

Chapter 1

Getting Started-I

Learning Objectives

After completing this chapter, you will be able to:

- Start AutoCAD and start a drawing in AutoCAD.
- Understand the different components of the initial AutoCAD screen.
- Invoke AutoCAD commands from the keyboard, menu, toolbar, shortcut menu, screen menu, and digitizer.
- Understand the functioning of dialog boxes in AutoCAD.
- Draw lines using the **LINE** command and its options.
- Understand different coordinate systems used in AutoCAD.
- Use the **ERASE** commands to clear the drawing area.
- Understand the two basic object selection methods: Window and Crossing options.
- Draw circles using different options of the **CIRCLE** command.
- Save the work using different file-saving commands.
- Use the different options of AutoCAD's help.
- Understand the use Active Assistance, Learning Assistance, and other interactive help topics.

STARTING AUTOCAD

When you turn on your computer, the operating system (Windows 95, Windows NT, or Windows 98) is automatically loaded. This will display the Windows screen with various application icons (Figure 1-1). You can load AutoCAD by double-clicking on the AutoCAD 2002 icon. You can also load AutoCAD from the Windows taskbar by choosing the **Start** button at the bottom left corner of the screen (default position) to display the menu. Choose **Programs** to display the program folders. Now, choose the **AutoCAD 2002** folder to display AutoCAD programs and then choose **AutoCAD 2002** to start AutoCAD.

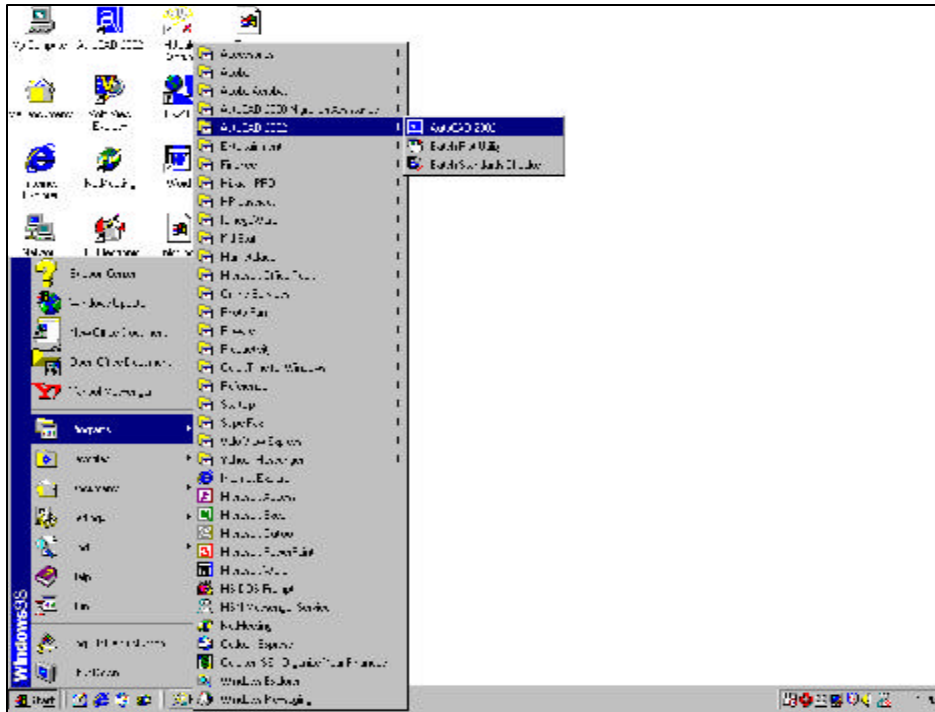


Figure 1-1 Windows screen with taskbar and application icons

STARTING A DRAWING

When you start AutoCAD, the **AutoCAD 2002 Today** window is displayed on the screen (Figure 1-2). The **AutoCAD 2002 Today** window has two main areas of work labeled as **My Workplace** and **The Web**. The **My Workplace** section has the **My Drawings** area that gives you the various options for starting a new drawing, opening a previously saved drawing, and loading the system libraries. It also has the **Bulletin Board** area that gives you space to display information and create a customized bulletin board. **The Web** section connects you to the Internet and provides you with the different links and resources. The **AutoCAD 2002 Today** window can be disabled for the subsequent sessions of AutoCAD by choosing a different option from the **Startup** drop-down list in the **System** tab of the **Options** dialog box. The **Options** dialog box can be accessed by choosing **Options** from the **Tools** menu. Depending on the Startup option you chose, an initial view will be displayed while starting AutoCAD. The other options apart from the **AutoCAD Today** window include the display of the traditional **Startup** dialog box, or bypassing the **Today** window and the **Startup** dialog box.

To start a new drawing you can simply minimize the **AutoCAD 2002 Today** window using the minus (-) button on the top right corner of the window. You have an initial drawing open with the name **Drawing1.dwg**. Instead of working on a drawing, you can first explore the different options in the **Today** window. **Maximize** the **Today** window by clicking on the **AutoCAD 2002 Today** button at the bottom of the screen.

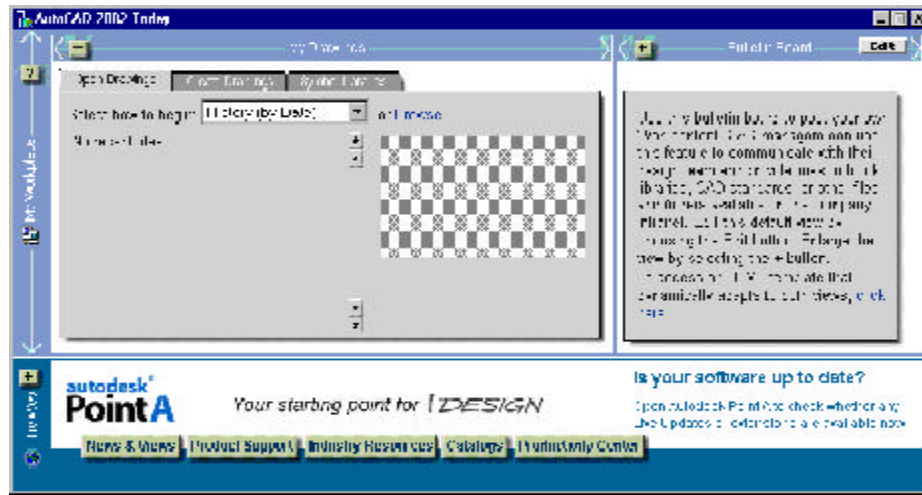


Figure 1-2 AutoCAD 2002 Today window

Open Drawings

The **Open Drawings** tab in the **My Drawings** area (Figure 1-2) is open by default. A list of the recently opened drawings is displayed for you to select from. If you are opening AutoCAD for the first time the list box will be empty. You can choose a category from the **Select how to begin** drop-down list. Depending on these categories the drawings are grouped and then displayed in the list box. This option is explained in detail in Chapter 2.

Create Drawings

The **Create Drawings** tab in the **My Drawings** area (Figure 1-3) allows you to start a new drawing with the specifications you specify. The different options for starting a new drawing are listed in the **Select how to begin** drop-down list.

Template

When you choose the **Template** button in the **Select how to begin** drop-down list, AutoCAD displays a list of templates supplied with AutoCAD (Figure 1-3). The default template file is `acad.dwt` or `acadiso.dwt`, depending on the installation. If you use a template file, the new drawing will have the same settings as specified in the template file. All the drawing parameters of the new drawing such as the units, limits, and other settings are already set according to the template file used. The preview of the template file selected is displayed in the dialog box. You can also define your own template files that are customized to your requirements (See Chapter 29, Template Drawings). To differentiate the template files from the drawing files, the template files have `.dwt` extension whereas the drawing files have `.dwg` extension. Any drawing file can be saved as a template file. You can use the **Browse** button to select other template files. When you choose the **Browse** button, the **Select File** dialog box is displayed with the **Template** folder open displaying all the template files.

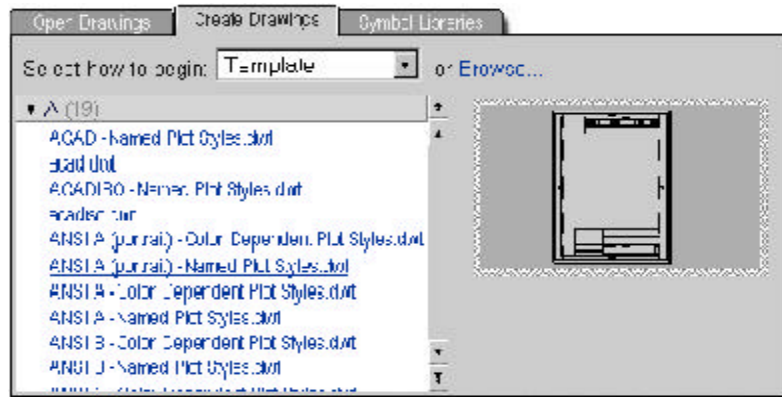


Figure 1-3 Selecting **Template** in the **Create Drawings** tab of the **Today** window

Start from Scratch

When you choose **Start from Scratch** from the **Select how to begin** drop-down list (Figure 1-4), AutoCAD lets you start a new drawing that contains the default setup for **English** (acad.dwt) or **Metric** drawings units (acadiso.dwt). For example, if you select the English default setting, the limits are 12 x 9, text height is 0.20, and dimensions and linetype scale factors are 1. If you start a drawing using the **Start from Scratch** settings, the units and limits for the drawing can be changed later.

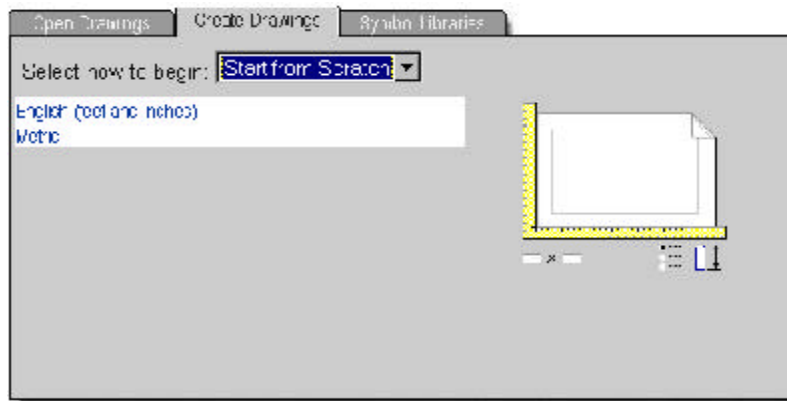


Figure 1-4 When using **Start from Scratch**, the new drawing contains the default settings

Wizard

The **Wizard** allows you to set the initial drawing settings. When you choose the **Wizard** from the **Select how to begin** drop-down list, you have the choice of using **Quick Setup** or **Advanced Setup** (Figure 1-5) options. In the **Quick Setup**, you can specify the units and the limits of the work area. In the **Advanced Setup** you can set the units, limits, and the different angle settings for a drawing.



Figure 1-5 Use the **Wizard** option in the **Create Drawings** tab

Quick Setup. When you choose **Quick Setup**, the **Quick Setup** dialog box is displayed with the **Units** page (Figure 1-6) open by default. You can select **Next** to display the **Area** page. The **Units** page is used to set the units and is displayed as default. A small arrow is displayed along its left side to indicate that this page is open. The units of measurements can be set by selecting the radio button for it and the respective preview image is displayed along with it. The different units of measurement you can choose from are Decimal, Engineering, Architectural, Fractional, and Scientific.

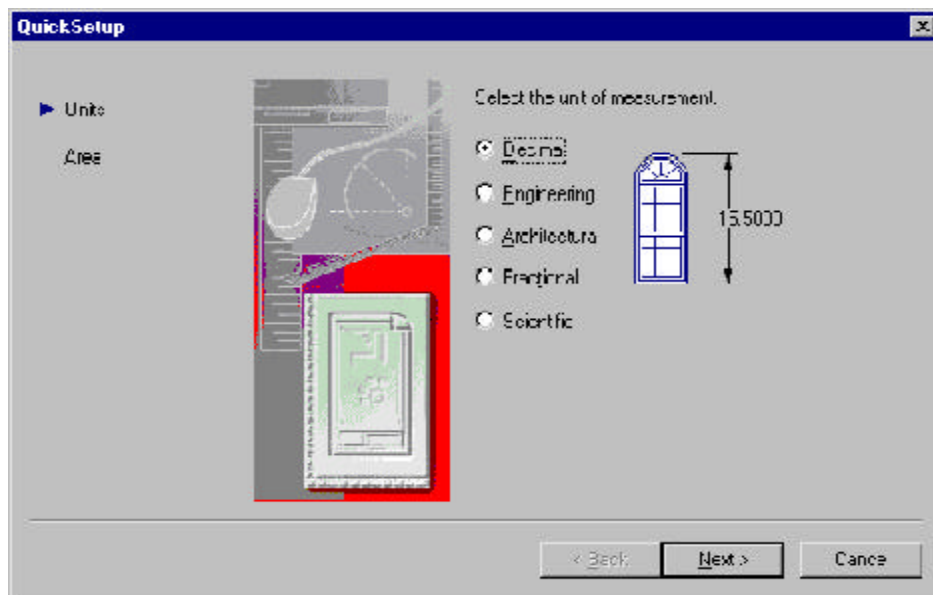


Figure 1-6 The **Units** page of the **Quick Setup** dialog box

To set the limits of the drawing choose the **Next** button in the dialog box to display the **Area** page of **Quick Setup**. You can enter the width and length of the drawing area in the respective edit boxes.

Advanced Setup. When you choose **Advanced Setup**, the **Advanced Setup** dialog box is displayed with the **Units** page open by default. The **Units** page has the same options as in the **Quick Setup** with the difference being you can also set the number of decimal places using the **Precision** drop-down list. The **Area** page also is similar to the one in the **Quick Setup** where you can set the drawing limits.

Choose the **Next** button to open the **Angle** page of the dialog box (Figure 1-7). In this page the different angle measuring systems and a **Precision** drop-down list are displayed. The angle of measurement can be set by selecting the radio button for it and the preview of that particular angular unit is displayed along with it. The format of precision also changes in the **Precision** edit box depending on the angle measuring system selected. You can then select the precision from the drop-down list. The angle measuring systems are Decimal Degrees, Deg/Min/Sec, Grads, Radians, and Surveyor.

