



AutoCAD[®] 2022

FOR INTERIOR DESIGN AND SPACE PLANNING

THE DESIGN APPROACH

**BEVERLY KIRKPATRICK
JAMES KIRKPATRICK
HOSSEIN ASSADIPOUR
DAVID BYRNES**



AutoCAD® 2022 for Interior Design and Space Planning

The Design Approach

Beverly L. Kirkpatrick

James M. Kirkpatrick

Hossein Assadipour

David Byrnes



Pearson

AutoCAD 2022® for Interior Design and Space Planning

Copyright © 2022 Pearson Education, Inc.

The authors and publisher have taken care in the preparation of this book, but make no expressed or implied warranty of any kind and assume no responsibility for errors or omissions. No liability is assumed for incidental or consequential damages in connection with or arising out of the use of the information or programs contained herein.

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and the publisher was aware of a trademark claim, the designations have been printed with initial capital letters or in all capitals.

AutoCAD is a registered trademark of Autodesk, Inc. Pro/Engineer is a registered trademark of Parametric Technology Corporation (PTC). CATIA is a registered trademark of Dassault Systèmes SA.

The publication is designed to provide tutorial information about AutoCAD® and/or other Autodesk computer programs. Every effort has been made to make this publication complete and as accurate as possible. The reader is expressly cautioned to use any and all precautions necessary, and to take appropriate steps to avoid hazards, when engaging in the activities described herein.

For information about buying this title in bulk quantities, or for special sales opportunities (which may include electronic versions; custom cover designs; and content particular to your business, training goals, marketing focus, or branding interests), please contact our corporate sales department at corpsales@pearsoned.com or (800) 382-3419.

For government sales inquiries, please contact governmentsales@pearsoned.com.

For questions about sales outside the U.S., please contact intlcs@pearson.com.

Visit us on the Web: informit.com

Library of Congress Control Number: 2021940292

ISBN-13: 978-0-13-678788-4

ISBN-10: 0-13-678788-6

ScoutAutomatedPrintCode

All rights reserved. This publication is protected by copyright, and permission must be obtained from the publisher prior to any prohibited reproduction, storage in a retrieval system, or transmission in any form or by any means, electronic, mechanical, photocopying, recording, or likewise. For information regarding permissions, request forms and the appropriate contacts within the Pearson Education Global Rights & Permissions Department, please visit www.pearson.com/permissions/.

Editor-in-Chief: Mark Taub

Acquisitions Editor: Malobika Chakraborty

Development Editor: Chris Zahn

Managing Editor: Sandra Schroeder

Senior Production Editor: Lori Lyons

Cover Designer: Chuti Prasertsith

Copy Editor: Kitty Wilson

Full-Service Project Manager:

Vaishnavi Venkatesan

Composition: codeMantra

Indexer: Cheryl Ann Lenser

Proofreader: Abigail Manheim

Features of AutoCAD® 2022 for Interior Design and Space Planning

This text uses the features of AutoCAD® 2022 in a variety of exercises specifically for interior design and architecture. Features include:

Chapter Objectives with a bulleted list of learning objectives at the beginning of each chapter provide users with a roadmap to the commands, concepts, and practices to be introduced.

CHAPTER OBJECTIVES

- Describe the AutoCAD user interface and begin using parts of the screen.
- Modify and

TUTORIAL 2-1

Part 1, Beginning an AutoCAD Drawing: Saving Your Work; Setting Units, Limits, Grid, and Snap; Creating Layers

Beginning an AutoCAD Drawing

When you click **New...** from the **Quick Access Toolbar** or **New** from the application menu button, or the **New** down arrow at the left side of the **Start** tab, AutoCAD allows you to select a template file from the **Template** folder or use the default template file. A template file has settings already established. These settings can include units, limits, grid, snap, and a

Because users need a lot of practice, Chapter 2, **Quick-Start Tutorials**, challenges the user to make 2D drawings. These tutorials are designed with special step-by-step instructions that will walk the reader through the entire development process while raising interest in mastering the content to come in the rest of the chapters.

The first appearance of each **key term** is bold and italic within the running text and accompanied by a brief definition in the margin. The glossary at the end of the book contains a complete list of the key terms and more detailed definitions to help students understand and use the language of the computer-aided drafting (CAD) world.

Drawing Window and Graphics

user interface: All the elements such as the AutoCAD screen that make up the interface between the user and the AutoCAD program.

The AutoCAD **user interface** (Figure 1-4) contains access to commands. The drawing window is where played. The graphics cursor (or crosshairs) follows mouse when points of a drawing are entered or a box at the center of the crosshairs is called a *pick*

Other components of the user interface.

OPTIONS	
Ribbon/ Panel	View/ Interface/ Dialog Box Launcher
Menu Bar:	Tools/ Options
Type a Command:	OPTIONS
Command Alias:	OP

- Application Menu Button
- Quick Access Toolbar
- Share Drawing Button
- Infocenter
- Ribbon and its Tabs and Panels
- ViewCube
- Navigation Bar

Command Grids appear in the margin alongside the discussion of the command or the particular exercise in which it is demonstrated. These grids provide specific information about the ways of invoking each command, including any of the following:

- Ribbon panel
- Toolbar icon
- Pull-down menu
- Command line
- Command alias

Tip, Note, and For More Details boxes highlight additional helpful information for the student. Such information may contain dos and don'ts, facts, warnings, and alternative ways of proceeding, as well as cross-references to other chapters and topics.

TIP

Items can automatically be added to a path array when you lengthen the path using the **Measure** option of **ARRAYEDIT**.

NOTE

After an object has been selected, you can use the **Array** option of the **COPY** command to make multiple copies of the object.

FOR MORE DETAILS

See Chapter 6 for more information about annotative text and Chapter 7 for more information about annotative dimensions.

EXERCISE 1-1
Examine the AutoCAD User and Save a Workspace



Launching AutoCAD 2022 displays the interface shown in Figure 1-1. The **Start** tab and a drawing tab labeled **Drawing1**. The **Start** tab is controlled by the **STARTMODE** system variable. When the **Start** tab is visible and remains open as drawing file is saved, the revised **Start** tab contains three areas.

On the left side area you can **Open** an existing drawing. The display in the center and right areas change when you click on the **Start** tab.

New to AutoCAD® 2022 icons indicate the commands and tools that are new to this specific release of the program. This feature allows instructors and other users to quickly identify topics that are completely new, saving them a good amount of research time. It also demonstrates to students the recent improvements to the AutoCAD software, as well as the valuable updated information contained in this textbook. This book uses many of the features new to the software since the previous release of this book for AutoCAD 2015.

