

ENGINEERING GRAPHICS WITH **AutoCAD**[®] 2023



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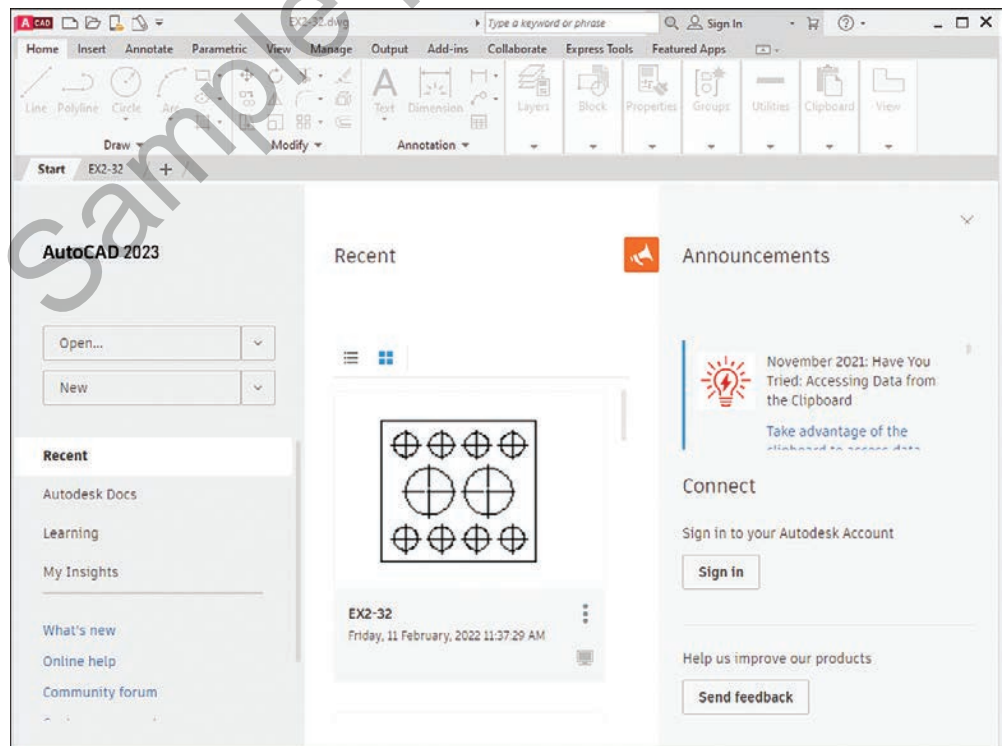
Appendix (Online Only)

Sample pages

chapter one

Getting Started

Figure 1-1



1-1 Introduction

This chapter introduces you to AutoCAD 2023. It covers basics such as using the **Application** menu, starting new drawings, making settings and entering data in dialog boxes, and saving your work.

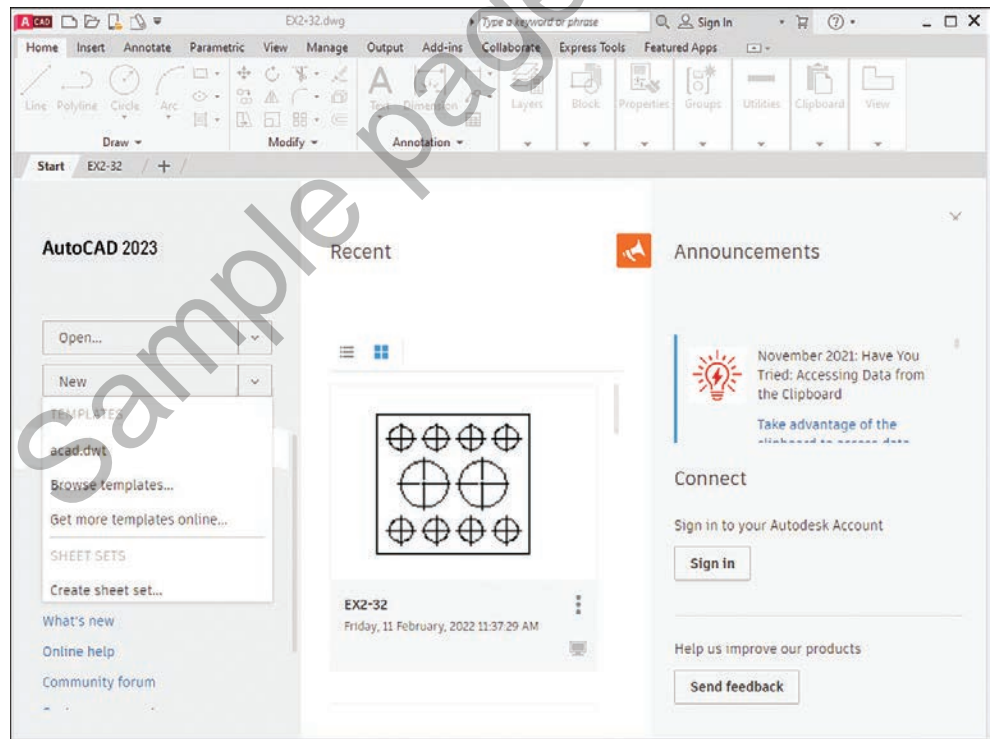
Figure 1-1 shows the initial AutoCAD drawing screen, which appears when the program is first started.

Starting a New Drawing

1 Click the down arrow beside the **New** button on AutoCAD's opening screen.

A list of recently used templates appears in the drop-down menu (Figure 1-2). You will use various templates throughout the text, but for a start, you will use the **acad.dwt** template. The **acad.dwt** template defines inches as its primary units. If the **acad.dwt** template does not appear in the drop-down, click **Browse templates...** and select it from there.