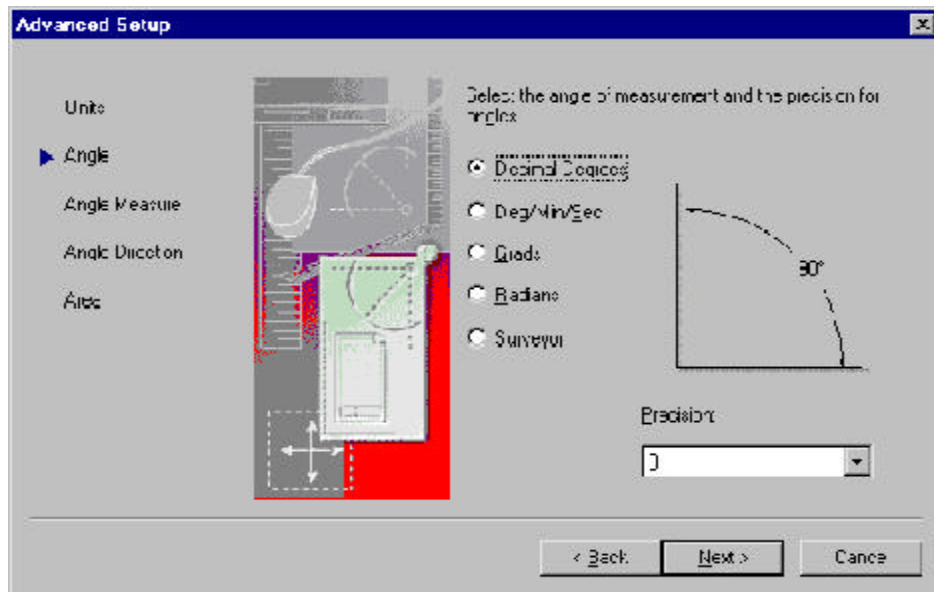


Figure 1-7 The **Angle** page of the **Advanced Setup** dialog box

The next page is the **Angle Measure** page where you can choose the direction of the base angle. You can set your own direction by selecting the **Other** radio button and then entering the value in its edit box, which becomes available when you select **Other**.

Choose **Next** to display the **Angle Direction** page to set the orientation for angle measurement. By default the angles are positive if measured in a counterclockwise direction.



Note

It is possible to change the drawing units and area later while working on the drawing using the **UNITS** and **LIMITS** commands. These commands are discussed in Chapter 2.

Symbol Libraries

The **Symbol Libraries** tab in the **My Drawings** area (Figure 1-8) allows you to load the different symbol libraries into the **DesignCenter**. A list of the symbol libraries are displayed when you choose the **Symbol Libraries** tab. You can modify the symbol libraries by using the **Edit DesignCenter Symbol Libraries** dialog box, which can be accessed by choosing the **Edit** button. The DesignCenter is explained in detail in Chapter 6.



Figure 1-8 Symbol Libraries tab in the AutoCAD 2002 Today window



Note

The **Bulletin Board** and the area for **The Web** that includes **Autodesk Point A** are discussed in Chapter 28.

AUTOCAD SCREEN COMPONENTS

After minimizing the **AutoCAD 2002 Today** window, or starting a new drawing using any of the start options in the **Today** window, the initial AutoCAD screen is displayed. The different components of the initial AutoCAD screen are the drawing area, the command window, menu bar, several toolbars, model and layout tabs, and the status bar (Figure 1-9). A title bar is displayed on top of the screen that has the AutoCAD symbol and the current drawing name.

Drawing Area

The drawing area covers the major portion of the screen. Here you can draw the different objects and use the different commands. To draw the objects you need to define the coordinate points which can be selected by using your pointing device. The position of the pointing device is represented on the screen by the cursor. There is a coordinate system icon at the lower left corner of the drawing area. The window has the standard windows buttons such as close, minimize, scroll bar, and so on, which have the same functions as for any other standard window.

Command Window

The command window is present at the bottom of the drawing area and has the Command prompt where you can enter the commands. It also displays the subsequent prompt sequences

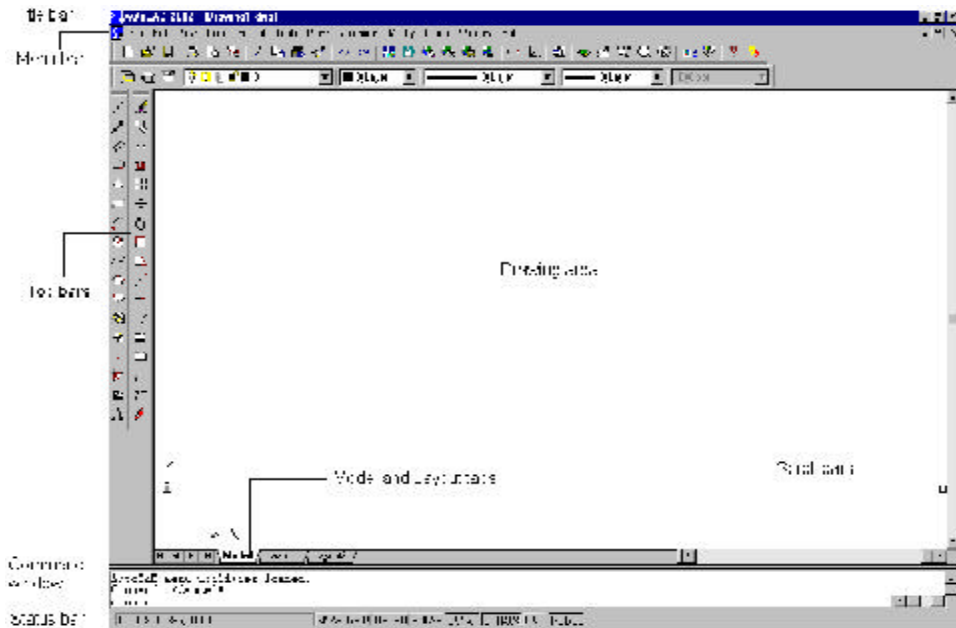


Figure 1-9 AutoCAD screen components

and the messages. You can change the size of the window by placing the cursor on the top edge (double line bar known as the grab bar) and then dragging it. This way you can increase its size to see all the previous commands you have used. By default the command window displays only three lines, that can be changed by entering a number in the **Text lines in command line window** edit box, in the **Display** tab of the **Options** dialog box. This dialog box can be displayed by choosing **Options** from the **Tools** menu. You can also press the **F2** key to display the **Text window** which displays the previous commands and prompts.

Status Bar

The status bar is displayed at the bottom of the screen (Figure 1-10). This bar contains some useful information and buttons that will make it easy to change the status of some AutoCAD functions. To change the status, you must choose the buttons that toggle between on and off.

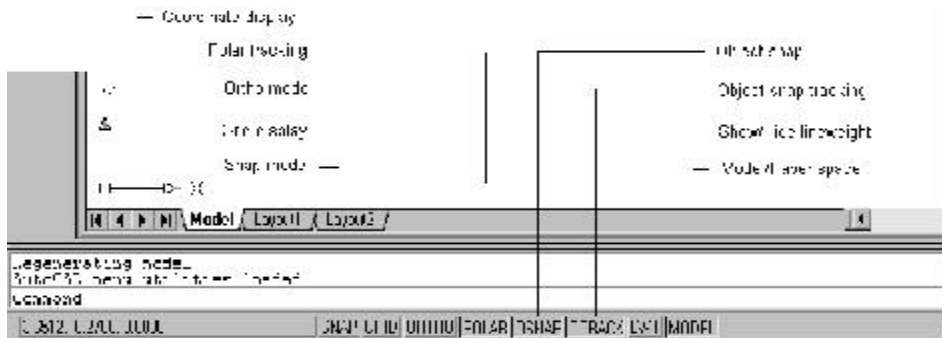


Figure 1-10 Default status bar display

Coordinate display. The **Coordinates** information is displayed in the left corner of the status bar. You can select this coordinate button to toggle between on and off. The **COORDS** system variable controls the type of display of the coordinates. If the value of the **COORDS** variable is set to 0, the coordinate display is static, that is, the coordinate values displayed in the status bar change only when you specify a point. If the value of the **COORDS** variable is set to 1 or 2, coordinate display is dynamic. When the variable is set to 1, AutoCAD constantly displays the absolute coordinates of the graphics cursor with respect to the UCS origin. The polar coordinates (length< angle) are displayed if you are in an AutoCAD command and the **COORDS** variable is set to 2. You can use the key F6 to turn the coordinate display on or off.

Snap. If **Snap Mode** is on, the **Snap** button is displayed as pressed in the status bar; otherwise, it is not displayed. This allows you to move the cursor in fixed increments. You can also use the function key F9 as a toggle key to turn Snap off or on.

Grid. If **Grid Display** is on, grid lines are displayed on the screen. These lines are used as reference lines in a drawing. The function key F7 can be used to turn the grid display on or off.

Ortho. If **Ortho Mode** is on, the **Ortho** button is pressed in the status bar. This allows you to draw lines at right angles only. You can use the F8 key to turn Ortho on or off.

Polar. Choosing the **Polar** button in the status bar turns on the **Polar Tracking**. The movement of the cursor is restricted along a path based on the angle set as the polar angle settings. You can also use the function key, F10. Turning the Polar Tracking on, automatically turns off the Ortho mode.

Osnap. If **Object Snap** is on, the **Osnap** button is displayed as pressed in the status bar. You can also use the F3 key to turn the Object Snap on or off. When Object Snap is on, you can use the running object snaps. If Osnap is off, the running Object Snaps are temporarily disabled. The status of Osnap (Off or On) does not prevent you from using immediate mode object snaps.

Otrack. Choosing the **Otrack** button, turns **Object Snap Tracking** on or off.

LWT. Choosing this button in the status bar, allows you to **Show/Hide Lineweight**. If the **LWT** button is not pressed, the display of Lineweight is turned off.

Model. The Model button is displayed in the status bar when you are working in the model space to create drawings. You can select this button to shift to the layouts (paper space) where you can create drawing views. Once you are working with the layouts, you can choose the **Model** tab to shift back to the model space.

**Note**

All the buttons in the status bar are discussed in detail in Chapter 4.

The menu bar and toolbar are discussed in the following section. The model and layout tab is discussed in Chapter 11.

INVOKING COMMANDS IN AUTOCAD

When you start AutoCAD and you are in the drawing area, you need to invoke AutoCAD commands to perform any operation. For example, if you want to draw a line, first you have to invoke the **LINE** command, and then you define the start point and endpoint of the line. Similarly, if you want to erase objects, you must enter the **ERASE** command, and then select the objects for erasing. AutoCAD has provided the following methods to invoke commands:

Keyboard	Menu	Toolbar
Shortcut menu	Screen menu	Digitizing tablet

Keyboard

You can invoke any AutoCAD command at the keyboard by typing the command name at the Command prompt, and then pressing ENTER or the SPACEBAR. Before you enter a command, make sure the Command prompt is displayed as the last line in the command window area. If the Command prompt is not displayed, you must cancel the existing command by pressing ESC (escape) on the keyboard. The following example shows how to invoke the **LINE** command from the keyboard:

Command: **LINE** or **L** « (L is command alias)

Menu

You can also select commands from the menu. The **menu bar** that displays the menu bar titles is at the top of the screen. As you move the cursor over the menu bar, different titles are highlighted. You can choose the desired item by pressing the pick button of your pointing device. Once the item is selected, the corresponding menu is displayed directly under the title. You can invoke a command from the menu by pressing the pick button of your pointing device. Some of the menu items in the menu display an arrow on the right side, which indicates that the menu item has a cascading menu. You can display the cascading menu by selecting the menu item or by just moving the arrow pointer to the right of that item. You can then choose any item in the cascading menu by highlighting the item or command and pressing the pick button of your pointing device. For example, if you want to draw an ellipse using the Center option, choose **Draw** from the menu bar, choose **Ellipse** from the **Draw** menu, then choose **Center** from the cascading menu (Figure 1-11). In this text, this command selection sequence will be referenced as **Draw > Ellipse > Center**. The menus and toolbars tend to vary in every release of AutoCAD.

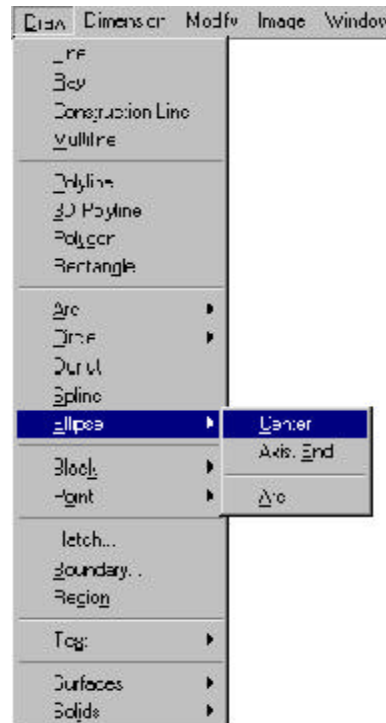


Figure 1-11 Invoking the **ELLIPSE** command from the **Draw** menu

Toolbar

In Windows, the toolbar is an easy and convenient way to invoke a command. For example, you can invoke the **LINE** command by choosing the **Line** button (the upper left button, Figure 1-12) in the **Draw** toolbar. When you choose a command from the toolbar, the command prompts are displayed in the command window. By default the **Standard**, **Object Properties**, **Draw**, **Modify**, and **Modify II** toolbars are displayed on the screen and are docked to the top and the left side edges of the drawing area.

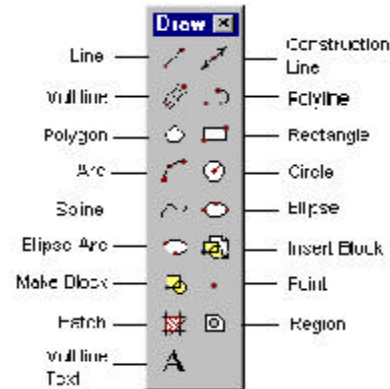


Figure 1-12 The **Draw** toolbar

Displaying toolbars. The different toolbars can be displayed by selecting their respective check boxes in the **Toolbars** tab of the **Customize** dialog box (Figure 1-13). The **Customize** dialog box can be invoked by selecting **Toolbars** in the **View** menu. You can also display a toolbar from the shortcut menu by selecting the name of the toolbar. The shortcut menu can be displayed by right-clicking anywhere on any toolbar on the screen. Each toolbar contains a group of buttons representing different AutoCAD commands. When you move the cursor over the buttons of a toolbar, the button gets lifted and a 3D box encloses the button on which the cursor is resting. The tooltip (name of command) is also displayed below the button. Once you locate the desired button, the command associated with that button can be invoked by choosing the button. Some of the buttons in a toolbar have a small triangular mark at the lower right corner. This indicates that the button has a flyout attached to it. If you hold the button down, the flyout is displayed. The flyout contains the different options for the command.

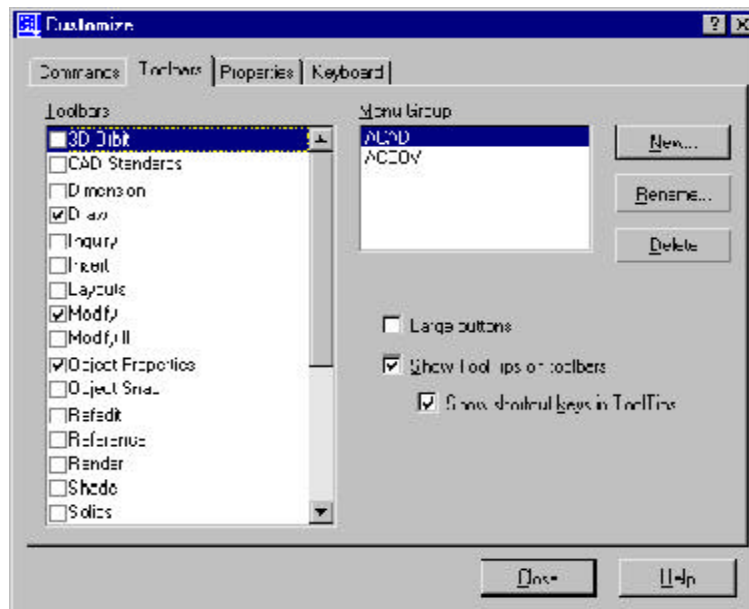


Figure 1-13 List of toolbars in the **Toolbars** tab of the **Customize** dialog box

Moving toolbars. The toolbars can be moved anywhere on the screen by placing the cursor on the title bar area and then dragging it to the desired location. You must hold the pick button down while dragging. While moving the toolbars you can dock them to the top or sides of the screen by dropping them in the docking area. You may also prevent docking by holding the **Control** key when moving the toolbar to a desired location. You can also change the shape of the toolbars by placing the cursor anywhere on the border of the toolbar where it takes the shape of a double arrow (Figure 1-14), and then pulling it in the desired direction (Figure 1-15). You can also customize toolbars to meet your requirements (See Chapter 32, Customizing Toolbars).