End-of-Chapter material can easily be located by the shading on the page edges. This material will help students evaluate and practice the knowledge they've acquired about the most important concepts explained in the chapter. This material's content includes:

- Chapter Summary
- Chapter Test Questions
 - Multiple Choice
 - Matching
 - True or False
 - List (Five different ways of executing commands in AutoCAD 2022)

chapterone

Chapter Summary

This chapter described the AutoCAD user interface and how to save a workspace so you can begin to work with the software.

Chapter Test Questions

Multiple Choice

chapterthree

Chapter Projects

Project 3-1: Rectangular Including Furniture [BASIC]

1. Draw the floor plan of the lecture room, including the dimensions shown in Figure 3-58, and measure the floor plan and draw it full.

Chapter Projects are additional assignments located at the end of each chapter in which students are directed to solve particular tasks on their own. The projects are labeled as basic, intermediate, and advanced according to the degree of complexity. Students will use the knowledge acquired throughout the chapter as well as in previous chapters in completing these assignments.

Preface

AutoCAD has become the industry-standard graphics program for interior design and space planning. This program is used to complete the many contract documents (CDs) that make up a design project. Many design firms have adopted AutoCAD as their standard because:

- It saves time.
- Affiliated professions have chosen it so that they can exchange files and work on the same drawing.
- Their competitors use it.
- Their clients expect it.

To be successful in design today, students must be proficient in the use of AutoCAD as it relates to interior design and space planning. The need for an AutoCAD textbook geared specifically to this field is what led us to write *AutoCAD® 2022 for Interior Design and Space Planning*.

This text, newly updated for AutoCAD® 2022, is divided into three parts:

- Part I: Preparing to Draw with AutoCAD (Chapter 1).
- Part II: Two-Dimensional AutoCAD (Chapters 2–13).
- Part III: Three-Dimensional AutoCAD (Chapters 14–15).

This new edition includes many features designed to help you master AutoCAD® 2022:

- The prompt-response format is clearly defined with numbered steps. This step-by-step approach is used in the beginning exercises of all chapters and then moves to an outline form in projects at the end of most chapters. This allows students to learn commands in a drawing situation and then practice applying them on their own.
- Lineweights have been carefully assigned to provide line contrast in all drawing exercises.
- Plotting is used in Chapter 2 to allow students to plot their first drawings.
- Chapter 7 covers updated ways to change dimension variables, as well as the recently introduced **DIM** command.
- Chapter 9 updates the process of finding and inserting blocks using the **BLOCKS** palette.
- Chapter 15 updates the sections on adding lights and rendering models.
- Exercises are geared to architects, interior designers, and space planners, allowing students to work with real-world situations.
- More than 600 illustrations (many printed to scale) support the text and reinforce the material.
- Screen shots and command grids help the user locate AutoCAD commands within the AutoCAD menus and ribbon.

- “Tip,” “Note,” and “For More Details” boxes give students additional support and information.
- Practice projects at the end of every chapter review the commands learned.
- Learning objectives and review questions in every chapter reinforce the learning process.
- An online Instructor’s Manual is available to support the text.

Organized around architectural and interior design–related projects, *AutoCAD® 2022 for Interior Design and Space Planning* gives students an understanding of the commands and features of AutoCAD® 2022 and demonstrates how to use the program to complete interior design and space planning projects. The book is appropriate for self-paced and lecture classes and covers both two-dimensional and three-dimensional drawings.

Throughout the exercises in this book, steps numbered in color provide instructions. **Prompt** and **Response** columns in the numbered steps provide step-by-step instructions for starting and completing a command. The **Prompt** column text repeats the AutoCAD prompt that appears in the command area of the AutoCAD screen. The **Response** column text shows how you should respond to the AutoCAD prompt. Screen shots of menus and command grids show you how to locate the command you are using.

Using numerous illustrations, the text captures the essence of this powerful program and the importance it plays in the interior design, architecture, and space planning professions.

Most importantly, this text was written to help you, the reader, master the AutoCAD program, which will be a valuable tool in your professional career.

Hallmark Features

Progresses from Basic Commands to Complex Drawing Exercises

- Builds confidence and basic skills before moving on to more complex assignments.
- Ensures students have mastered the fundamental features and commands of the AutoCAD program before they apply it to more complex problems.
- Guides readers step-by-step through each new AutoCAD command.
- Encourages students to learn commands and features on their own.

Provides More Than 100 Exercises and Projects

- Gives students the opportunity to work with a variety of real-world situations, including both commercial and residential projects.

Highlights Projects Appropriate for Interior Design, Space Planning, and Architecture Students

- Projects are a tenant space, hotel room, and wheelchair-accessible commercial restroom.
- Includes project floor plans, dimension plans, elevations, furniture plans, reflected ceiling plans, and voice/data/power plans, as well as isometric drawings, a presentation sheet, and the sheet set command that combines multiple plans.

Includes More Than 600 Figures

- Helps students by allowing them to compare their work and progress with the many figures available.
- Shows many drawings to scale so students can assess and check their understanding of chapter material.

The AutoCAD DesignCenter

- The **DesignCenter** is used to import blocks, layers, and dimension styles from other drawings into existing drawings.

Covers Solid Modeling in Two Chapters

- Splits solid modeling material into two chapters: Chapter 14, Solid Modeling; and Chapter 15, Advanced Modeling.
- Uses the **3DWALK** and **Animation Motion** commands to create walk-through presentations.

New to This 2022 Edition

- **Revised Start Tab**
- **Floating drawing tabs**
- **Commands introduced in all areas of the program since the previous edition**
- **Enhanced Help (to locate tools in AutoCAD)**
- **(View) Ribbon Enhancements**

Instructor Resources

The **Online Instructor's Manual** provides answers to unit exercises and tests, solutions to end-of-chapter questions, and lecture-supporting PowerPoint® slides.

Instructor materials are available from Pearson's Instructor Resource Center. Go to <https://www.pearson.com/us/higher-education/subjectcatalog/download-instructor-resources.html> to register, or to sign in if you already have an account.

