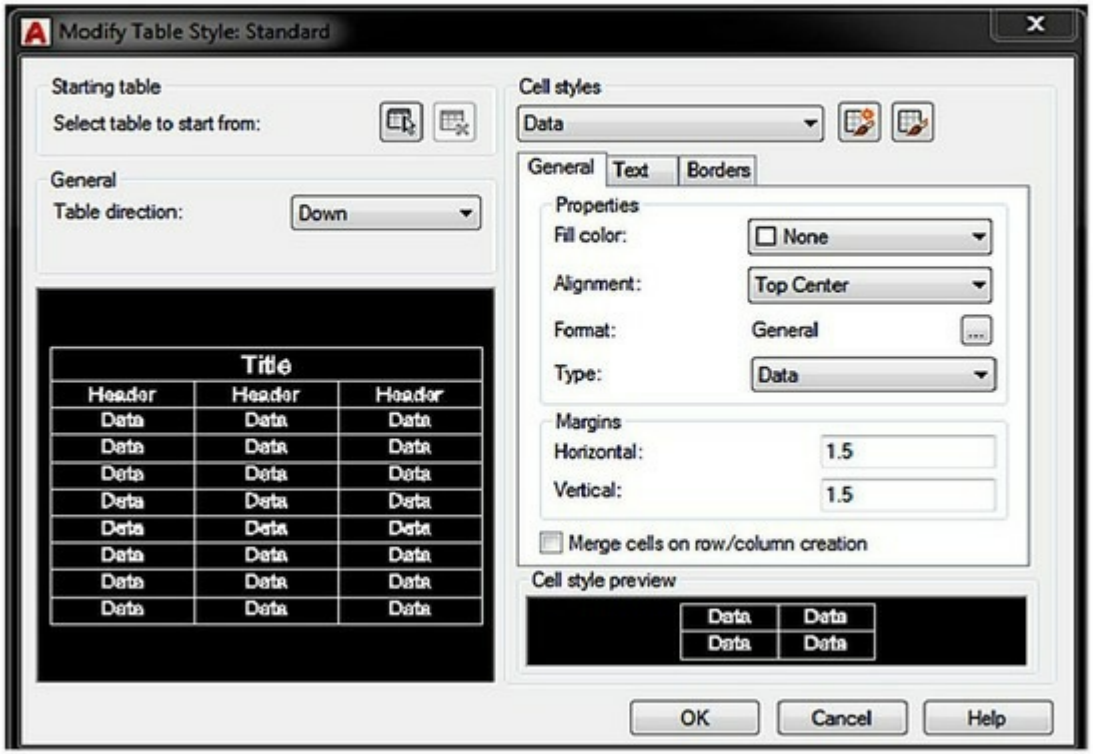


Figure A16: Table style

Figure A16: Table style

1. CIVIL INDUSTRY AND DRAFTING

Civil industry relates to any Civil structure idea, planning, designing, detailing, analysis, construction, and maintenance.

1.1 IMPORTANT PLANS

Most of the Civil industry works are done with help of multiple plans, initially to visualize the work, further making a plan to construct them. Below are a few plans which come along the way.

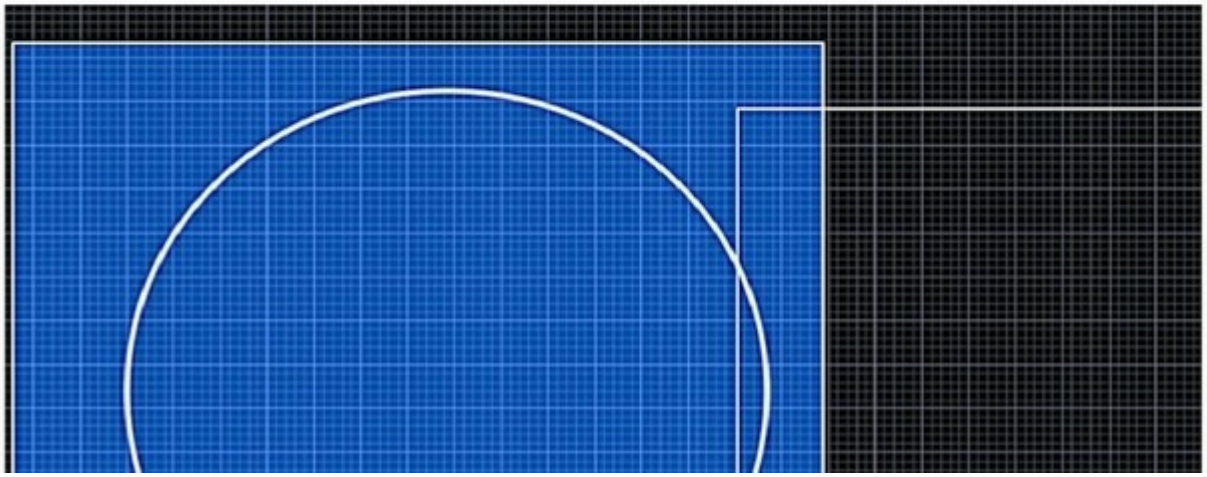
Site Plan:
A site plan is an architectural plan, topographical plan, and a detailed engineering drawing of proposed

Site Plan:

A site plan is an architectural plan, topographical plan, and a detailed engineering drawing of proposed improvements to a given land.

Figure 1.1: Sample output of a site plan

is completely selected inside the blue window, then the element will be selected. If the element is partially covered then it will not be selected. Look at *figure 4.2* in which the circle is selected as it is completely enclosed in blues selection window, but a rectangle is not selected as it is partially covered in the blue window.



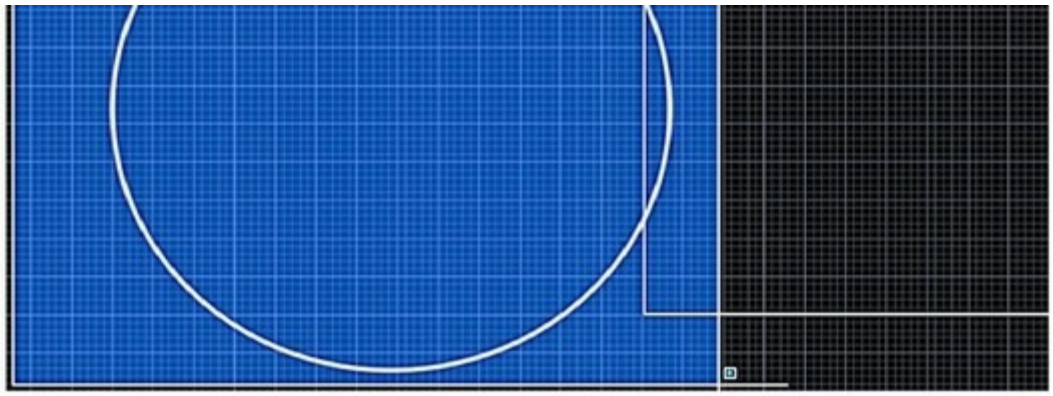


Figure 4.2: Blue selection window

Option 2: Crossing window: If we want to select an element even if it is partially covered by the selection window, then we use this option. Here we drag the cursor from lower right to upper left corner making a green window. Refer *figure 4.3* in which circle and rectangle, both are selected as both are partially or fully covered by green window.

Scale

Select object → give scale command [Sc] → specify base point (which will remain fixed and scaling will happen around the base point) → scale factor to increase or decrease the size (value greater than 1 will increase the size and value less than 1 will decrease the size, negative values are not allowed as it does not make sense)

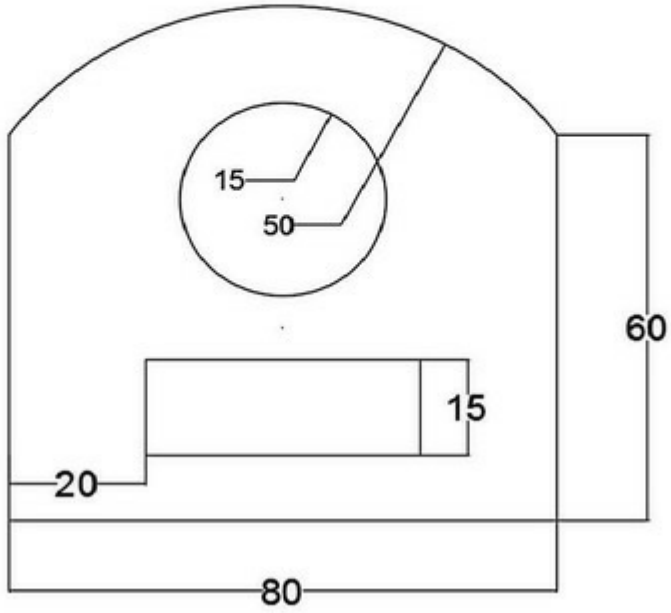
Look at video lecture 16 for the mirror, rotate and scale tools

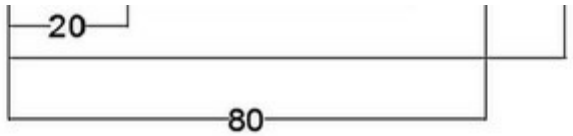
Look at video lecture 16 for the mirror, rotate and scale tools.

Video 16: Mirror, rotate and scale

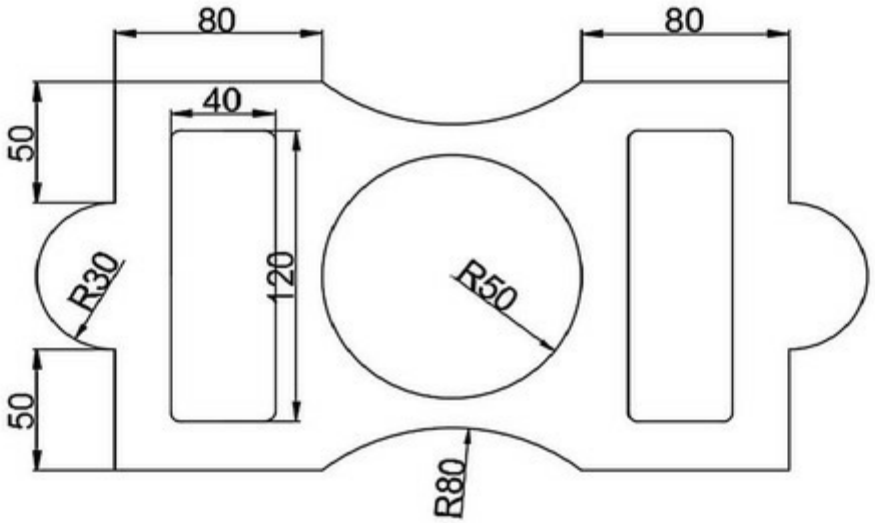
6.5 EXERCISES

Exercise 6.1: Estimated duration: 15 minutes





Exercise 6.2: Estimated duration: 20 minutes



A2 ADIITIONAL EDITING OPTIONS

- **Delete** – Select object and press delete button on the keyboard to delete the object.
- **Erase** – It is same as delete option but it is provided as modifying command.
- **Undo** – Ctrl+Z
- **Redo** – Ctrl+Y

Chamfer

- **Redo** – Ctrl+Y

Chamfer

Give chamfer command [CHA] → give distance (D1, D2) → select lines respectively.

Figure A7: Chamfer

Creating a new layer:

Click on the Layer Properties to create layers → Insert a new layer → rename it from layer1,2, etc. → Add color, line type, and line weight

Look at layer property manager shown in *figure 9.2,* to control layers:

Figure 9.2: Layer property manager

3.2 APPLICATION MENU BAR

As in any software, we have toolbar in AutoCAD You can use it to access several important commands such as new, open, save, print, and close, as shown in *figure 3.3*.

Look at a lecture in Video 2 to explore all important options of application menu bar

Look at a lecture in Video 2 to explore all important options of application menu bar.

Figure 3.2: Application menu bar

Video 2: Application menu bar

3.3 QAT AND WORKSPACE

Quick access toolbar is a placeholder for frequently used commands such as open, save, save as, print, undo, redo, line, workspace, etc., as shown in figure 3.4a. Workspace shows the space in which we work in AutoCAD, as shown in figure 3.4b. Refer to video 3 lecture to see the details.

Figure 3.4a: QAT

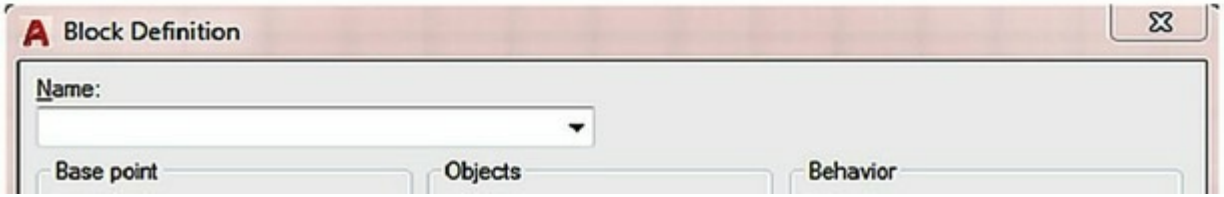
Figure 3.4b: Workspace

Video 3: QAT and workspace

8.1 CREATING AND INSERTING BLOCKS

Creating Blocks: It is used when you want to create a new block.

Give block command [B] → give a name → specify base point → provide block unit → select elements to convert into the block → switch on allow exploding (to segregate it later, if required) → press ok.



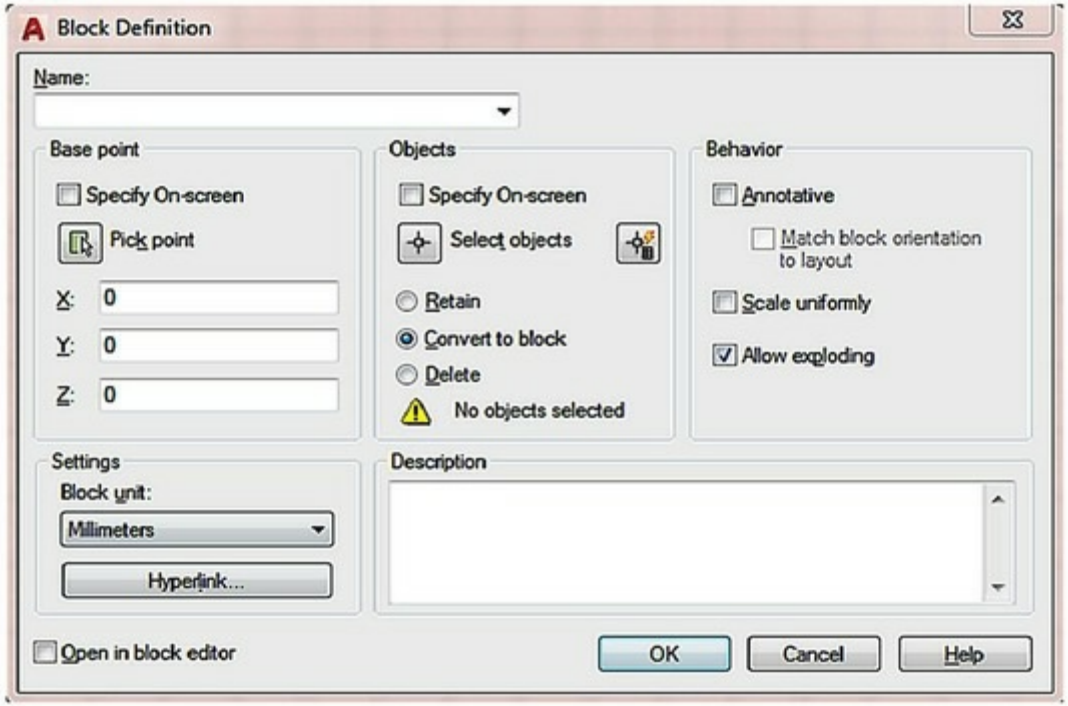


Figure 8.2: Creating a block

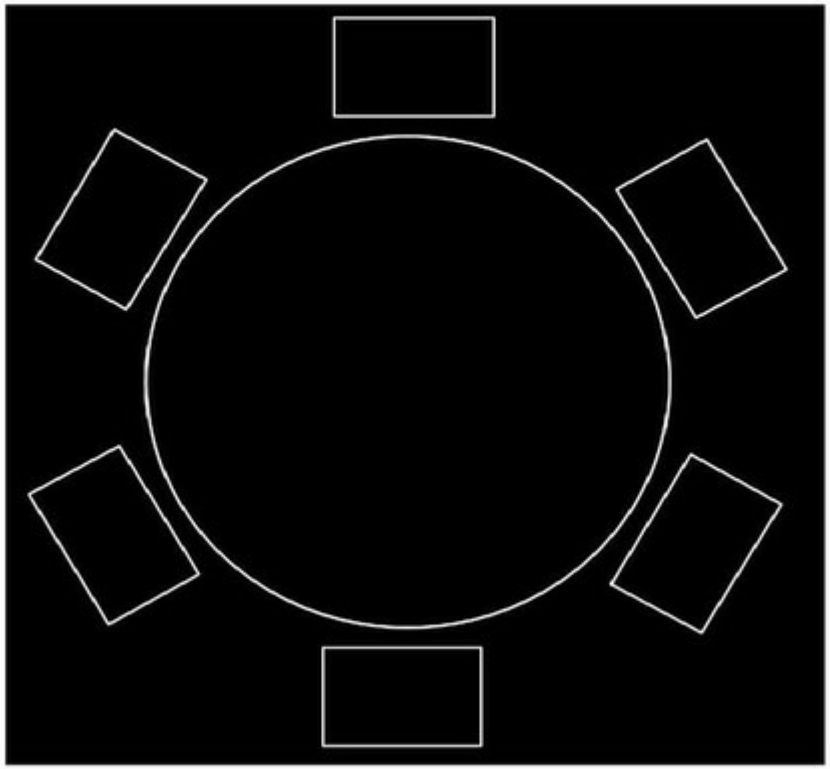


Figure A12: Polar array

Figure A12: Polar array

Copy base

Copy base – define base and then copy object on the clipboard. In paste clip, you can paste the copied object and paste it with reference to base selected earlier. It can be used in another drawing as well.

