



LANDMARK UNIVERSITY, OMU-ARAN

LECTURE NOTE: 3

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Course title: Computer-Aided Engineering Design and Analysis

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COMPUTER AIDED DRAFTING (PRACTICAL)

INTRODUCTION

Engineering drawing generally, deals with drawings. It is concerned with the geometrical representation of physical object used in engineering system or component design. Computer aided drafting on the other hand, is the application of computer techniques, with the aid of data processing systems, to present a graphical solution. It deals with the creation, storage and manipulation of models of objects and their pictures. The user generates graphics by interactive communication with the computer. Graphics are displayed on a video display and can be converted into hard copy with a plotter or printer. Computer Aided Drafting provides many benefits such as improved quality of design information, reduction in draughting errors, improved draughting productivity and proper staff utilization. There are many graphics software packages available for commercial purpose. Examples include AutoCAD, PRO, ArchiCAD, etc. Graphics package is a set of functions, which are called by the user in his application program to generate the drawings and pictures. AutoCAD has been developed to run on any micro-computer system with ease to use and as a result will be used in this work.

BEFORE YOU BEGIN.

Designing and drafting effectively with a computer requires a skilled CADD operator. To be a proficient AutoCAD user, you must have detailed knowledge of AutoCAD commands and processes and know which command and process is best suited for a specific task. You must also understand and be able to apply design and drafting systems and conventions when using AutoCAD.

As you begin your CADD training, develop effective methods for managing your work.

First, plan your *drawing sessions* thoroughly to organize your thoughts.

Second, learn and use industry, classroom, or office standards.

Third, save your work often. If you follow these procedures, you will find it easier to use AutoCAD commands and methods, and your drawing experience will be more productive and enjoyable.

EQUIPMENT REQUIRED FOR COMPUTER AIDED DRAFTING

Computer aided graphics systems are made up of three major components. They are the draughtsman, hardware and software. The physical components of a computer are called the hardware. They include computer terminal, input devices and output devices. Software is the

draughtsman's instructions to the computer while the draughtsman is the person who supplies information to the computer via commands to generate the drawings.

COMPUTER

Computers are classified based on size as main frames, mini-computers and microcomputers. They are used to execute instructions received through the input devices from the user and then produce the desired output.

TERMINAL

It consists of keyboard, cathode ray tube and inter-connections with the computer. The terminal allows the user to communicate effectively with the system.

KEYBOARD

Keyboard normally contains many functional keys. This permits communication through a set of alphanumeric and functional keys.

CATHODE RAY TUBE (CRT)

A CRT is a video display device, consisting of a phosphor coated screen and electron gun. The electron gun throws a beam and sweeps-out raster lines on the screen. Each raster line consists of a number of dots called pixels. By turning the pixels on and off, the images are generated on the screen. One measure of quality of picture produced on the screen is resolution and for good quality of graphics to be drawn, high-resolution screens are used.

PLOTTERS

Plotter is used to make drawing as instructed by the computer. Flat bed plotters and drum type plotters are commonly used. Both black and white and colour graphics can be made by the use of different pens.

PRINTERS

Ink jet and laser printers are most commonly used. They can print on A4 paper size. The print quality is very good and both line sketches and photographs can be printed. For the purpose of desktop publication, these printers are recommended.

DIGITIZERS

This involves scanning a drawing by placing it on digitizer and then converts the picture to a digital form, based on the x , y co-ordinates of individual points. These drawings can also be stored for later use or corrected/modified. Thus, a digitizer is a graphics input device to the computer for display, storage or modification of drawings.

LOCATORS AND SELECTORS

These devices enable the user to interact with the computer with ease. The locators give the position information. The computer receives the co-ordinates of a point from a locator. The examples are thumb wheels, joystick, mouse, track balls, etc. The selectors are used to pick a particular object, but no information is provided about its screen position, e.g light pen.

FUNDAMENTALS OF OPERATING SYSTEM

Operating system belongs to the class of system software. An operating system is a set of programs designed to manage the entire operations of computer system. Some examples are window XP, window Vista, windows 7, window 8 etc. Basically the operating system performs two fundamental tasks for the computer:

(i) Managerial task

(ii) Interface task

The operating system does not do any specific task, but it is a general program which assists the user by doing the following operations:

- i. Controlling all the operations including input/output operations, arithmetic operations and internal transfer of information.
- ii. Communicating with peripheral devices (printer, disk and tape device).
- iii. Supporting the running of other software.

DISPLAY TECHNOLOGY

In co-ordinate geometry, a line segment consists of infinite number of points whereas in computer graphics a line segment has a finite number of points. The entire screen resembles a two dimensional array of points. These points are represented by their x and y co-ordinates. The value of x increases from left to right and y increases from bottom to top. Displays have been built with as many as 4096×4096 points and with as few as 256×256 . The particular points, which lie on the line segment selected, are displayed with the required intensity. This means that they cannot be positioned with infinite precision.

PLOTTING THE DRAWINGS

AutoCAD drawing may be plotted either by a pen plotter or a printer plotter. Pen plotters are very accurate and multiple colours may be obtained. Printer plotters have limited resolution and smaller paper sizes and produce monochrome output. However, printer plotters are usually faster than pen plotters. For pen plotter, PLOT command is used, whereas for a printer plotter, PRPLOT command is used.

Beginning a plot from the main menu, tell AutoCAD, which portion of the drawing to be plotted. Specify the part of the drawing to be plotted by entering: Display, Extents, Limits, View or window: the response specifies a rectangular area of the drawing.

By Specifying:

D (Display) — this option plots the view that was displayed in the current view port just prior to the last SAVE or END command for that drawing.

E (Extents) — this option is similar to ZOOM extents. The extents are updated automatically as one draws new entities.

L (Limits) — plots the entire drawing area as defined by the drawing limits.

V (View) — plots a view that was previously saved, using the drawing editor's view command.

W (Window) — plots any portion of the drawing. Specify the lower left corner and upper right corner of the area to be plotted.

Computer-aided design and drafting (CADD) is the process of using a computer with CADD software to design and produce drawings and models according to specific industry and company standards. The terms computer-aided design (CAD) and computer-aided drafting (CAD) refer to specific aspects of the CADD process. This section introduces the AutoCAD CADD system. You will begin working with AutoCAD and learn to control the AutoCAD environment.

AutoCAD Applications

AutoCAD *commands* and *options* allow you to draw objects of any size or shape. Use AutoCAD to prepare two-dimensional (2D) drawings, three-dimensional (3D) models, and animations. AutoCAD is a universal CADD software program that applies to any drafting, design, or engineering discipline. For example, use AutoCAD to design and document mechanical parts and assemblies, architectural buildings, civil and structural engineering projects, and electronics.

2D Drawings

2D drawings display object length and width, width and height, or height and length in a flat (2D) form. 2D drawings are the established design and drafting format and are common in all engineering and architectural industries and related disciplines. A complete 2D drawing typically includes dimensions, notes, and symbols that describe view features and information. This practice results in a document used to manufacture or construct a product. 2D drawings are the conventional and often required method of communicating a project. Figure 1-1 shows an example of a 2D architectural floor plan created using AutoCAD.