Style Conventions in AutoCAD® 2022 for Interior Design and Space Planning

Text Element	Example
Key Terms — Boldface and italic on first mention (first letter lowercase, as it appears in the body of the text). Brief definition in margin alongside first mention. Full definition in Glossary at back of book.	Views are created by placing <i>viewport</i> objects in the paper space layout.
AutoCAD commands — Bold and uppercase.	Start the LINE command.
Ribbon and panel names, palette names, toolbar names, menu items, and dialog box names — Bold and follow capitalization convention in AutoCAD toolbar or pull-down menu (generally first letter cap).	The Layer Properties Manager palette The File menu
Panel tools, toolbar buttons, and dialog box controls/buttons/input items — Bold and follow the name of the item or the name shown in the AutoCAD tooltip.	Choose the Line tool from the Draw panel. Choose the Symbols and Arrows tab in the Modify Dimension Style dialog box. Choose the New Layer button in the Layer Properties Manager palette. In the Lines and Arrows tab, set the Arrow size : to .125 .
AutoCAD prompts —Dynamic input prompts are set in a different font to distinguish them from the text. Command window prompts are set to look like the text in the command window, including capitalization, brackets, and punctuation. Text following the colon of the prompts specifies user input in bold.	AutoCAD prompts you to <i>Specify first point: Specify center point for circle or [3P 2P Tr (tan radius)]:</i> 3.5
Keyboard Input — Bold with special keys in brackets.	Type 3.5 <Enter>

Register Your Book

Register your copy of *AutoCAD 2022 for Interior Design and Space Planning* on the InformIT site for convenient access to updates and/or corrections as they become available. To start the registration process, go to informit.com/register and log in or create an account. Enter the product ISBN (9780136787884) and click Submit. Look on the Registered Products tab for an Access Bonus Content link next to this product, and follow that link to access any available bonus materials. If you would like to be notified of exclusive offers on new editions and updates, please check the box to receive email from us.

Contents at a Glance

Preface	v
PART I Preparing to Draw with AutoCAD	
Chapter 1 Introducing the AutoCAD User Interface	1
PART II Two-Dimensional AutoCAD	
Chapter 2 Quick-Start Tutorials: Basic Settings and Commands	29
Chapter 3 Drawing with AutoCAD: Conference and Lecture Rooms	103
Chapter 4 Adding Text and Tables to the Drawing	183
Chapter 5 Advanced Plotting: Using Plot Styles, Paper Space, Multiple Viewports, and PDF Files	223
Chapter 6 Drawing the Floor Plan: Walls, Doors, and Windows	255
Chapter 7 Dimensioning and Area Calculations	297
Chapter 8 Drawing Elevations, Sections, and Details	337
Chapter 9 Drawing the Furniture Installation Plan, Adding Specifications, and Extracting Data	401
Chapter 10 DesignCenter, Dynamic Blocks, and External References	435
Chapter 11 Drawing the Reflected Ceiling Plan and Voice/Data/Power Plan	471
Chapter 12 Creating Presentations with Layouts and Making a Sheet Set	485
Chapter 13 Isometric Drawing and Gradient Hatch Rendering	509
PART III Three-Dimensional AutoCAD	
Chapter 14 Solid Modeling	547
Chapter 15 Advanced Modeling	593
PART IV Appendixes	
A Keyboard Shortcuts	633
B Shortcut and Temporary Override Keys	641
Glossary	643
Index	647

This page intentionally left blank

Contents

Part I Preparing to Draw with AutoCAD

Chapter 1 Introducing the AutoCAD User Interface

Chapter Objectives

Introduction

Exercise 1-1 Examine the AutoCAD User Interface and Save a Workspace

Drawing Window and Graphics Cursor

Application Menu Button

Inputting or Selecting a Command

Ribbon

Expanded Panels

Dialog Boxes and Palettes

Tooltips

Flyouts

Command Line Window (<Ctrl>+9)

Quick Access Toolbar

Customizing the Quick Access Toolbar Down Arrow and Showing the Menu Bar

Using AutoCAD Toolbars

User Coordinate System Icon

Advantage of Using the UCS

Viewport Label Menus

ViewCube

Navigation Bar

Infocenter

Status Bar

Drawing Coordinates Values (<Ctrl>+I)

Model or Paper Space

Quick View Tools

Annotation Scaling Tools

Workspace Switching

Lock/Unlock Toolbar and Window Positions

On/Off Hardware Acceleration

Clean Screen (<Ctrl>+0 [Zero])

Modifying and Saving a Workspace

Getting Help in AutoCAD 2022

Closing AutoCAD

Chapter Summary

Chapter Test Questions

Part II Two-Dimensional AutoCAD

Chapter 2 Quick-Start Tutorials: Basic Settings and Commands

1 Chapter Objectives

1 Introduction

1 Following the Tutorials in This Book

Tutorial 2-1 Part 1, Beginning an AutoCAD

2 Drawing: Saving Your Work; Setting Units, Limits, Grid, and Snap; Creating Layers

4 Beginning an AutoCAD Drawing

7 Saving the Drawing

Save

Save As

DWT

DWS

DXF

Drawing Name and File Name Extension

8 Units

8 Controlling Your Drawing

Drawing Scale

Drawing Limits and the Cartesian

Coordinate System

12 Grid

GRIDDISPLAY

14 Snap

16 Zoom

17 Drafting Settings Dialog Box

18 Layers

Layer Lists

18 Linetypes

18 Lineweights

Lineweight Settings Dialog Box

Lineweight Display

22 Setting the Annotation Scale

22 Saving the Drawing

22 Using the Mouse and Right-Click Customization

22 Tutorial 2-1 Part 2, Drawing Lines, Circles, Arcs, Ellipses, and Donuts

25 Ortho

26 Drawing Lines Using the Grid Marks and Snap Increments

29

29

29

30

31

31

32

32

32

34

34

34

35

36

36

37

37

38

38

40

41

41

42

44

46

46

46

48

50

50

51

52

52

53

Erase and Undo	54	SCALE	80
Drawing Lines Using Absolute Coordinates	56	Reference	80
Drawing Lines Using Relative Coordinates	57	Adding Text	82
Drawing Lines Using Polar Coordinates	58	Command History	82
Drawing Lines Using Direct Distance Entry	59	Tutorial 2-2 Plot Responses for CH2-TUTORIAL1,	
DYNMODE	59	Using the Model Tab	83
Circle	60	Plot - Name	84
Center, Radius	61	Page Setup	84
Center, Diameter	62	Printer/Plotter	84
2 Points	62	Plot to File	85
3 Points	63	Browse for Plot File...	85
TTR	63	Plot Style Table (Pen Assignments)	85
LTSCALE	63	Paper Size	86
ZOOM	64	Plot Area	87
Zoom-Window	64	Plot Scale	87
Zoom-All	65	Annotative Property and Annotation Scale	88
Zoom-Previous	65	Plot Offset (Origin Set to Printable Area)	89
Zoom-Extents	66	Shaded Viewport Options	89
Zoom-Object	66	Plot Options	89
Zoom-Realtime	66	Drawing Orientation	90
PAN REALTIME	66	Preview...	90
Transparent Commands	66	Chapter Summary	92
REDRAW	67	Chapter Test Questions	92
REGEN	67	Chapter Projects	95
HIGHLIGHT	67		
Move and Editing Commands Selection Set	67	Chapter 3 Drawing with AutoCAD: Conference	
Options for Selecting Objects to Modify	70	and Lecture Rooms	103
Window (W) and Crossing Window (C)	71	Chapter Objectives	103
All (ALL)	71	Exercise 3-1 Drawing a Rectangular Conference	
Fence (F)	71	Room, Including Furniture	103
Remove (R) and Add (A)	71	Making a Drawing Template	105
Last (L) and Previous (P)	71	Polyline	107
Undo (U)	72	Undo	108
Grips	72	OFFSET	108
UNDO and REDO	73	Through	109
ARC	74	Erase	109
3-Point	74	Layer	109
Start, Center, End	76	EXPLODE	109
Start, Center, Angle	76	ID Point	109
Start, Center, Length	76	TRIM	111
Start, End, Angle	77	Rectangle	111
Start, End, Direction	77	CHAMFER	114
Start, End, Radius	77	Polyline	114
Continue	77	Undo	114
ELLIPSE	77	Angle	115
Axis, End	77	Trim	115
Center	79		
DONUT	79		