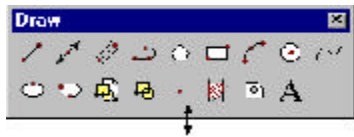


Figure 1-14 Reshaping the **Draw** toolbar



Figure 1-15 **Draw** toolbar reshaped

Shortcut Menu

AutoCAD has provided shortcut menus as an easy and convenient way of invoking commands. These menus are context sensitive which means that the commands present in it are dependent on the place/object for which it is displayed. This menu is invoked by right-clicking and is displayed at the cursor location.

You can right-click anywhere on the drawing area to display the general shortcut menu. It generally contains an option to select the previously invoked command again (Figure 1-16) apart from the common commands for Windows.

If you right-click on the drawing area while a command is in effect, the shortcut menu displayed contains the different options of that particular command. Figure 1-17 shows the shortcut menu when the **POLYLINE** command is active.



Figure 1-16 Shortcut menu without an active command

If you right-click on the layout tabs, the shortcut menu displayed contains the different options for the layouts (Figure 1-18).

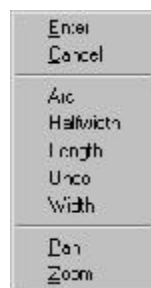


Figure 1-17 Shortcut menu with the **POLYLINE** command active

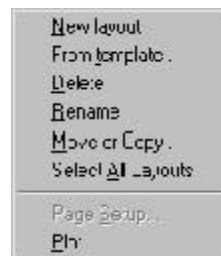


Figure 1-18 Shortcut menu for the Layout tab

You can also right-click on the command window to display the shortcut menu. This menu displays the six most recently used commands and some of the Window's options like Copy and Paste (Figure 1-19). The commands and their prompt entries are displayed in the History window (previous command lines not visible) and can be selected, copied, and pasted in the command line using the shortcut menu. As you press the up arrow key, the previously entered commands are displayed in the command window. Once the desired command is displayed at the Command prompt you can execute the command by simply pressing the ENTER key. You can also copy and edit any previously invoked command by locating it in the History window and then selecting the lines. Right-click in the command window to display the shortcut menu (Figure 1-19), select copy, and then paste the selected lines in the command line. After the lines are pasted, you can edit them.



Figure 1-19 Command line window shortcut menu

You can right-click on the status bar to display the shortcut menu. This menu contains the options to change the settings of drawing tools (Figure 1-20).



Figure 1-20 Status bar shortcut menu

You can also right-click on any of the toolbars to display the shortcut menu from where you can choose any toolbar to be displayed.



Tip

A shortcut menu is available for any situation while working in AutoCAD. You should try to make use of it frequently by right-clicking at different positions.

Screen Menu

In AutoCAD the screen menus are not displayed by default. To display the screen menus, select the **Display screen menu** check box in the **Options (Display tab)** dialog box. This dialog box can be accessed by choosing **Options** from the **Tools** menu. The screen menus are then displayed on the right side of the drawing area and can be docked on either side of the screen. You can choose an item from the screen menu by moving the cursor up or down along the screen menu bar until the item you want is highlighted and then picking it. The first screen menu that AutoCAD displays is the root menu. In the screen menus, the commands are arranged in different groups as shown in Figure 1-21. For example, if you want to invoke the **ELLIPSE** command, you must first choose **DRAW 1** from the root menu, and then choose **Ellipse**. A menu item that consists of all uppercase letters (**DRAW 1**) represents a group heading. If you choose this item it will load that submenu and display the submenu items. If you select a command, AutoCAD will invoke that command and display its options in the screen menu area. You can return to root menu by selecting the

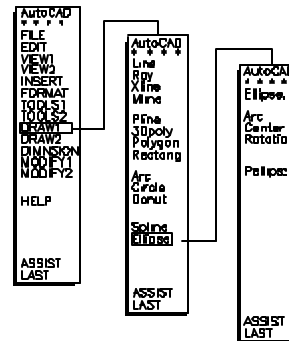


Figure 1-21 Invoking the **ELLIPSE** command from the screen menu

Digitizing Tablet

AUTOCAD DIALOG BOXES

You can select the desired tile using the pointing device which is represented by an arrow when a dialog box is invoked. The title bar displays the name of the dialog box. The **tabs** specify the different sections with a group of related options under them. The **check boxes** are toggle

buttons for making the particular option available or unavailable. The **drop-down list** displays an item and a arrow on the right which when selected displays a list of items to choose from. You can make a selection in the **radio buttons**. Only one can be selected at a time. The **image box** displays the preview image of the item selected. The **text box** is an area where you can enter a text like a file name. It is also called an **edit box** because you can make any change to the text entered. In some dialog boxes there is the **[...]** button which displays another related dialog box. There are certain **command buttons** (OK, Cancel, Help) at the bottom of the dialog box. The name implies their functions. The button with a dark border is the default button. The dialog box has a **Help** button for getting help on the different features of the dialog box. There is also a **question mark (?)** button near the top right corner of the dialog box meant for feature-specific help. If you want help on a particular feature of a dialog box, select the ? button. The ? gets attached with the cursor. You can then select the feature to display its help.

DRAWING LINES IN AUTOCAD

Toolbar: Draw > Line
Menu: Draw > Line
Command: LINE or L



Figure 1-23 Invoking the **LINE** command from the **Draw** toolbar

The most fundamental object in a drawing is the line. A line can be drawn between any two points by using AutoCAD's **LINE** command. You can invoke the **LINE** command by choosing the **Line** button in the **Draw** toolbar, or by choosing **Line** from the **Draw** menu, or by entering **LINE** at the Command prompt. Once you have invoked the **LINE** command, the next prompt, **Specify first point**, requires you to specify the starting point of the line. You can either select a point using the pointing device or you can enter its coordinates. After the first point is selected, AutoCAD will prompt you to enter the second point at the **Specify next point or [Close/Undo]** prompt. When you select the second point of the line, AutoCAD will again display the prompt **Specify next point or [Close/Undo]**. At this point you may continue to select points or terminate the **LINE** command by pressing ENTER, ESC, or the SPACEBAR. You can also right-click to display the shortcut menu from where you can choose **Enter** or **Cancel** options to exit from the **LINE** command. After terminating the **LINE** command, AutoCAD will again display the Command prompt. The prompt sequence for the drawing, Figure 1-25 is as follows:



Figure 1-24 Invoking the **LINE** command from the **Draw** menu

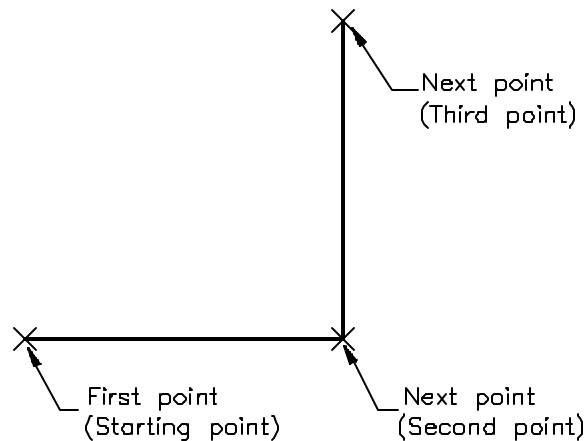


Figure 1-25 Drawing lines using the **LINE** command

Command: LINE «

Specify first point: Move the cursor (mouse) and left-click to specify the first point.

Specify next point or [Undo]: Move the cursor and left-click to specify the second point.

Specify next point or [Undo]: Specify the third point.

Specify next point or [Close/Undo]: « (Press ENTER to exit the **LINE** command.)

The **LINE** command has the following three options:

Continue

Close

Undo



Tip

When you select the points with the cursor, a rubber-band line appears that stretches between the previous point selected and the current position of the cursor. This line is sensitive to the movement of the cursor and helps you to select the direction and the placement of the next point for the line.



Note

To clear the drawing area to gain space to work out the exercises and the examples, choose the **Erase** button from the **Modify** toolbar or type **ERASE** at the Command prompt and press ENTER. The screen crosshairs will change into a box called a pick box and AutoCAD will prompt you to select objects. You can select the object by positioning the pick box anywhere on the object and pressing the pick button of the pointing device. Once you have finished selecting the objects, press ENTER to terminate the **ERASE** command and the objects you selected will be erased. If you enter **All** at the **Select objects:** prompt, AutoCAD will erase all objects from the screen. (See "Erasing Objects" discussed later in this chapter). You can use the **U (undo)** command to undo the last command by choosing the **Undo** button from the **Standard** toolbar.



Command: **ERASE or E** « (E is the command alias of the **ERASE** command.)
 Select objects: Select objects. (Select objects using the pick box.)
 Select objects: «

Command: **ERASE** «
 Select objects: **ALL** «
 Select objects: «
 Command: **U** « (The **U** command will undo the last command.)

The Continue Option

After exiting from the **LINE** command, you may want to draw another line starting from the point where the previous line ended. In such cases you can use the **Continue** option. This option enables you to grab the endpoint of the previous line and to continue drawing the line from that point (Figure 1-26). The following is the prompt sequence for the **Continue** option:

Command: **LINE or L** « (L is the command alias of the **LINE** command.)
 Specify first point: Pick first point of the line.
 Specify next point or [Undo]: Pick second point.
 Specify next point or [Undo]: «

Command: **LINE** « (Or select **Repeat Line** from the shortcut menu.)
 Specify first point: « (Press ENTER or right-click to continue the line from the last line.)
 Specify next point or [Undo]: Pick second point of second line (third point in Figure 1-26).
 Specify next point or [Undo]: «

You can also type the @ symbol to start the line from the **last point**. For example, if you draw a circle and then immediately start the **LINE** command, the @ will snap to the center point of the circle. The Continue option snaps to the endpoint of the last line or arc, even if other points have been defined after the line was drawn.

Command: **LINE** «
 Specify first point: Pick first point of the line.
 Specify next point or [Undo]: Pick second point.
 Specify next point or [Undo]: «

Command: **LINE or L** « (L is command alias for **LINE**)
 Specify first point: @ « (Continues drawing the line from the last point.)
 Specify next point or [Undo]: Pick second point of the second line.
 Specify next point or [Undo]: «

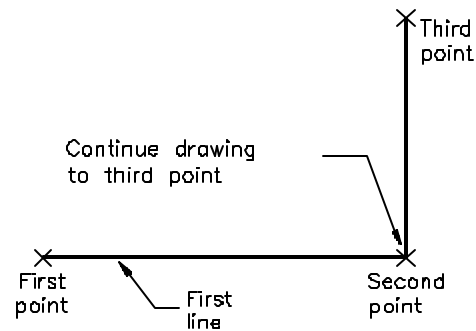


Figure 1-26 Using the **Continue** option with the **LINE** command

The Close Option

The **Close** option can be used to join the current point with the initial point of the first line when two or more lines are **drawn in continuation**. For example, this option can be used when an open figure needs one more line to close it and make a polygon (a polygon is a closed figure with at least three sides, for example, a triangle or rectangle). The following is the prompt sequence for the **Close** option (Figure 1-27):

Command: **LINE** «
 Specify first point: Pick first point.
 Specify next point or [Undo]: Pick second point.
 Specify next point or [Undo]: Pick third point.
 Specify next point or [Close/Undo]: Pick fourth point.
 Specify next point or [Close/Undo]: **C** « (Joins the fourth point with the first point.)

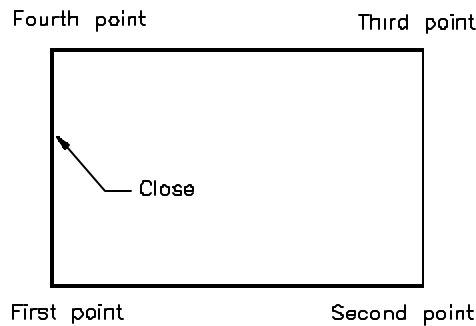


Figure 1-27 Using the **Close** option with the **LINE** command

You can also choose the **Close** option from the shortcut menu, which appears when you right-click in the drawing area.

The Undo Option

If you draw a line, and then realize that you made an error, you can remove the line using the **Undo** option. If you need to remove more than one line, you can use this option multiple times and go as far back as you want. In this option, you can type **Undo** (or just **U**) at the **Specify next point or [Undo]:** prompt. You can also right-click to display the shortcut menu which gives you the **Undo** option. The following example illustrates the use of the **Undo** option (Figure 1-28):

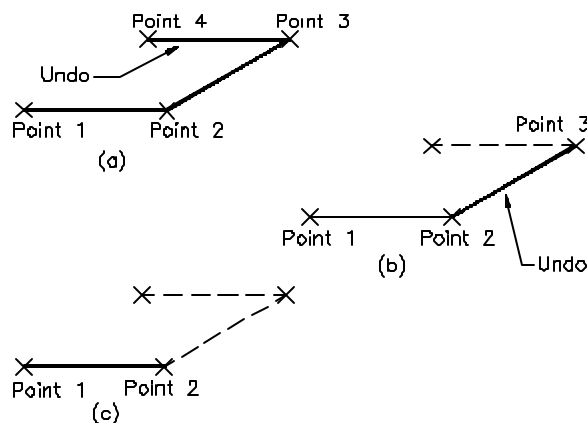


Figure 1-28 Removing lines using the **Undo** option of the **LINE** command

Command: **LINE** or **L** « (L is command alias of **LINE** command)
 Specify first point: Pick first point (Point 1 in Figure 1-28).
 Specify next point or [Undo]: Pick second point (Point 2).
 Specify next point or [Undo]: Pick third point.
 Specify next point or [Close/Undo]: Pick fourth point.
 Specify next point or [Close/Undo]: **U** « (Removes last line from Point 3 to Point 4.)
 Specify next point or [Close/Undo]: **U** « (Removes next line from Point 2 to Point 3.)
 Specify next point or [Close/Undo]: «



Tip

AutoCAD allows you to enter the command aliases in place of the complete command name. For example, you can enter **L** instead of **LINE** at the Command prompt to invoke the **LINE** command.