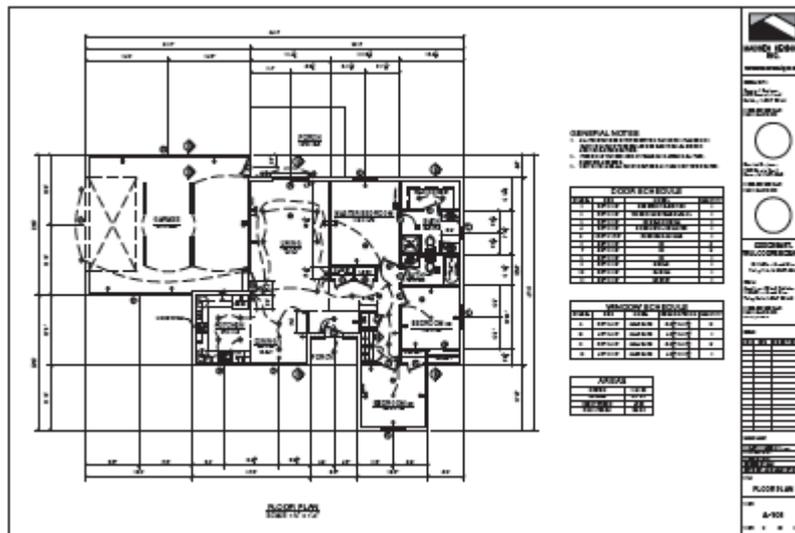
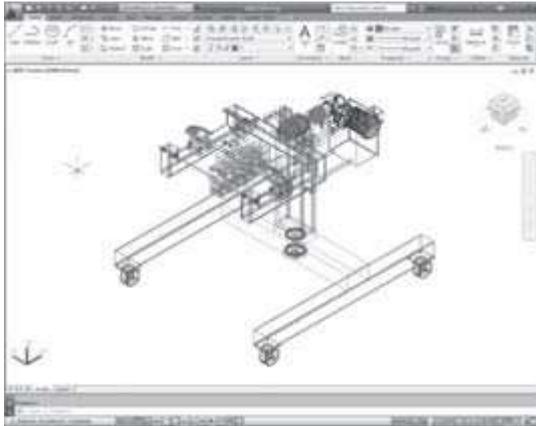


Figure 1-1.

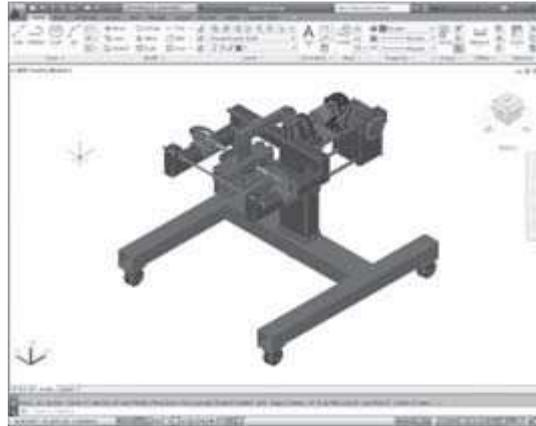
AutoCAD provides commands and options to accurately create 2D drawings for building design and construction, such as this architectural floor plan of a home.

3D Models

3D models allow for advanced visualization, simulation, and analysis typically not possible with 2D drawings. AutoCAD provides commands and options for developing *wireframe*, *surface*, and *solid models*. An accurate solid model is an exact digital representation of a product. Add color, lighting, and texture to display a realistic view of the model. See Figure 1-2A. Use view tools to view the model from any angle. See Figure 1-2B. Apply animation to a model to show product design or function. For example, you can perform a *walkthrough* of a model home or a *flythrough* of a model civil engineering project. *AutoCAD and Its Applications—Advanced* provides detailed instruction on 3D modeling and rendering.



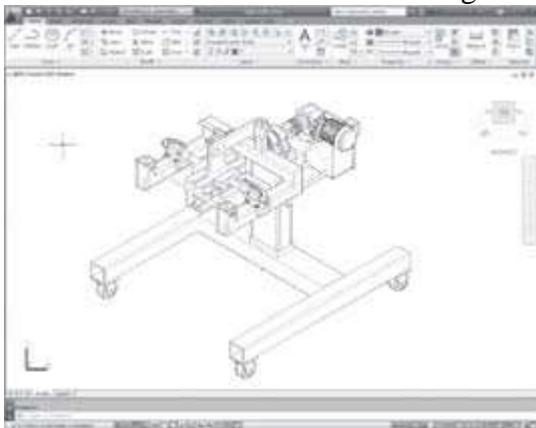
Wireframe Visual Style



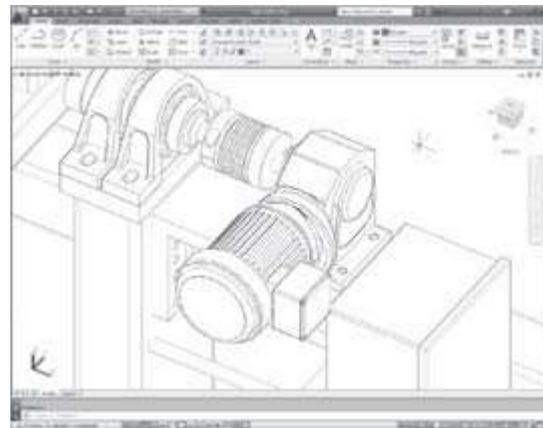
Realistic Visual Style

(A)

Figure 1-2.



Hidden Visual Style,
Zoomed to Model Extents



Alternate View Angle,
Zoomed to Specific Area

(B)

Figure 1-2.

A 3D AutoCAD model of a mechanical assembly. A—A wireframe visual style (left) and a realistic visual style with color, lighting, and texture (right). B—A hidden visual display style (left) and the same display viewed at an alternate angle and zoomed in (right).

AutoCAD DRAUGHTING AND MODEL

AutoCAD provides a set of entities use for geometrical construction of engineering drawings. An entity is a drawing element such as a line, circle, dimensions, cross-hatching, layers, etc. By typing a command on the keyboard or selecting it from a menu, the entity can be drawn. Parameters should be supplied for the chosen entity in response to the prompts on the screen. The entity is then drawn and appears on the screen. The effect of every change made appears on the screen immediately. These entities may be erased or moved or copied to form repeated patterns. The information about the drawing also may be displayed.

TYPES OF MODEL

Geometrical models provide means of representing component geometry in graphical form. This constitutes the most important and complex part, in many software packages. There are two main types of models available in the industry for the variety of functions. They are 2D and 3D models.

TWO DIMENSIONAL MODELS (2D)

Objects are represented by a number of lines with their end point co-ordinate (x,y). These consist of physical object drawn in orthographic projection. A 2D model is used to develop

basically the outline of a part, which in most cases is composed of lines and circles as shown in Fig.2.0. This is the easiest and most popular way to model simple parts or systems. They are easy to understand.