Delete Duplicate Object

Select duplicate object → delete duplicate command → give tolerance zero → enter.

End of Table of content

3. WORKING WITH AUTOCAD GUI

This chapter will make you well versed with AutoCAD screens, that is GUI-(Graphical user interface). We will also go through few video lectures and make ourselves comfortable with AutoCAD. Let's begin with the initial screen.

3.1 INITIAL SCREEN

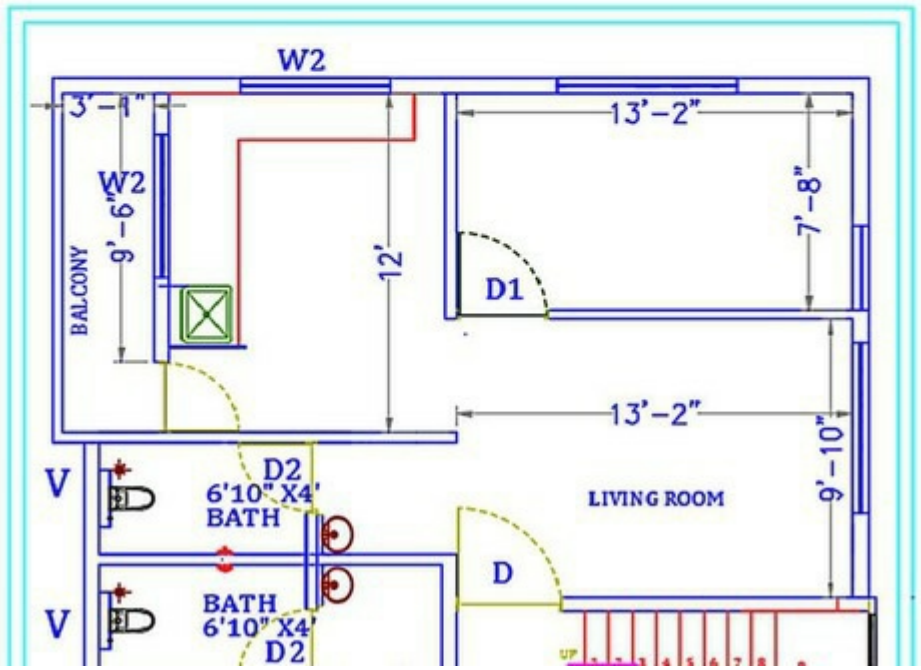
The first screen you see is "Start Drawing", as shown below in *figure 3.1*.

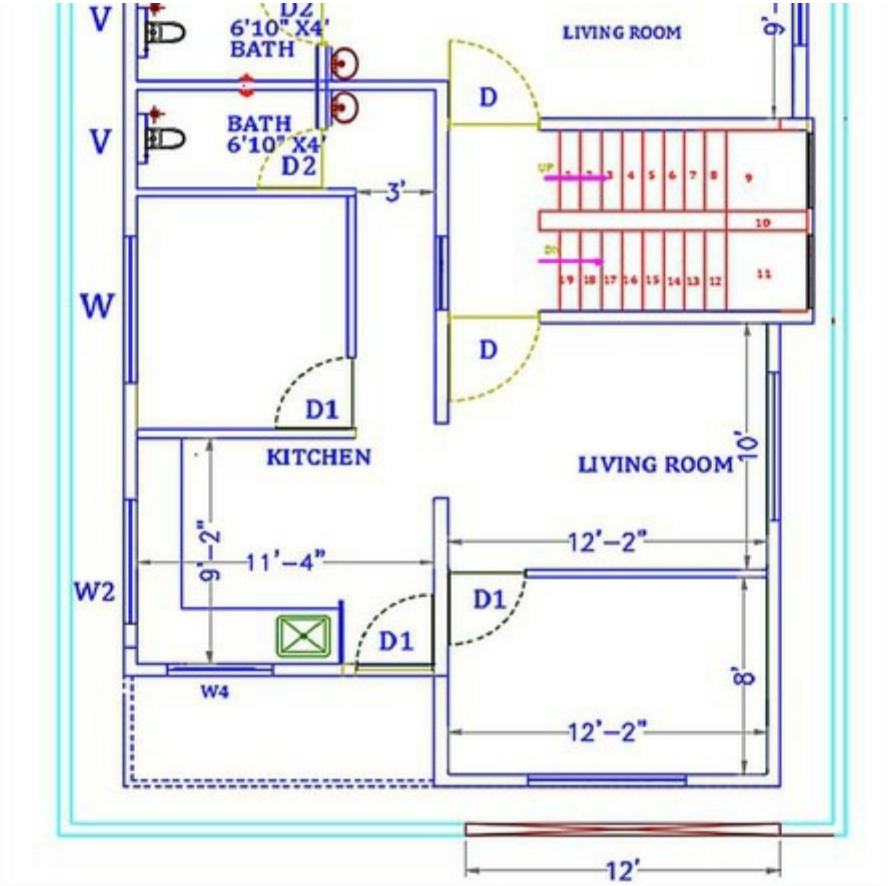
shown below in *figure 3.1*.

Figure 3.1: Getting started

Exercise 9.2: Estimated duration: 15 minutes

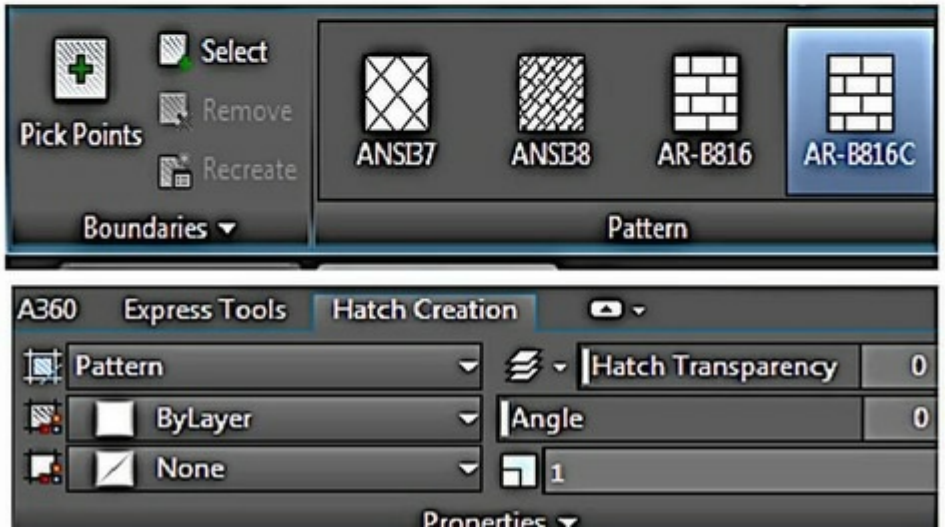
Draw following plans and apply layers on it

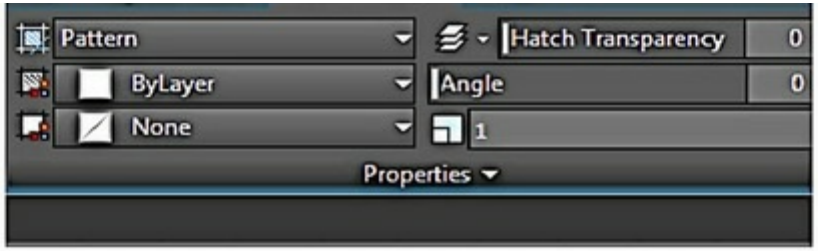




9.3 HATCH

Hatch command is used to fill an area or selected objects with a hatch pattern or a fill. It is available in draw panel in home tab, shown in *figure 9.3*, given below:





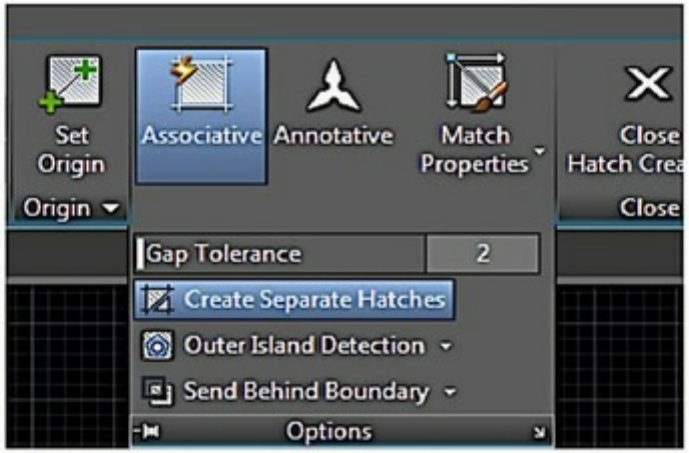
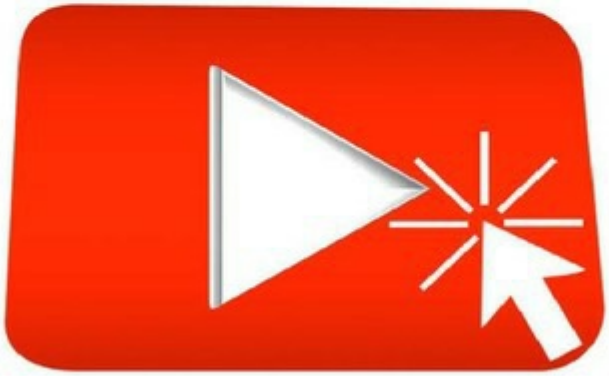


Figure 9.3: Hatch creation panel

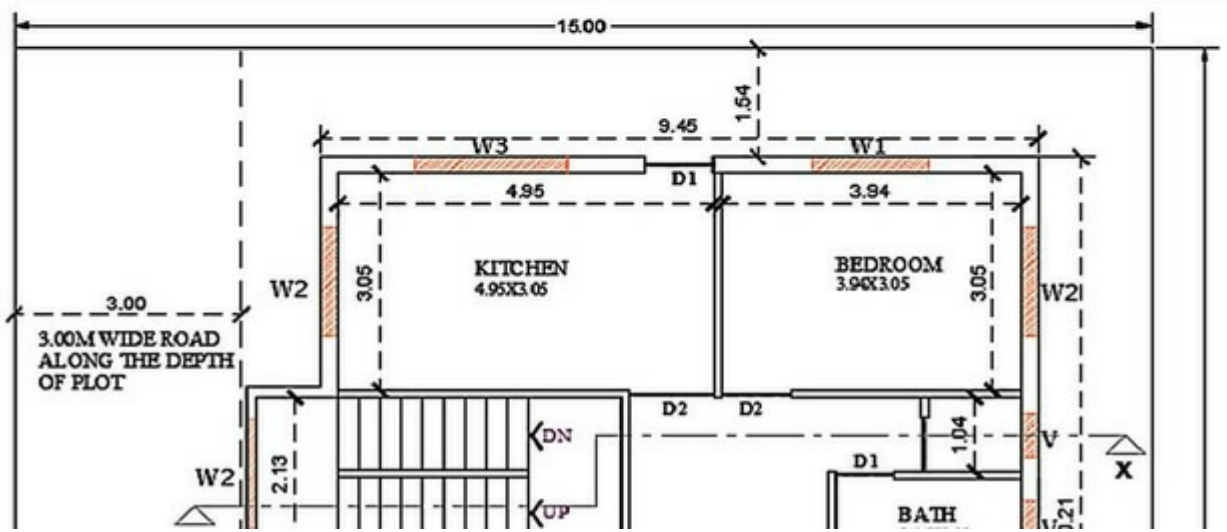
Have a look at video lecture 21 to draft floor plan by using the line, ortho, offset, trim, and extend commands.



Video 21: Drafting floor plan

Video 21: Drafting floor plan

Floor Plan: is a drawing to scale, showing a view from above, of the relationships between rooms, spaces and other features at one level of a structure, as shown in *figure 7.2*.



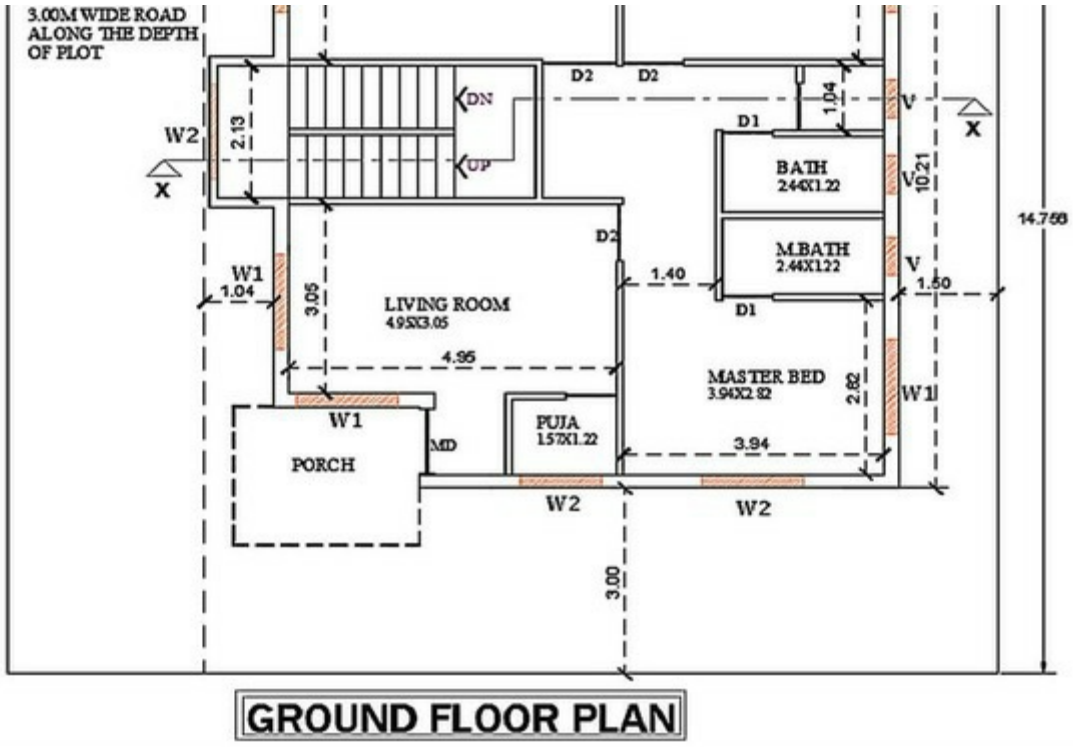


Figure 7.2: Floor plan

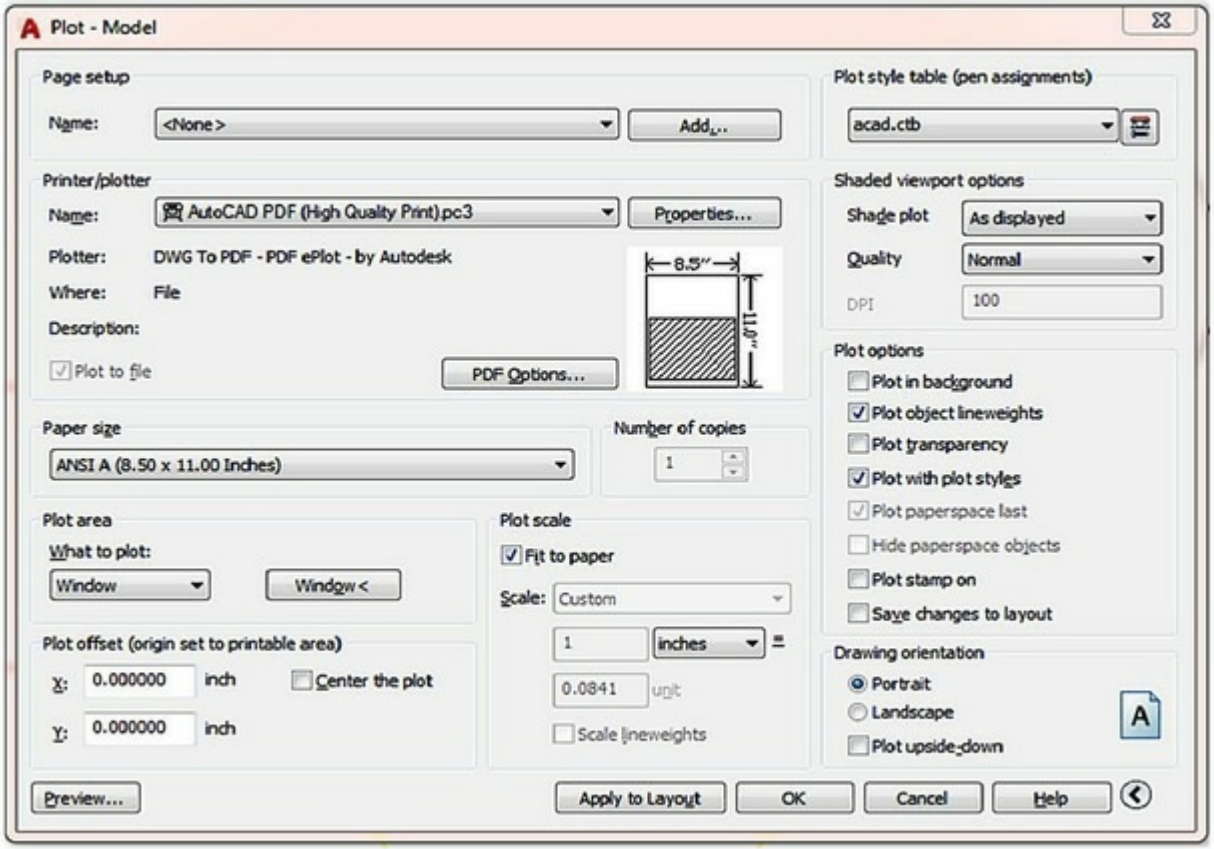
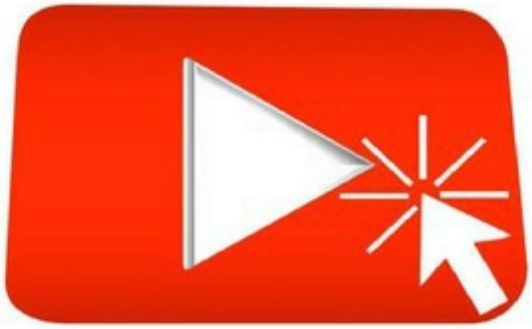


Figure 11.1: Plot window

Figure 11.1: Plot window

Have a look at video lecture 28 to learn about plotting options and examples.