COORDINATE SYSTEMS

To specify a point in a plane, we take two mutually perpendicular lines as references. The horizontal line is called the **X axis**, and the vertical line is called the **Y axis**. The point of intersection of these two axes is called the **origin**. The X and Y axes divide the XY plane into four parts, generally known as quadrants. The X coordinate measures the horizontal distance from the origin (how far left or right) on the X axis. The Y coordinate measures the vertical distance from the origin (how far up or down) on the Y axis. The origin has the coordinate values of $X = 0$, $Y = 0$. The origin is taken as the reference for locating any point in the XY plane. The X coordinate is positive if measured to the right of the origin and negative if measured to the left of the origin. The Y coordinate is positive if measured above the origin and negative if measured below the origin. This method of specifying points is called the **Cartesian coordinate system** (Figure 1-29). In AutoCAD, the default origin is located at the lower left corner of the graphics area of the screen. AutoCAD uses the following coordinate systems to locate a point in an XY plane:

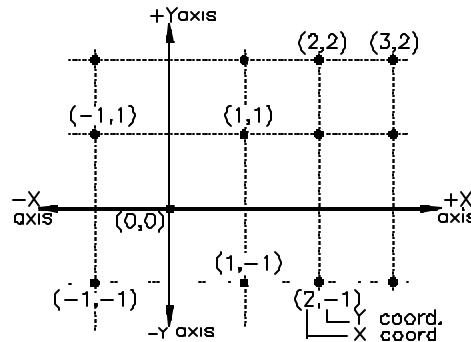


Figure 1-29 Cartesian coordinate system

1. **Absolute coordinates**
2. **Relative coordinates**
 - a. **Relative rectangular coordinates**
 - b. **Relative polar coordinates**
3. **Direct distance entry**

Absolute Coordinate System

In the absolute coordinate system the points are located with respect to the origin (0,0), Figure 1-30. For example, a point with $X = 4$ and $Y = 3$ is measured 4 units horizontally (displacement along the X axis) and 3 units vertically (displacement along the Y axis) from the origin (Figure 1-31).

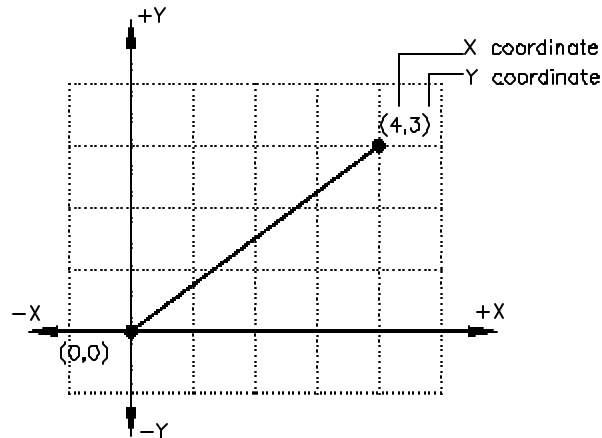


Figure 1-30 Absolute coordinate system

In AutoCAD, the absolute coordinates are specified by entering X and Y coordinates, separated by a comma. The following example illustrates the use of absolute coordinates (Figure 1-31):

```
Command: LINE «
Specify first point: 1,1 «
                                (X = 1 and Y = 1.)
Specify next point or [Undo]: 4,1 «
                                (X = 4 and Y = 1.)
Specify next point or [Undo]: 4,3 «
Specify next point or [Close /Undo]: 1,3 «
Specify next point or [Close/Undo]: 1,1 «
Specify next point or [Close/Undo]: «
```



Figure 1-31 Drawing lines using absolute coordinates

Example 1

General

For Figure 1-32, enter the absolute coordinates of the points in the following table. Then draw the figure using absolute coordinates. Save the drawing under the name Exam1.dwg.

Point	Coordinates	Point	Coordinates
1	3,1	5	5,2
2	3,6	6	6,3

3	4,6	7	7,3
4	4,2	8	7,1

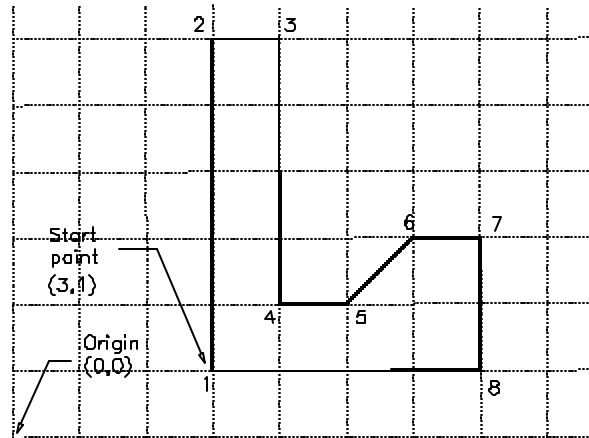


Figure 1-32 Drawing a figure using absolute coordinates

Once the coordinates of the points are known you can draw the figure by using AutoCAD's **LINE** command. The prompt sequence is:

```
Command: LINE <
Specify first point: 3,1 < (Start point.)
Specify next point or [Undo]: 3,6 <
Specify next point or [Undo]: 4,6 <
Specify next point or [Close/Undo]: 4,2 <
Specify next point or [Close/Undo]: 5,2 <
Specify next point or [Close/Undo]: 6,3 <
Specify next point or [Close/Undo]: 7,3 <
Specify next point or [Close/Undo]: 7,1 <
Specify next point or [Close/Undo]: 3,1 <
Specify next point or [Close/Undo]: <
```

Save this drawing. Enter **SAVE** at the Command prompt and then press ENTER. The **Save Drawing As** dialog box is displayed. Enter the name **Exam2** in the **File name** edit box to replace Drawing1.dwg and then choose the **Save** button. The drawing will be saved with the given name in the **AutoCAD 2002** default directory and you can continue using the original drawing file (Drawing1.dwg) for further practice.

Exercise 1

General

For Figure 1-33, enter the absolute coordinates of the points in the following table, then use these coordinates to draw the same figure. Distance between the dotted lines is 1 unit.

Point	Coordinates	Point	Coordinates
1	2, 1	6	
2		7	
3		8	
4		9	
5			

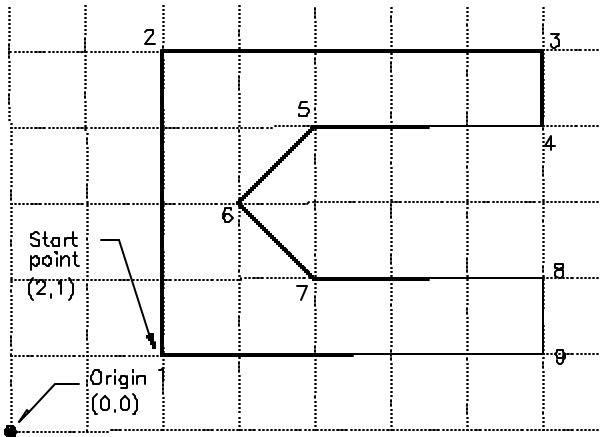


Figure 1-33 Drawing for Exercise 1

Relative Coordinate System

There are two types of relative coordinates; the relative rectangular and relative polar coordinates.

Relative Rectangular Coordinates

In the relative rectangular coordinate system, the displacements along the X and Y axes (DX and DY) are measured with reference to the previous point rather than to the origin. In AutoCAD, the relative coordinate system is designated by the symbol @ and it should precede any relative entry. The following prompt sequence illustrates the use of the relative rectangular coordinate system to draw a rectangle with the lower left corner at point (1,1). The length of the rectangle is 4 units and the width is 3 units (Figure 1-34).

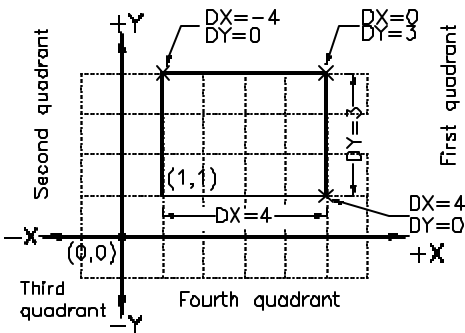


Figure 1-34 Drawing lines using relative rectangular coordinates

Command: **LINE** «
Specify first point: **1,1** « (Start point.)
Specify next point or [Undo]: **@4,0** «
Specify next point or [Undo]: **@0,3** «

(Second point DX = 4, DY = 0.)
(Third point DX = 0, DY = 3.)

Specify next point or [Close/Undo]: @-4,0 « (Fourth point DX = -4, DY = 0.)
Specify next point or [Close/Undo]: @0,-3 « (Start point DX = 0, DY = -3.)
Specify next point or [Close/Undo]: «

Sign Convention. As just mentioned, in the relative rectangular coordinate system the displacements along the X and Y axes are measured with respect to the previous point. Imagine a horizontal line and a vertical line passing through the previous point so that you get four quadrants. If the new point is located in the first quadrant, the displacements DX and DY are both positive. If the new point is located in the third quadrant, the displacements DX and DY are both negative. In other words up or right are positive and down or left are negative.

Example 2

General

Draw Figure 1-35 using relative rectangular coordinates of the points given in the table that follows.

Point	Coordinates	Point	Coordinates
1	3,1	8	@-1,-1
2	@4,0	9	@-1,1
3	@0,1	10	@-1,0
4	@-1,0	11	@0,-2
5	@1,1	12	@1,-1
6	@0,2	13	@-1,0
7	@-1,0	14	@0,-1

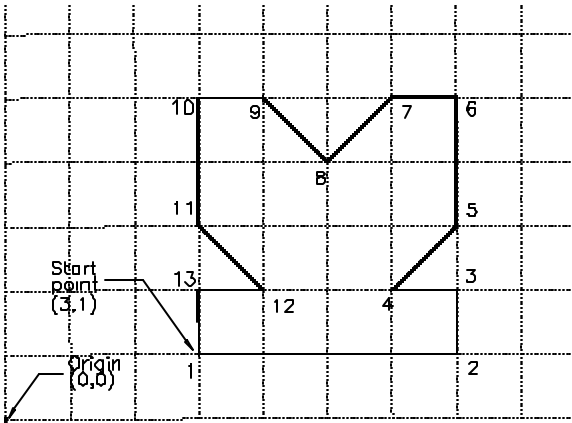


Figure 1-35 Using relative rectangular coordinates with the **LINE** command

Once you know the coordinates of the points, you can draw the figure by using AutoCAD's **LINE** command and entering the coordinates of the points.

Command: **LINE** «
Specify first point: **3,1** « (Start point.)
Specify next point or [Undo]: **@4,0** «
Specify next point or [Undo]: **@0,1** «

Specify next point or [Close/Undo]: @-1,0 «
 Specify next point or [Close/Undo]: @1,1 «
 Specify next point or [Close/Undo]: @0,2 «
 Specify next point or [Close/Undo]: @-1,0 «
 Specify next point or [Close/Undo]: @-1,-1 «
 Specify next point or [Close/Undo]: @-1,1 «
 Specify next point or [Close/Undo]: @-1,0 «
 Specify next point or [Close/Undo]: @0,-2 «
 Specify next point or [Close/Undo]: @1,-1 «
 Specify next point or [Close/Undo]: @-1,0 «
 Specify next point or [Close/Undo]: @0,-1 «
 Specify next point or [Close/Undo]: «

Exercise 2

General

For Figure 1-36, enter the relative rectangular coordinates of the points in the following table, then use these coordinates to draw the figure. The distance between the dotted lines is 1 unit.

Point	Coordinates	Point	Coordinates
1	2, 1	12	
2		13	
3		14	
4		15	
5		16	
6		17	
7		18	
8		19	
9		20	
10		21	
11		22	

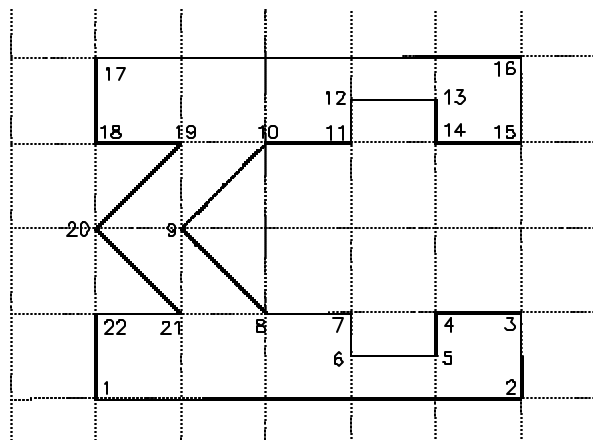


Figure 1-36 Drawing for Exercise 2

Relative Polar Coordinates

In the relative polar coordinate system, a point can be located by defining both the distance of the point from the current point and the angle that the line between the two points makes with the positive X axis. The prompt sequence to draw a line from a point at 1,1 to a point at a distance of 5 units from the point (1,1), and at an angle of 30 degrees to the X axis (Figure 1-37) is:

Command: **LINE** «
Specify first point: **1,1** «
Specify next point or [Undo]: **@5<30** «

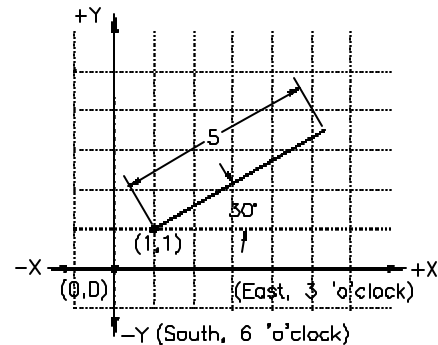


Figure 1-37 Drawing a line using relative polar coordinates

Sign Convention. In the relative polar coordinate system, the angle is measured from the horizontal axis (3 'o' clock) as the zero degree baseline. Also, the angle is positive if measured in a counterclockwise direction and negative if measured in a clockwise direction. Here we assume that the default setup of angle measurement has not been changed.

Example 3	General
-----------	---------

For Figure 1-38, enter the relative polar coordinates of each point in the table, then generate the drawing. Use absolute coordinates for the start point (1.5, 1.75). The dimensions are shown in the drawing. Also, save this drawing as **Exam3.dwg**.

Point	Coordinates	Point	Coordinates
1	1.5,1.75	7	@1.0<180
2	@1.0<90	8	@0.5<270
3	@2.0<0	9	@1.0<0
4	@2.0<30	10	@1.25<270
5	@0.75<0	11	@0.75<180
6	@1.25<-90 (or <270)	12	@2.0<150

Once you know the coordinates of the points, you can generate the drawing by using AutoCAD's **LINE** command and entering the coordinates of the points.

Command: **LINE** «
Specify first point: **1.5,1.75** « (Start point.)
Specify next point or [Undo]: **@1<90** «
Specify next point or [Undo]: **@2.0<0** «
Specify next point or [Close/Undo]: **@2<30** «
Specify next point or [Close/Undo]: **@0.75<0** «
Specify next point or [Close/Undo]: **@1.25<-90** «
Specify next point or [Close/Undo]: **@1.0<180** «
Specify next point or [Close/Undo]: **@0.5<270** «

Specify next point or [Close/Undo]: @1.0<0 «
 Specify next point or [Close/Undo]: @1.25<270 «
 Specify next point or [Close/Undo]: @0.75<180 «
 Specify next point or [Close/Undo]: @2.0<150 «
 Specify next point or [Close/Undo]: C « (Joins the last point with the first point.)