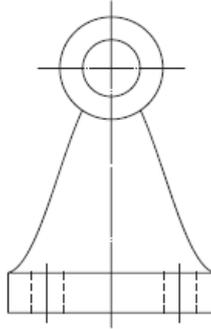


Fig 2.0

Guidelines

For 2D Drafting

- (i) Geometry should be drawn accurately and at full size.
- (ii) One should ensure there is no duplication or superposition of geometry.
- (iii) Lines should not be inadvertently segmented.
- (iv) More space should be left for dimension compared to drawings obtained using hand.

THREE DIMENSIONAL MODELS (3D)

In 3D, the object is completely represented by a number of lines with their end point coordinates (x, y, z) and their connectivity relationships. 3D could be in form of wire frame or surface or solid. Example of 3D representing is shown in Fig. 2.1.

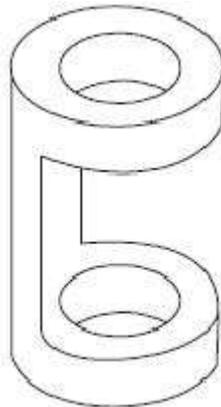


Fig. 2.1

STARTING AUTOCAD

AutoCAD can be started by double-clicking on the AutoCAD icon available on the desktop of the computer. The various components of the initial AutoCAD screen are as shown in Fig. 3.0 and Fig. 3.1 consisting of the following:



Fig. 3.0

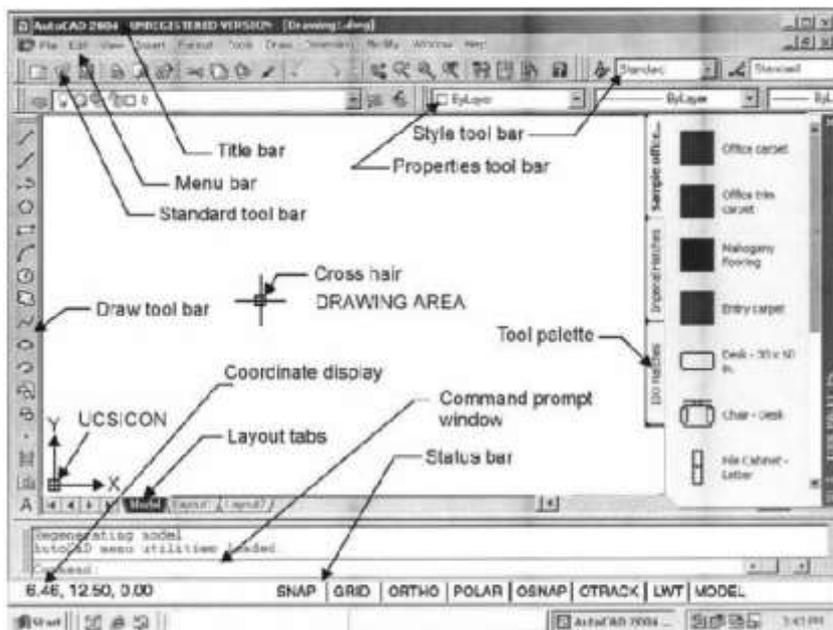


Fig.3.1

Welcome Screen

The Welcome Screen appears by *default* when you first launch AutoCAD. See Figure 3.2. The Welcome Screen provides access to AutoCAD resources online, including the AutoCAD help system. The Work column includes options for beginning a new drawing or opening a saved file. The Learn column provides access to online AutoCAD learning tools developed by Autodesk. The Extend column offers links to additional AutoCAD and Autodesk resources online. Deselect the Display at Startup

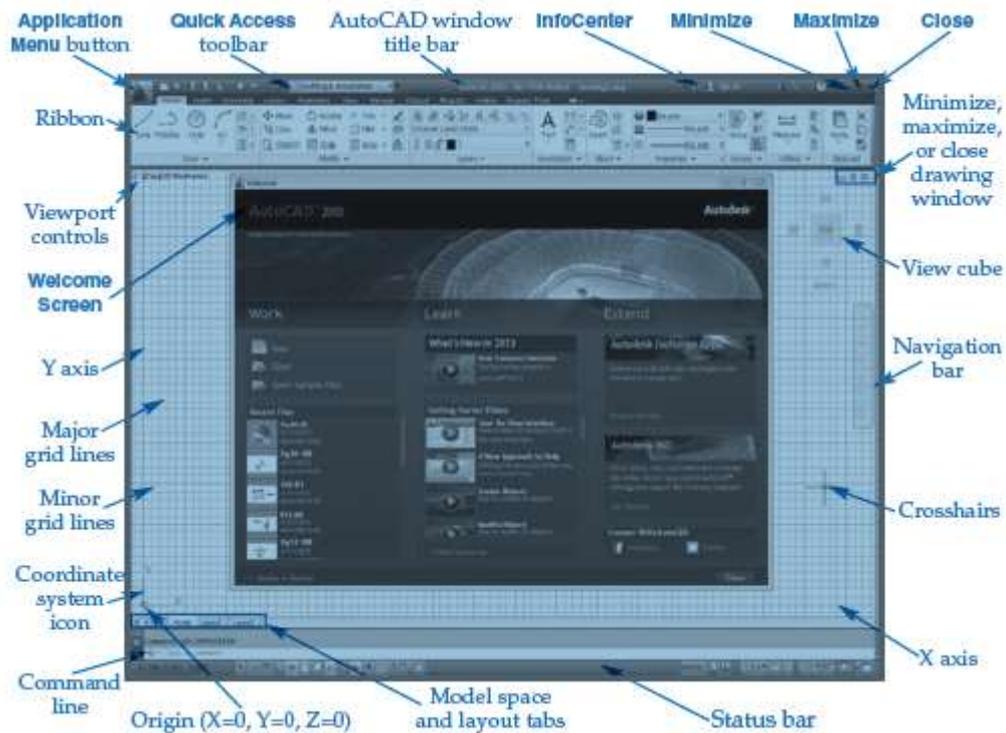


Fig. 3.2: The default AutoCAD window with the Drafting & Annotation workspace active.

1. **Drawing Area:** The drawing area covers a major portion of the screen. Various objects can be drawn in this region by the use of AutoCAD commands. The position of the pointing device is represented on the screen by the cursor. On the lower left corner, a coordinate system icon is present. On the top right corner, standard windows buttons are also available.
 2. **Command Window:** At the bottom of the drawings area, command window is present and commands can be entered by keyboard.
 3. **Status Bar:** At the bottom of the screen, status bar is displayed, which will make it easy to change the status of some AutoCAD functions by proper selection.
 4. **Standard Tool Bar:** Standard tool bar displays coordinates and they will change only when a point is specified. The absolute coordinates of the cursor will be specified with respect to the origin.
 5. **Snap:** Snap mode allows the cursor to be moved in specified/fixed increments.
 6. **Grid** By choosing this button, grid lines are displayed on the screen and can be used as reference lines to draw AutoCAD objects.
 7. **Ortho:** By selecting the orthomode, lines can be drawn only at right angles on the screen.
 8. **Polar:** The movement of the cursor is restricted along a path based on the angle set as the polar angle. One can use either polar mode or orthomode only at a particular time.
- After starting AutoCAD, operation can be performed with the cursor in the drawing area by invoking commands. The following methods are provided to invoke the commands:
1. **Keyboard:** Using keyboard, command name can be typed at the command prompt and by pressing ENTER or SPACE BAR, the command can be invoked.
 2. **Menu:** The menu bar is at the top of the screen which displays the menu bar titles. As the cursor is moved over this, various titles are highlighted and by means of pick button, a desired item can be chosen. Once it is selected, the corresponding menu is displayed directly under the title. A command can be invoked by picking from this (Fig. 3.3a).
 3. **Draw Toolbar:** This is an easy and convenient way to invoke a command. This is displayed on the left extreme of the initial AutoCAD screen (Fig. 3.3b) and very easy to choose by picking.