Video 28: Plotting

3. **Side views**: Refer to *figure 1.10* showing left side view and right side view of the same house shown in *figure 1.9*. These are also an elevation and generally shown in Y-Z plane in AutoCAD.

Figure 1.10a: Left side view (Elevation)

Figure 1.10b: Right side view (Elevation)

??? Question Time ???

Figure 1.11 shows rear view of same house. Which plane will be used in AutoCAD to draw it?

Hint: Will not it be same as front view? X-Z?

Figure 1.11: Rear view

We advice you to explore following two topics by playing with them:

1. **UCS (user coordinate system):** It is the coordinate system. For 2D sketches, X-axis is used for length, Y-axis is used for width. In 3D, Z axis is used for height. It is shown in *figure 3.7*.

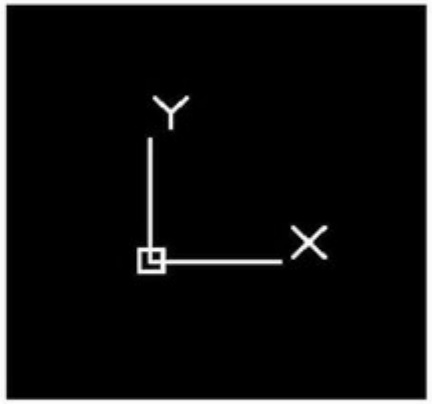


Figure 3.7: UCS

2. **View cube:** It helps in visualizing 3D objects at non perpendicular (orthogonal)

2. **View cube:** It helps in visualizing 3D objects at non perpendicular (orthogonal) angle. With help of view cube, you may have isometric view or any other view of your choice by rotating the cube in center or by rotation surrounding circular strip as shown in *figure 3.8*.

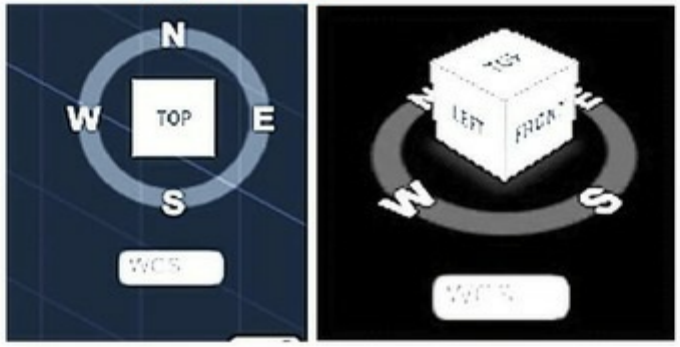


Figure 3.8: View cube in 2D (left) and 3D (right)

12.2 TYPICAL DETAIL OF MAIN AND SECONDARY BEAM

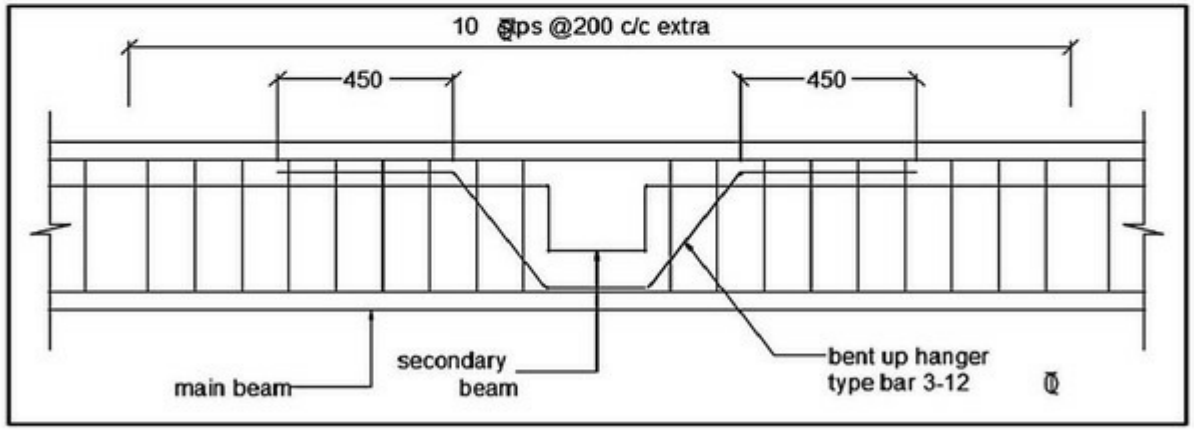


Figure 12.2: Beam junction

Figure 12.2: Beam junction

Have a look at video lecture 30 for details.

Video 30: Structure-Main and secondary beam junction

5.2 CIRCLE AND ARC

Making a Circle

Circle command[C] → Select center point (either using the cursor or providing X,Y coordinates) → provide Radius → Enter

Look at *figure 5.6* to find other options, which are also explained in video lecture ahead.

Look at *figure 5.6* to find other options, which are also explained in video lecture ahead.

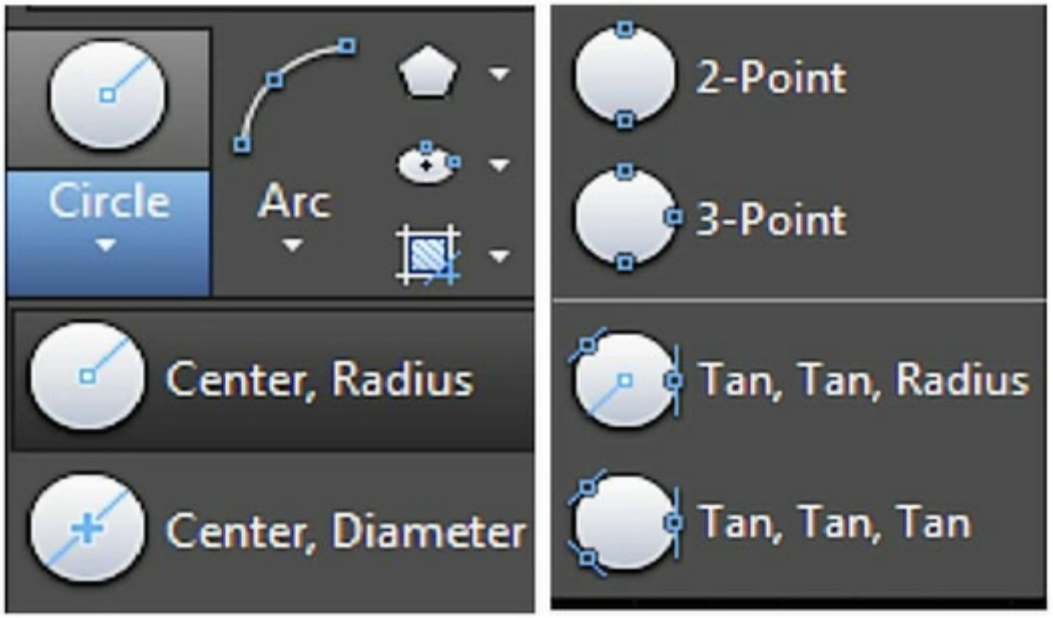


Figure 5.6: Types of circle

Look at video lecture 19 for trim and extend.

Video 19: Trim and extend

Look at video lecture 20 for application of

Look at video lecture 20 for application of offset and trim.

Video 20: Application of offset and trim

Offset

Give offset command [Of] → give offset distance → direction to offset (using cursor)

Look at video lecture 18 for fillet and offset.

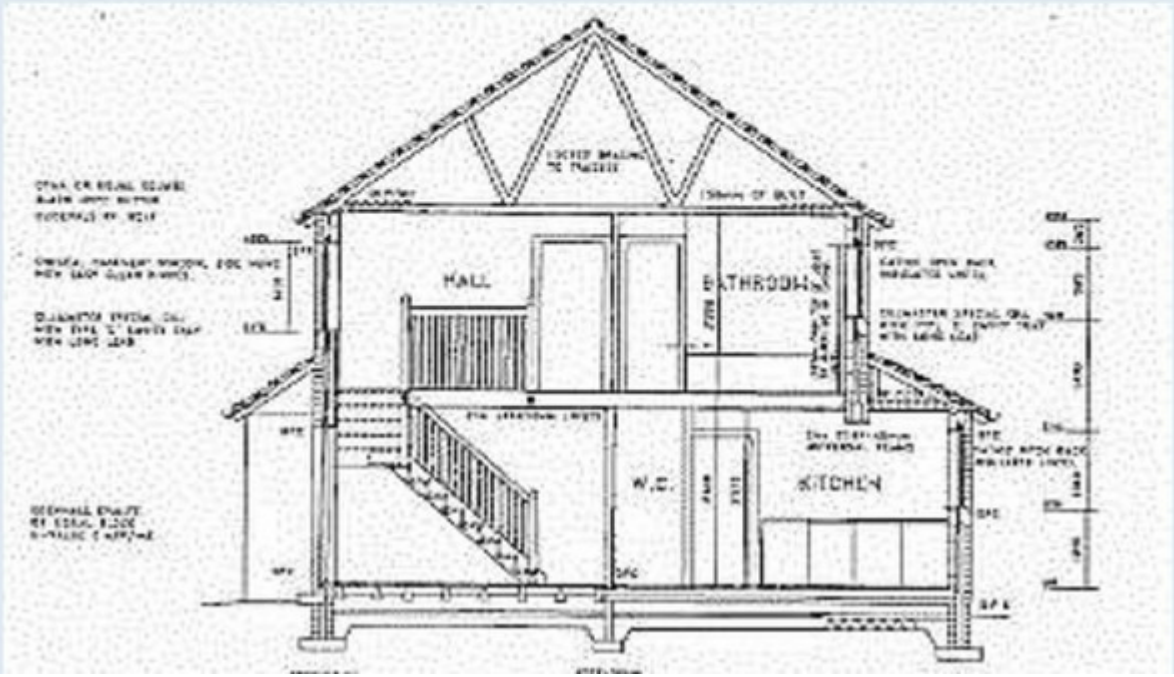
Video 18: Fillet and offset

Answers:

1. A
2. D
3. C
4. B
5. A

Section:

It cuts through the civil structure. It describes how the building will be constructed and discusses how the internal finishes are to look.



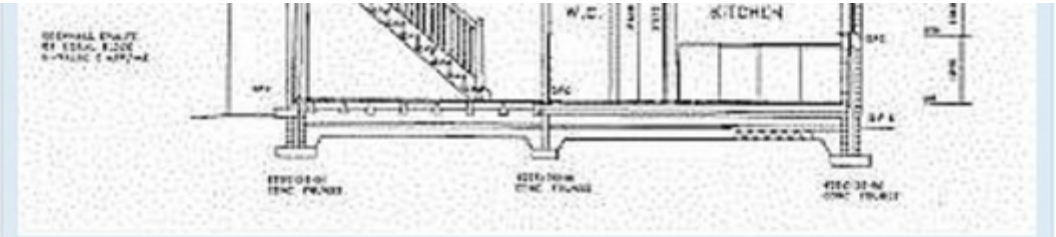


Figure 1.4: Sample output of a section

DYK (Did you know?):

Even plan (top view) is a section view. The section plane of a plan may be taken at plinth level, lintel level, or ceiling level. Generally in a standard plan, we show walls, doors, and windows however, you may keep you section plane at any level and put details as per your need. For example, a plan at ceiling level may include lighting, fans, etc., attached to the ceiling.

Step 6: Plotting

The final step is converting drafting into pdf or printing.

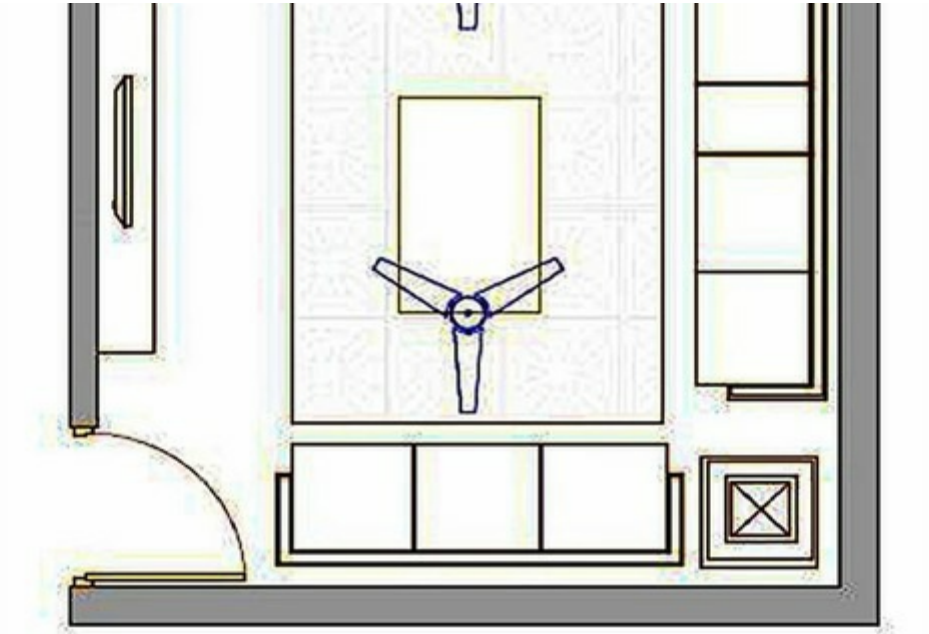


Figure 2.9: PDF conversion of the hall

Using six steps of the workflow, we can make any sketch from start to end. Soon we will look at all these steps in our videos lectures

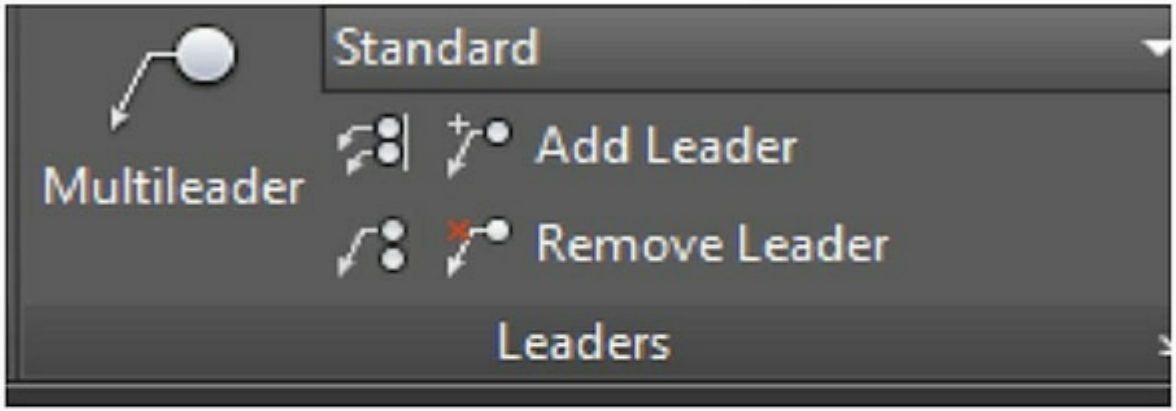


Figure A13: Leader panel

You can create your own multileader style.