Figure 1-2



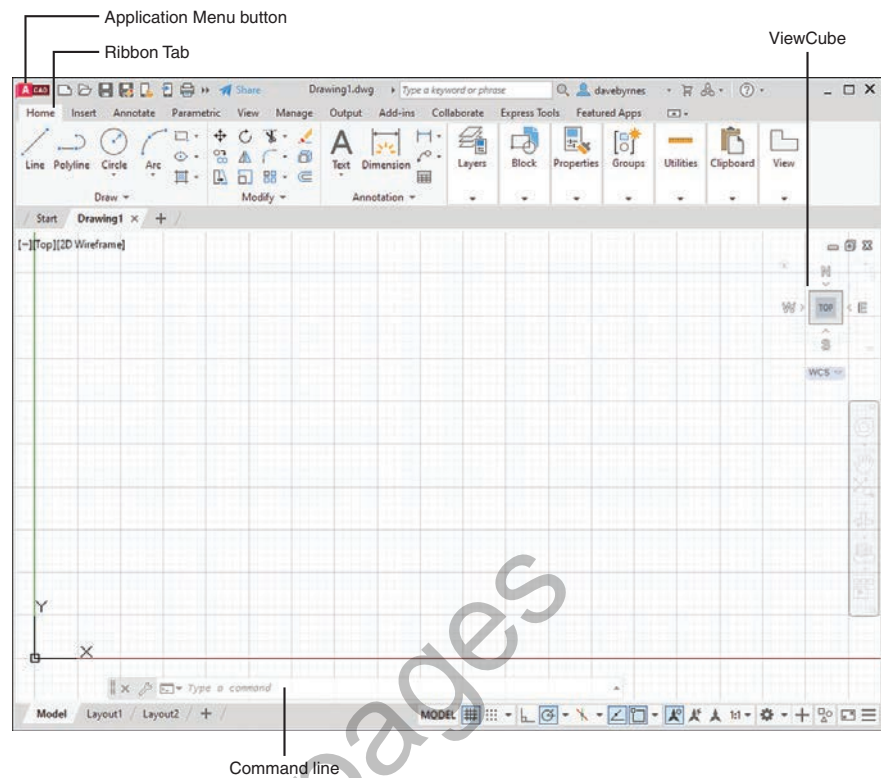
2 Click **acad.dwt** on the **Templates** list.

The drawing screen appears (Figure 1-3).

NOTE

The tool panels in the figure have a light-colored background—for printing clarity. Your background may be dark.

Figure 1-3



An Alternative Method to Starting a New Drawing

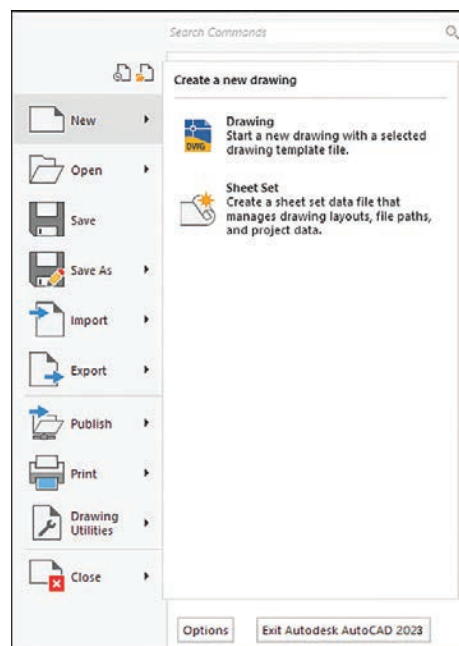
- 1 Click the **Application Menu** button in the upper-left corner of the drawing screen to display the **Application** menu.

A list of drawing commands and utilities appears (Figure 1-4).

- 2 Click **New**.

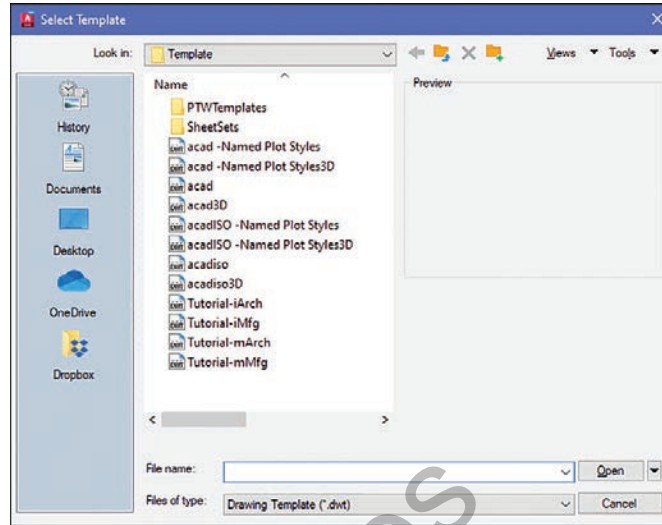
The **Select Template** dialog box appears (Figure 1-5).

Figure 1-4



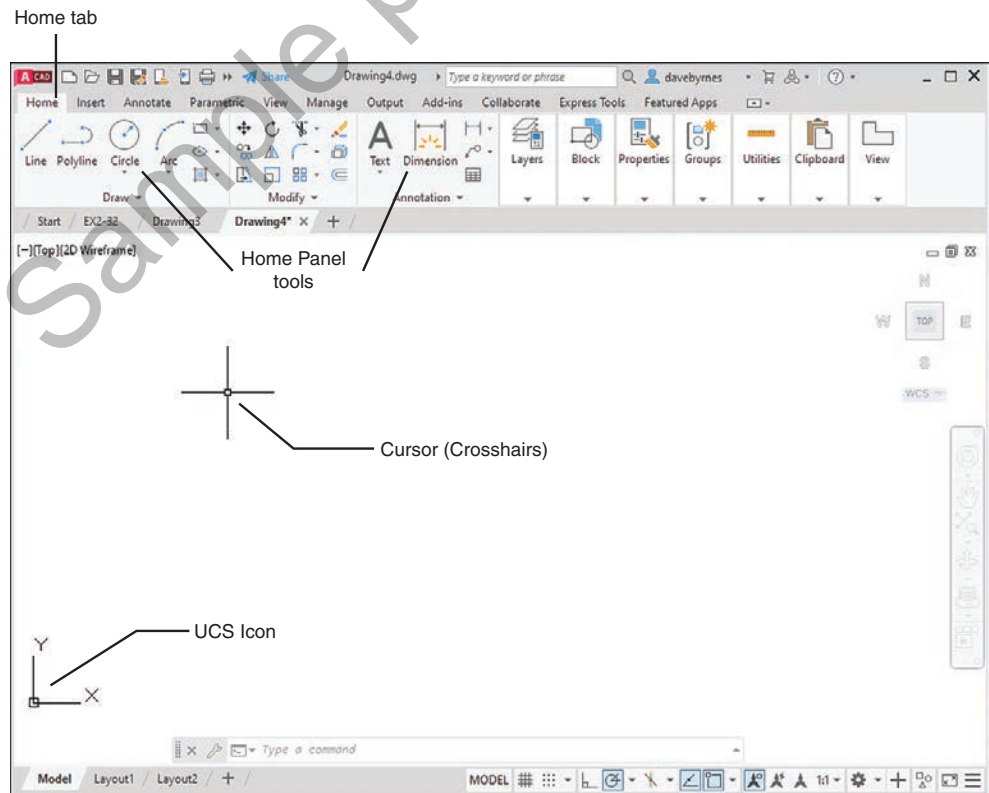
- 3 Select the **acad** template and click **Open**.