4. **Tool Palettes:** These are shown on the right side of the monitor screen (Fig. 3.1). By default, AutoCAD displays the tool palettes on the right of the drawing area. Various hatching patterns also can be selected from this.

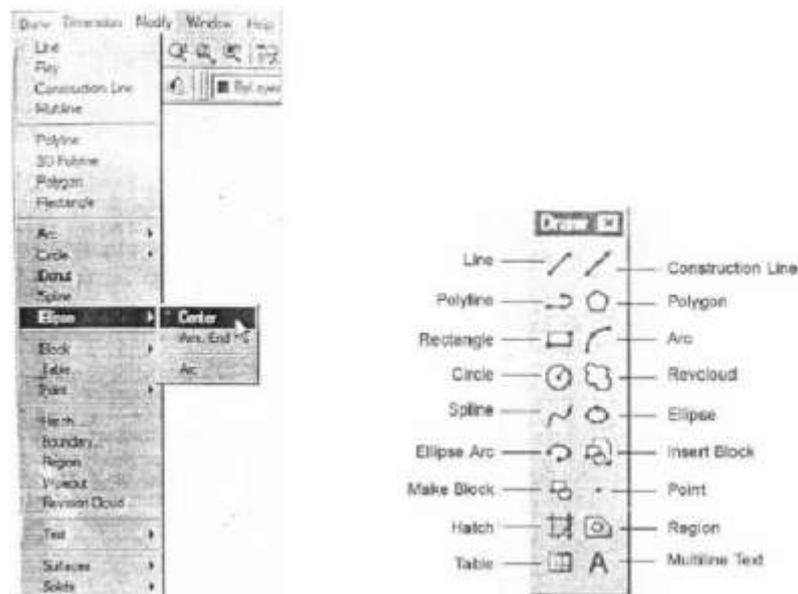


Fig 3.3 (a) Invoking ellipse (b) Draw toolbar

Interactive Techniques

Developing drawing by AutoCAD is done by interactive technique, so that it is easy to follow and achieve the results. The popular interactive techniques are layers, drawing insertion, object snap, zooming, panning, plan view and 3D views, view ports, resolution, editing the drawing, etc. The layer allows the user to view and plot-related aspects of a drawing separately or in any combination. In drawing insertion, a drawing can be stored in a drawing file and this may be inserted in subsequent drawings for any number of copies. To refer to geometric features of existing objects when entering points, the object snap may be used. The visual image of the drawing on the screen may be magnified or shrunk by zooming. Panning allows viewing different portions of the drawing, without changing the magnification. The graphics area of the screen can be divided into several view ports, each displaying a different view of the drawing. Physical resolution refers to the amount of detail that can be represented. This resolution can be changed at any time. The editing facilities of AutoCAD make it easy to correct or revise a drawing. Multiple copies of an object, arranged in rectangular or circular patterns are easy to create.

PLANNING FOR DRAWING

Co-ordinate System

The system used by all CAD packages is generally the rectangular cartesian co-ordinate system designated as x , y and z axes. The positive direction of these axes follows the right hand rule. Any point in space can therefore be designated by the co-ordinate values of these 3 axes namely, x , y and z .

The co-ordinates can be input into the system by:

- (i) The direct input of co-ordinate values in the respective order of x , y and z . If z coordinate is not mentioned, then the values are assumed to be at a single given level.
- (ii) Specifying the co-ordinates in an incremental format from the current cursor position in the drawing area. The distance is specified by using @ parameter before the actual values. The incremental values apply to all the ordinates.

(iii) Point co-ordinates may also be specified using the polar co-ordinate format. It can also be an extension of the incremental format.

(iv) Using the mouse button, the cursor may be taken to the required position and the button is clicked.

Geometric Commands

One can make simple drawing in AutoCAD by choosing basic command required for calling various entities. The Different entities that can be used for making an AutoCAD drawing in 2D are: point, line, ellipse, polygon, rectangle, arc, circle, etc. AutoCAD provides a default option as < > in each of the command response. The various options available for each command are shown in the command window. But the user need to respond by choosing one letter in most cases, which makes the AutoCAD choose the right option.

Drawing Point

The point command locates a point in the drawing. A point is placed at the given location (i.e 10, 15). After setting the limits of the drawing, the following drawing tools can be used to locate specific points on the screen.

ORTHO Command—this is orthogonal drawing mode. This command constrains the lines drawn in horizontal and vertical direction only.

Command: ORTHO ON/OFF <current>:

SNAP Command—this command is used to set increments for cursor movement. If the screen is on SNAP mode, the cursor jumps from point to point only. The cursor movement can be effectively controlled using the SNAP command.

Command: SNAP

Snap spacing or ON/OFF/Aspect/Locate/Style <current>: 0.1 (default)

GRID Command-working on a plain drawing area is difficult since there is no means for the user to understand the relative positions or straightness of the various objects made in the drawing. The command enables to draw dotted lines on the screen at pre-defined spacing. These lines will act as graph for reference lines in the drawing. The grid spacing can be changed at will. The grid dots do not become part of the drawing.

Command: GRID

Grid spacing or ON/OFF/Snap/Aspect <0>: 0.5 (default)

SAVE Command—AutoCAD provides the following commands to save the drawing on the system:

SAVE SAVEAS QSAVE

Command: SAVE

Save drawing as <current name>

Drawing Line

Lines can be constrained to horizontal/ vertical by the ORTHO commands. CLOSE option uses the starting point of the first line segment in the current LINE command as the next point.