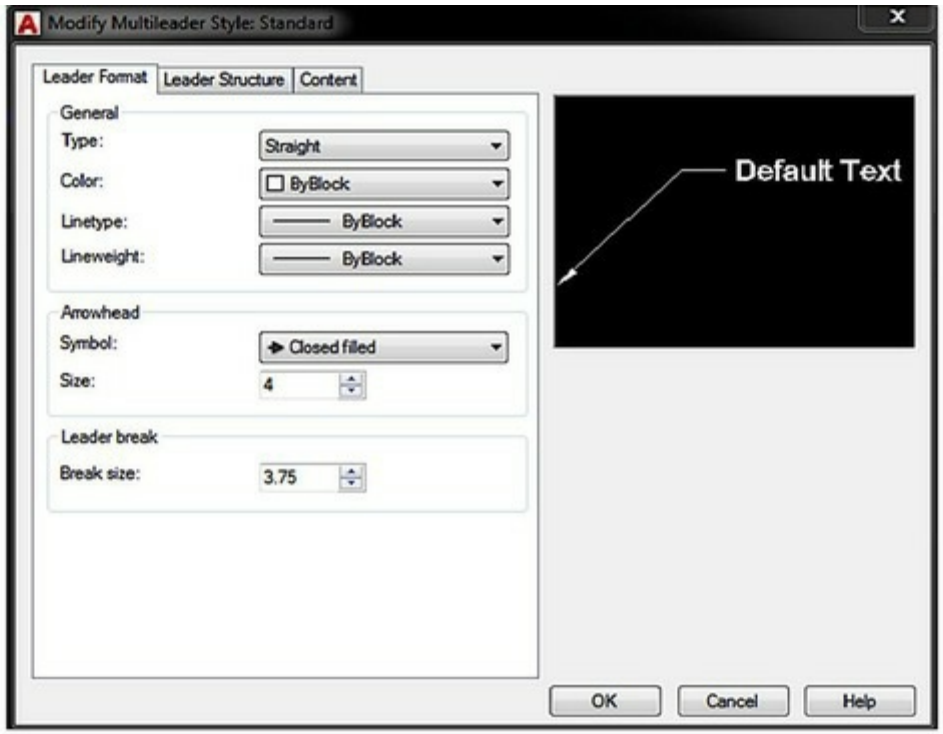


Figure A14: Multileader style

learning, we have included **Appendix** section, following current section, in which seven set of advanced topics are provided. You will find brief introduction, navigation and samples to provide you enough detail for self exploration.

Get rocking, keep learning new things, go for advanced topics, establish yourself as AutoCAD expert, and stay blessed!

Thanks for reading!

Thanks for reading!

Review our performance:

Through new concept of AppBook, we are trying to keep it cost effective such that larger student community of growing country like India can benefit. We invite you to review this AppBook at Amazon. Put your frank review comments, suggestion, etc., and we will work on it in interest of students...

Thanks again!

8.3 QUIZ

1. What is the advantage of using a block in a drawing?
   A. Easy to modify
   B. Reduces the file size
   C. It contains attributes
   D. All of the above

2. What is non-mandatory action while creating a block?
   A. Select a base point
   B. Give a name
   C. Select objects

A. Select a base point
B. Give a name
C. Select objects
D. Add attributes

3. Can hyperlink be added to a block?
   A. Yes
   B. No

4. What is the shortcut of tool palette command?
   A. Tp
   B. Ctrl+3
   C. All of the above

Procedure:

Click on multiline text → specify opposite corners of a bounding box to define the width of the multiline text object → Text Editor contextual tab will be displayed as shown in *figure 10.2*, given below:

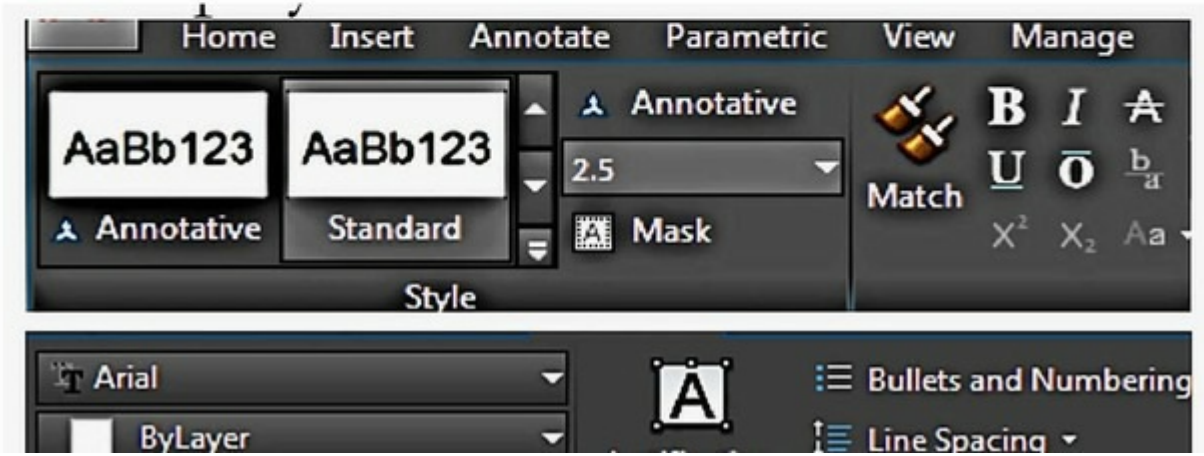


Figure 10.2: Text editor contextual tab

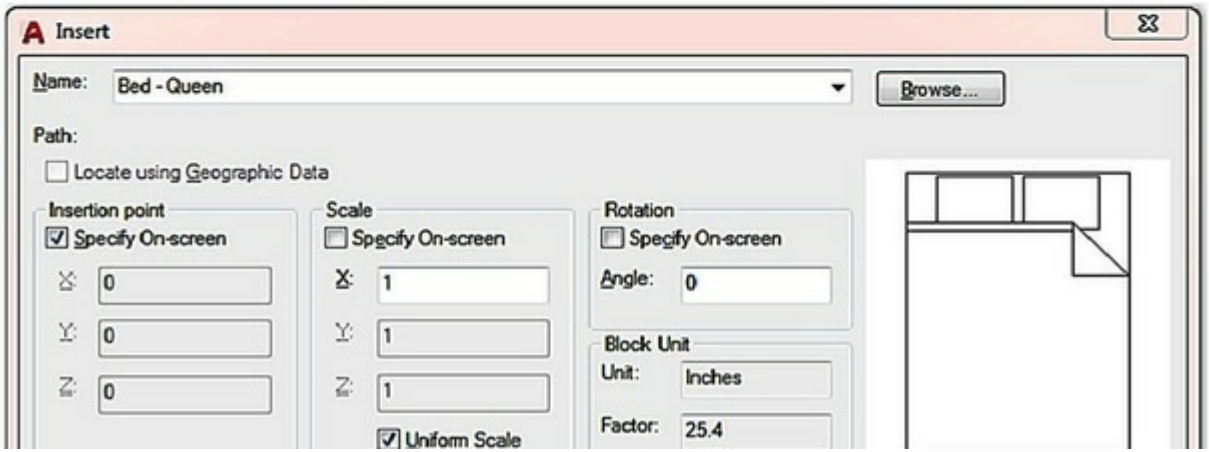
To change the current text style, select the desired text style from the drop-down list → type the text → press escape to exit command.

Create Single-line Text

For short, simple notes, use single-line text.

Inserting Blocks: It is used when you want to use an existing block from current drawing.

Give Insert command [I] → select the block from the drop-down list → switch on insertion point → keep scale uniform or non-uniform → give angle → Press Ok.



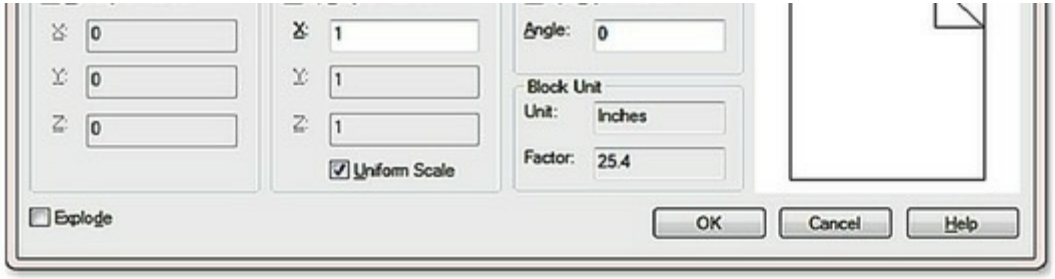


Figure 8.3: Inserting block

Region and Boundary

Draw fours lines to form a rectangle → provide region command [Reg] → select all lines of the rectangle → its converted into a united body.

Boundary command is used to create a boundary for open and closed geometric shapes, however, region command cannot create a boundary for open geometrical shapes.

Draw three lines to form a geometric shape (may be part of a rectangle)→ provide

Draw three lines to form a geometric shape (may be part of a rectangle)→ provide boundary command [BO] → select all lines → its converted into a united body.

Region Boolean Operations

The boolean operation is used to perform add/union, intersect, subtract, operations on regions.

Explode

Explode (X): is used to make all segments as separate objects

AutoCAD file commands

- **Time** command shows saved time duration with the date.
- **The list** shows **a** summary of all previous commands.
- **Dwgprefix**-shows where the document is saved.

- **Dwgprefix**-shows where the document is saved.

A3 CONCEPT OF A BLOCK

Bcount

Select blocks → provide bcount command [BC] → Summary of all blocks is shown

Nested copy (to modify a component of a block without exploding)

Select block → select nested copy command → changes can be done in block

Case 2:

SUB → select the circle → select the rectangle → press enter

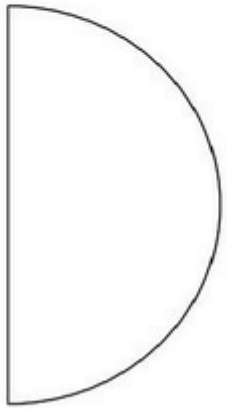


Figure A5: Subtract – Case 2

Intersect [INT] – To keep common area

Figure A5: Subtract – Case 2

Intersect [INT] – To keep common area

INT → Select all objects → press enter

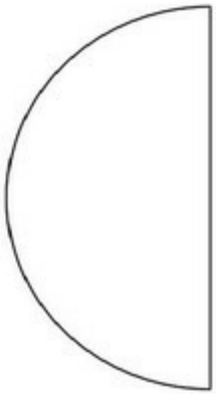


Figure A6: Intersect

Join

Provide Join command [J] → select source and destination object to join

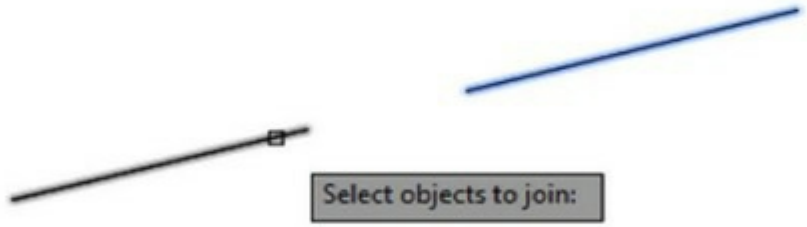


Figure A10: Join

Reverse

Select line → Provide reverse command [REV]

Reverse

Select line → Provide reverse command [REV] → it will change the direction of the line

Array [AR]

The array is used for a specific pattern like rectangular, circular or path

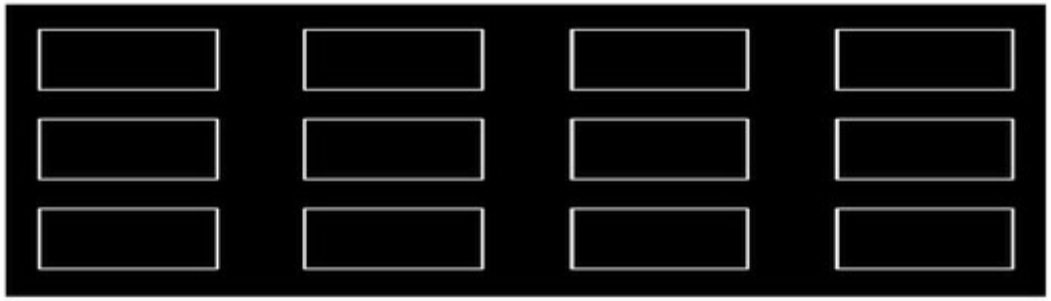


Figure A11: Rectangular array

Difference between Line and Polyline is, a polyline is a continuous line whereas line is an individual element as you can see in *figure 5.4*.

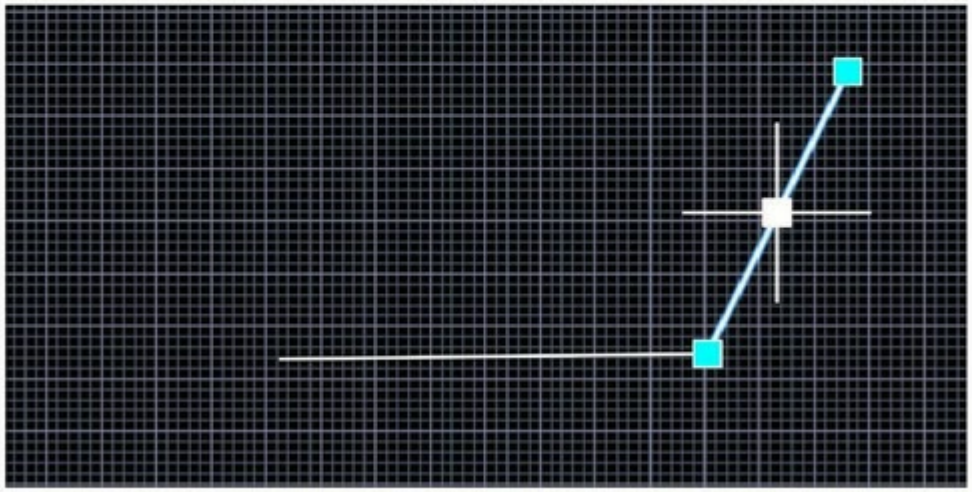


Figure 5.4: Line as individual element

Figure 5.4: Line as individual element

Polyline is continuous with editable vertices as shown below in *figure 5.5*, whereas line does not have any vertex.

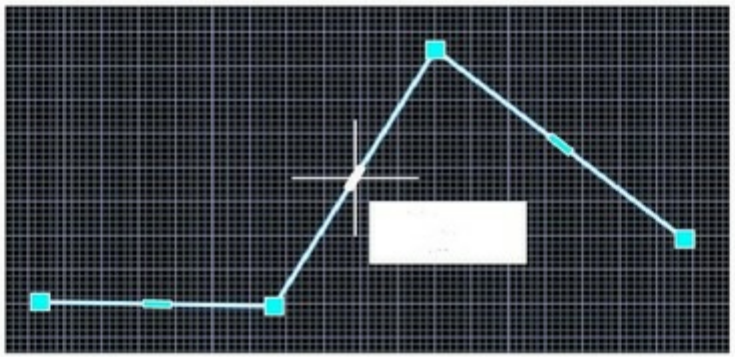


Figure 5.5: Polyline with editable vertices

A7 EXTERNAL REFERENCE

To reuse or refer any existing drawing files (.dwg file), PDF files, or image files then you may use this function. It is used for team collaboration.