Figure 1-5



The AutoCAD drawing screen appears (Figure 1-6). The Ribbon appears at the top of the screen, showing a group of tabs and panels. Select different tabs to access other groups of panels. Panels contain commands.

Figure 1-6



The command line is located at the bottom of the screen, as are other tools (icons) for commands such as **Grid** and **Snap**. Use the command line to enter inputs for the commands, among other uses.

The drawing's name appears at the top of the screen. In Figure 1-4, for example, the drawing name is Drawing1.dwg. This is a default name created by AutoCAD. If a drawing name had been entered, it would appear where the Drawing1.dwg title currently appears.

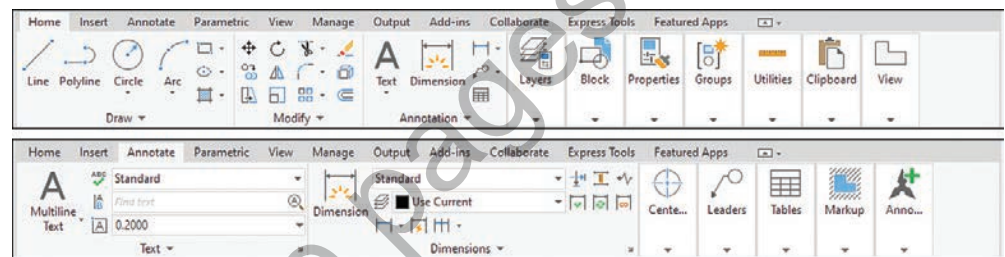
The large open area in the center of the screen is the *drawing area* or *drawing editor*. You create drawings in this area.

The symbol at the bottom-left corner of the drawing area is called the **User Coordinate System (UCS)** icon. It shows the direction of positive X and Y coordinates.

1-2 Tabs and Panels

The headings across the ribbon at the top of the screen (**Home**, **Insert**, etc.) are called *tabs*, and the groups of commands on the tabs are called *panels*. Figure 1-7 shows the **Home** panels and the **Annotate** panels.

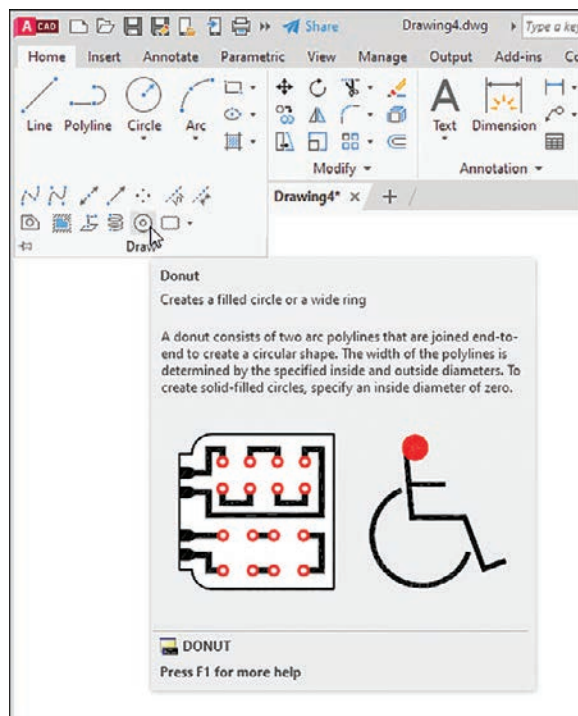
Figure 1-7



Accessing Additional Commands Within a Panel

Each panel shows a group of the most commonly used commands. Additional commands are available by clicking the arrow to the right of the panel's name. Figure 1-8 shows the additional **Draw** commands available.

Figure 1-8



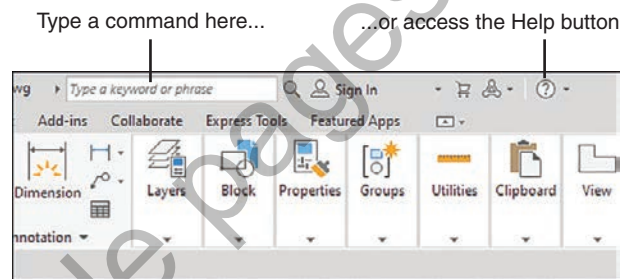
Tooltips for Commands

A *tooltip* is a pop-up help window that appears when the cursor is hovered over a command's icon (Figure 1-8). Initially, when you place the cursor over a command icon but don't click, a tooltip appears, identifying the command. After a few seconds the tooltip expands to further define the command.

Accessing Other Help Information

If you cannot find a command or if you need further instructions for operating a particular command, type a keyword into the text box in the program's title bar, and press **Enter** or click the **Access to Help** button located in the top-right section of the screen (Figure 1-9). The icon for the **Access to Help** tool is a question mark within a circle. The **Help** dialog box appears. Type in the name of what you are seeking and click the magnifying glass icon just to the right of the search box.