1. Lines can be drawn using co-ordinate system (rectangular cartesian co-ordinates). To draw a rectangle (Fig. 4.0a):

Command: LINE

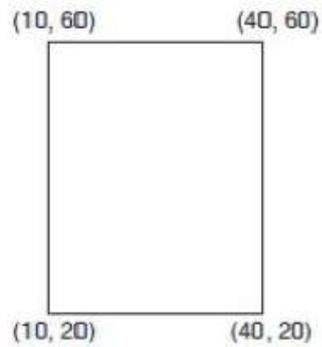
From point: 10, 20 ↵

To point: 40, 20 ↵

To point: 40, 60 ↵

To point: 10, 60 ↵

To point: ↵



(a)

2. It is also possible to specify the co-ordinates in the incremental format as the distances from the current cursor position in the drawing area. The distance is specified by using the @ parameter before the actual value. To construct a triangle of given altitude (30) and base (40) (Fig. 4.0b):

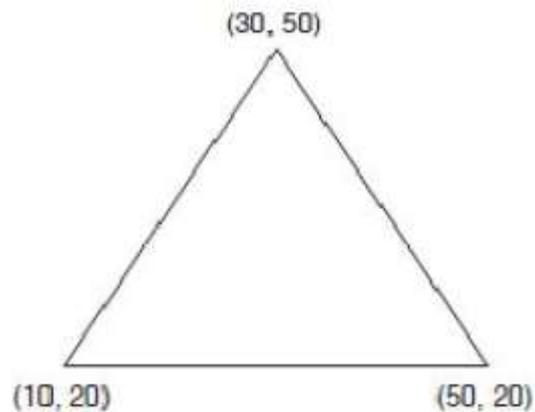
Command: LINE

From Point: 10, 20 ↵

To point: @ 40, 0 ↵

To point: @ -20, 30 ↵

To point: ↵



(b)

3. It is also possible to specify the point co-ordinate using the polar co-ordinate format. To construct a hexagon (Fig. 4.0c) of side 30:

Command: LINE

From point: 10, 20 ↵ (A)

To point: @ 30<0 ↵ (B)

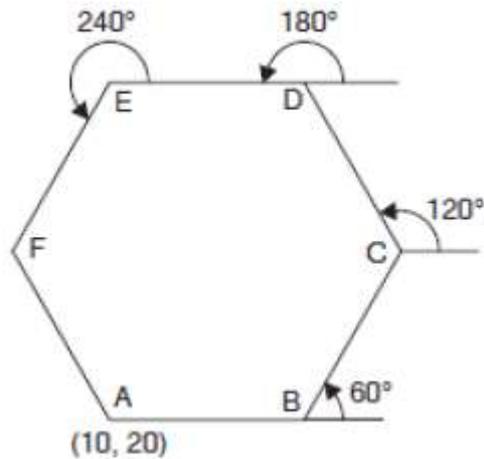
To point: @ 30<60 ↵ (C)

To point: @ 30<120 ↵ (D)

To point: @ 30<180 ↵ (E)

To point: @ 30<240 ↵ (F)

To point: close



(c)

Fig 4.0c

Drawing Ellipse

This command allows one to draw ellipses. The methods available for making ellipses are:

1. By means of axis end points: (Fig. 4.1a)

Command: ELLIPSE <axis end point 1>/ center: point ↵

Axis end point 2: (point)

<other axis distance>/ Rotation:

Now, if the distance is entered, AutoCAD interprets it as half the length of the other axis.

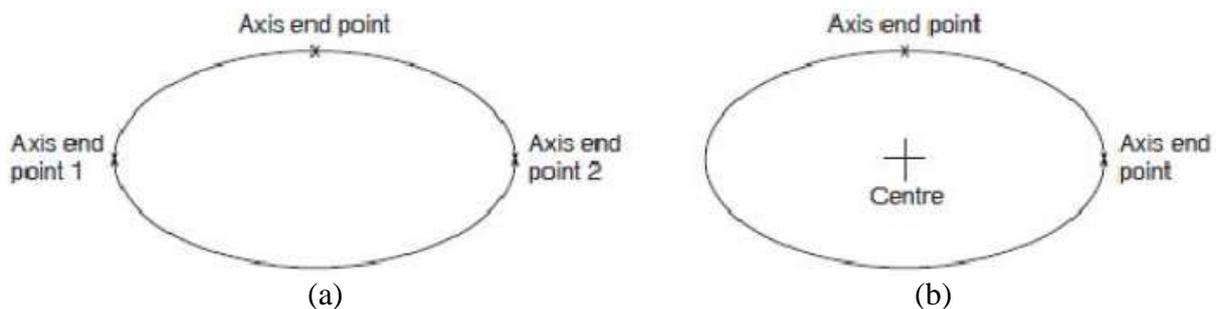


Fig 4.1

2. By means of centre, axis end points (Fig. 4.1b)

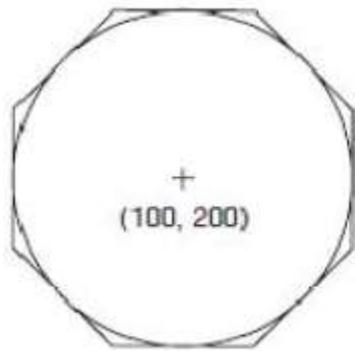
Command: ELLIPSE <axis end point 1>/ centre: C ↵

Centre point and one end point of each axis should be provided for the response of the AutoCAD.

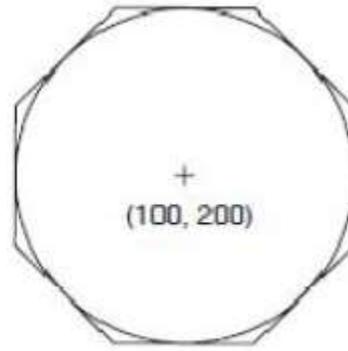
Drawing Polygon

This option allows us to draw polygons from 3 to 24 sides in a number of ways:

1. Making inscribed/circumscribed polygon with a side parallel to x-axis: (Fig. 4.2a, b)



(a) Inscribed



(b) Circumscribed

Fig. 4.2

Command: POLYGON

Number of sides: 8

Edge/ <centre of polygon>: 100, 200 ↵

Inscribed / circumscribed about a circle (I/C): I or C ↵

Radius of circle: 80

2. Using edge option, specifying the size of the edge and orientation: (Fig. 4.3)

Command: POLYGON

Number of sides: 7

Edge/<center of polygon>: E ↵

First end point of edge: 15, 15 ↵

Second end point of edge: 15, 30 ↵

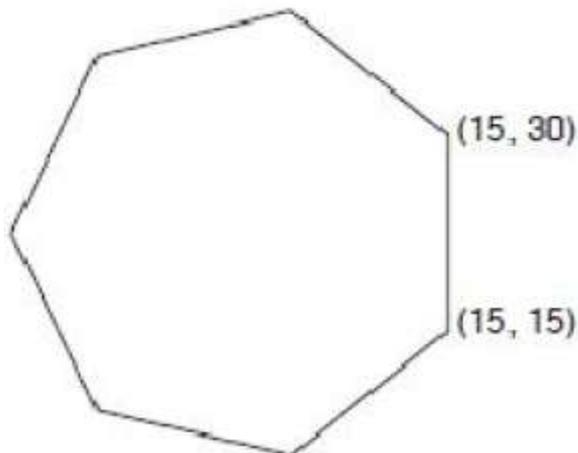


Fig 4.3

The above and various other entities that can be used for making an AutoCAD drawing may also be selected from the tool bar.

Drawing Rectangle

A rectangle is a polygon based on two opposite corner points known as diagonal points (Fig 4.).

Command: RECTANGLE

First corner: 10, 15 ↵

Second corner: 60, 50 ↵

Or from the tool bar menu icon, the pointing device can drag the rectangle and the rectangle can be completed.



Fig.4

Drawing Circle

Circle command offers several methods for drawing circles, the default being to choose a centre point and enter or pick a diameter or radius (Fig. 5).