mMethod	115	Polyline Edit	159
Multiple	115	Specifying Points with Tracking	160
FILLET	116	Drawing the Chairs around the Conference Table	162
COPY and Osnap-Midpoint	117	Completing the Conference Room	164
ROTATE	118	Using Command Preview	165
Reference	119	Choosing Selection Options	166
POINT	119	Chapter Summary	167
DIVIDE	120	Chapter Test Questions	167
MEASURE	121	Chapter Projects	170
OSNAP	122	 Chapter 4 Adding Text and Tables to the Drawing	 183
Activating Osnap	122	Chapter Objectives	183
Copy, Osnap-Midpoint, Osnap-Node	123	Exercise 4-1 Placing Text on Drawings	183
MIRROR	124	Making Settings for Text Style	185
Osnap Modes That Snap to Specific Drawing Features	127	Style Name	185
Running Osnap Modes	129	Font Name	185
Osnap Settings: Marker, Aperture, Magnet, Tooltip	130	Making a New Text Style	186
Exercise 3-2 Drawing a Rectangular Lecture Room, Including Furniture	130	Using the Single Line Text Command to Draw Text	189
Making Solid Walls Using Polyline and Solid Hatch From	132	Setting the Justify Option	191
BREAK	133	Using Standard Codes to Draw Special Characters	192
First	134	Using the Multiline Text Command to Draw Text Paragraphs in Columns	195
@ 134		Changing Text Properties	198
Polyline Edit	134	Checking the Spelling	202
HATCH	136	Exercise 4-2 Using the TABLE Command to Create a Door Schedule	203
ARRAY	138	Exercise 4-3 Using the TABLE Command to Create a Window Schedule	214
Rectangular	140	Chapter Summary	215
Path	141	Chapter Test Questions	215
ARRAYEDIT	141	Chapter Projects	218
Distance	141	 Chapter 5 Advanced Plotting: Using Plot Styles, Paper Space, Multiple Viewports, and PDF Files	 223
Exercise 3-3 Drawing a Curved Conference Room, Including Furniture	144	Chapter Objectives	223
Polyline	145	Understanding Layer Names, Colors, and Lineweights	223
Width	146	Choosing a Plot Style	224
Half Width	146	Named Plot Style (STB)	225
Length	147	Color-Dependent Plot Style (CTB)	226
Close	147	Exercise 5-1 Make a Color-Dependent Plot Style to Change Colors to Plot Black	226
POLYGON	148	Exercise 5-2 Plot a Layout with One Viewport	228
Edge	149	Model, Layout1, and Layout2 Tabs	229
Grips—Add Vertex	149	Page Setup Manager	229
Grips—Convert to Arc	151		
ARRAY	152		
Polar	152		
Exercise 3-4 Drawing a Conference Room Using Polar Tracking	155		
Polar Tracking	157		

Center and Scale the Plan	230	Insert	278
Complete the Layout	232	Insertion Point	281
Exercise 5-3 Plot a Layout with Two Viewports	233	X Scale Factor, Y Scale Factor	281
Insert an Entire Drawing into a Current Drawing	233	Using Annotative Text	282
Page Setup Manager	236	Inserting Entire Drawings as Blocks	284
Copy a Viewport	237	Advantages of Using Blocks	284
Center and Scale the Plans	237	Exercise 6-2 Hotel Room 1 Floor Plan	285
Complete the Layout	239	AutoCAD DesignCenter	287
Exercise 5-4 Plot a Layout with Four Viewports	241	Chapter Summary	291
Viewports (VPOR TS)	242	Chapter Test Questions	291
Use MVIEW to Restore the Viewport VP4 into Layout1	244	Chapter Projects	294
Page Setup Manager	245	Chapter 7 Dimensioning and Area Calculations	297
Center and Scale the Plans	246	Chapter Objectives	297
Complete the Layout	246	Eight Basic Types of Dimensions	297
Exercise 5-5 Make PDF Files That Can Be Attached to E-mails and Opened without the AutoCAD Program	247	Using Dimension Variables	298
Chapter Summary	250	Exercise 7-1 Dimensioning the Tenant Space Floor Plan Using Linear Dimensions	301
Chapter Test Questions	250	Setting the Dimension Variables Using the Command Prompt	303
Chapter Projects	253	Setting the Dimension Variables Using the Dimension Style Manager Dialog Box	304
Chapter 6 Drawing the Floor Plan: Walls, Doors, and Windows	255	Using the Fit Tab to Scale for Dimension Features	309
Chapter Objectives	255	Annotative	309
The Tenant Space Project	255	Scale Dimensions to Layout	310
Exercise 6-1 Tenant Space Floor Plan	256	Use Overall Scale of: (DIMSCALE)	310
RECTANGLE	257	Linear and Continue Dimensioning	311
HATCH	258	Aligned Dimensioning	315
ARRAY	258	Baseline Dimensioning	315
Multiline Style	260	Adding a Dimension Break	318
Multiline Command	262	Using Adjust Space	318
Edit Multiline Command	268	Exercise 7-2 Revisions and Modifying Dimensions	319
EXTEND	269	Setting the DIMASSOC Dimension Variable	319
PROPERTIES	269	Understanding Associative Dimension Commands	321
LIST	270	Oblique	321
COLOR	270	Align Text (Home-Angle-Left-Center-Right)	322
Linetype	272	Override	322
Lineweight	272	Update	322
Make Object's Layer Current	272	Defpoints Layer	322
Match Properties	272	Using the PROPERTIES Palette	323
Block	273	Accessing Match Properties	323
Wblock	276	Using Grips	323