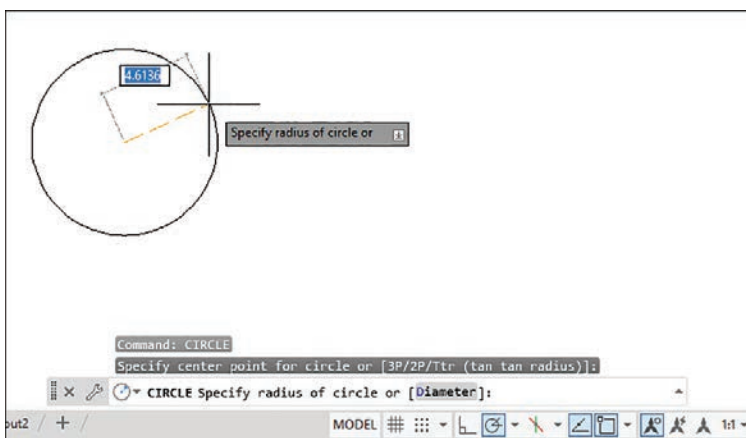
Figure 1-9



1-3 The Command Line Window

The command line window is located at the bottom of the drawing screen. Use it to access commands that do not have their own icons or to select options associated with the command. Figure 1-10 shows a circle. The word **CIRCLE** automatically appears in the command line when you click the **Circle** tool on the **Draw** panel. As presented, the circle will be defined by entering a radius value. Enter the radius value into the box with the blue background before clicking the left mouse button to complete the circle. If the radius value does not appear, press the F12 function key and ensure that the Dynamic Input is **ON**.

Figure 1-10



The command line shows the word Diameter in brackets: [Diameter]. Follow the next steps to use the **Circle** command's **Diameter** option.

Entering a Diameter Value

- 1 Click the **Circle** tool on the Home panel and draw a circle.
- 2 Click the command line box.
- 3 Type **d** and press **Enter**.

The system is now set for a diameter value for the circle.

- 4 Enter a value for the diameter of the circle and press **Enter**.

The options shown at the command line always include one uppercase letter. It may not always be the first letter. Type that letter and press **Enter** to access the option.

Diameter values may also be entered by first clicking the arrowhead next to the **Circle** tool and selecting the **Center, Diameter** option.

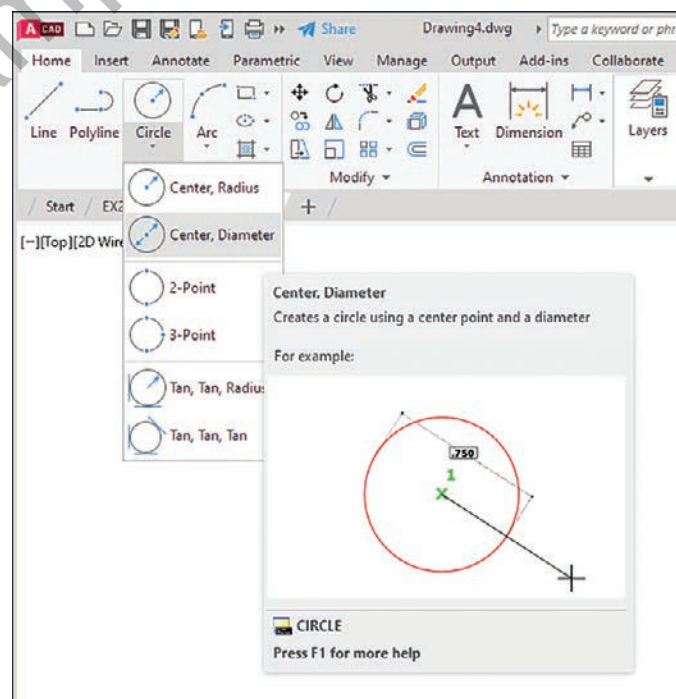
1-4 Command Tools

A *tool button* displays a picture (icon) that represents an AutoCAD command. Most commands have equivalent tool buttons.

Determining the Command That a Tool Button Represents

Figure 1-11 shows the steps to find the name and description of the command that the tool button executes.

Figure 1-11



1 Hover the cursor arrow over the selected tool button.

In the example shown, the **Circle** command tool button with the **Diameter** option is selected.

2 Hold the arrow still without pressing any mouse buttons.

The command name appears in a tooltip. If you continue to keep the cursor arrow on the tool button, an expanded tooltip that further describes the command appears.

1-5 Starting a New Drawing

When you start a new drawing, AutoCAD assigns a drawing name. The drawing units are specified, the drawing limits are modified, if needed, and **Grid** and **Snap** values are defined. The following four sections show you how to start a new drawing.

1-6 Naming a Drawing

You can use any combination of letters and numbers as a file name. Either uppercase or lowercase letters can be used, since AutoCAD file names are not case sensitive. The symbols \$, -, and _ (underscore) can also be used. Other symbols, such as % and *, cannot be used (Figure 1-12).

Figure 1-12

Correct drawing names:

FIRST EK-131-1 PA1-1a

Incorrect drawing names:

100% *.*

To locate a file on a the C: drive:

C:FIRST

All AutoCAD drawing files will automatically have the extension .dwg added to the given file name by default. If you name a drawing **FIRST**, it will appear in the files as **FIRST.dwg**. (A default setting is one that AutoCAD will use unless specifically told to use some other value.)

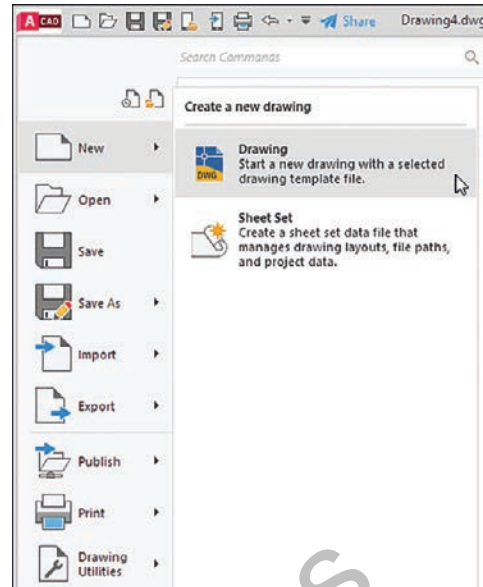
If you want to locate a file on another drive, specify the drive letter followed by a colon in front of the drawing name. For example, in Figure 1-12 **C:FIRST** will locate the drawing file **FIRST** on the C: drive.