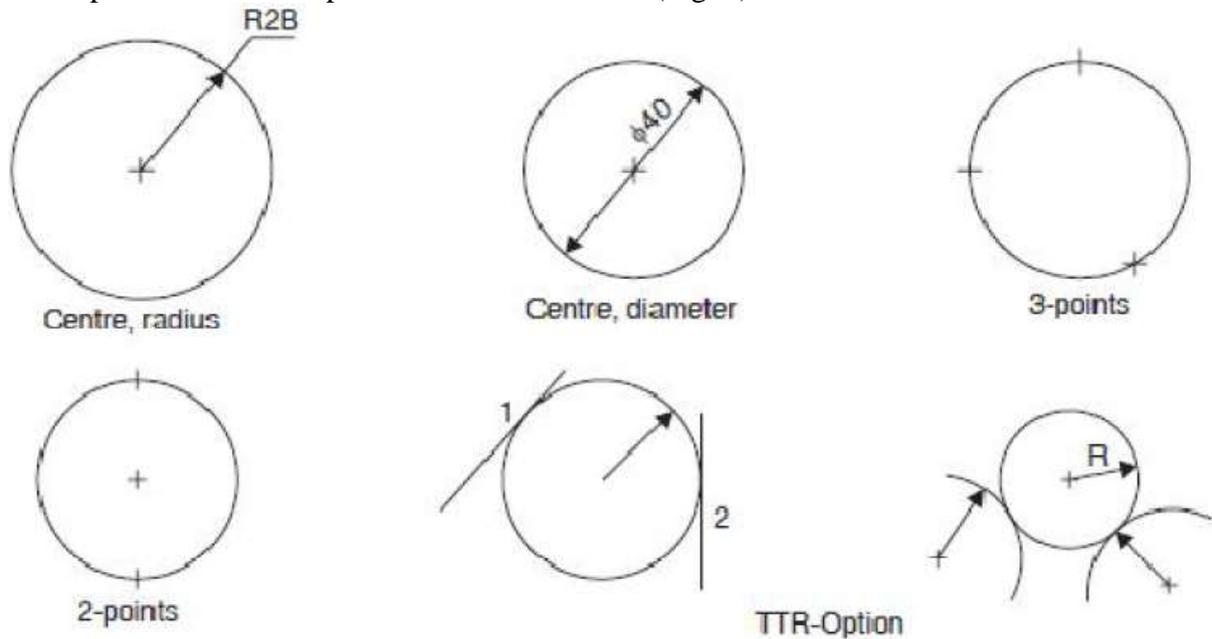


Fig. 5

1. 3P/ 2P/ TTR/ <centre point>:
Pick a centre point or enter an option
2. Diameter/ <Radius><current default>: select D or R

3. 3P (3 point) option: one is prompted for a first, second and third point. The circle will be drawn to pass through these points.
4. 2p (2 point) option: one is prompted for the selection of two points which form the opposite ends of the diameter.
5. TTR option: allows one to define a circle based on two tangent points and a radius. The tangent points can be on lines, arcs or circles.

Drawing Arc

Arc command permits arc to be drawn using various methods.

Command: ARC

1. Centre/ <start point>: pick a start point using mouse or select C for more options.
2. Centre/End/ <second point>: pick a second point of the arc or select C, if option is C.
3. Angle/length of chord/end point: pick end point of the arc, if option is E.
4. Angle/Direction/Radius/ <centre point>: pick end point of the arc or specify the option.

Options (Fig. 6)

Angle — “included angle” prompt appears, to enter the value.

Centre — enter the location of an arc’s centre point-at the prompt centre-pick a point,

Direction — enter a tangent direction from the starting point of an arc. At this prompt, pick a point with cursor.

End — at this prompt, pick the end point of the arc.

Length — enter the length of a arc’s chord. At this prompt, enter a length or drag and pick a length with cursor.

Radius — at the prompt “radius”, enter a radius value.

Start point — enter the beginning point of an arc.

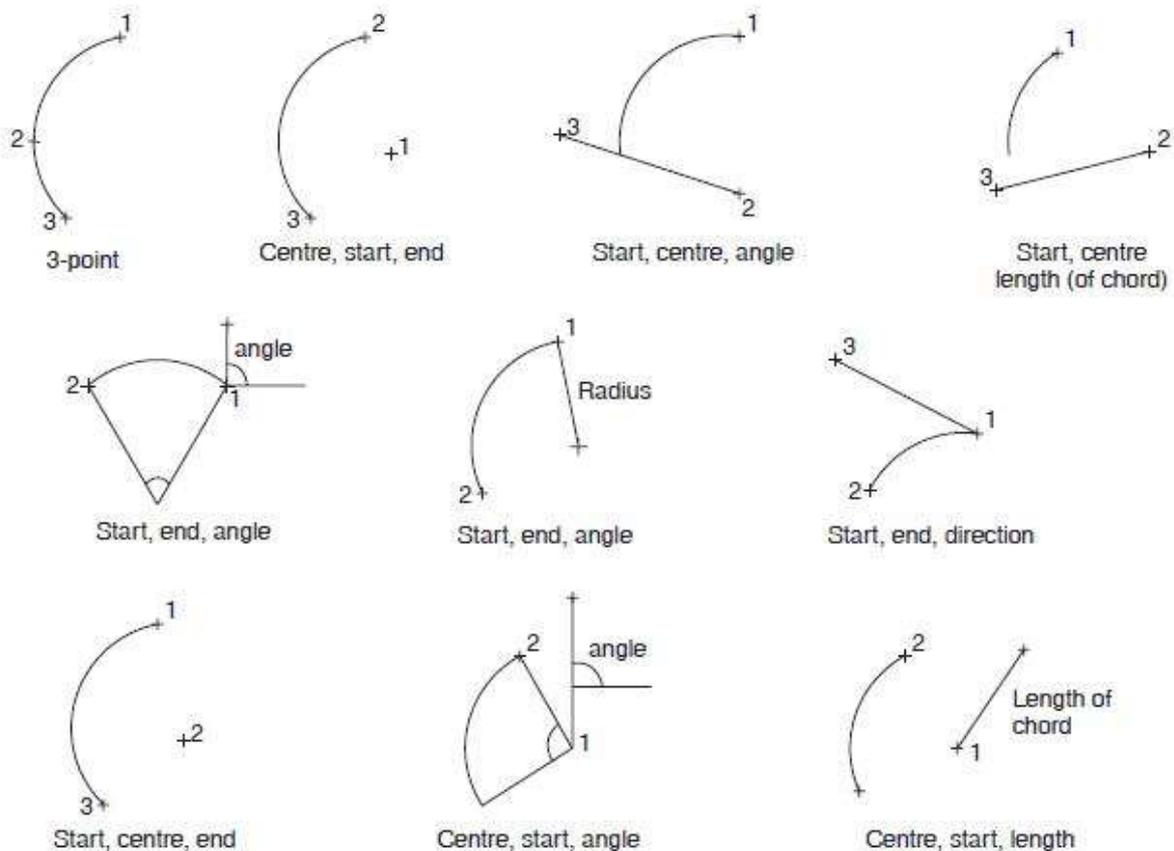


Fig. 6

OBJECT SELECTION

This is done to edit an object. The editing capabilities are the most useful part of AutoCAD system, by making use of the already existing drawing. There are various options available for the selection of an object:

1. Pick box—the cursor is converted to a small box/square, called pick box. By pressing the left button of the mouse when the pick box touches an entity, the object can be selected for editing.
2. Window option—a single or group entities can be selected by bringing them fully inside a rectangular window. Entities, which lie only partially inside the boundaries of window, will not be selected. Rectangular window may be created by picking the first corner, by pressing the left button and then moving the mouse to the desired position of diagonally opposite corner. Selection of the object is complete, by pressing the button again.