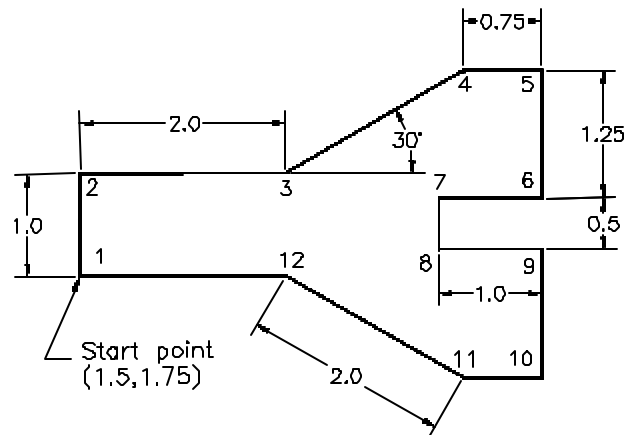


Figure 1-38 Drawing for Example 3

Save this drawing by entering **SAVE** at the Command prompt and then press ENTER. The **Save Drawing As** dialog box is displayed. Enter the name **Exam3** in the **File name** edit box to replace Drawing1.dwg and then choose the **Save** button. The drawing will be saved with the given name in the **AutoCAD 2002** default directory and you can continue using the original drawing file (Drawing1.dwg) for further practice.

Exercise 3

General

Draw the object shown in Figure 1-39 using the absolute, relative rectangular, and relative polar coordinate systems to locate the points. Do not draw the dimensions; they are for reference only.

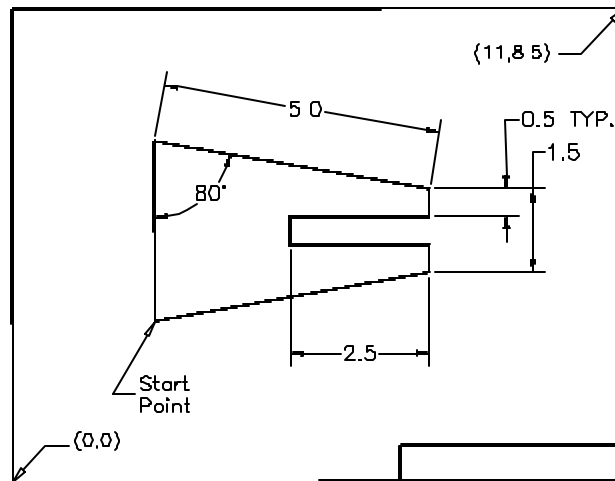


Figure 1-39 Drawing for Exercise 3

Direct Distance Entry

You can draw a line by specifying the length of the line and its direction, using the Direct Distance Entry, (Figure 1-40). The direction is determined by the position of the cursor, and the length of the line is entered from the keyboard. If Ortho is on, you can draw lines along the X or Y axis by specifying the length of line and positioning the cursor along ortho direction. You can also use it with other draw commands like **RECTANGLE**. You can also use the Direct Distance Entry with polar tracking and **SNAPANG**. For example, if **SNAPANG** is 45 degrees and ortho is off, you can draw a line at 45 or 135 degrees direction by positioning the cursor and entering the distance from the keyboard. Similarly, if the polar tracking is on, you can position the cursor at the predefined angles and then enter the length of the line from the keyboard.

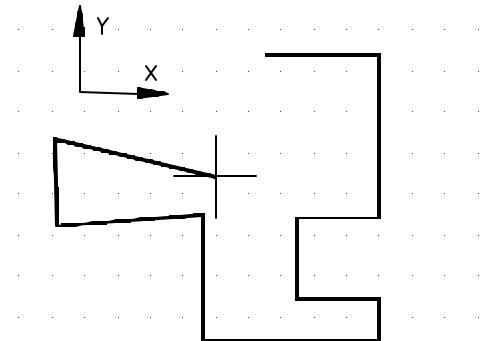


Figure 1-40 Using Direct Distance Entry to draw lines

Command: **LINE**

Specify first point: Start point.

Specify next point or [Undo]: Position the cursor and then enter distance.

Specify next point or [Undo]: Position the cursor and then enter distance.

Example 4

General

In this example you will draw the object as shown in Figure 1-41, using Direct Distance Entry. The starting point is 2,2.

Before you invoke the **LINE** command, you should turn on polar tracking. This will make it easier to specify the direction of lines. To turn polar tracking on, choose the **POLAR** button in the status bar. You can also turn polar tracking on or off while you are in a command. As you move the cursor, AutoCAD displays a dotted line when the position of the cursor matches one of the predefined angles for polar tracking. The following is the Command prompt sequence for drawing the object in Figure 1-41:

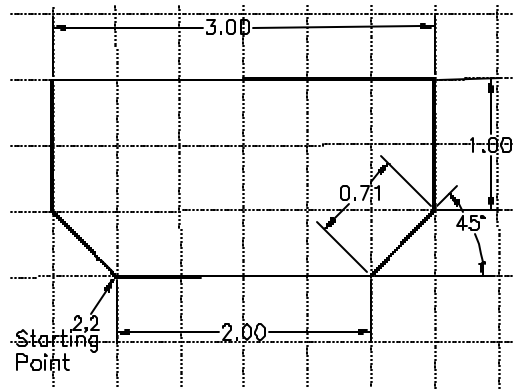


Figure 1-41 Drawing for Example 4

Command: **LINE**

Specify first point: **2,2**

Specify next point or [Close/Undo]: **2** « (Move the cursor horizontally and enter the length of the line, 2, from the keyboard.)

Specify next point or [Close/Undo]: **.7071** (Select **POLAR** in the status bar and position the cursor in a 45-degree direction and enter .7071.)

Specify next point or [Close/Undo]: **1** Move the cursor up vertically, then enter 1.

Specify next point or [Close/Undo]: **3** Move the cursor left horizontally, then enter 3.

Specify next point or [Close/Undo]: **1** Move the cursor down vertically, then enter 1.

Specify next point or [Close/Undo]: **C**



Note

It is possible to set the angle for the polar tracking. Right-click on the **POLAR** button in the status bar to display the shortcut menu and select **Settings** to display the **Drafting Settings** dialog box. Set the Increment angle to 45.

Exercise 4

General

Use the direct distance entry method to draw a parallelogram. The base of the parallelogram equals 4 units, the side equals 2.25 units, and the angle equals 45 degrees. Draw the same parallelogram using absolute, relative, and polar coordinates. Note the differences and the advantage of using direct distance entry.

ERASING OBJECTS

Toolbar: Modify > Erase
Menu: Modify > Erase
Command: ERASE

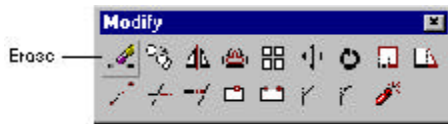


Figure 1-42 Invoking the **ERASE** command from the **Modify** toolbar

After drawing some objects you may want to erase some of them from the screen. To erase you can use AutoCAD's **ERASE** command. This command is used exactly the same way as an eraser is used in manual drafting to remove unwanted information. When you invoke the **ERASE** command, a small box known as the pick box replaces the screen cursor. To erase an object, move the **pick box** so it touches the object. You can select the object by pressing the pick button of your pointing device, Figure 1-44. AutoCAD confirms the selection by changing the selected objects into dashed lines, and the **Select objects:** prompt returns. You can either continue selecting objects or press ENTER to terminate the object selection process and erase the selected objects. If you are entering the command from the keyboard, you can type **E** or **ERASE**. The following is the prompt sequence:

Command: **ERASE** «
 Select objects: Select first object.
 Select objects: Select second object.
 Select objects: «

If you enter **All** at the **Select objects:** prompt, AutoCAD will erase all objects in the drawing, even if the objects are outside the screen display area.

Command: **ERASE** «
 Select objects: **All**

You can also first select the objects to be erased from the drawing and then right-click on the drawing area to display the shortcut menu. From here, you can choose the **Erase** option.



Figure 1-43 Invoking the **ERASE** command from the **Modify** menu

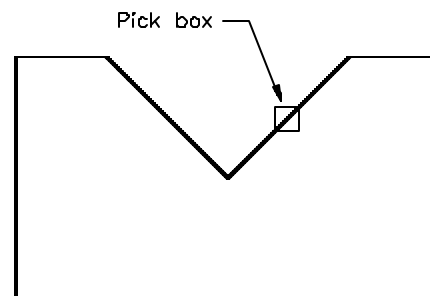


Figure 1-44 Selecting objects by positioning the pick box at the top of the object and then pressing the pick button on the pointing device

CANCELING AND UNDOING A COMMAND

If you are in a command and you want to cancel or get out of that command, press the ESC (Escape) key on the keyboard.

Command: **ERASE** «
 Select objects: Press ESC (Escape) to
 cancel the command.

Similarly, sometimes you unintentionally erase some object from the screen. When you discover such an error, you can correct it by restoring the erased object by means of the **OOPS** command. The **OOPS** command restores objects that have been accidentally erased by the previous **ERASE** command, Figure 1-45. You can also use the **U** (Undo) command to undo the last command.

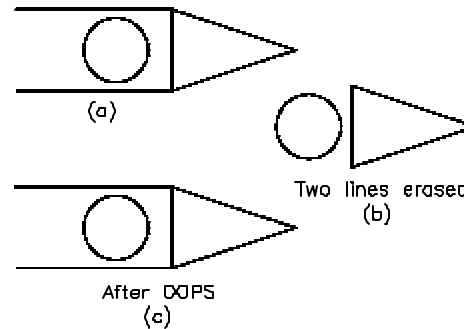


Figure 1-45 Use of the **OOPS** command

Command: **OOPS** « (Restores erased objects.)
 Command: **U** « (Undoes the last command.)

OBJECT SELECTION METHODS

One of the ways to select objects is to select them individually, which can be time consuming if you have a number of objects to edit. This problem can be solved by creating a selection set that enables you to select several objects at a time. The selection set options can be used with those commands that require object selection, such as **ERASE** and **MOVE**. There are many object selection methods, such as All, Last, and Add. At this point we will explore the two options: **Window** and **Crossing**. The remaining options are discussed in the Chapter 5.

The Window Option

This option is used to select an object or group of objects by enclosing them by a box or window. The objects to be selected should be completely enclosed within the window; those objects that lie partially inside the boundaries of the window are not selected. You can select the **Window** option by typing W at the **Select objects:** prompt. You are prompted to select the two opposite corners of the window. After selecting the first corner, you can select the other corner by dragging the cursor to the desired position and specifying the particular point. As you move the cursor, a window is displayed that changes in size as you move the cursor. The objects selected by the **Window** option are displayed as dashed objects (Figure 1-46).

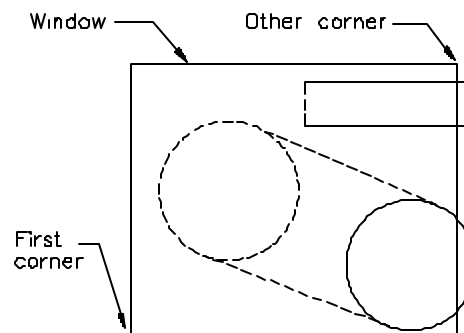


Figure 1-46 Selecting objects using the **Window** option

The prompt sequence for using the **Window** option with the **ERASE** command is:

Command: **ERASE** «
 Select objects: **W** «
 Specify first corner: Select the first corner.
 Specify opposite corner: Select the second corner.
 Select objects: «

You can also select the **Window** option by selecting a blank point on the screen at the **Select objects:** prompt. This is automatically taken as the first corner of the window. Dragging the cursor to the right will display a window. After getting all the objects to be selected inside this window, you can specify the other corner with your pointing device. The objects that are completely enclosed within the window will be selected and highlighted. The following is the prompt sequence for automatic window selection with the **ERASE** command:

Command: **ERASE** «
 Select objects: Select a blank point as the first corner of the window.
 Specify opposite corner: Drag the cursor to the right to select the other corner of the window.
 Select objects: «

The Crossing Option

This option is used to select an object or group of objects by creating a box or window around them. The objects to be selected should be touching the window boundaries or completely enclosed within the window. You can invoke the **Crossing** option by entering **C** at the **Select objects:** prompt. After you choose the Crossing option, AutoCAD prompts you to select the first corner at the **Specify first corner:** prompt. Once you have selected the first corner, a box or window made of dashed lines is displayed. By moving the cursor you can change the size of the crossing box, hence putting the objects to be selected within (or touching) the box. Here you can select the other corner. The objects selected by the Crossing option are highlighted by displaying them as dashed objects Figure 1-47. The following prompt sequence illustrates the use of the Crossing option when you choose the **Erase** button is:

Select objects: **C** «
 Specify first corner: Select the first corner of the crossing window.
 Specify opposite corner: Select the other corner of the crossing window.
 Select objects: «

You can also select the **Crossing** option automatically by selecting a blank point on the screen at the **Select objects:** prompt and dragging the cursor to the left. The blank point you selected becomes the first corner of the crossing window and AutoCAD will then prompt you to select

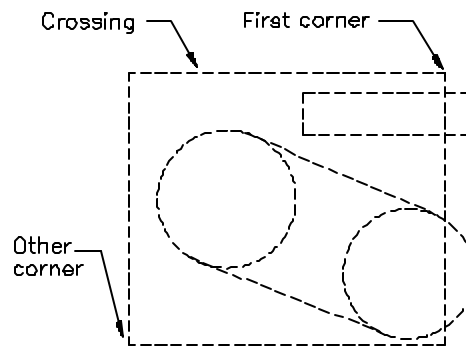


Figure 1-47 Selecting objects using the Crossing option

the other corner. As you move the cursor, a box or window made of dashed lines is displayed. The objects that are touching or completely enclosed within the window will be selected. The objects selected by the Crossing option are highlighted by being displayed as dashed objects. The prompt sequence for automatic crossing selection when you choose the **Erase** button is:

Select objects: Select a blank point as the first corner of the crossing window.

Specify opposite corner: Drag the cursor to the left to select the other corner of the crossing window.

Select objects: «

DRAWING CIRCLES

Toolbar: Draw > Circle
Menu: Draw > Circle
Command: CIRCLE



Figure 1-48 Invoking the **CIRCLE** command from the **Draw** toolbar

To draw a circle you can use the AutoCAD **CIRCLE** command. The following is the prompt sequence for the **CIRCLE** command:

Command: **CIRCLE** «

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

The different options of the **CIRCLE** command are explained in the following sections.