Creating a New Drawing

There are three ways to access the **Create New Drawing** dialog box that is used to name a new drawing:

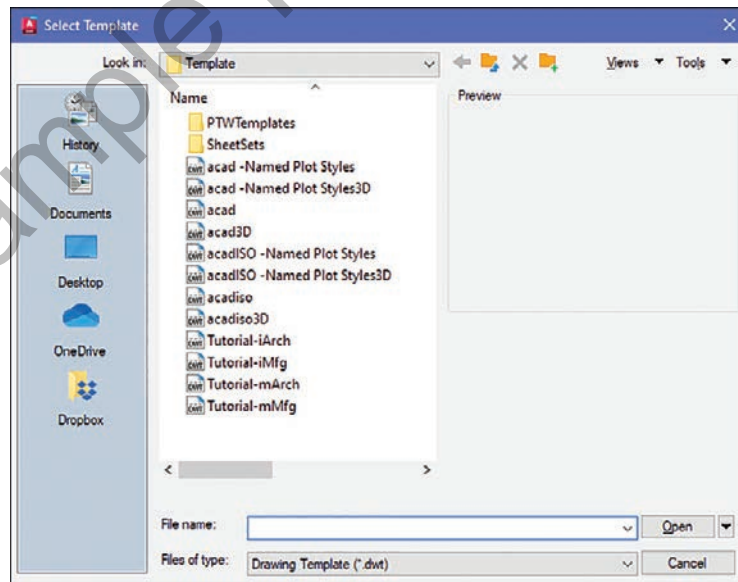
- Select **New** from the **Application** menu (Figure 1-13).
- Type the word **new** at a command prompt.
- Hold down the **Ctrl** key and press **N**.

Figure 1-13



Any of these methods will open the **Select Template** dialog box (Figure 1-14). The **acad** template will set up a drawing with inch values and ANSI style dimensions. The **acadiso** template will set up a drawing with millimeter values and ISO-style dimensions.

Figure 1-14



Saving a New Drawing File

The first time you use one of the **Save** tools to save your drawing, you must give your drawing a name (Figure 1-15). When you click **Save** for the first time in a new drawing, the **Save Drawing As** dialog box appears (Figure 1-16). Select a folder in which to save your work and enter a file name in the text box.

Figure 1-15

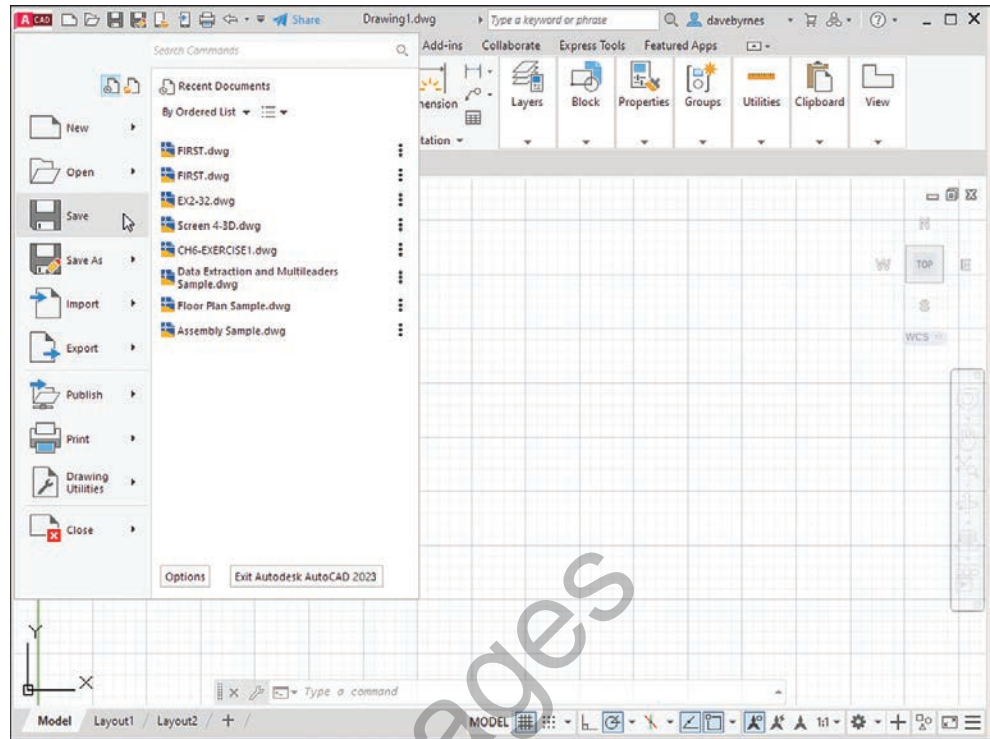
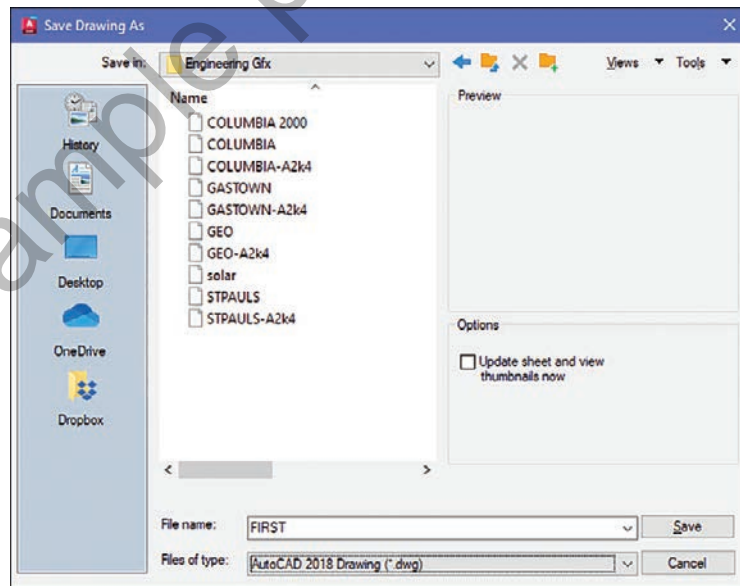