Navigation: Insert tab → Reference panel

Suppose you want to attach another file then click on Attach option in reference panel, as

Suppose you want to attach another file then click on Attach option in reference panel, as shown below:

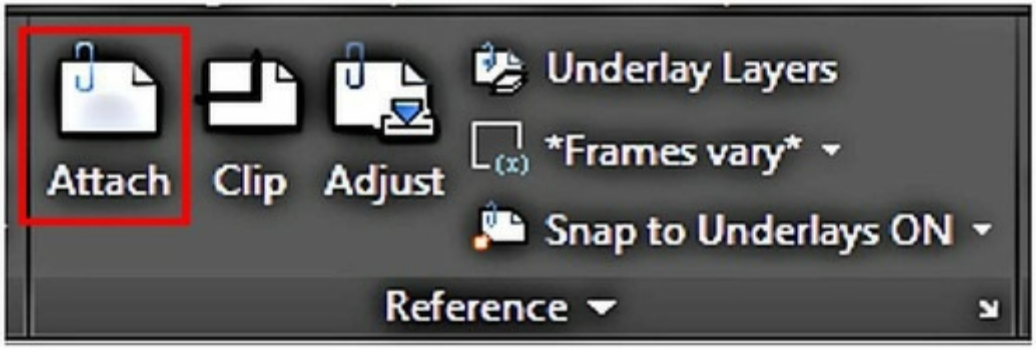


Figure A19: Reference panel

Figure 5.8: Inscribed polygon

Figure 5.8: Inscribed polygon

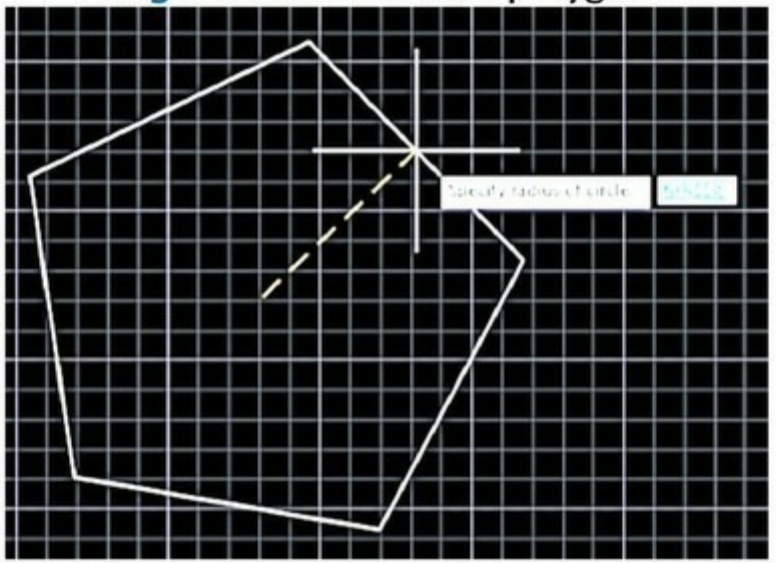


Figure 5.9: Circumscribed polygon

soon learn about drawing such plans. A sample roof plan is shown below is *figure 1.8.*

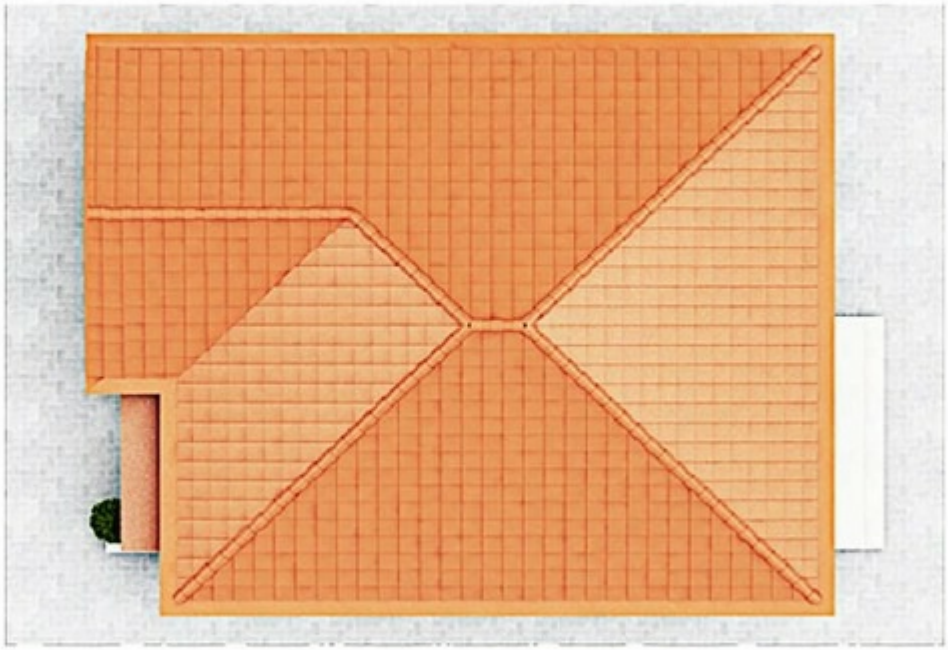


Figure 1.8: Roof plan

2. **Front view (Elevation):** Refer to *figure 1.9*

Figure 1.8: Roof plan

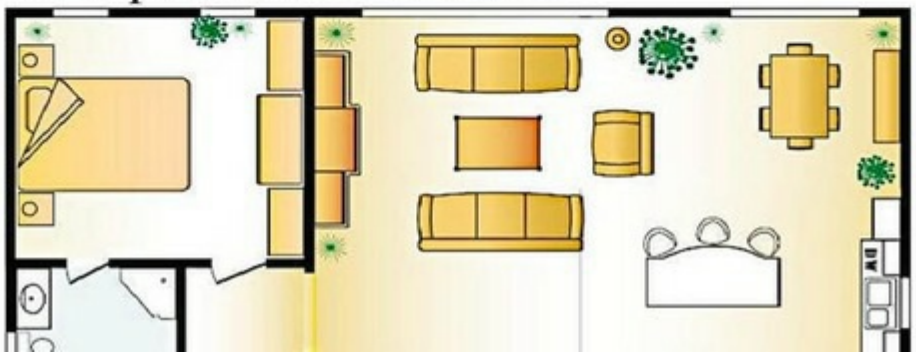
2. **Front view (Elevation)**: Refer to *figure 1.9*, given below, showing the front of a house, which is generally shown in X-Z plane in AutoCAD.

Figure 1.9: Front view (Elevation)

Orthographic projection views

For drafting purposes, we make use of two-dimensional projections of these three-dimensional objects. These 2D projection views, called orthographic projections, are used to make drawings. There are three types of projections:

1. **Top view (Plan)**: Refer to *figure 1.7*, given below showing the top view. It is usually drawn in X-Y plane in AutoCAD.



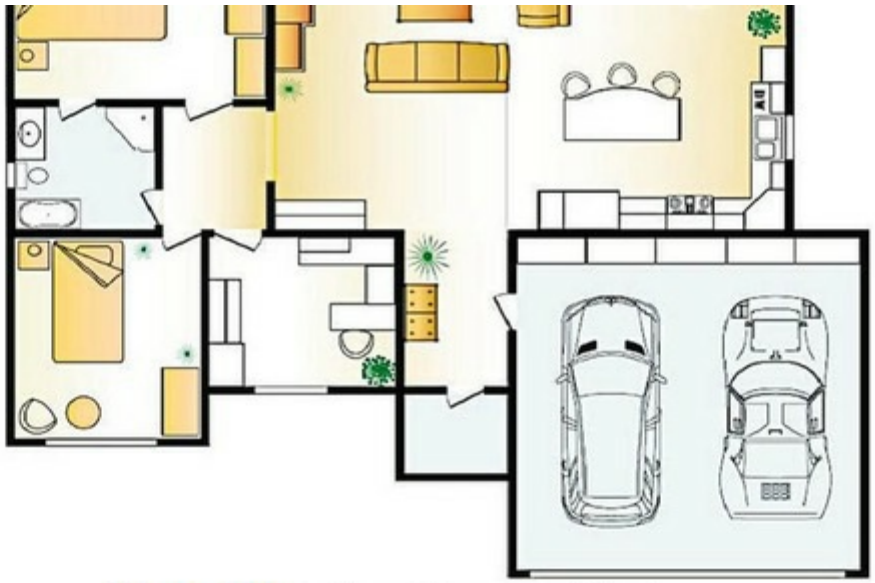
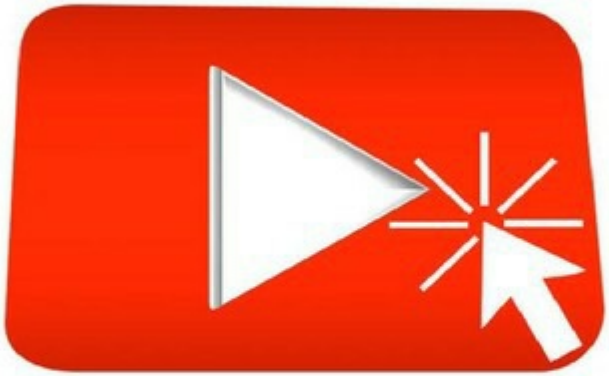


Figure 1.7: Sectional Top view (Plan)

One point is worth noting here. *figure 1.7* shows the top view which is actually a sectional top view, which is used in civil engineering as plan. We will

Look at video lecture 12 for circle and arc.



Video 12: Circle and Arc

5.3 RECTANGLE AND POLYGON

5.3 RECTANGLE AND POLYGON

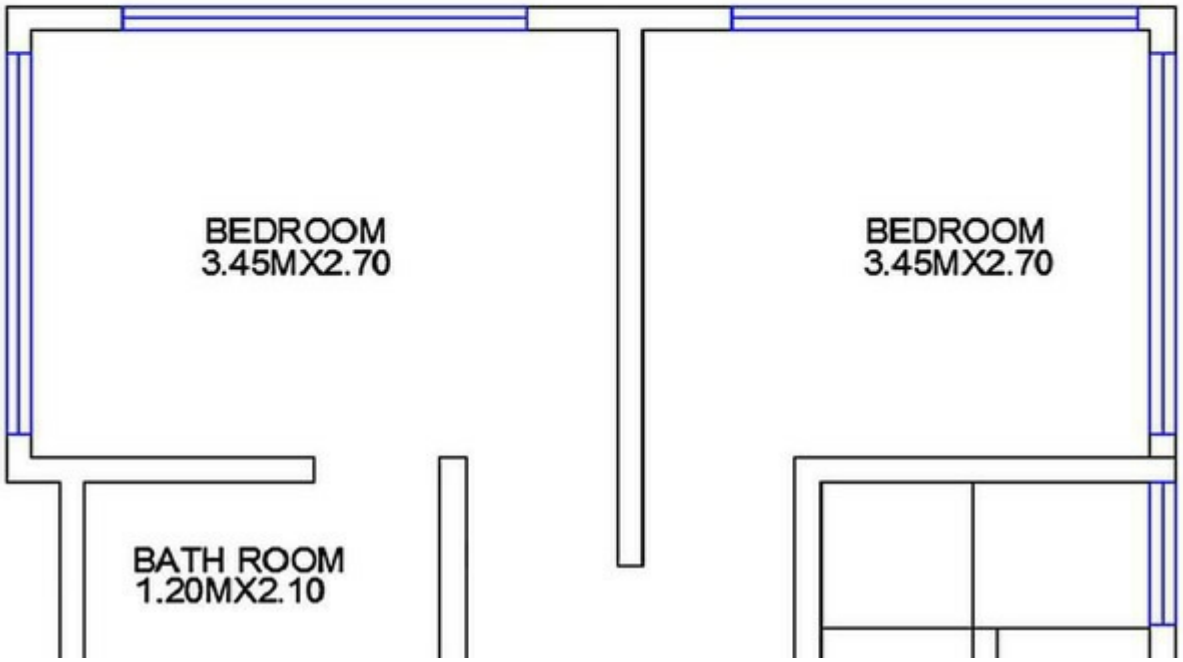
Rectangle with sharp corners

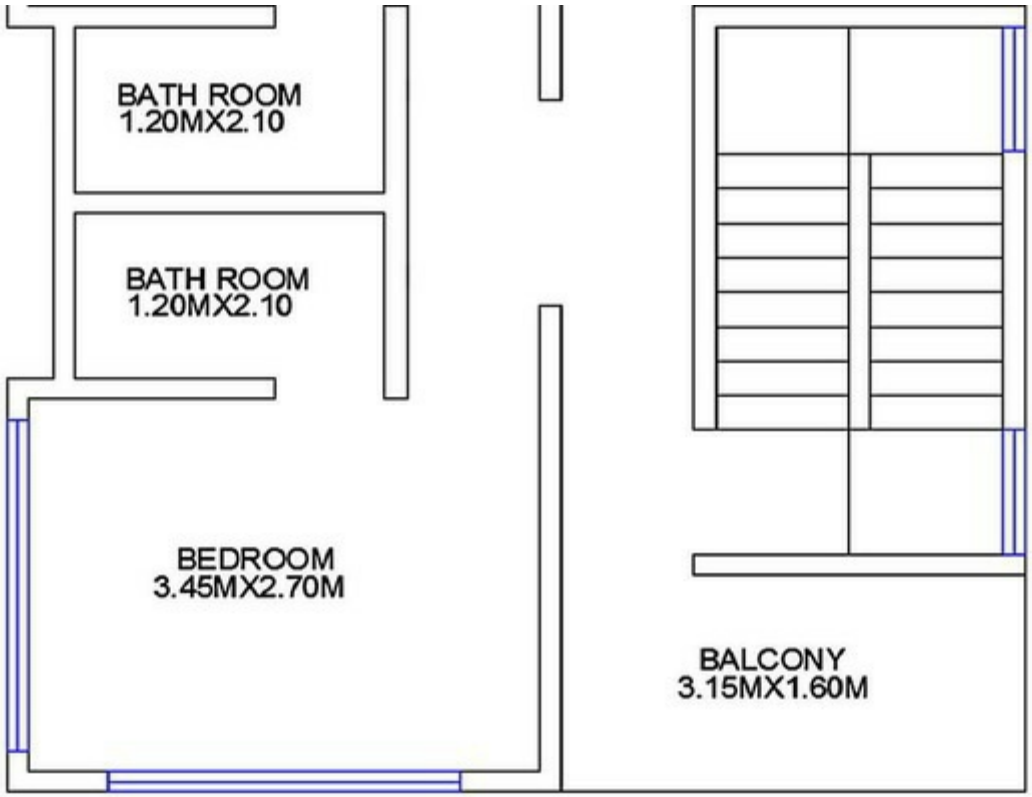
Rectangle command [Rec] → Specify 1st corner point (x,y) → Specify 2nd corner point (x,y) → Rectangle will be drawn.

Rectangle with fillet corners

Rectangle command [Rec] → Choose fillet from command bar → Provide radius → Specify 1st corner point (x,y) of the rectangle → Specify 2nd corner point (x,y) of the rectangle → Rectangle with fillet will be drawn.

Exercise7.2: Estimated duration: 30 minutes





Subtract [SUB]

Output depends upon the sequence of operation, in subtract case 1, the first step is a selection of rectangle and the second step is a selection of circle, and vice versa for subtract case 2.

Case 1:

SUB → select the rectangle → select the circle → press enter

SUB → select the rectangle → select the circle → press enter

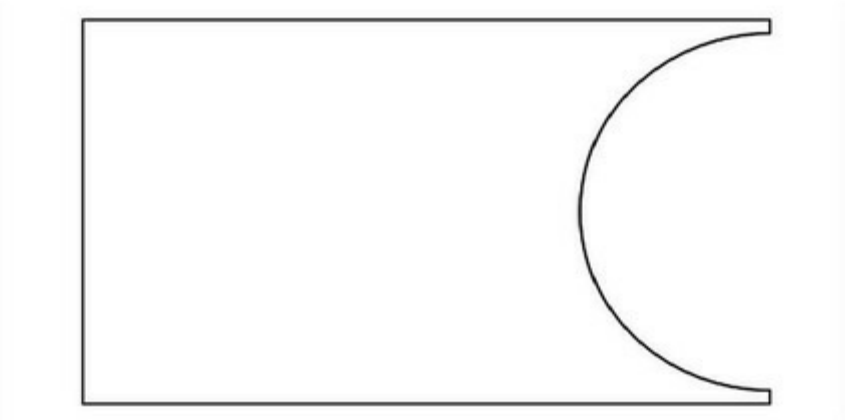
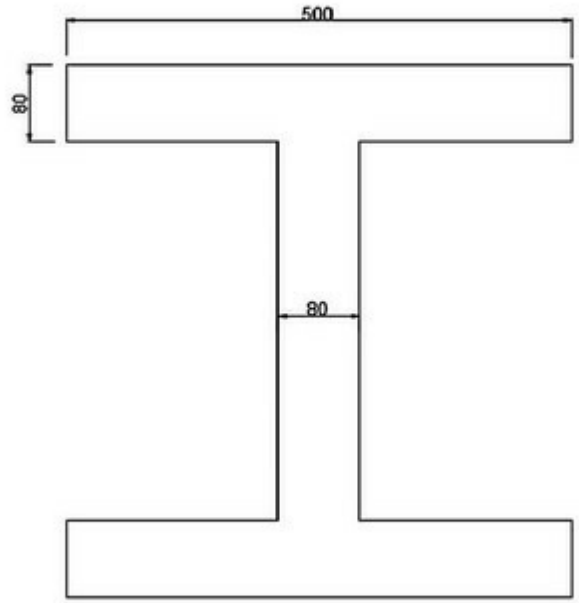


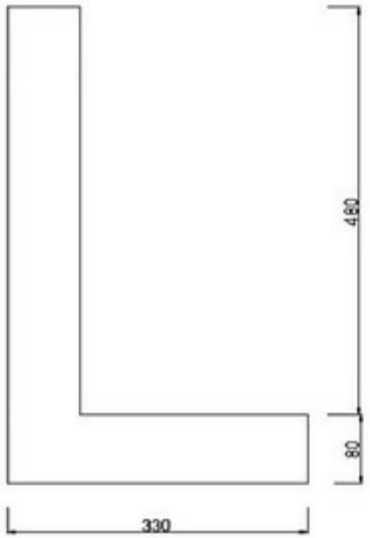
Figure A4: Subtract – Case 1

Exercise 4.2: Estimated time: 10 minutes



Exercise 4.3: Estimated time: 10 minutes

Exercise 4.3: Estimated time: 10 minutes



9.5 QUIZ

1. If your hatch doesn't work at all...?
   A. Used wrong color
   B. Used the wrong scale
   C. Hatching pattern is wrong
   D. There was a problem in the area selected.
2. Hatching can be done only in a closed loop.
   A. True
   B. False
3. If you create an object on layer zero, it cannot be moved to another layer?
   A. True
   B. False

cannot be moved to another layer?

A. True
B. False

4. What is the shortcut for layer state manager?
   A. Alt+F
   B. Alt+S
   C. Alt+C
   D. Alt+G
5. Layer zero can be deleted?
   A. True
   B. False

Making new palette using blocks

To make new palette (collection of blocks), right-click on any palette and select new palette option from the menu which appears. Give a palette name. Drag and drop block(s) from drawing file to the tool palette but make sure drawing is saved before adding blocks to the palette.

Design Center

Design Center

Figure 8.5 and *figure 8.6* show the navigation to design center and blocks inside it.