The Center and Radius Option

In this option you can draw a circle by defining the center and the radius of the circle, Figure 1-50. After entering the **CIRCLE** command, AutoCAD will prompt you to enter the center of the circle, which can be selected by specifying a point on the screen or by entering the coordinates of the center point. Next, you will be prompted to enter the radius of the circle. Here you can accept the default value, enter a new value, or select a point on the circumference of the circle to specify the radius. The following is the prompt sequence for drawing a circle with a center at 3,2 and a radius of 1 unit:

Command: **CIRCLE** «

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

Specify radius of circle or [Diameter]< current>: **1** «

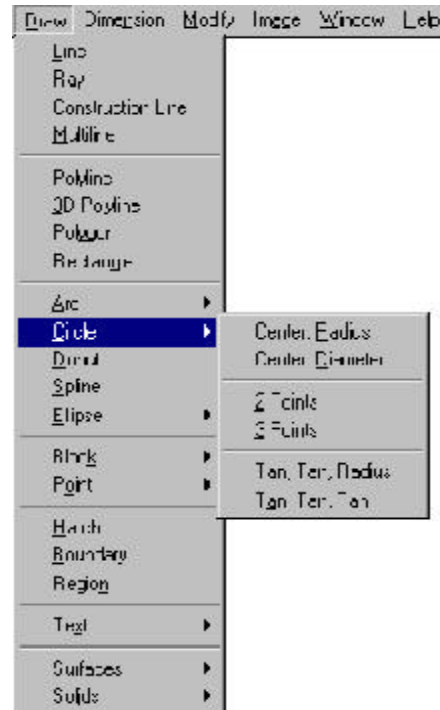


Figure 1-49 Invoking the **CIRCLE** command from the **Draw** menu

**Note**

You can also set the radius by assigning a value to the **CIRCLERAD** system variable. The value you assign becomes the default value for radius.

The Center and Diameter Option

In this option you can draw a circle by defining the center and diameter of the circle. After invoking the **CIRCLE** command, AutoCAD prompts you to enter the center of the circle, which can be selected by specifying a point on the screen or by entering the coordinates of the center point. Next, you will be prompted to enter the radius of the circle. At this prompt enter **D**. After this you will be prompted to enter the diameter of the circle. For entering the diameter you can accept the default value, enter a new value, or drag the circle to the desired diameter and select a point. If you use a menu option to select the **CIRCLE** command with the **Diameter** option, the menu automatically enters the **Diameter** option and prompts for the diameter after you specify the center. The following is the prompt sequence for drawing a circle with the center at (2,3) and a diameter of 2 units, Figure 1-51:

Command: **CIRCLE** «
 Specify center point for circle or [3P/2P/Ttr(tan tan radius)]: **2,3** «
 Specify radius of circle or [Diameter]<current>: **D** «
 Specify diameter of circle <current>: **2** «

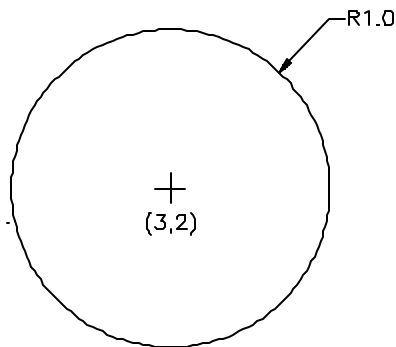


Figure 1-50 Drawing a circle using the Center and Radius option

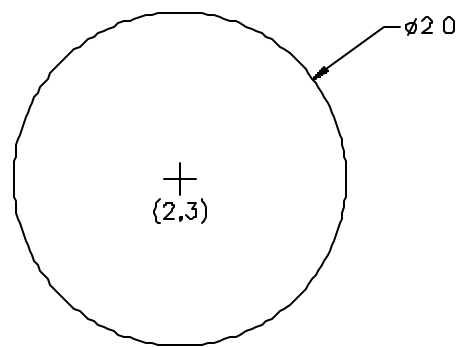


Figure 1-51 Drawing a circle using the Center and Diameter option

The Two-Point Option

You can also draw a circle using the **Two-Point** option. In this option AutoCAD lets you draw the circle by specifying the two endpoints of the circle's diameter. For example, if you want to draw a circle that passes through the points (1,1) and (2,1), you can use the **CIRCLE** command with 2P option, as shown in the following example (Figure 1-52):

Command: **CIRCLE** «
 Specify center point for circle or [3P/2P/Ttr(tan tan radius)]: **2P** «
 Specify first endpoint of circle's diameter: **1,1** «
 Second endpoint of circle's diameter: **2,1** « (You can also use the relative coordinates.)

The Three-Point Option

For drawing a circle, you can also use the **Three-Point** option by defining three points on the circumference of the circle. The three points may be entered in any order. To draw a circle that passes through the points 3,3, 3,1 and 4,2, Figure 1-53, the prompt sequence is:

```
Command: CIRCLE «
Specify center point for circle or [3P/2P/Ttr(tan tan radius)]: 3P «
Specify first point on circle: 3,3 «
Specify second point on circle: 3,1 «
Specify third point on circle: 4,2 «
```

You can also use **relative rectangular coordinates** to define the points:

```
Command: CIRCLE «
Specify center point for circle or [3P/2P/Ttr(tan tan radius)]: 3P «
Specify first point on circle: 3,3 «
Specify second point on circle: @0,-2 «
Specify third point on circle: @1,1 «
```

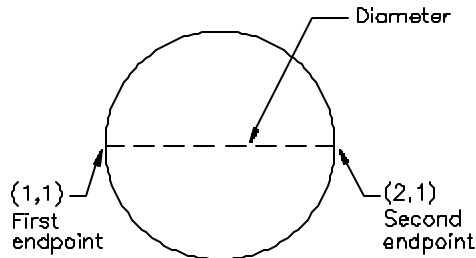


Figure 1-52 Drawing a Circle using the Two-Point option

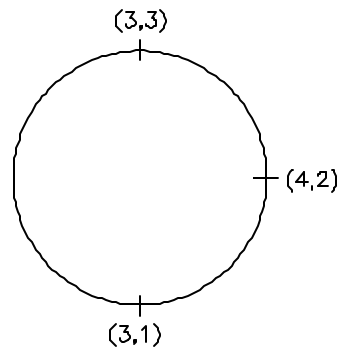


Figure 1-53 Drawing a Circle using the Three-Point option

The Tangent Tangent Radius Option

A tangent is an object (line, circle, or arc) that contacts the circumference of a circle at only one point. In this option AutoCAD uses the Tangent object snap to locate two tangent points on the selected objects that are to be tangents to the circle. Then you have to specify the radius of the circle. The prompt sequence for drawing a circle using the **Ttr** option is:

```
Command: CIRCLE «
Specify center point for circle or [3P/2P/Ttr(tan tan radius)]: T «
Specify point on object for first tangent of circle: Select first line, circle, or arc.
Specify point on object for second tangent of circle: Select second line, circle, or arc.
Specify radius of circle <current>: 0.75 «
```

In Figures 1-54 through 1-57, the dotted circles represent the circles that are drawn by using

the **Ttr** option. The circle actually drawn depends on how you select the objects that are to be tangent to the new circle. The figures show the effect of selecting different points on the objects. The dashed circles are the circles that are drawn using the **Ttr** option. If you specify too small or large radius, you may get unexpected results or the “Circle does not exist” prompt.

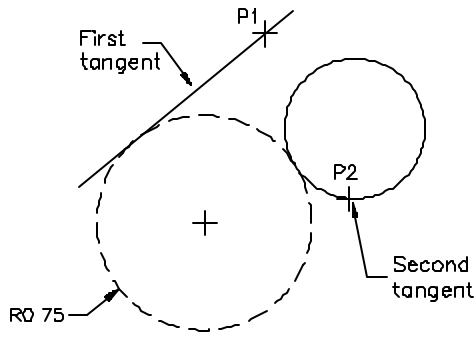


Figure 1-54 Tangent, tangent, radius (Ttr) option

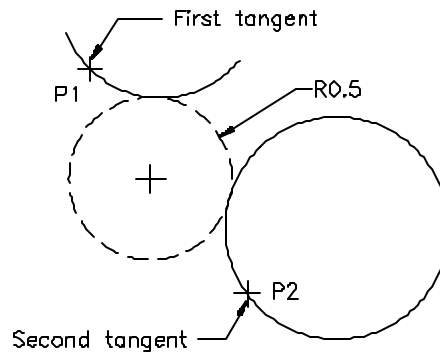


Figure 1-55 Drawing a circle using the tangent, tangent, radius (Ttr) option

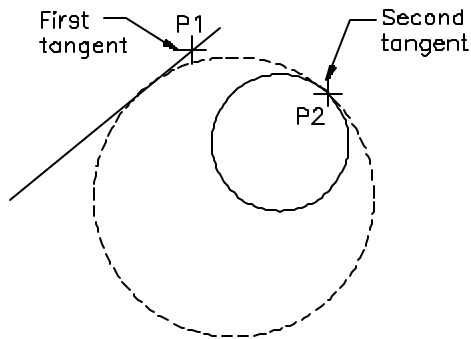


Figure 1-56 Tangent, tangent, radius option

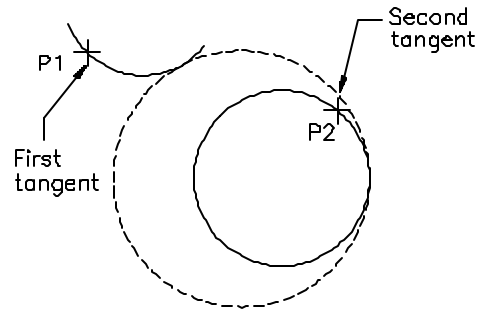


Figure 1-57 Tangent, tangent, radius (Ttr) option

The Tangent, Tangent, Tangent Option

You can invoke this option from the menu bar. This option is a modification of the Three-Point option. In this option AutoCAD uses the Tangent osnap to locate three points on three selected objects to which the circle is drawn tangent. The following is the prompt sequence for drawing a circle using the **Tan, Tan, Tan** option (Figure 1-58):

Command: **CIRCLE** «
Specify center point for circle or [3P/

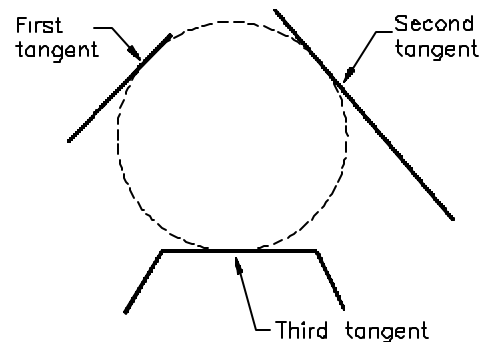


Figure 1-58 Drawing a circle using the Tan, Tan, Tan option

2P/Ttr(tan tan radius): Select Tan, Tan, Tan option from the **Draw** menu.

_ 3P Specify first point on circle: **_tan** to Select the first object.

Specify second point on circle: **_tan** to Select the second object.

Specify third point on circle: **_tan** to Select the third object.

Exercise 5

Mechanical

Draw Figure 1-59 using different options of the **LINE** and **CIRCLE** commands. Use absolute, relative rectangular, or relative polar coordinates for drawing the triangle. The vertices of the triangle will be used as the center of the circles. The circles can be drawn using the Center and Radius, Center and Diameter, or Tan, Tan, Tan option. (Height of triangle = $4.5 \times \sin 60 = 3.897$.) Do not draw the dimensions; they are for reference only.

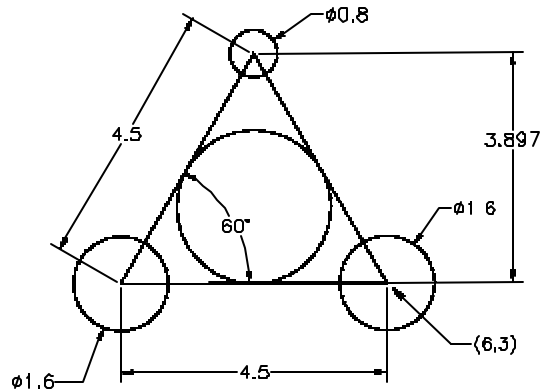


Figure 1-59 Drawing for Exercise 5

SAVING YOUR WORK

Toolbar:	Standard > Save
Menu:	File > Save or Save As
Command:	QSAVE , SAVEAS , SAVE



In AutoCAD or any computer system, you must save your work before you exit from the drawing editor or turn the system off. Also, it is recommended that you save your drawings after regular time intervals. In case of a power failure, an editing error, or other problems, all work saved before the problem started will be retained.

AutoCAD has provided the following commands that let you save your work on the hard disk of the computer or on the floppy diskette:

QSAVE SAVEAS SAVE

The **QSAVE**, **SAVEAS**, and **SAVE** commands allow you to save your drawing by writing it to a permanent storage device, such as a hard drive, or on a diskette in the A drive.

When you choose **Save** from the **File** menu, or choose the **Save** button in the **Standard** toolbar, the **QSAVE** command is invoked. If the current drawing is unnamed and you are saving the drawing for the first time in the present session, the **QSAVE** command will prompt you to enter the file name in the **Save Drawing As** dialog box (Figure 1-61). You can enter the name for the drawing and then choose the **Save** button in the dialog box. Once the drawing is saved and you make some changes to it, you can use the **QSAVE** command to save the drawing with the current name without prompting you to enter a file name. This allows you to do a quick save.

When you invoke the **SAVEAS** command, the **Save Drawing As** dialog box (Figure 1-61) is displayed always. Even if the drawing has been saved with a file name, this command gives you an option to save it with a different file name. In addition to saving the drawing, it sets the name of the current drawing to the file name you specify, which is displayed in the title bar. This command is used when you want to save a previously saved drawing under a different file name. You can also use this command when you make certain changes to a template and want to save the changed template drawing but leave the original template unchanged.

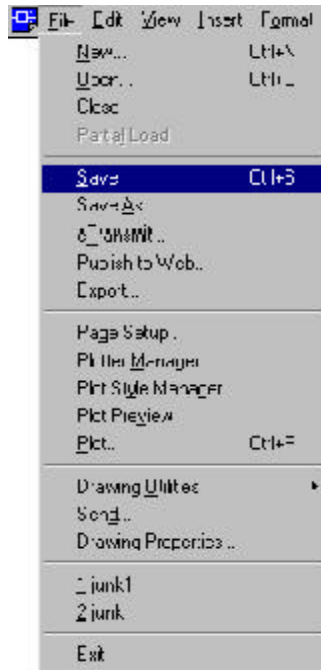


Figure 1-60 Different Save options in the **File** menu

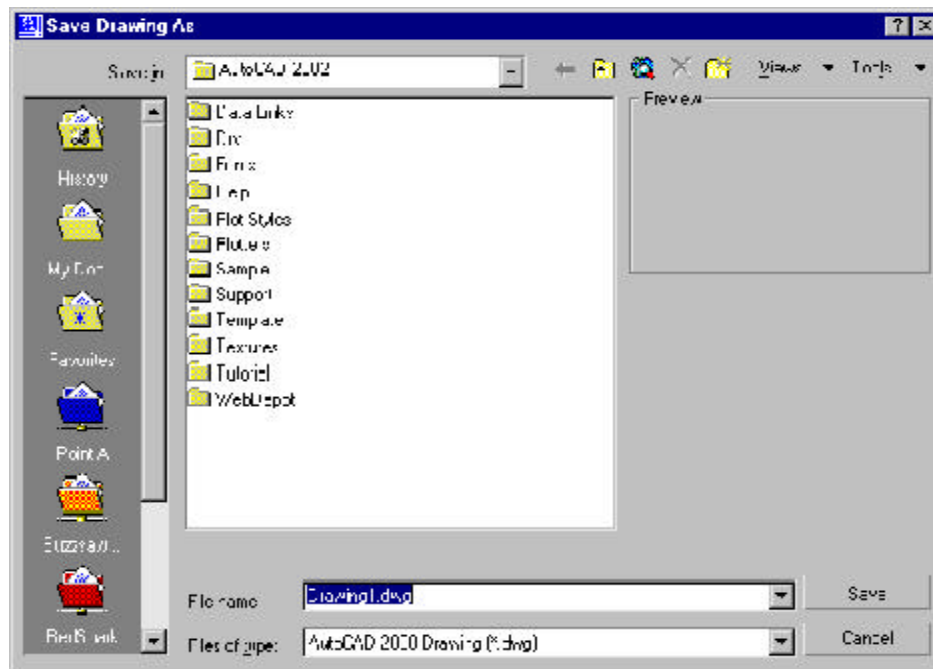


Figure 1-61 **Save Drawing As** dialog box

The **SAVE** command is the most rarely used command and can be invoked only from the command line by entering **SAVE** at the Command prompt. It is similar to the **SAVEAS** command and displays the **Save Drawing As** dialog box always. With this command you can save a previously saved drawing under a different file name, but this command does not set it as the current drawing.