Figure 1-16



It's a good idea to save your work frequently. AutoCAD can be configured to save your drawings automatically, but it's a much better process to actively save your work. After you've created your drawing file in the **Save Drawing As** dialog box, using the **Save** command creates a backup version (*filename.bak*) and updates your saved file.

To save your work after you've given it a name, click the **Save** button in the **Quick Access Toolbar** at the top of the screen, or you can use the standard Windows shortcut: **Ctrl+S**.

- 1 Click the large **Application Menu** button in the upper-left corner of the screen.
- 2 Click **Save**.

Since you have not yet named and saved this drawing file, the **Save Drawing As** dialog box appears (Figure 1-16).

The **Save Drawing As** dialog box lists all existing drawings. Click on the thumbnail option to change the list to thumbnail drawings.

3 Enter the drawing name.

In this example, the drawing name **FIRST** was used.

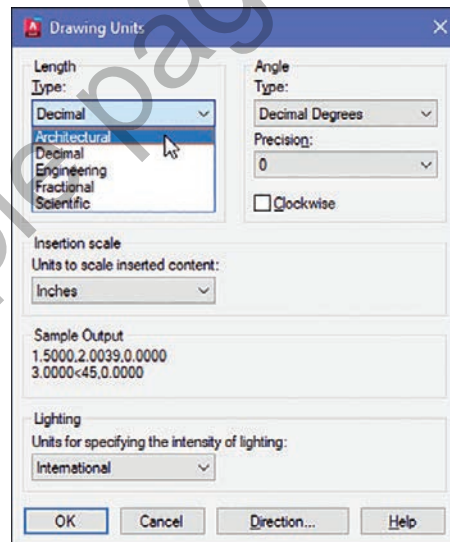
4 Click **Save**.

The name of the drawing appears at the top of the screen.

1-7 Drawing Units

AutoCAD 2023's **Drawing Units** dialog box allows for either English or metric units to be used as default values; however, AutoCAD can work in any of five different unit systems: scientific, decimal, engineering, architectural, or fractional. The default system is the decimal system, and it is used with either English values (inches) or metric values (millimeters). See Figure 1-17.

Figure 1-17



Access the Drawing Units dialog box by first opening the **Application** menu and then selecting **Drawing Utilities**.

Specifying or Changing the Drawing Units

1 Select **Drawing Utilities** in the **Application** menu.

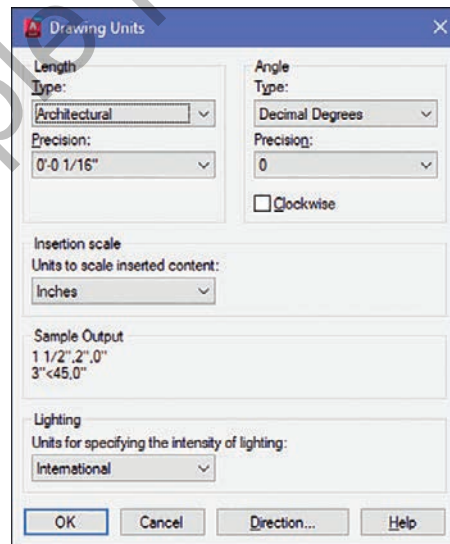
2 Select **Units** (Figure 1-18).

The **Drawing Units** dialog box appears (Figure 1-19).

Figure 1-18



Figure 1-19



- 3 In the **Length** area, select architectural units by clicking the arrow to the right of the **Type** text box.

A list of the five unit options cascades down.

- 4 Select **Architectural**.

Note that the **Sample Output** section, located slightly below the center of the **Drawing Units** dialog box, shows fractional inches.

- 5 Repeat the procedure and set the drawing units back to **Decimal**.

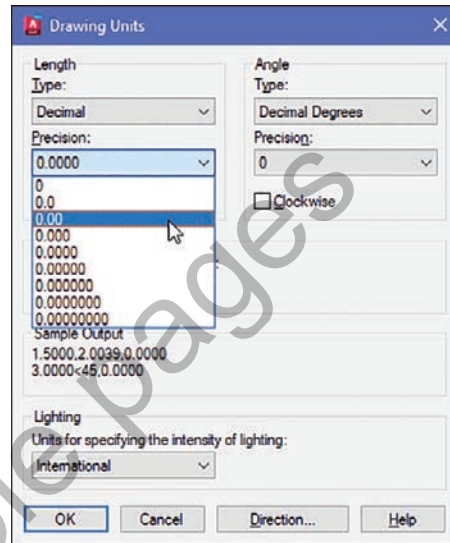
Specifying or Changing the Precision of the Units System

Unit values can be expressed with decimal places from zero to eight or in inches from 0 to 1/256 inch.

- 1 Access the **Drawing Units** dialog box as explained previously.
- 2 In the **Length** area, click the arrow to the right of the current precision value display box below the word **Precision**.

A drop-down list of the possible decimal precision values cascades from the box (Figure 1-20).

Figure 1-20



- 3 Select **0.00**.
The value 0.00 appears in the **Precision** box.
- 4 Click **OK**.
The original drawing screen appears.

Specifying or Changing the Angle Units Value

You can specify angles in one of five different units: **Decimal Degrees**, **Degrees/Minutes/Seconds**, **Gradians**, **Radians**, or **Surveyor** units. **Decimal Degrees** is the default value.

Change the angle units in the **Angle** area by selecting the desired units in the drop-down menu under **Type**. The precision of the angle units is changed in the same way as for linear units.