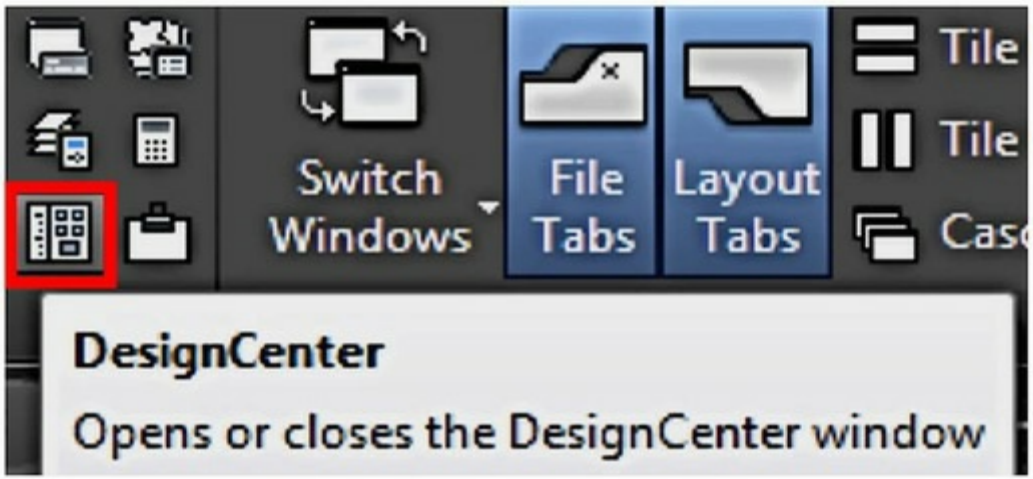


Figure 8.5: Navigation to design center

12. DRAFTING STRUCTURAL AND FOUNDATION PLAN

In this chapter, we will work on real-life drafts. These are more like learning engineering than learning AutoCAD and, therefore, these are included to give you exposure to real life drafts such that you are ready for the industry.

We will work on following seven cases:

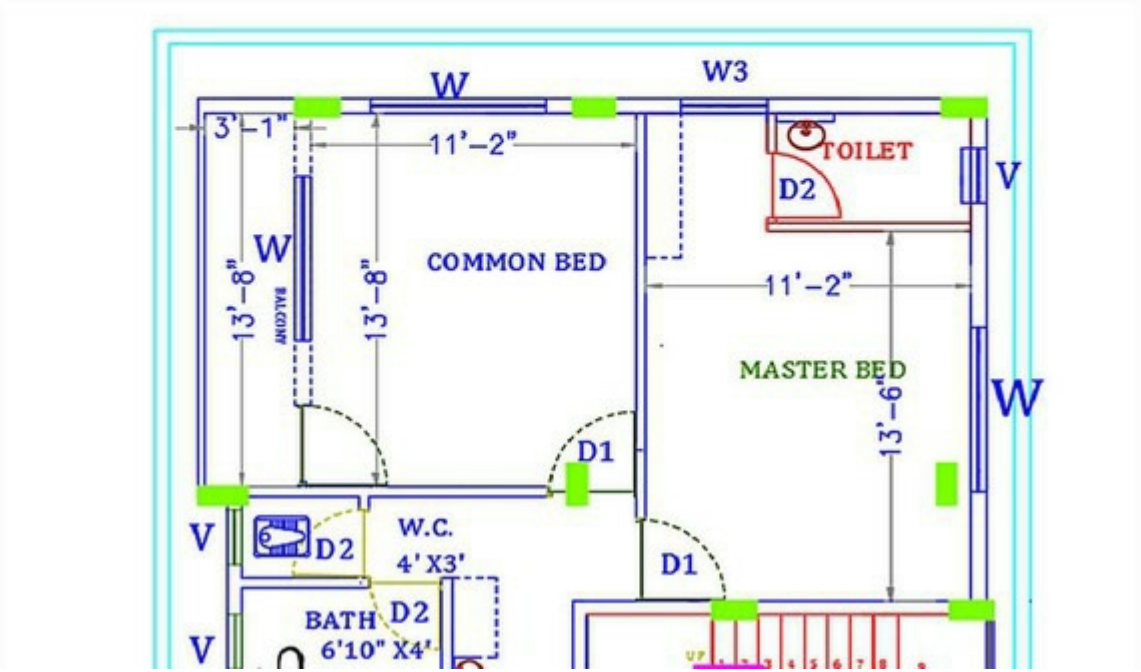
- **Structural plan (Covered in section 12.1 to 12.4)**

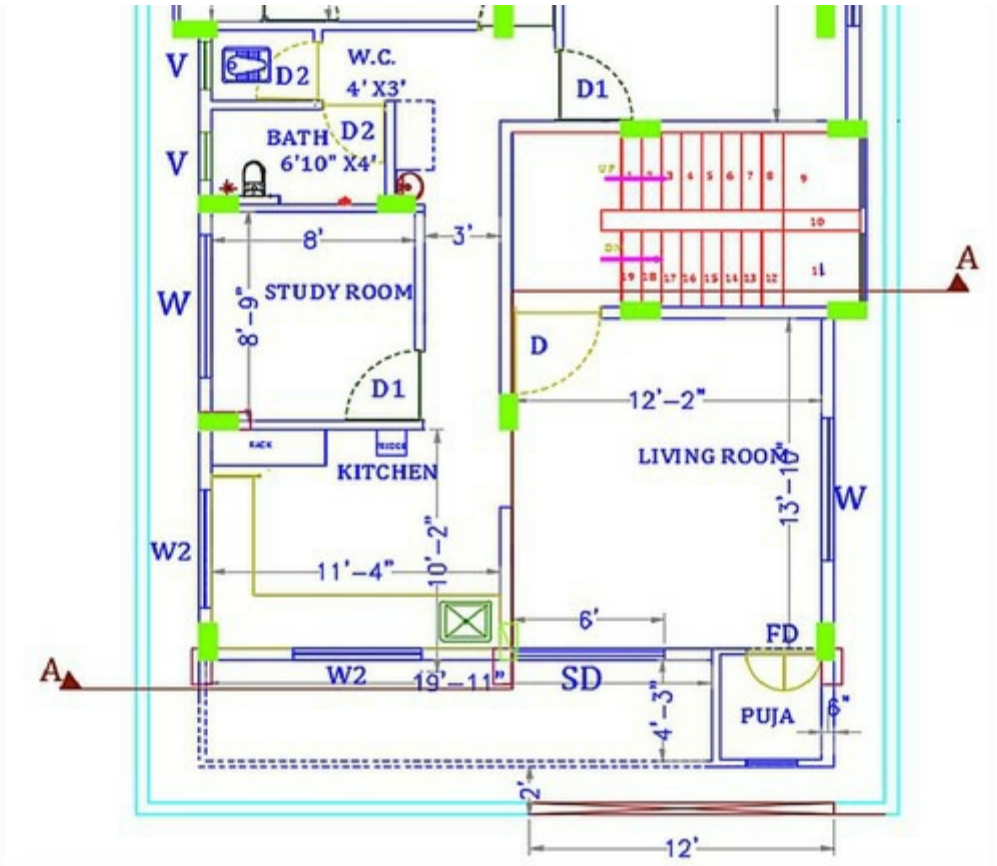
We will work on following seven cases:

- **Structural plan (Covered in section 12.1 to 12.4)**
  - Typical details of lap splice in beam and column
  - Typical details of the main and secondary beam
  - Typical details of beam and column junction at the end
  - Typical details of beam and column junction at the intersection
- **Foundation plan (covered in section 12.5 to 12.7)**

Exercise 9.3: Estimated duration: 15 minutes

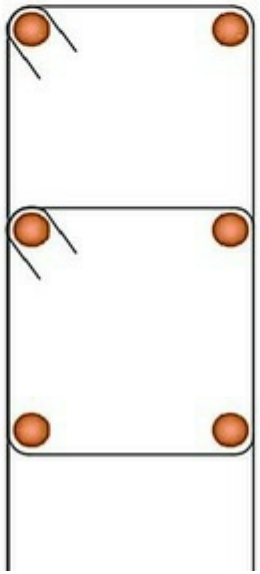
Draw following plans and apply layers on it





FOUNDATION PLANS

12.5 TYPICAL DETAIL OF COLUMN REINFORCEMENT DETAIL



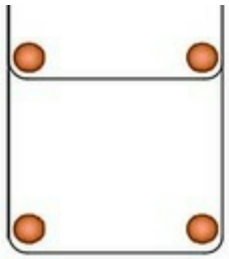
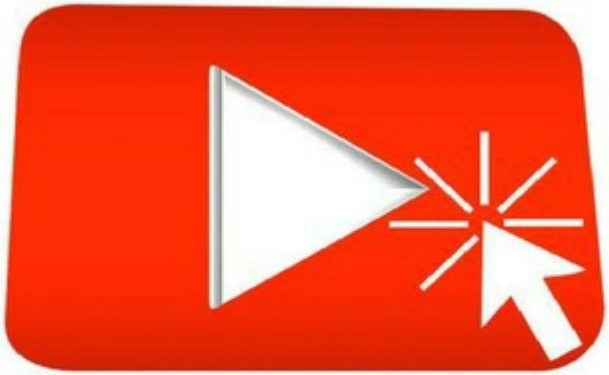


Figure 12.5: Column reinforcement details

Have a look at video lecture 33 for details.

Video 33: Foundation- column reinforcement

Look at video lecture 17 for move, copy and mirror command applications.



Video 17: Move, copy and mirror applications

6.3 FILLET AND OFFSET

6.3 FILLET AND OFFSET

Fillet

Give fillet command [F] → give the radius of the fillet → select first line → select second line → corner will be converted into a curve as shown in *figure 6.2*.

Figure 6.2: Fillet

11. PLOTTING

Plotting is used for printing and conversion of drawing to PDF format.

Shortcut: [ctrl+p]

Procedure:

- Select printer name or conversion to pdf
- Give paper size from A0 to A8
- The select window for plotting and center the plot
- Give acad.ctb plot style for color presentation and monochrome.ctb for

the plot

- Give acad.ctb plot style for color presentation and monochrome.ctb for black output.
- Give the specific orientation (landscape, portrait, etc.) and click on preview.
- Then press escape for exiting preview
- Apply ok.

Look at *figure 11.1*, given below for above details.

Answers:

1 - A

2 - B

3 – C

4 – D

5 – D

Arc Length Dimension: gives arc length of an arc.

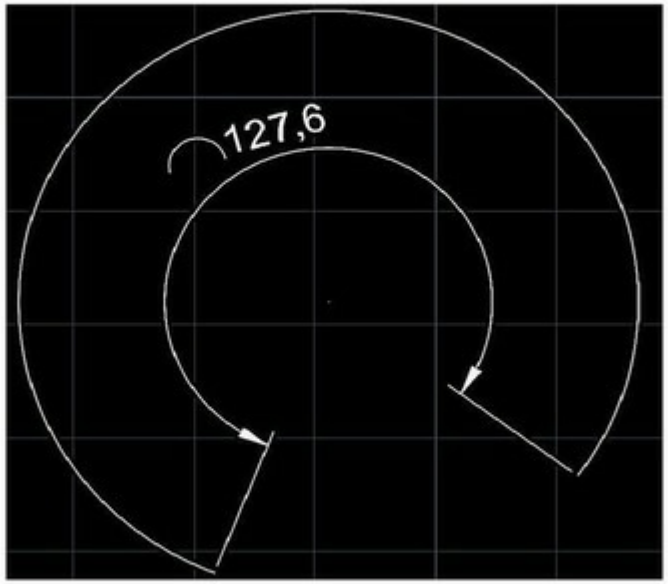


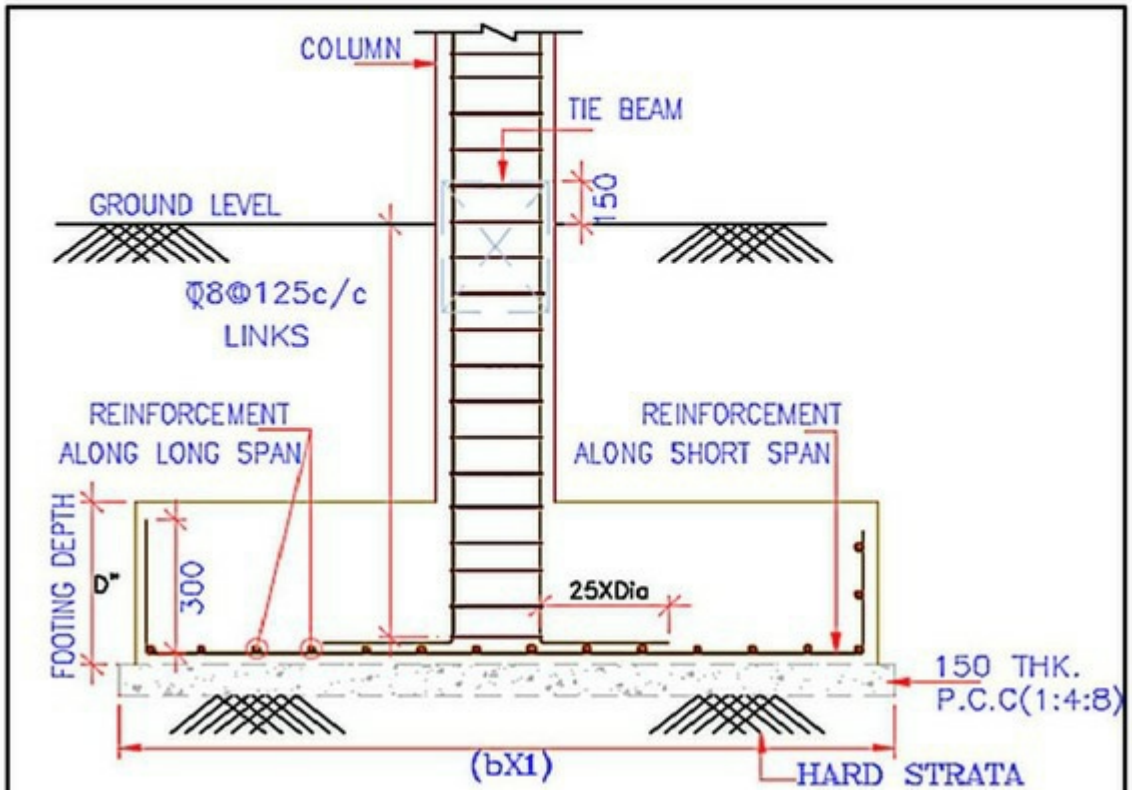
Figure 10.10: Arc length dimension

Figure 10.10: Arc length dimension

Have a look at video lecture 27 to learn about dimension options and examples.

Video 27: Dimensions

13.2 ADDING LAYERS TO THE BOX FOOTING



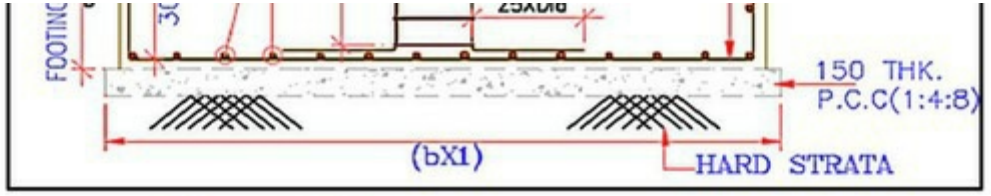


Figure 13.1: Box footing with layers

Have a look at video lecture 37 for putting layers in box footing drawing:

Video 37: Layer in Box footing

5. STARTING WITH BASIC SHAPES

Any AutoCAD component starts with basic shapes, like line, circle, arc, rectangle, polygon, etc. and then modified to make complex shapes as needed. In this section, we will learn how to make basic shapes.

5.1 LINE AND POLYLINE

You can find Drawing panel in the home tab as shown below in *figure 5.1*.