Drawing a Revision Cloud	324	Gap Tolerance	380
Exercise 7-3 Tenant Space Total Square Footage	326	Inherit Options	380
Defining the Area for Square Footage	326	Edit Hatch	381
Using the Cal Calculator	329	Exercise 8-4 Detail of Door Jamb with Hatching	385
Chapter Summary	331	Exercise 8-5 Use Point Filters and Object Snap Tracking to Make an Orthographic Drawing of a Conference Table	386
Chapter Test Questions	331	Point Filters	388
Chapter Projects	334	Object Snap Tracking	389
 		Chapter Summary	393
Chapter 8 Drawing Elevations, Sections, and Details	337	Chapter Test Questions	393
Chapter Objectives	337	Chapter Projects	396
Introduction	337	 	
Exercise 8-1 Tenant Space: Elevation of Conference Room Cabinets	337	Chapter 9 Drawing the Furniture Installation Plan, Adding Specifications, and Extracting Data	401
UCS	339	Chapter Objectives	401
UCS Icon	340	Introduction	401
Draw the Upper Cabinets	341	Exercise 9-1 Tenant Space Furniture Installation Plan with Furniture Specifications	402
Mirror	342	Draw the Furniture Symbols	403
Draw the Lower Cabinets	344	Define Attributes... (ATTDEF)	403
Stretch	345	Constant Attribute	408
Complete the Drawing	354	Variable Attribute	410
Exercise 8-2 The Multileader Command	357	Verify Attribute	412
Circles to Be Used with Multileaders	357	Edit Text (TEXTEDIT)	413
Multileader Standard Style	357	QP (Quick Properties)	414
Multileader	360	Properties Palette	414
Multileader Align	362	WBLOCK the Furniture with Attributes Symbol	414
Change Multileader Style	362	Insert the Furniture Symbols with Attributes into the Drawing	416
Multileader Collect	366	Complete the Tenant Space Furniture Installation Plan	418
Multileader Add	367	Edit Attribute, Single...	418
Exercise 8-3 Tenant Space: Section of Conference Room Cabinets with Hatching	368	Edit Attribute, Global	420
Prepare to Use the Hatch Command with the Add: Select Objects Boundary Option	371	Attribute Display (ATTDISP)	422
Use the Hatch Command with the Add: Select Objects Boundary Option	372	Redefining an Inserted Block with Attributes Using the BLOCK Command	422
Use the Hatch Command with the Add: Pick Points Boundary Option	373	Block Attribute Manager (BATTMAN)	423
Hatch; Hatch and Gradient Dialog Box; Hatch Tab	376	Synchronize Attributes (ATTSYNC)	423
Type and Pattern	376	Exercise 9-2 Extracting Attributes from the Tenant Space Furniture Installation Plan	424
Angle and Scale	377	Data Extraction...	425
Hatch Origin	378	Chapter Summary	430
Boundaries	378	Chapter Test Questions	430
Options	378	Chapter Projects	432
More Options	379		
Islands	380		
Boundary Retention	380		
Boundary Set	380		

Chapter 10 DesignCenter, Dynamic Blocks, and External References	435	Use Layer Properties Manager to Freeze Viewport Layers	490
Chapter Objectives	435	Scale and Center the Plans	492
Introduction	435	Using MVSETUP to Align the Plans	492
Exercise 10-1 Reception Area Furniture Installation Plan Using DesignCenter	435	Complete the Presentation	494
The DesignCenter	436	Exercise 12-2 Making a Four-Sheet Presentation of the Tenant Space Project Using a Sheet Set	495
DesignCenter Tabs	436	Make New Layout Tabs and Rename the New Layout Tabs	496
DesignCenter Buttons	437	Prepare the Layout Tabs for Plotting Drawings	496
Exercise 10-2 Training Room Furniture Installation Plan Using DesignCenter and Dynamic Blocks	440	Use MVSETUP to Insert a Title Block	498
Use Block Editor to Make Dynamic Blocks	445	Quick View Tools	500
Exercise 10-3 Attach an External Reference to an Office Plan	456	New Sheet Set and Sheet Set Manager	501
XATTACH (Attach External Reference)	456	Chapter Summary	504
External Reference (XREF)	457	Chapter Test Questions	504
XBIND	457	Chapter Project	507
Features of External References	457	Chapter 13 Isometric Drawing and Gradient Hatch Rendering	509
Chapter Summary	463	Chapter Objectives	509
Chapter Test Questions	463	Axonometric Drawing	509
Chapter Projects	465	Isometric Drawing	509
Chapter 11 Drawing the Reflected Ceiling Plan and Voice/Data/Power Plan	471	Exercise 13-1 Fundamentals of Isometric Drawing	510
Chapter Objectives	471	Drafting Settings Dialog Box	512
Introduction	471	Shape 1: Drawing the Isometric Rectangle	512
Exercise 11-1 Part 1, Tenant Space Lighting Legend and Reflected Ceiling Plan	471	Shape 2: Drawing Isometric Ellipses	513
Tenant Space Lighting Legend Symbols	473	Shape 3: Drawing a Chair with Ellipses That Show the Thickness of a Material	515
Tenant Space Reflected Ceiling Plan	473	Shape 4: Drawing a Shape That Has a Series of Isometric Ellipses Located on the Same Centerline	518
Exercise 11-1 Part 2, Tenant Space Voice/Data/Power Legend and Plan	474	Shape 5: Isometric Detail with Rounded Corners	520
Tenant Space Voice/Data/Power Legend Symbols	474	Shape 6: A TV Shape with an Angled Back	521
Tenant Space Voice/Data/Power Plan	476	Shape 7: Isometric Detail: A Hexagonal-Shaped Vase	524
Chapter Summary	478	Exercise 13-2 Tenant Space Reception Desk in Isometric	525
Chapter Test Questions	478	Dimensioning in Isometric	532
Chapter Projects	480	Gradient Hatch	532
Chapter 12 Creating Presentations with Layouts and Making a Sheet Set	485	Exercise 13-3 Using Gradient Patterns to Render the Shapes of Exercise 13-1	533
Chapter Objectives	485	Chapter Summary	540
Exercise 12-1 Make a Printed Presentation of the Tenant Space Project by Combining Multiple Plans on One Sheet of Paper	485	Chapter Test Questions	540
Use Create Layout Wizard to Set Up Four Viewports on a Single Sheet	486	Chapter Projects	543
Complete the Title Block	487		