1-8 Drawing Limits

You can use **drawing limits** to set the boundaries of a drawing. The drawing boundaries are usually set to match the size of a sheet of drawing paper. This means that when the drawing is plotted and a hard copy is made, it will fit on the drawing paper.

Figure 1-21 shows a list of standard flat-size drawing sheets for engineering applications, Figure 1-22 shows standard metric sizes, and Figure 1-23 shows standard architectural sizes.

Figure 1-21

Standard Drawing Sheet Sizes—Inches	
A	8.5 × 11
B	11 × 17
C	17 × 22
D	22 × 34
E	34 × 44

Figure 1-22

Standard Drawing Sheet Sizes—Millimeters	
A4	210 × 297
A3	297 × 420
A2	420 × 594
A1	594 × 841
A0	841 × 1189

Figure 1-23

Standard Drawing Sheet Sizes—Architectural USA	
A	9 × 12
B	12 × 18
C	18 × 24
D	24 × 36
E	36 × 48

A standard 8.5" × 11" letter-size sheet of paper as used by most printers is referred to as an *A-size* sheet of drawing paper.

NOTE

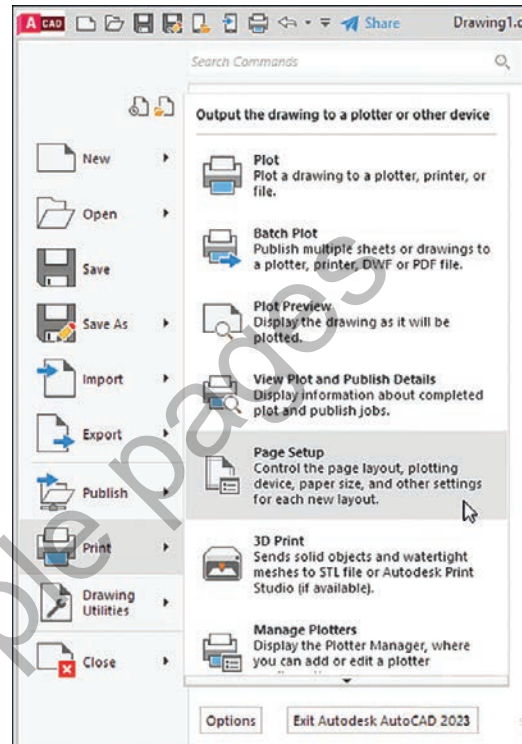
A sheet of paper can be sized to match standard sheet sizes by the capabilities of the printer or plotter. Many printers and plotters have built-in scaling features, and some list standard sheet sizes that can be applied to a drawing.

Aligning the Drawing Limits with a Standard A3 (Metric) Paper Size

- 1 Click the **Application Menu** button in the upper-left corner of the screen.
- 2 Click **Print**, then click **Page Setup** (Figure 1-24).

The **Page Setup Manager** dialog box appears.

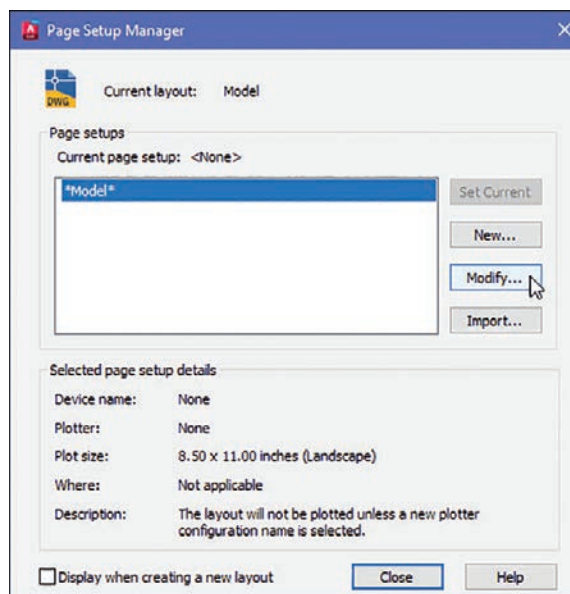
Figure 1-24



- 3 Click **Modify...** (Figure 1-25).

The **Page Setup - Model** dialog box appears.

Figure 1-25



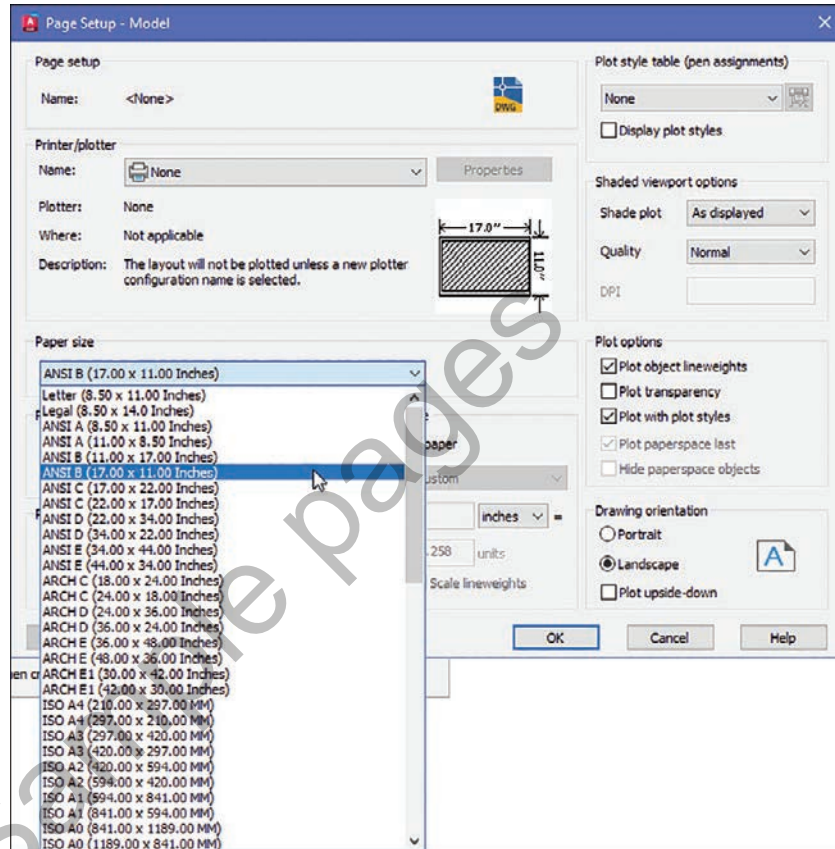
- 4 Click the arrow to the right of the **Paper size** box.