Save Drawing As Dialog Box

The **Save Drawing As** dialog box displays the information related to the drawing files on your system. The different components of the dialog box are described next.

Places list

A column of icons is displayed on the left side of the dialog box. These icons contain the shortcuts to the folders that are frequently used. You can quickly save your drawings in one of these folders. The **History** folder displays the list of most recently saved drawings. You can save your personal drawings in the **My documents** or the **Favorites** folder. The **Point A**, **RedSpark**, and **Buzzsaw** icons connect you to their respective pages on the Web. You can add any new folder in this list for easy access by simply dragging this folder on to the Places list area and then leaving it. You can rearrange all these folders by dragging them and then placing them at the desired locations. It is also possible to remove the folders when not in frequent use. Right-click on the particular folder and then select **Remove** from the shortcut menu. The Point A, RedSpark and the Buzzsaw shortcuts are permanent and cannot be removed.

File name edit box

To save your work, enter the name of the drawing in the **File Name** edit box. This can be done by typing the file name or selecting it from the drop-down list. If you select the file name you want from the drop-down list, the name you select automatically appears in the **File name** edit box. If you have already assigned a name to the drawing, the current drawing name is taken as default. If the drawing is unnamed, the default name **Drawing1** is displayed in the **File Name** edit box. You can also choose the down arrow at the right of the edit box to display the names of the previously saved drawings and choose a name here.

Files of type drop-down list

The **Files of type** drop-down list (Figure 1-62) is used to specify the drawing format in which you want to save the file. For example, to save the file as AutoCAD 2000 drawing file, select **AutoCAD 2000 Drawing** from the drop-down list.



Figure 1-62 Files of type drop-down list

Save in drop-down list

The current drive and path information is listed in the **Save in** drop-down list (Figure 1-63). AutoCAD will initially save the drawing in the default directory, but if you want to save the

drawing in a different directory, you have to specify the path. For example, if you want to save the present drawing under the file name **HOUSE** in the C1 subdirectory, choose the arrow button in the **Save in** drop-down list to display the drop-down list and select C:. When you select C: all directories in C drive will be listed in the **File** list box. Double-click on **2000edit1** or select 2000edit1 and choose the **Open** button to display its directories. Again double-click on C1 or select C1 and choose the **Open** button to display drawing names in the **File** list box. Select HOUSE from the list, if it is already listed there, or enter it in the **File name** edit box and then choose the **Save** button. Your drawing (House) will be saved in the C1 folder (C:\2000edit1\C1\HOUSE.dwg). If you want to save the drawing on the A drive, select A: in the **Save in** drop-down list.

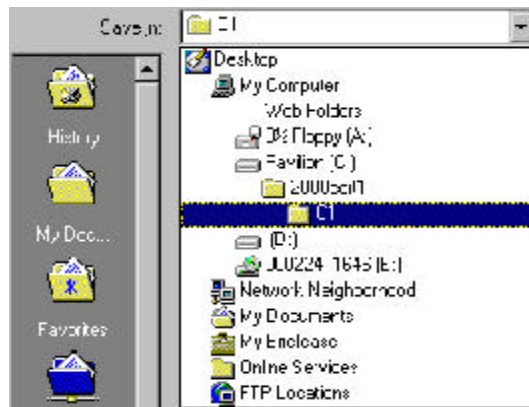


Figure 1-63 Save in drop-down list



Tip

The file name you enter to save a drawing should match the contents of the drawing. This helps you to remember the drawing details and makes it easier to refer to them later. Also the file name can be 255 characters long and can contain spaces and punctuation marks.



Note

If you want to save a drawing on the A or B drive, make sure the diskette you are using to save the drawings is formatted.

Views List

The **Views** drop-down list has options for the type of listing of files and displaying the preview images (Figure 1-64).



Figure 1-64 Views list

List, Detail, and Preview options

If you choose the **Detail** option, it will display detailed information about the files (size, type, date, and time of modification) in the **Files** list box. In the detailed information if you click on the **Name** label, the files are listed with the names in alphabetical order. If you double-click on the Name label, the files will be listed in reverse order. Similarly if you click on the **Size** label the files are listed according to the size in ascending order. Double-clicking on the **Size** label will list the files descending by order of size. Similarly you can click on the **Type** label or the **Modified** label to list the files accordingly. If you choose the

List option, all files present in the current directory will be listed in the **File** list box. If you select the **Preview** option, the list box displays the Preview image box wherein the bitmap image of the file chosen is displayed. If cleared the Preview box is not displayed.

Folder Button



If you choose the **Create New Folder** button, AutoCAD creates a new directory under the name **New Folder**. The new folder is displayed in the **File** list box. You can accept the name or change it to your requirement.

Up One Level Button



The **Up One Level** button displays the directories that are up by one level. For example, if you are in the **Samples** subdirectory of the **AutoCAD 2002** directory, then choosing the **Up one level** button will take you to the **AutoCAD 2002** directory.

Search the Web



It displays the **Browse the Web** dialog box that enables you to access and store AutoCAD files on the Internet.

Tools List

The **Tools** drop-down list (Figure 1-65) has an option for adding or modifying the FTP sites. These sites can then be browsed from the FTP shortcut in the **Places** list. The **Prompt for PointA Login** option can be used to reenter your login and password if you have asked the password to be remembered while opening the PointA portal from the Places list which bypasses the login prompt. The **Add Current Folder to Places** and **Add to Favorites** options adds the folder displayed in the **Save in** edit box to the Places list or to the Favorites folder. The **Options** button displays the **Saveas Options** dialog box where you can save the proxy images of custom objects. It has the **DWG** and **DXF** options tabs.

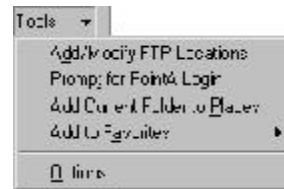


Figure 1-65 Tools list

AUTOMATIC TIMED SAVE

AutoCAD allows you to save your work automatically at specific intervals. To change the time intervals you can enter the time intervals in minutes in the **Minutes between saves** text box in the **Options** dialog box (**Open and Save** tab). This dialog box can be invoked from the **Tools** menu. Depending on the power supply, hardware, and type of drawings, you should decide on an appropriate time and assign that time to this variable. AutoCAD saves the drawing under the file name **AUTO.SVS**. The extension of the auto-save file is **.SVS**. You can also change the time interval by using the **SAVETIME** system variable.

CREATION OF BACKUP FILES

If the drawing file already exists and you use **SAVE** or **SAVEAS** commands to update the current drawing, AutoCAD creates a backup file. AutoCAD takes the previous copy of the drawing and changes it from a file type **.DWG** to **.BAK**, and the updated drawing is saved as

a drawing file with the **.DWG** extension. For example, if the name of the drawing is **MYPROJ.DWG**, AutoCAD will change it to **MYPROJ.BAK** and save the current drawing as **MYPROJ.DWG**.

**Tip**

Although the Automatic save saves your drawing after a certain time interval, you should not completely depend on it because the procedure for converting the SVS file into a drawing file is cumbersome. Therefore it is recommended that you save your files regularly using the **QSAVE** or **SAVEAS** commands.

CLOSING A DRAWING

You can use the **CLOSE** command to close the current drawing file without actually quitting AutoCAD. If you choose **Close** from the **File** menu or enter **CLOSE** at the Command prompt, the current drawing file is closed. If you have not saved the drawing after making the last changes to it, and you invoke the **CLOSE** command, AutoCAD displays a dialog box that allows you to save the drawing before closing. This box gives you an option to discard the current drawing or changes made to it. It also gives you an option to cancel the command. After closing the drawing you are still in AutoCAD from where you can open a new or an already saved drawing file. You can also use the close button (**X**) of the drawing window to close the drawing.

QUITTING AUTOCAD

You can exit from the AutoCAD program by using the **EXIT** or **QUIT** command. Even if you have a drawing file open you can use the **EXIT** command to close it as well as quit the AutoCAD program. In case the drawing has not been saved, it allows you to save the work first through a dialog box. You can also use the close button (**X**) of the main AutoCAD window (present in the title bar) to end the AutoCAD session.

AUTOCAD'S HELP

Toolbar:	Standard > Help
Menu:	Help > Help
Command:	HELP

You can get the online help and documentation on the working of AutoCAD 2002 commands from the **Help** menu (Figure 1-66).

Help



Invoking **HELP** displays the **AutoCAD 2002 Help: User Documentation** dialog box (Figure 1-67). You can use this dialog box to access help on different

topics and commands. It has five tabs: **Contents**, **Index**, **Search**, **Favorites**, and **Ask me**, which display the corresponding help topics. If you are in the middle of a command and require help regarding it, choosing the **Help** button, displays information about that particular command in the dialog box.



Figure 1-66 Help menu

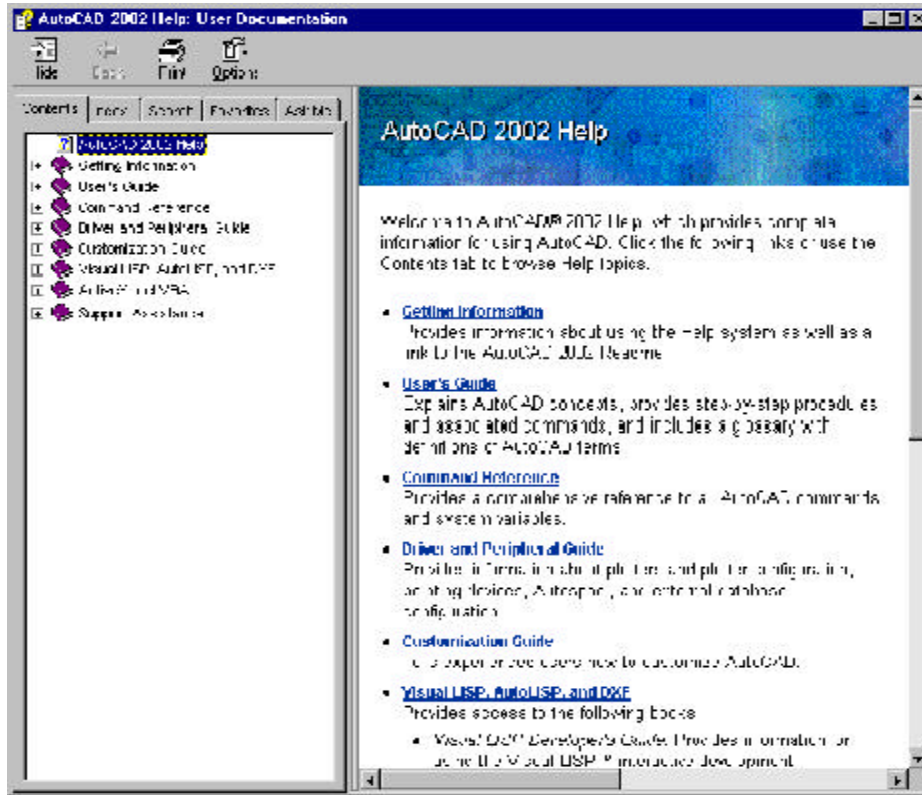


Figure 1-67 Help Topics: AutoCAD Help dialog box (Index tab)

Contents

This tab displays the help topics that are organized by categories pertaining to different sections of AutoCAD such as the User's Guide, Command Reference, and so on. To select a category, double-click on the corresponding book icon or choose the plus sign on the left. The icon becomes an open book with a minus (-) sign and a list of headings associated with that category are displayed. Use the plus sign (+) to further open the headings until you reach the help topic which has a question mark (?) displayed with it. Choose the topic to display information about the selected topic or command in the window present on the right side of the dialog box.

Index

This tab displays the complete index (search keywords) in an alphabetical order. To display information about an item or command, type the item (word) or command name in the edit box. With each letter entered the listing keeps on changing in the list area, displaying the possible topics. When you enter the word and if AutoCAD finds that word, it is automatically highlighted in the list area. Choose the **Display** button to display information about it.

Search

This tab creates a word list based on all the keywords present in the online help files. When

you type a word you are looking for and then choose the **List Topics** button, a list of matching words appears in a window below to narrow down your search. This search is dependent on the option you have selected at the bottom of the dialog box. Use the scroll bar to scroll through the list, select the desired topic, and then choose the **Display** button to display its help.

Favorites

This tab lets you create a list of your own topics that you need to access regularly. The topic which you have chosen in any other tab of Help is displayed in the **Current Topic** box when you choose the **Favorites** tab. Use the **Add** button to add it to your own list. You can use the **Remove** button to remove a topic from your list and the **Display** button to display its help.

Ask Me

When you choose this tab, you are allowed to enter a query in the edit box and then press ENTER. A list of topics related to the question follow. It also shows the book (category) from which it has been selected.

Active Assistance



This option gives you an access to context sensitive help. This help can be started by choosing the **Active assistance** button in the **Standard** toolbar, or the **Help** menu, or by entering **ASSIST** at the Command prompt. Whenever you enter a command, an Active Assistance window with information regarding that command is displayed. Its icon is displayed in the main Task bar of the Windows at the bottom of the screen. To disable this help, right-click on the Active Assistance icon in the window's bar and choose Exit.

What's New

This option gives you an interactive list of all the new features in AutoCAD 2002. You can choose this option from the **Help** menu that displays the **What's New in AutoCAD 2002** screen with a list of new features and enhanced features. Open the **New Features** folder to display a list of topics (Figure 1-68). When you choose a topic, a description of the feature improvement is displayed. It has a file that displays an overview of the features added since AutoCAD R13.

Learning Assistance

This is a multimedia learning option that provides you an online environment where you can learn the AutoCAD software application interactively. You can choose this option from the **Help** menu. Choosing this option opens the **AutoCAD 2000 Help: User Documentation** dialog box with the **Learn AutoCAD** screen displayed. You can move the cursor on **Go to Autodesk e-Learning** where the cursor changes to a hand. Choosing this option connects you to the Uniform Resource Locator (URL) <http://www.autodesk.com/autocad-elearning>. The AutoCAD page is opened using the Internet Explorer and displays information regarding the AutoCAD products. You can select Home to display the Autodesk home page. Here you can register with Headlight.com which is the Autodesk vendor. You can also select other pages such as My Profile, Team Profile to get specific help.