Part III Three-Dimensional AutoCAD

Chapter 14 Solid Modeling	547	Chamfering and Filletting the Top Four Edges of Two Separate Boxes	566
Chapter Objectives	547	Chamfering and Filletting the Top Edge of Two Separate Cylinders	567
Introduction	547	Exercise 14-1 Part 5, Using UNION to Join Two Solids; Using SUBTRACT to Subtract Solids from Other Solids	568
Creating Primitive Shapes with Solid Commands	548	Drawing Solid Shape 1	568
Creating Composite Solids with Solid Commands	548	Drawing Solid Shape 2	569
Editing Solids with Solid Commands	548	Joining with Union	570
Controlling UCS in Three Dimensions	549	Using Subtract	570
Dynamic UCS	549	Performing a Hide	571
Viewing Solids	549	Exercise 14-1 Part 6, Using Sweep, Helix, Subtract, Loft, Planar Surface, Thicken, and Polysolid to Draw Solid Shapes	571
3D Views Menu Options	549	Sweeping an Object	571
SteeringWheels	551	Using Loft	574
ViewCube	552	Creating a Bowl-Shaped Object	575
Editing Solids with Other Commands	552	Using Planar Surface	575
Controlling Solids Display	552	Using POLYSOLID	576
Exercise 14-1 Part 1, Drawing Primitive Solids	553	Exercise 14-1 Part 7, Using Intersection to Form a Solid Model from the Common Volume of Two Intersecting Solids	577
Box	555	Drawing Two Extruded Shapes at Right Angles to Each Other	578
Sphere	555	Using Intersect	579
Wedge	556	Wblocking the Intersected Model	580
Cone	556	Completing Exercise 14-1	581
Cylinder	557	Chapter Summary	583
Torus	557	Chapter Test Questions	583
Exercise 14-1 Part 2, Using Extrude to Draw Extruded Solids	558	Chapter Projects	586
Drawing an Extruded Circle	558	Chapter 15 Advanced Modeling	593
Drawing an Extruded Polygon	558	Chapter Objectives	593
Drawing an Extruded Rectangle	559	Introduction	593
Drawing an Extruded Structural Angle	560	Exercise 15-1 Creating a Solid Model of Chair 2	594
Drawing an Extruded Shape	561	Exercise 15-2 Creating a Solid Model of a Patio	597
Exercise 14-1 Part 3, Using REVOLVE to Draw Revolved Solids; Using 3DROTATE to Rotate Solids about the X-, Y-, and Z-Axes	562	RENDER	608
Drawing Revolved Shape 1	562	Render Quality	608
Drawing a Revolved Rectangle	564	Destinations	608
Drawing a Revolved Paper Clip Holder	565	Lights	608
Using 3DROTATE	565	Materials	609
Exercise 14-1 Part 4, Using CHAMFER and FILLET to Form Chamfers and Fillets on Solid Edges	566	Other Commands Available to Render, Animate, Attach Scanned Files, and Shade 3D Models	609

Exercise 15-3 Use Render Commands to Make a Photo-Realistic Rendering of the Solid Model in Exercise 15-2	610
Exercise 15-4 Create a Walk-Through AVI File for the Rendered 3D Patio	621
Chapter Summary	627
Chapter Test Questions	627
Chapter Projects	630

Part IV **Appendixes**

Appendix A	
Keyboard Shortcuts	633

Appendix B	
Shortcut and Temporary Override Keys	641

Glossary	643
-----------------	------------

Index	647
--------------	------------



chapter one

Introducing the AutoCAD User Interface

CHAPTER OBJECTIVES

- Describe the AutoCAD user interface and begin using parts of the screen.
- Modify and save a workspace.

Introduction

Before you start using the exercises in this book, you need to understand their structure and purpose. Throughout the exercises in this book:

- Numbered steps provide instructions.
- **Prompt** and **Response** columns within the numbered steps provide step-by-step instructions for starting and completing a command.
- The **Prompt** column text repeats the AutoCAD prompt that appears in the command line area of the AutoCAD screen.
- The **Response** column text shows your response to the AutoCAD prompt.
- Command grids in the margins and menu screens show you how to locate the command you are using.

EXERCISE 1-1

Examine the AutoCAD User Interface and Save a Workspace



Launching AutoCAD 2022 displays the interface shown in Figure 1-1, with the **Start tab** and a drawing tab labeled **Drawing1**. The presence of the **Start tab** is controlled by the **STARTMODE** system variable. By default, the **Start tab** is visible and remains open as drawing files are opened. The revised **Start tab** contains three areas.

On the left side area you can **Open** an existing drawing or create a **New** drawing. The display in the center and right areas changes depending on your choice of **Recent**, **Autodesk Docs**, or **Learning**. Below those three options are six links to different options and applications:

- **What's new:** Displays links to new features in AutoCAD 2022 in a new browser window
- **Online help:** Opens AutoCAD 2022 Help in a browser window
- **Community forum:** Opens the main page for all AutoCAD forums of the Autodesk Knowledge Network in a browser window
- **Customer support:** Opens the Support & Learning page of the Autodesk Knowledge Network in a browser window
- **AutoCAD mobile app:** The AutoCAD mobile app is a paid subscription available from Google Play and Apple's App Store
- **AutoCAD web app:** If you have an Autodesk account, you can run all tools and commands in a web browser.

By default, **Recent** in the left side of the **Start tab** is selected. The center area of the tab displays a list of recently open drawings, and the right side shows Announcements from Autodesk. Clicking a filename or icon in the center area opens the drawing on its own file tab.

The area on the right is visible only when the **Recent** option on the left is selected. In it, you see **Announcements** and "Have you tried..." items.

Autodesk Docs is a file management system that requires a subscription to AutoCAD. It links to a system of virtual drives connected through the cloud. Autodesk Docs is primarily intended as a way for teams remote from one another to connect remotely. This option is not covered in this book.

Clicking **Learning** on the left side of the **Start tab** displays links to specific tips to learning and using AutoCAD, to a series of videos showing program operation, and to a series of free online learning resources (see Figure 1-2).

Clicking **New** at the left side of the **Start tab** prompts you to select from a series of drawing template files to begin your new drawing. Figure 1-3 shows the list of available drawing templates. The last template used becomes the default template.