Edit Commands

These commands are used for modifying drawings. For edit command, the objects may be erased, retrieved, moved to another location, made into multiple copies, rotated, enlarged, mirror imaged, part of a drawing may be moved and the above effects can also be reversed (undo).

Zoom command

It is used to change the scale of the display. This can be used to magnify part of the drawing to any higher scale, for looking closely at some fine detail in the drawing. This is often quite useful during the construction stage. If zoom closer, more details are visible but only a part of the drawing is seen, whereas if zoom out, larger portion of the drawing is seen but less details are visible. This command can be invoked from standard tool bar, from the pull down menu bar, from screen menu or from the command area by entering zoom.

Cross-hatching and pattern Filling

It is common practice to fill an area with a pattern of some sort. The pattern can help differentiate between components, or it can signify the material composition of an object. This is accomplished by HATCH command. Hatching generates line entities for the chosen pattern and adds them to the drawing. AutoCAD normally groups these lines into a general block.

Utility Commands

END Command — this command exits the drawing editor and returns to the main menu and updates the drawing file.

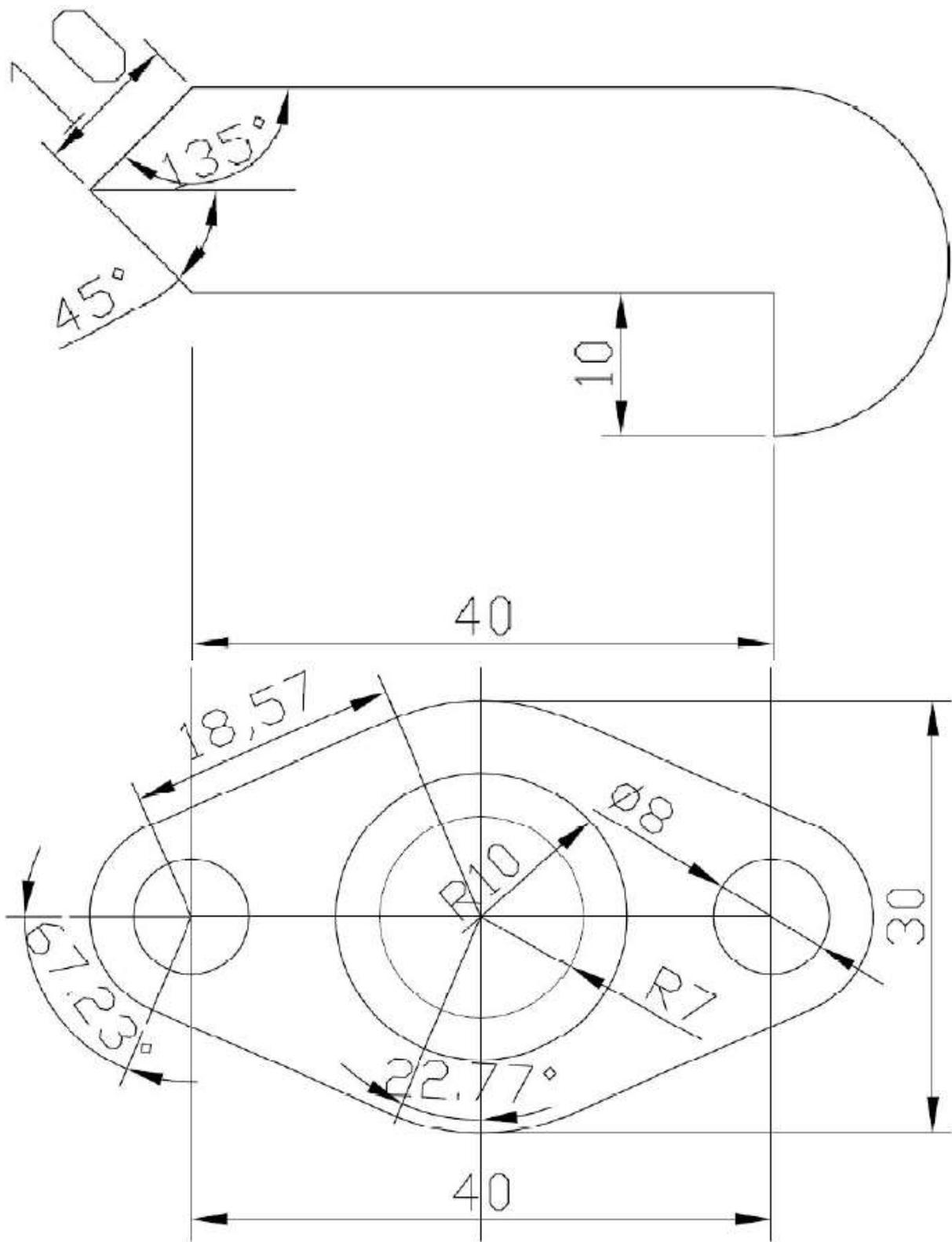
SAVE Command — this command saves the new/modified drawing and returns to the main menu. However, without exiting the drawing editor, if the changes are to be periodically saved, it is desirable to use this command. It protects the work from possible power failures, editing errors, etc.