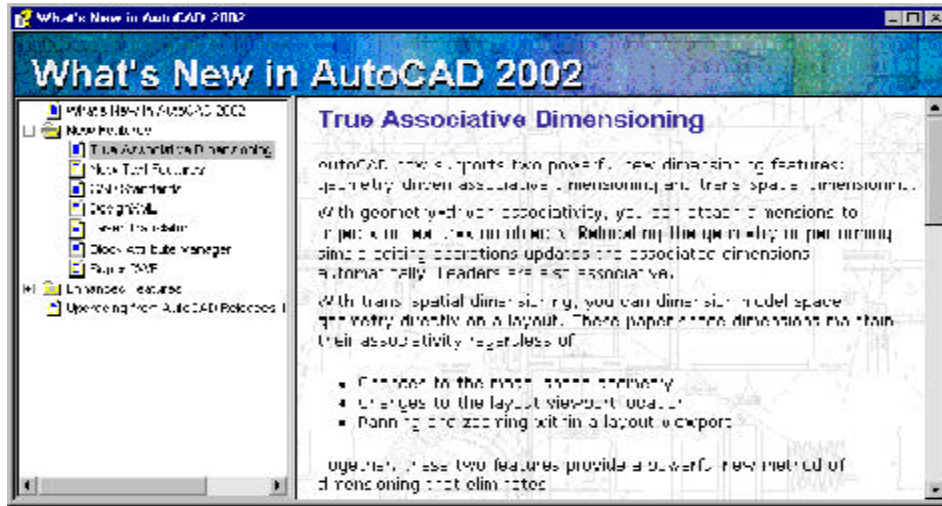


Figure 1-68 What's New in AutoCAD 2002 screen

Support Assistance

This help option displays the Autodesk Support Assistance screen with five main headings: **Search for solution**, **Download**, **What's hot**, **More Resources**, and **Phone Support**. Choosing any one of these topics displays further subtopics to choose from with their brief explanations. You can choose any of these to look for their respective descriptions and related topics. To go to Search or Up one level, you choose the **Search** or **Up one level** buttons, provided at the end of the screen. This option gives you all the Technical Support information in a question and answer format. It also provides information about other help resources.

Autodesk User Group International

This utility connects you to the **Autodesk User Group International** Web pages and sites through the Microsoft Internet Explorer.

About AutoCAD

This option gives you information about the Release, Serial Number, Licensed To, and also the legal description about AutoCAD.

ADDITIONAL HELP RESOURCES

1. You can get help for a command while working by pressing the F1 key. The **Help** dialog box containing information about the command is displayed. You can exit the dialog box and continue with the command.
2. You can get help about a certain dialog box by choosing the **Help** button in that dialog box.
3. Some of the dialog boxes have a **question mark (?)** button at the topright corner just adjacent to the **close** button. When you choose this button the ? gets attached to the

cursor. You can then drop it on any item in the dialog box to display information about that particular item.

4. Autodesk has provided several resources that you can use to get assistance with your AutoCAD questions. You can also use these resources to get information on Autodesk products, product updates, and other services provided by Autodesk. The following is a list of some of the resources:
 - a. Autodesk Web Site **<http://www.autodesk.com>**
 - b. AutoCAD 2000 Web Site: **<http://www.autodesk.com/autocad>**
 - c. Autodesk Fax Information System: **(415) 446-1919**
 - d. AutoCAD Technical Assistance Web site **autodesk.com/support**.
 - e. AutoCAD Discussion Groups Web site **autodesk.com/support/discsgrp/acad.htm**.
5. **The Web** section in the **AutoCAD Today** window connects you to the Internet and provides you with the different links and resources.
6. You can also get help by contacting the author, Sham Tickoo, at **stickoo@calumet.purdue.edu** or **tickoo@cadcim.com**.
7. You can download AutoCAD drawings, programs, and special topics by accessing the authors Web site at **www.cadcim.com** or **www.calumet.purdue.edu/public/mets/tickoo/index.html**.

Self-Evaluation Test

Answer the following questions and then compare your answers to the correct answers given at the end of this chapter.

1. It is possible to change the initial (startup) view displayed while starting AutoCAD. (T/F)
2. If the value of the **COORDS** variable is set to 1, the coordinate display is static, that is, the coordinate values displayed in the status bar change only when you specify a point. (T/F)
3. Using the **Crossing** method of object selection, the objects to be selected should be completely enclosed within the boundaries of the crossing box. (T/F)
4. If the current drawing is unnamed and you are saving the drawing for the first time in the present session, the **QSAVE** command will prompt you to enter the file name in the **Save Drawing As** dialog box. (T/F)

5. You can draw a line by specifying the length of the line and its direction, using the _____.
6. In the _____ coordinate system, the displacements along the X and Y axes (DX and DY) are measured with reference to the previous point rather than to the origin.
7. You can use the _____ command to close the current drawing file without actually quitting AutoCAD.
8. The _____ option of the **CIRCLE** command can be used to draw a circle, if you want the circle to be tangent to two previously drawn objects.
9. You can erase a previously drawn line using the _____ option of the **LINE** command.
10. The _____ system variable can be used to change the time interval for automatic save.

Review Questions

Answer the following questions.

1. The **My Drawings** area of the **AutoCAD 2002 Today** window includes the **Bulletin Board** that gives you space to display information and create a customized bulletin board. (T/F)
2. The shortcut menu invoked by right-clicking in the command window displays the six most recently used commands and some of the Window's options such as Copy, Paste. (T/F)
3. The **Three-Point** option of the **CIRCLE** command lets you draw the circle by specifying the two endpoints of the circle's diameter. (T/F)
4. The file name you enter to save a drawing in the **Save Drawing As** dialog box file name can be 255 characters long but cannot contain spaces and punctuation marks. (T/F)
5. The **My Drawings** area in the **AutoCAD 2002 Today** window does not give you the option for:
 - (a) Opening a drawing
 - (b) Creating a new drawing
 - (c) Saving a drawing
 - (d) Opening Symbol libraries
6. You cannot terminate the **LINE** command by pressing which of the following key on the keyboard at the **Specify next point or [Close/Undo]:** prompt?

- (a) SPACEBAR
 - (b) BACKSPACE
 - (c) ENTER
 - (d) ESC
7. Which of the following commands is used to close the current drawing file without actually quitting AutoCAD?
- (a) **EXIT**
 - (b) **END**
 - (c) **CLOSE**
 - (d) **QUIT**
8. Which of the following shortcuts can be removed from the **Places** list in the **Save Drawing As** dialog box?
- (a) Favorites
 - (b) Point A
 - (c) RedSpark
 - (d) Buzzsaw
9. When you choose **Save** from the **File** menu, or choose the **Save** button in the **Standard** toolbar, which of the following commands is invoked?
- (a) **SAVE**
 - (b) **LSAVE**
 - (c) **QSAVE**
 - (d) **SAVEAS**
10. Using the **Advanced Setup** option of the **Wizard** you can set the units, limits, and the different _____ settings for the new drawing.
11. A _____ is displayed on top of the AutoCAD screen that has the AutoCAD symbol and the current drawing name.
12. You can change the shape of the toolbars by placing the cursor anywhere on the _____ of the toolbar where it takes the shape of a double sided arrow.
13. The _____ option of the **LINE** command can be used to join the current point with the initial point of the first line when two or more lines are drawn in continuation.
14. In the _____ coordinate system, the points are located with respect to origin 0,0.
15. To draw a circle, you can use the **Three-Point** option of the **CIRCLE** command by defining three points on the _____ of the circle.
16. The _____ tab of the **AutoCAD 2002 Help: User Documentation** dialog box displays the help topics that are organized by categories pertaining to different sections of AutoCAD.

Exercises

Exercise 6

General

Use the following relative rectangular and absolute coordinate values in the **LINE** command to draw the object.

Point	Coordinates	Point	Coordinates
1	3.0, 3.0	5	@3.0,5.0
2	@3,0	6	@3,0
3	@-1.5,3.0	7	@-1.5,-3
4	@-1.5,-3.0	8	@-1.5,3

Exercise 7

General

For Figure 1-69, enter the relative rectangular and relative polar coordinates of the points in the following table, then use these coordinates to draw the figure. The distance between the dotted lines is 1 unit. Save this drawing as Exer7.dwg.

1	3.0, 1.0	9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8		16	

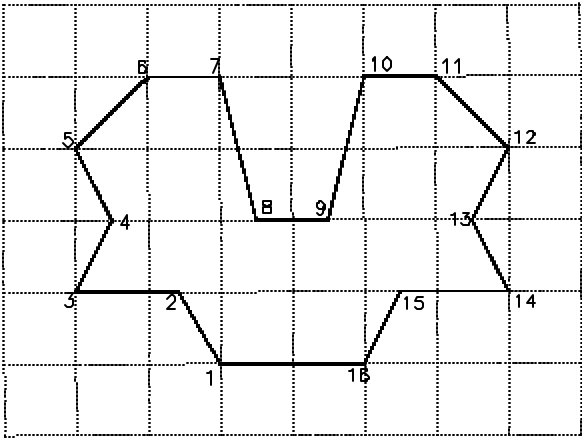


Figure 1-69 Drawing for Exercise 7

Exercise 8

General

For Figure 1-70, enter the relative polar coordinates of the points in the following table. Then use these coordinates to draw the figure. Do not draw the dimensions.

Point	Coordinates	Point	Coordinates
1	1.0, 1.0	6	
2		7	
3		8	
4		9	
5			

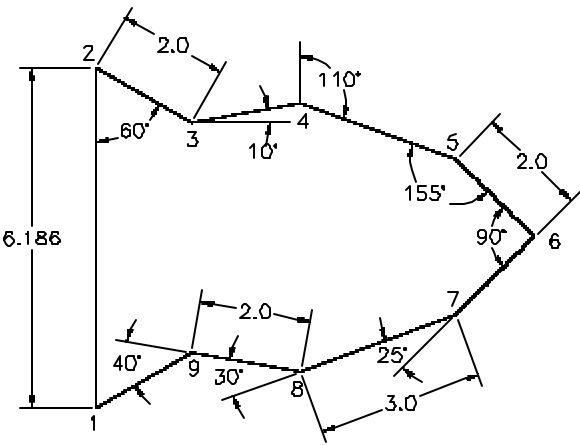


Figure 1-70 Drawing for Exercise 8

Exercise 9

Mechanical

Draw Figure 1-71, using the **LINE** and **CIRCLE** commands. The distance between the dotted lines is 1.0 units.

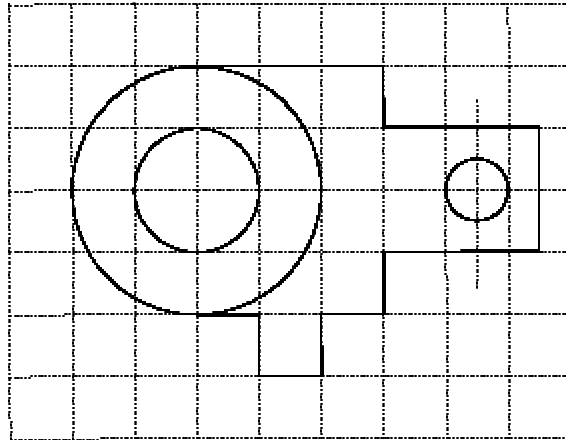


Figure 1-71 Drawing for Exercise 9

Exercise 10

Generall

Draw Figure 1-72, using the **LINE** command and the **Ttr** option of the **CIRCLE** command.

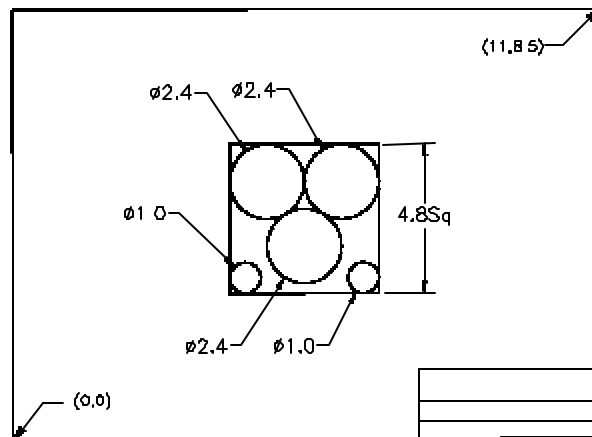


Figure 1-72 Drawing for Exercise 10

Problem Solving Exercise 1

General

Draw the object shown in Figure 1-73, using the **LINE** and **CIRCLE** commands. In this exercise only the diameters of the circles are given. To draw the lines and small circles (Dia 0.6), you need to find the coordinate points for the lines and the center points of the circles. For example, if the center of concentric circles is at 5,3.5, then the X coordinate of the lower left corner of the rectangle is $5.0 - 2.4 = 2.6$.

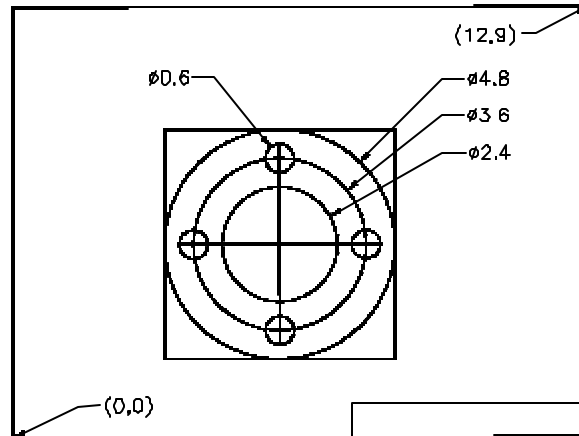


Figure 1-73 Drawing for Problem Solving Exercise 1

Problem Solving Exercise 2

General

Draw Figure 1-74, using various options of the **CIRCLE** and **LINE** commands. In this exercise you have to find the coordinate points for drawing the lines and circles. Also, you need to determine the best and easiest method to draw the 0.85 diameter circles along the outermost circle.

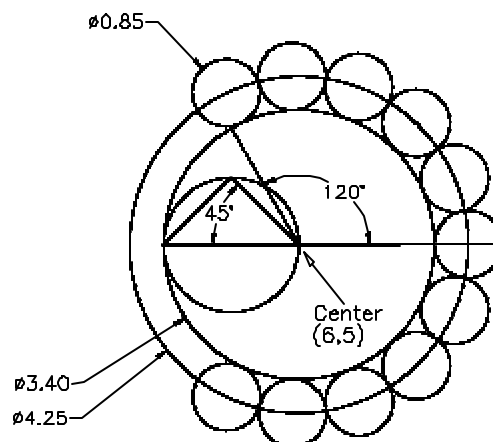


Figure 1-74 Drawing for Problem Solving Exercise 2

Problem Solving Exercise 3

General

Draw the drawing in Figure 1-75, using the absolute, relative rectangular, or relative polar coordinate system. Draw according to the dimensions shown in the figure, but do not draw the dimensions.



1 - T, **2** - F, **3** - F, **4** - T, **5** - Direct distance entry, **6** - relative rectangular, **7** - **CLOSE**,
8 - Tangent tangent radius, **9** - Undo, **10** - **SAVETIME**