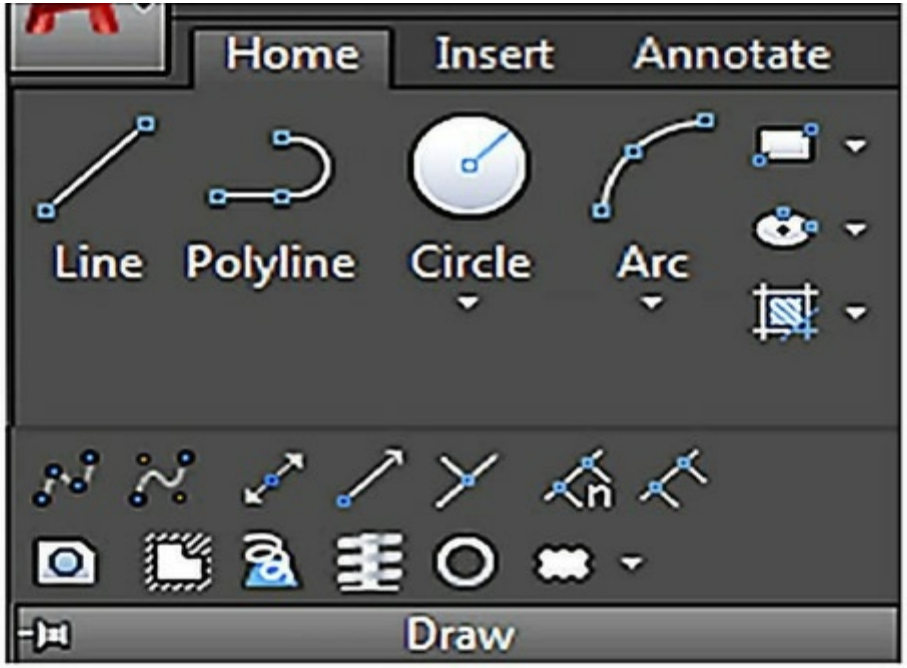


Figure 5.1: Draw panel

Using the trim command:

Give trim command [Tr] → press enter twice → press shift key → select object to extend

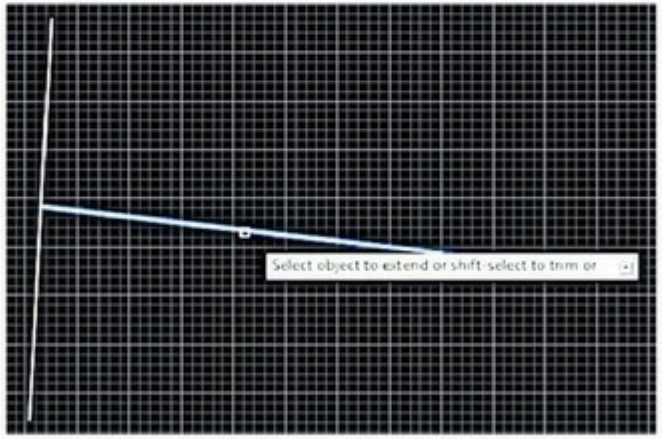


Figure 6.4: Extend

Figure 6.4: Extend

Important point: Trim needs intersecting edges or boundaries and Extend needs objects in the perpendicular plane.

Types of Dimensions:

Linear Dimension: gives a straight dimension

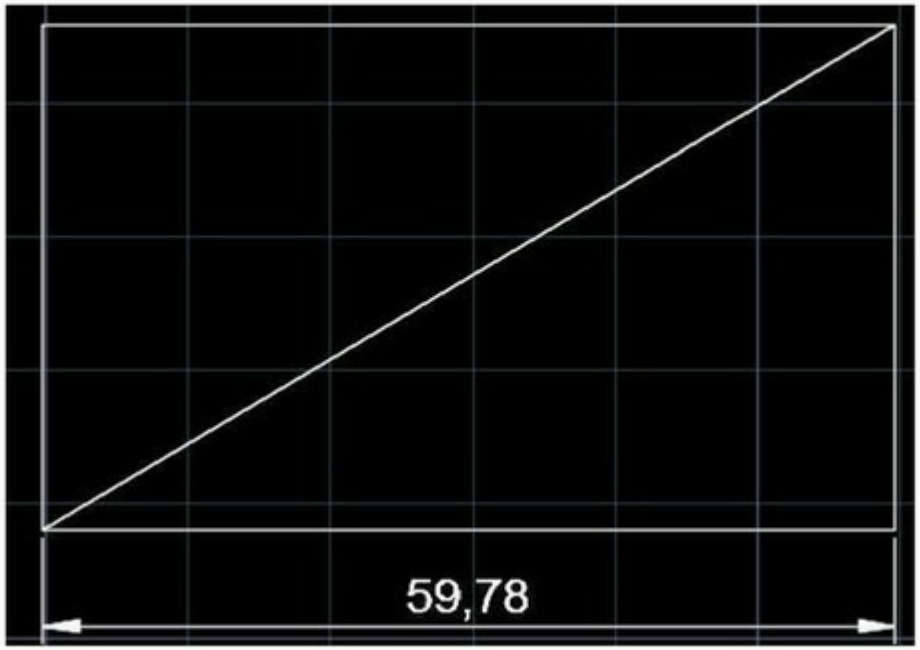


Figure 10.6: Linear dimension

Figure 10.6: Linear dimension

Aligned Dimension: gives a slant dimension

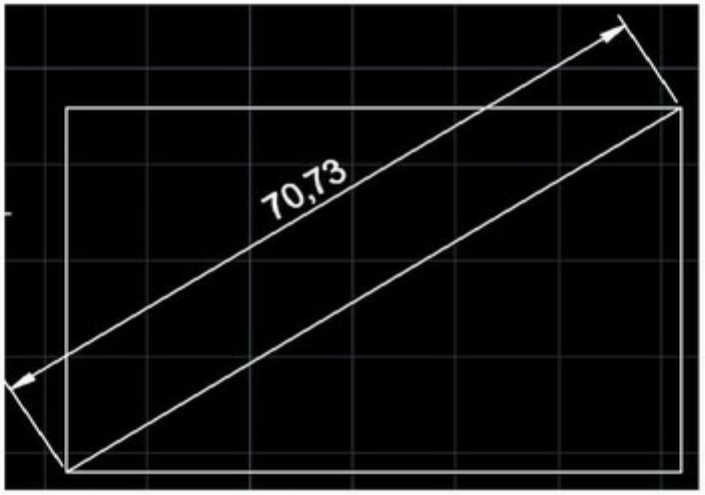


Figure 10.7: Aligned dimension

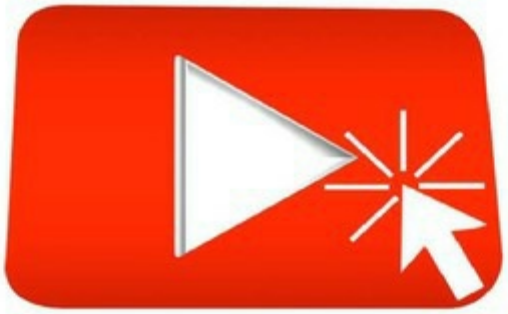
Note:

The file extension for drawing file is .dwg unless we change the default format. AutoCAD 2018 file is saved in 2013 version by default. We can save it in lower version to open the file in lower versions.

Now its time to begin our video lectures!

The first video, given below, will show you all the steps explained earlier. You may begin with a template of your choice, or go with the advice as given in the video lecture. Save your first drawing. To see the video lecture, double tap on the small

template of your choice, or go with the advice as given in the video lecture. Save your first drawing. To see the video lecture, double tap on the small video camera black icon in the center of the big icon to see the video.



Video 1: Initial screen and template

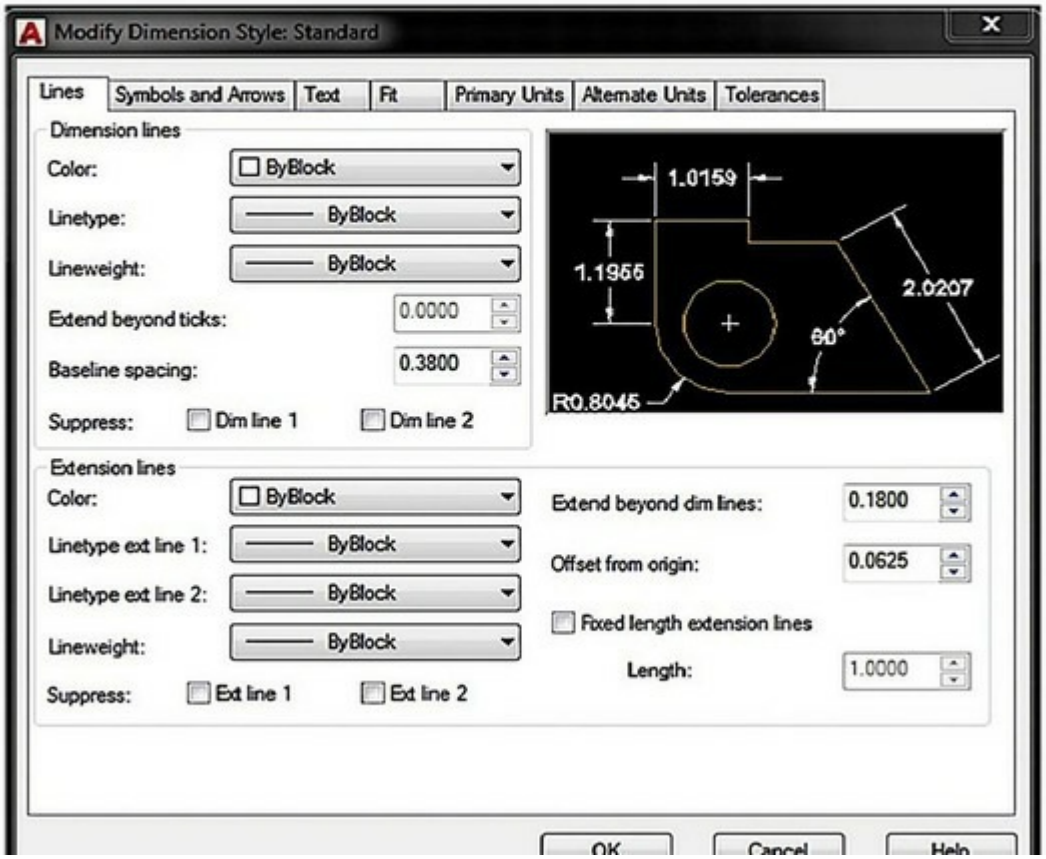


Figure 10.4: Dimension style window

Dimensions:

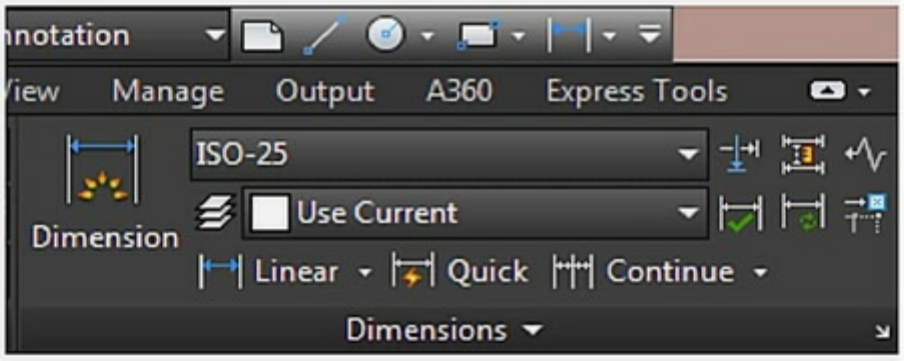


Figure 10.5: Dimension

3. From which direction does AutoCAD start measure angles?
   A. 3 O'clock
   B. 6 O'clock
   C. 9 O'clock
   D. 12 O'clock

4. Is 290 degrees same as -70 degree in AutoCAD?
   A. Yes
   B. No

5. Where should one concentrate while learning AutoCAD?
   A. Command bar

5. Where should one concentrate while learning AutoCAD?
   A. Command bar
   B. Status bar
   C. Ribbon
   D. QAT

6. Which is not a valid zoom option?
   A. Zoom Extent
   B. Zoom Previous
   C. Zoom Out
   D. Zoom Next

Tool Palette (Tp):

Using existing blocks from the tool palette

Press [CTRL+3] or [Tp] to open tool palettes. You will find multiple palettes arranged in the tool palette, e.g., annotation, construction, modeling, etc. From architecture palette, you can get readymade blocks like tree, car, door, etc. Double click on the blocks and specify the insertion point to insert these blocks in the drawing.

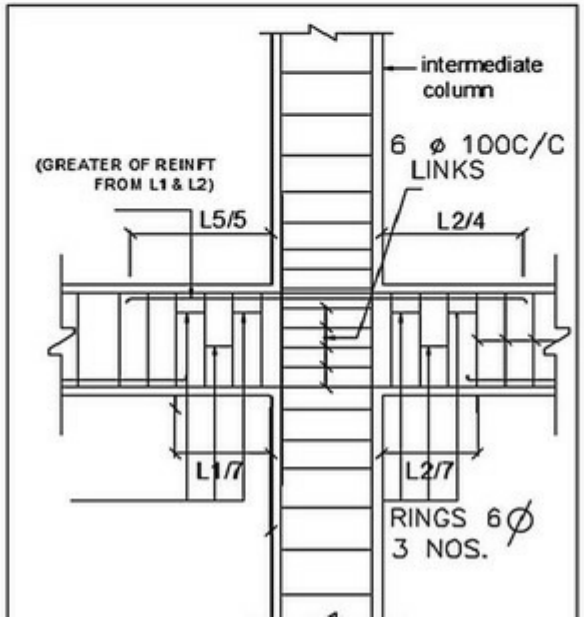
Look at figure 8.4, showing a portion of a tool

insertion point to insert these blocks in the drawing.

Look at figure 8.4, showing a portion of a tool palette along-with option for dynamic block appearance in the drawing.

Figure 8.4: Tool palette

12.4 TYPICAL DETAIL OF BEAM AND COLUMN JUNCTION AT THE INTERSECTION



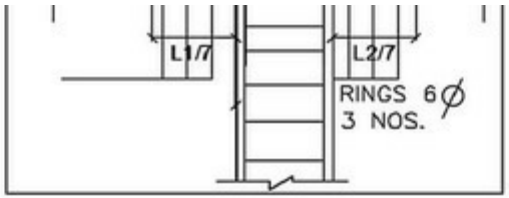


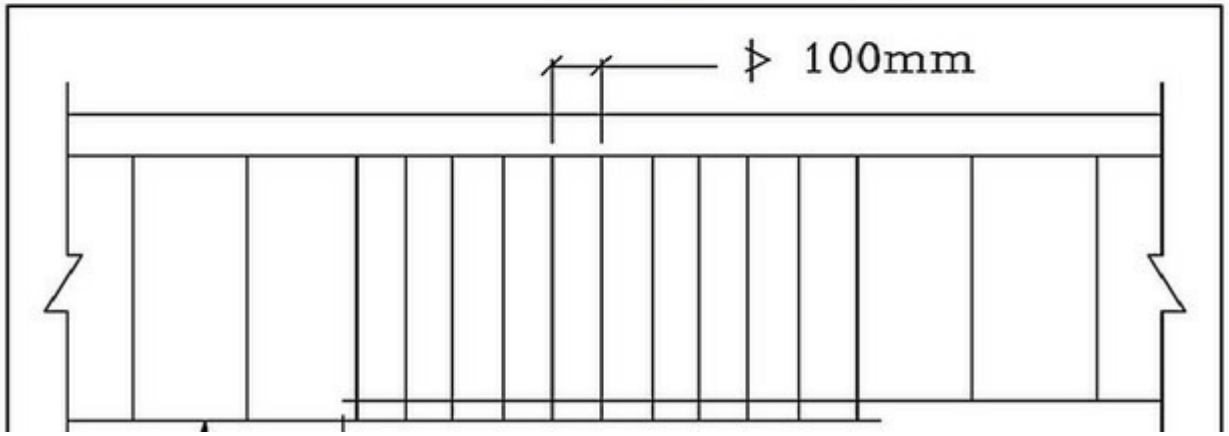
Figure 12.4: Column and beam junction at intersection

Have a look at video lecture 32 for details.

Video 32: Structure-beam and column junction at the intersection

- Typical detail of column reinforcement detail
- Typical detail of Box Footing
- Typical detail of Splicing column bars at the intermediate floor.

12.1 TYPICAL DETAIL OF LAP SPLICE IN BEAM AND COLUMN



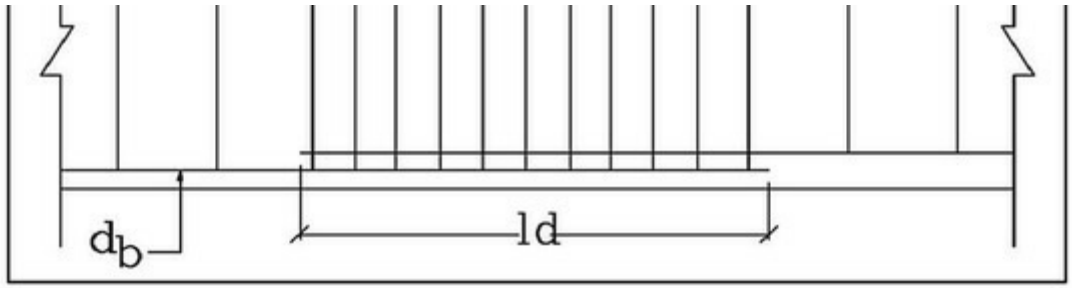


Figure 12.1: Lap splice

Have a look at video lecture 29 for details.