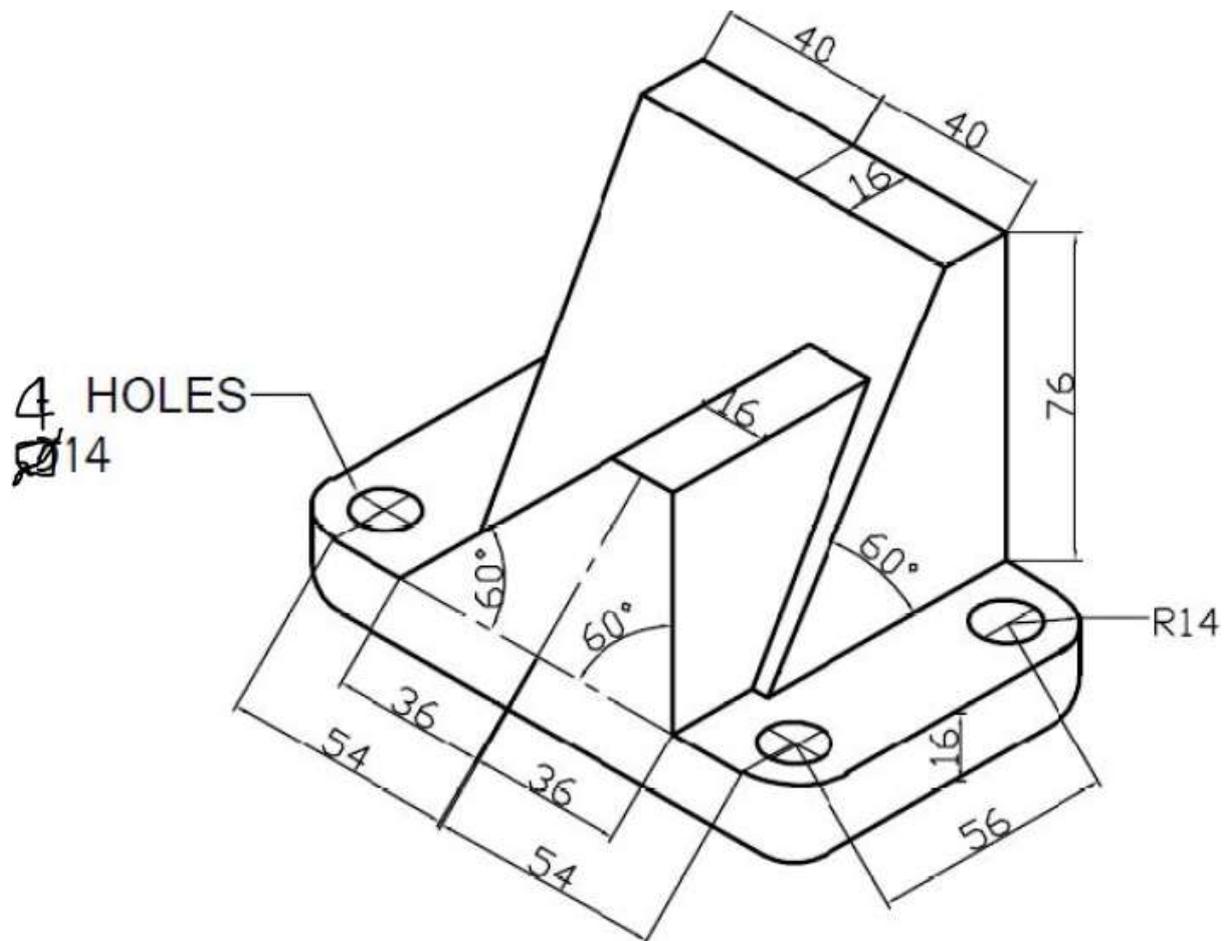
QUIT Command — this exits the drawing editor without saving the updated version of the current drawing and returns to the main menu.

TEXT Command — text may be added to a drawing by means of the TEXT command. Text entities can be drawn with a variety of character patterns or fonts and can be stretched, compressed or drawn in a vertical column by applying a style to the font.

EXPERIMENTING WITH AUTOCAD

Dimensions in mm





BASIC DIMENSIONING

Dimensions are an important part of most drawings. Dimensions indicate the measurement of the models created, and are used in the manufacturing process. The dimensions in AutoCAD offer a great deal of flexibility. In many field of engineering, drawings contain annotations showing lengths or distances or angles between objects to convey the desired information. Dimensioning is the process of adding these annotations to a drawing. AutoCAD provides four basic types of dimensioning; linear, angular, diameter and radius as shown in Fig.7.

Dimensioning Commands

The dimensioning commands can be grouped into six categories:

1. Linear — is done with a horizontal, vertical, aligned and rotated command.
2. Angular — is used to dimension angles. Here, one has to select two non-parallel lines to introduce the angular dimension.
3. Diameter — this can be invoked for dimensioning arcs and circles.
4. Radius — it is almost identical to diameter dimensioning, except that only a radius line is drawn. This line has only one arrow.
5. Associative — used to make various changes to associative dimension entities.
6. Dimensioning utility commands — to draw a centre line or centre mark for a circle/arc, this command is used.

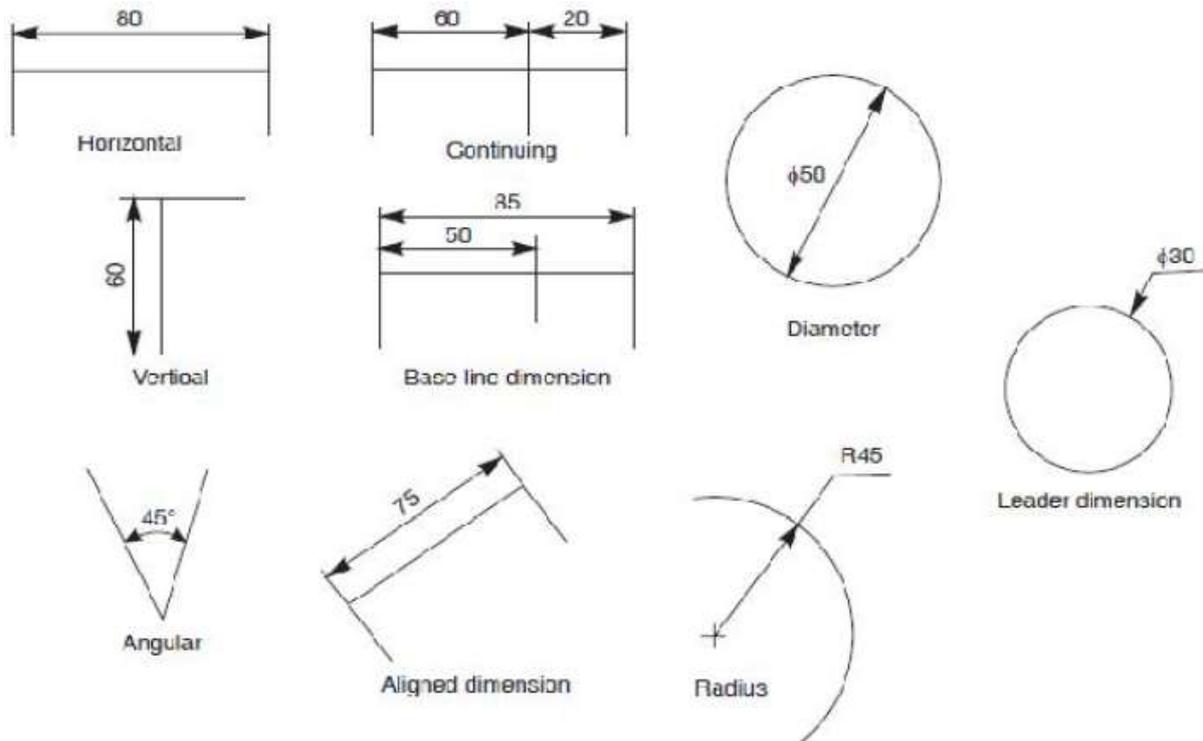


Fig. 7 shows types of dimensions possible: linear, angular, diametric, radial and aligned.

Dimension Methods

The procedure to be followed for dimensioning in AutoCAD is as follows:

1. Set-up the basic parameters for dimensioning. They are,
 - (a) arrow head size,
 - (b) arrow head type,
 - (c) extension line offset, and
 - (d) placement of dimension text.
2. Identify what to measure—pick the end points, lines, arcs or circles or other points of existing drawing entities using OSNAP if necessary.
3. Specify where the dimension line and text are to be located.
4. Approve AutoCAD's measurements or can type one's own text.