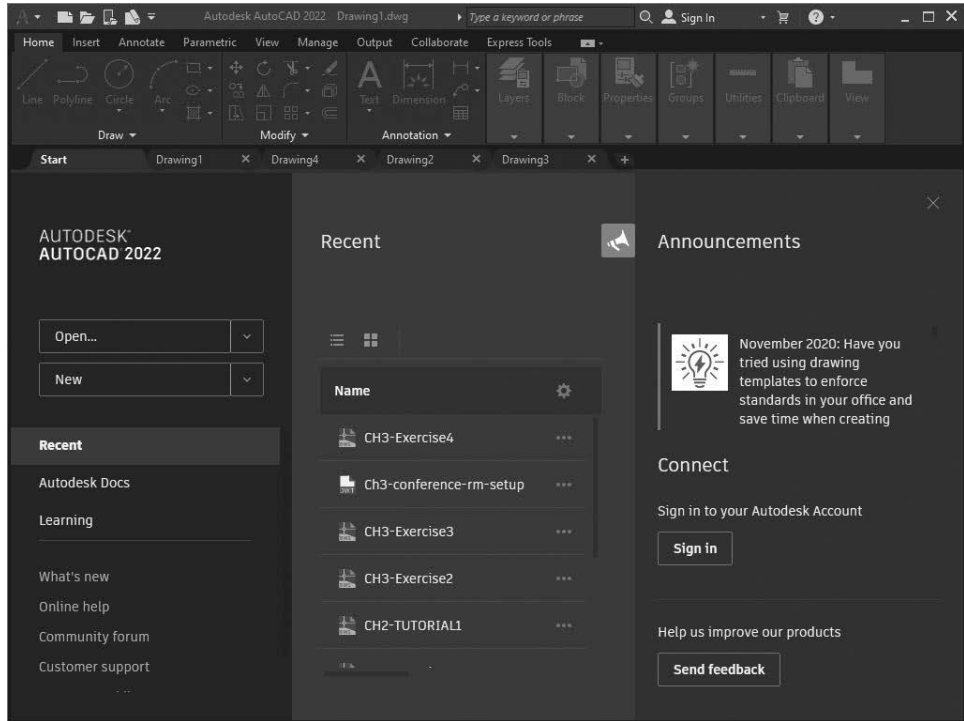


Figure 1-1
The Start tab of AutoCAD 2022 showing recently opened files in the center area

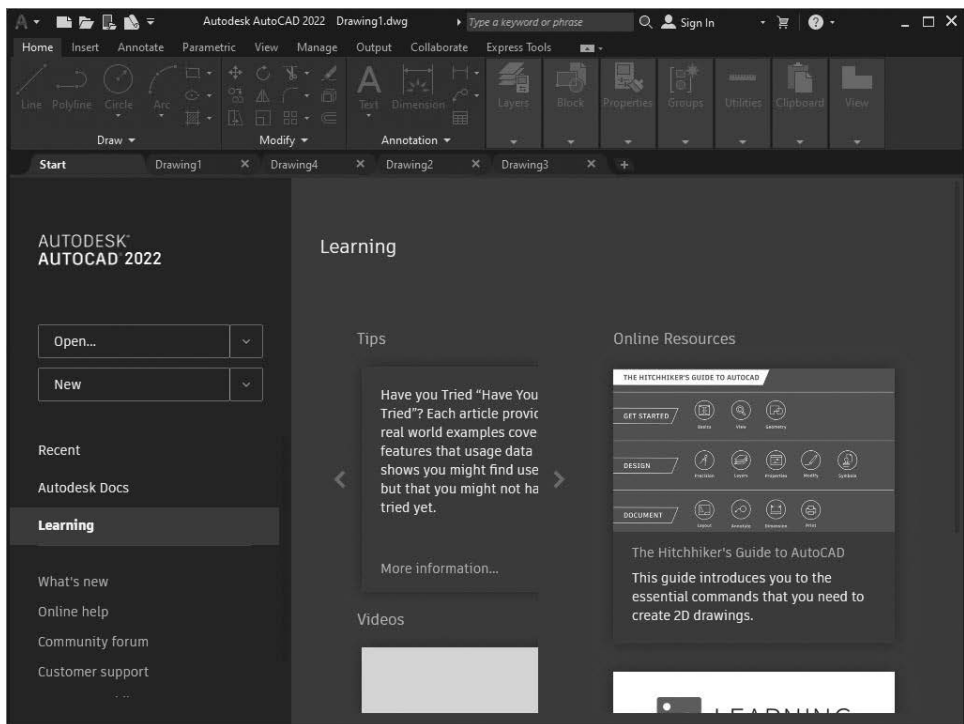
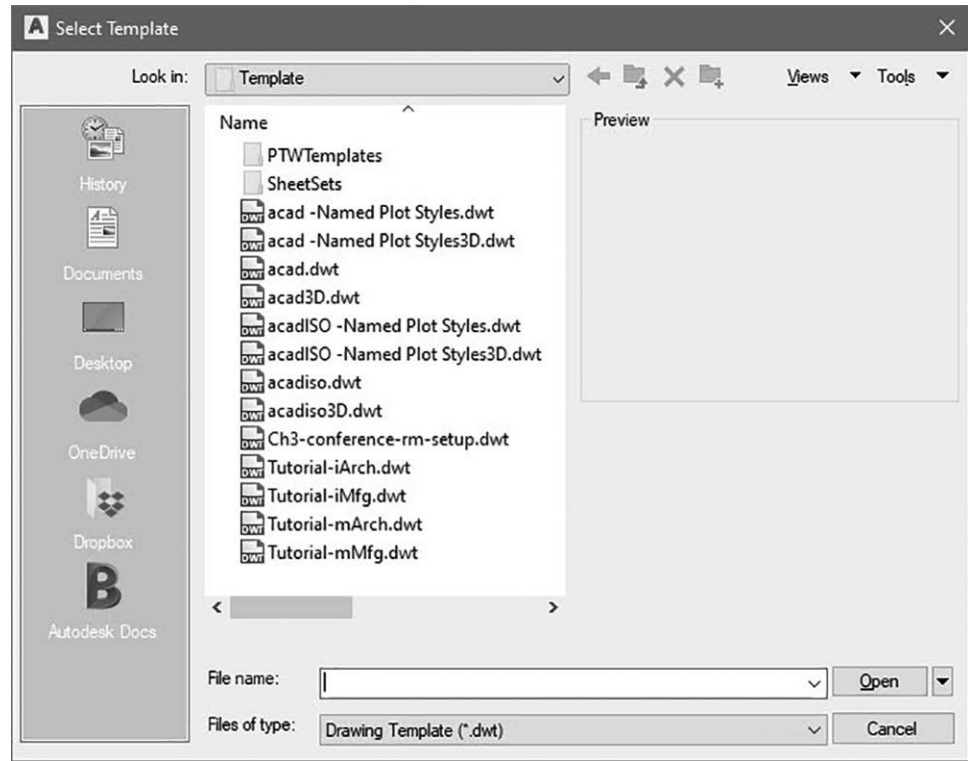


Figure 1-2
Click Learning on the Start tab to display aids to learning AutoCAD

The real advantage is that each drawing that you open, whether from a tab or by using the **Open** command, has its own tab. Now switching among drawings is easy to do.