Video 29: Structure- lap splice

Elevations:

It includes front, rear, and both side views. It is necessary to give the civil structure it is exterior architectural styling, as shown in *figure 7.3*, given below:

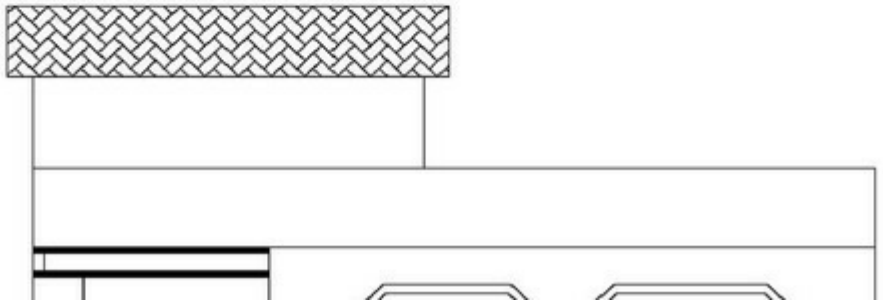


Figure 7.3: Elevation

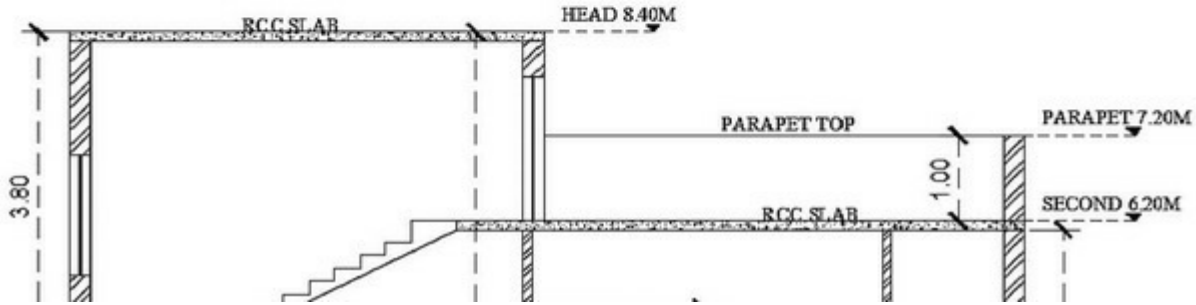
10.3 EXERCISES

Exercise 10.1: Estimated duration: 30 minutes

Add text and dimensions in plans created in exercises 9.1, 9.2, and 9.3.

Section:

It cuts through the civil structure. It describes how the building will be constructed and provides the details of internal finishing, as shown in *figure 7.4*, given below:



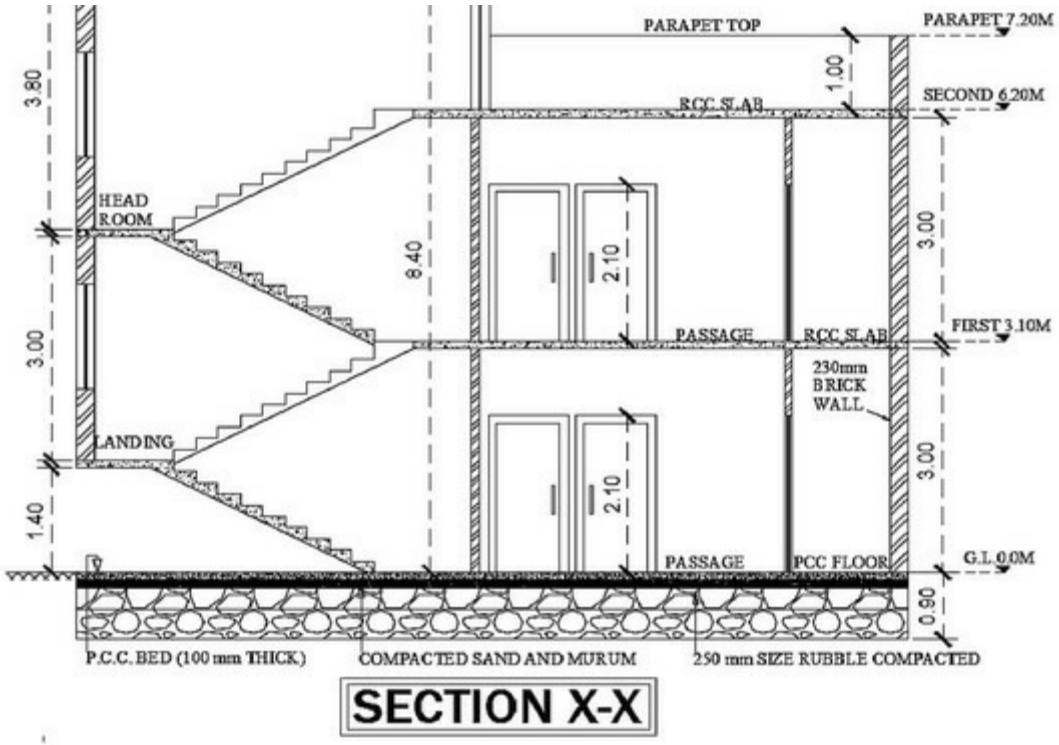


Figure 7.4: Section view

- **Multiline** – It is used to draw two parallel lines with the particular distance between them. Command ML → press Enter + Distance + Angle → press Enter

Ellipse

Command: Ellipse/EL → Specify center point → Distance of 1st axis → press Enter → Distance of 2nd axis

Spline

Distance of 2nd axis

Spline

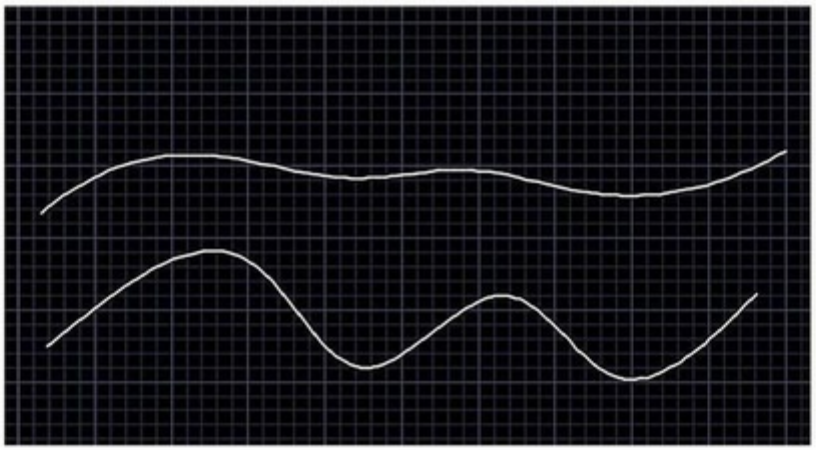


Figure A1: Spline samples

9. LAYERS AND HATCH

9.1 LAYERS

It allows grouping of the drawn objects in the different categories (like text, furniture, plumbing fixtures, door windows, etc.) based on similarities. You can control properties, like color, line weight, and line type of all objects together in a layer. Layer panel is available in home tab, as shown below in *figure 9.1*.

home tab, as shown below in *figure 9.1*.

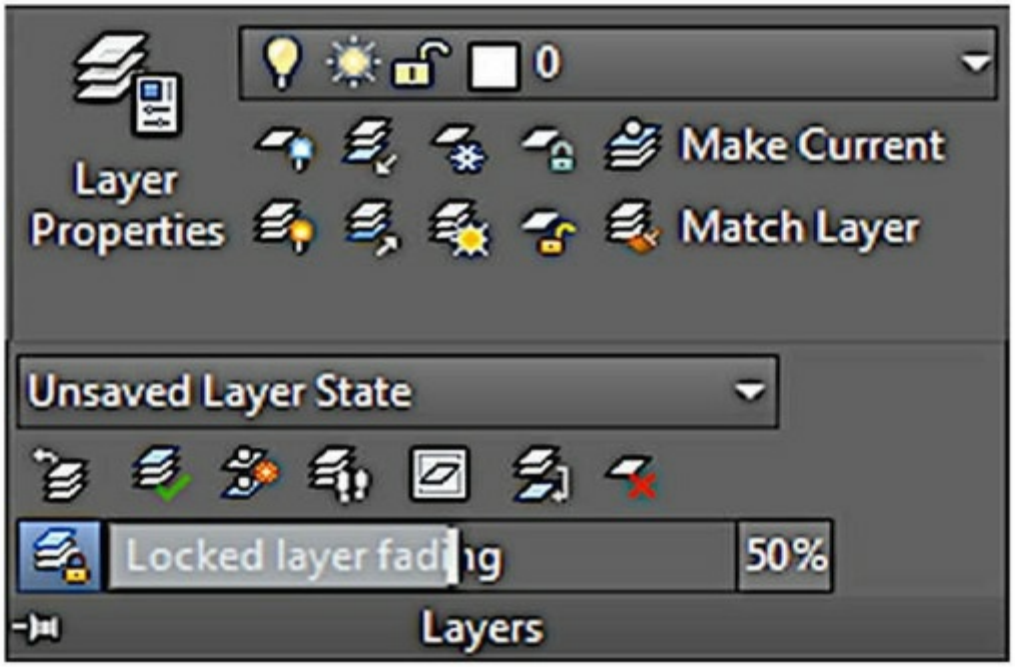


Figure 9.1: Layer panel

There are other advanced selection approaches available which you may like to explore. Below are few examples:

- **Polygon selection:** Instead of rectangular selection area, you may like to create a polygon to form a selection area. Here again you have options of window polygon or crossing polygon. Simply type WP for window polygon and CP for crossing polygon to have the fun.
- **Fence selection:** It is used when you want to select all elements on a path. Type F on the command line, press enter and start the fun.
- **Lasso selection (free hand)**: Even free hand region option is provided by AutoCAD to

select all elements on a path. Type P on the command line, press enter and start the fun.

- **Lasso selection (free hand)**: Even free hand region option is provided by AutoCAD to create your selection area. Simply click and keep mouse pressed and move around. If you move your cursor towards right direction then window lasso (blue) will be made and if you move your cursor left then crossing lasso (green) will be made.

There are many more options provide by AutoCAD. I would urge you to explore more when you are going for advanced learning. In this AppBook, we are limiting ourselves to basic drafting to start working on the AutoCAD.

6.1 MOVE AND COPY

Move [M]

Select object → Give move command [M] → Specify a first base point → Specify second displacement point.

Copy [Co]

Select object → Give copy command [Co] → Specify first base point to select the object to be copied → specify the second point where the object to be pasted.

Specify first base point to select the object to be copied → specify the second point where the object to be pasted.

Look at video lecture 15 for move and copy.

Video 15: Move and copy

10. TEXT AND DIMENSION

Text and dimensions are important tools used in detailing of the draft.

10.1 TEXT (TEXT PANEL IN ANNOTATE TAB)

Create Multiline Text

For longer notes and paragraph writing, use multiline text.

For longer notes and paragraph writing, use multiline text.

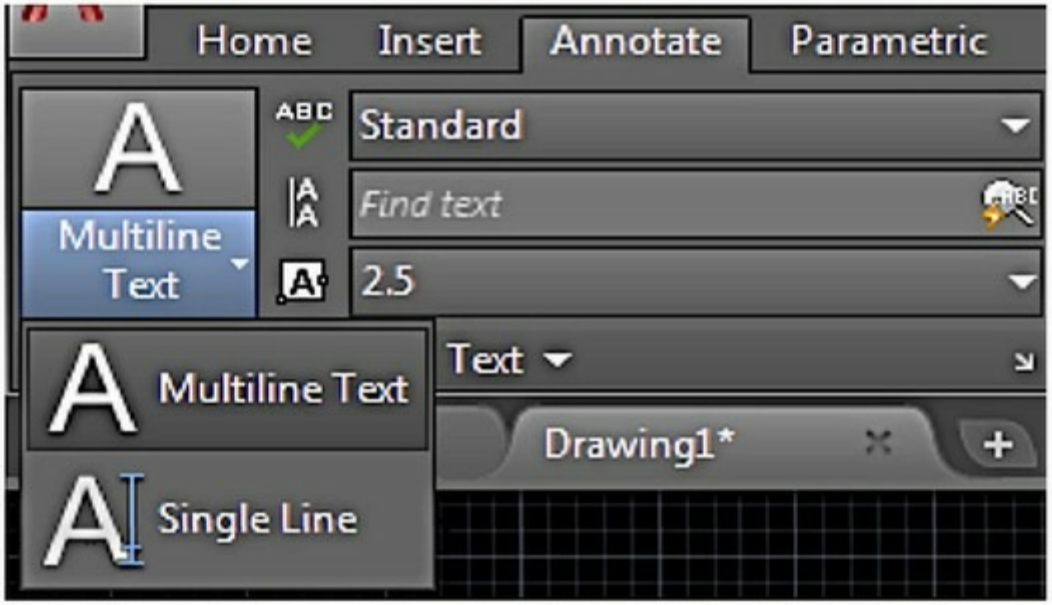
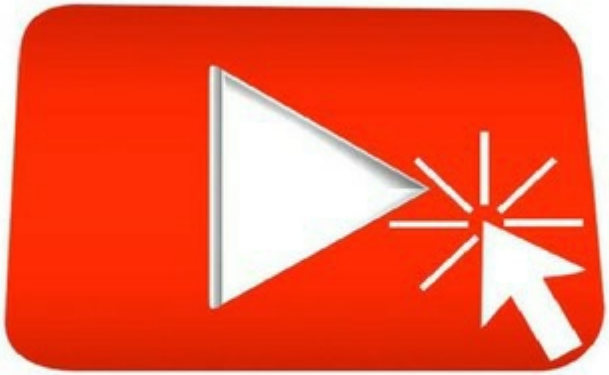


Figure 10.1: Text panel

Have a look at video lecture 22 to learn to create and to insert blocks



Video 22: Creating and inserting blocks

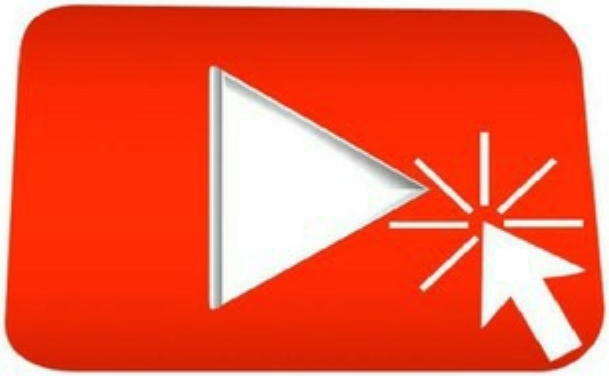
8.2 TOOL PALETTES AND DESIGN CENTER

These are placeholders for blocks, along with

CENTER

These are placeholders for blocks, along with multiple other reusable components. **Tool palette** contains dynamic blocks (whose dimension and views can be changed to fit in the drawing, for example, doors, windows, trees, vehicles, etc.). On another hand, **Design Center** contains blocks, whose dimension and views cannot be changed, for example, sofa, TV unit, Refrigerator, etc.) to be used in the drawing. Both are available in palette panel inside view tab.

Look at video lecture 13 for Rectangle and polygon.



Video 13: Rectangle and polygon

Look at video lecture 14 for applications of

Look at video lecture 14 for applications of circle, arc, and polygon.

Video 14: Application of circle, arc, and polygon

We are taking two objects, a rectangle and a circle, to apply Boolean operations. Boolean commands can be applied on region objects only.

Union

Provide command [UNI] → select the objects → press enter

→ press enter

Figure A3: Union

13. ADDING DETAILS TO STRUCTURAL AND FOUNDATION PLAN & PLOTTING

In this chapter, we will put text and layers to one of our drawing drawn in previous lectures and plot (print) the same.

13.1 ADDING TEXT TO THE BOX FOOTING

13.1 ADDING TEXT TO THE BOX FOOTING

Have a look at video lecture 36 for putting text in box footing drawing:

Video 36: Text in Box footing

A5 USING TABLE OPTIONS

Table option is provided to create tables in a very simple way to put any details, for example creating a schedule, you may like to insert in your drawing.

Navigation: Annotate tab → Table panel → Table style.

Navigation: Annotate tab → Table panel → Table style.

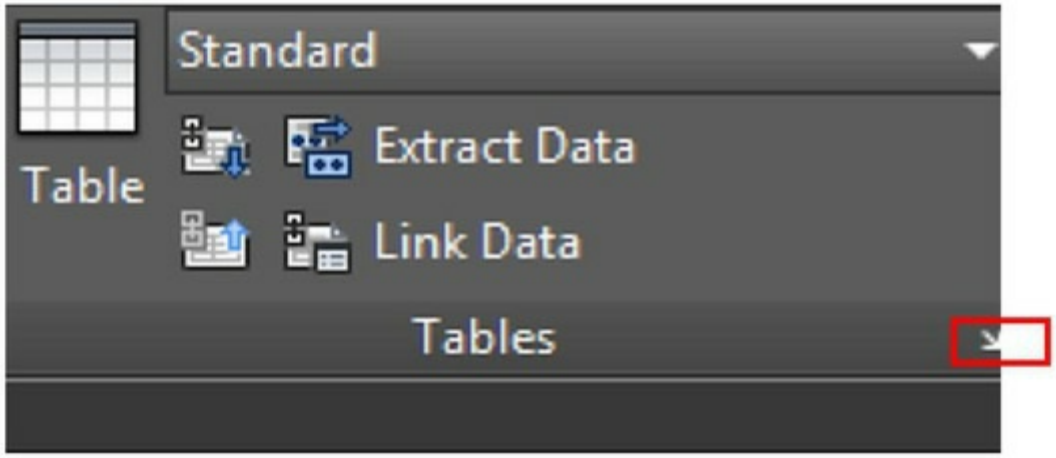


Figure A15: Table panel

6.2 MIRROR, ROTATE, AND SCALE

Mirror

Select object → give mirror command [Mi] → specify mirror line by providing two points (either using ortho or without ortho command) → Erase source object(y/n) – Yes to erase original and No to keep it.

Rotate

Select object → give a rotate command (Ro) →

Rotate

Select object → give a rotate command (Ro) → specify base point (around which you need to rotate the object. It can be on the border, inside the object or even outside the object for which you need an external point) → angle of rotation (anticlockwise from x-axis is considered positive angle).