A drop-down list of available paper sizes appears (Figure 1-26).

- 5 Select the **ISO A3 (420.00 x 297.00)** size.

The dimensions in the preview box in the **Printer/plotter** area of the **Page Setup-Model** dialog box change to the selected values.

Figure 1-26



- 6 Click **OK**.

The drawing screen is now sized to the 420.00 × 297.00 ISO A3 dimensions.

NOTE

The sheet size may also be set with the **Limits** command. Type **Limits** at a command prompt and define the drawing limits by specifying the lower-left corner of the drawing as **0.00,0.00** (which is the default setting) and the upper-right corner as needed. If the new limits exceed the current screen limits, type **zoom** at a command prompt, then type **a** for **Zoom All**. The new drawing limits are matched to the screen size. The default sheet size for the **acad** template is 8.5 × 11 (ANSI A), and for the **acadiso** template the default is 210 × 297 (ISO A4).

1-9 Grid and Snap

The **Grid** command is used to place a grid background on the drawing screen. This background grid is helpful for establishing visual reference points for sizing and for locating points and lines. The grid may appear as lines or dots. You can specify the type of grid in the **Drafting Settings** dialog box.

NOTE

A graph paper-style grid background is used in most figures in this book.

The **Snap** command limits the movement of the cursor to predefined points on the screen. For example, if the **Snap** command values are set to match the **Grid** values, the cursor will snap from intersection to intersection (or dot to dot) on the grid.

The default **Grid** and **Snap** setting for the **acad** template is **.50** inch, and the default setting for **Grid** and **Snap** for the **acadiso** template is **10** millimeters.

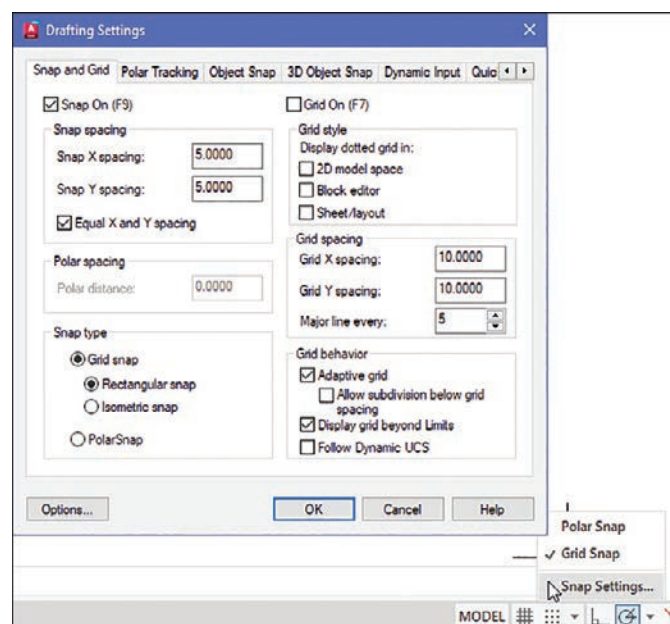
NOTE

The **Grid** function can be toggled off and on with the **F7** key, and the **Snap** function can be toggled with the **F9** key.

Setting the Grid and Snap Values

- 1 Start a new drawing and select the **acadiso** template (where values are in millimeters).
- 2 Right-click the **Snap** tool located at the bottom of the screen and click **Snap Settings** (Figure 1-27).

Figure 1-27



The **Drafting Settings** dialog box appears (Figure 1-27). If it is not already selected, click the **Snap and Grid** tab.

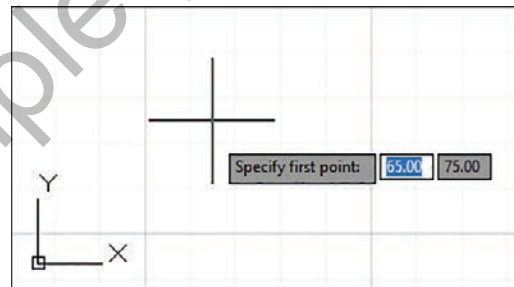
- 3** Click the **Grid On** and **Snap On** checkboxes. A check mark appears in each of the boxes.
- 4** Place the cursor in the **Snap X spacing** text box to the right of the given value under the **Snap On** heading.
A vertical flashing cursor appears.
- 5** Backspace out the existing value and type in **5**.
- 6** Click the **Snap Y spacing** box.

The Y spacing automatically equals the X spacing value. You can create rectangular grid spacing by specifying different X and Y spacing values.

- 7** Select the **Grid X spacing** text box under the **Grid spacing** heading.
- 8** Backspace out the existing value and type in **10** if needed.
- 9** Click the **Grid Y spacing** box to make the X and Y values equal.
- 10** Click **OK**.

Figure 1-28 shows the result. Since the **Snap** values have been set to exactly half of the **Grid** values, the cursor can be located either directly on grid intersections or halfway between them.

Figure 1-28



You can turn the grid on and off either by double-clicking the **Grid** icon at the bottom of the screen or by pressing the **F7** key on the keyboard. Turn Snap on and off by double-clicking the **Snap** icon at the bottom of the screen or by pressing the **F9** key on the keyboard. You can also turn **Grid** and **Snap** off and on by clicking their respective buttons on the status bar located at the bottom of the screen.

1-10 Drawing Problem

Set up a drawing that uses millimeter dimensions and the following parameters:

Sheet size = **297,420 (A3)**

Grid = **10** spacing

Snap = **5** spacing

Whole-number precision