AutoCAD 2022 introduces **Floating Drawing tabs**. You can now drag a tab to an area outside AutoCAD’s application window and view two drawings at the same time, without having to switch tabs and see them one at a time. The command line window and all other interface features are active in the floated window. To return a **Floating Drawing tab** to the application window, simply drag it next to another tab in the main window.

Figure 1-3
List of available drawing templates in AutoCAD 2022



Drawing Window and Graphics Cursor

user interface: All the elements such as the AutoCAD screen that make up the interface between the user and the AutoCAD program.

The AutoCAD **user interface** (Figure 1-4) contains the drawing window and access to commands. The drawing window is where your drawing is displayed. The graphics cursor (or crosshairs) follows the movement of a mouse when points of a drawing are entered or a command is selected. The box at the center of the crosshairs is called a *pickbox*.

Other components of the user interface, as shown in Figure 1-4, are

- Application Menu Button
- Quick Access Toolbar
- Share Drawing Button
- Infocenter
- Ribbon and its Tabs and Panels
- ViewCube
- Navigation Bar

OPTIONS	
Ribbon/ Panel	View/ Interface/ Dialog Box Launcher
Menu Bar:	Tools/ Options
Type a Command:	OPTIONS
Command Alias:	OP

- User Coordinate System Icon
- Status Bar
- Command Line

The size of the graphics cursor and pickbox can be changed to accommodate individual preferences. The colors of the elements in the drawing window also can be changed.

Information regarding commands is attached to the cursor. This can be turned on or off using the **DYNMODE** toggle in the status bar, as described later in this chapter.

Step 1. Locate the **Options** dialog box, where you can change the size of the graphics cursor, the colors of the elements in the drawing window, and the pickbox, as described next.

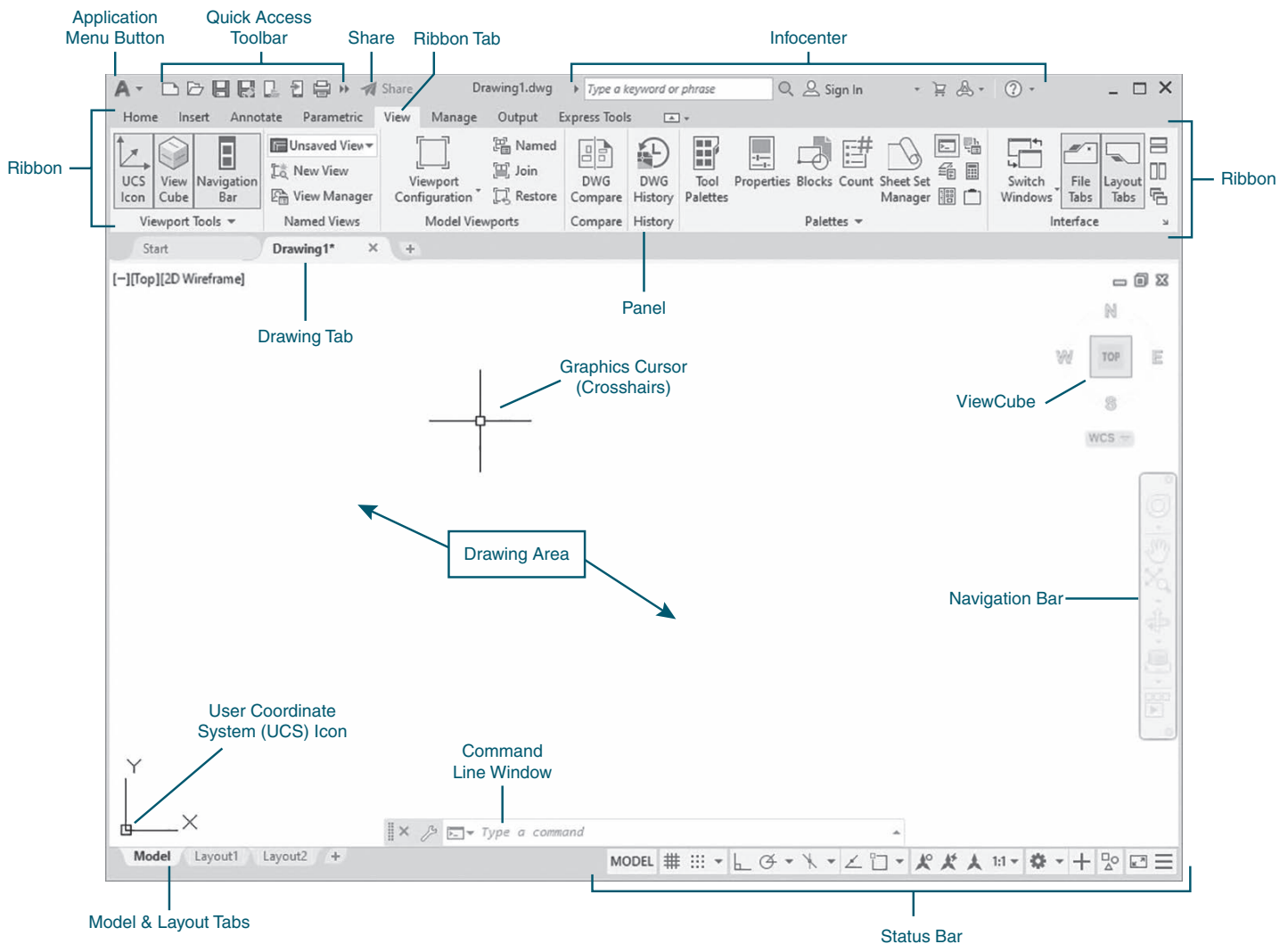


Figure 1-4
The AutoCAD user interface

Prompt

Type a command:

The **Options** dialog box appears

The **Display** tab appears

(Figure 1-5):

The **Drawing Window Colors**

dialog box (Figure 1-6) appears:

The **Selection** tab appears:

Response

Type **OP <Enter>** (in this book, **<Enter>** means to press the **<Enter>** key or press the right mouse button to enter a command)

Click the **Display** tab

Click the **Crosshair size** slider in the lower right to decrease or increase the size of the crosshairs
Click the **Colors...** button on the left

This is where you can change colors of the elements in the drawing window

Click **Cancel** to exit the **Drawing Window Colors** dialog box

Click the **Selection** tab

Click the **Pickbox size** slider in the upper left to decrease or increase the size of the pickbox

Click **Cancel** to exit the **Options** dialog box

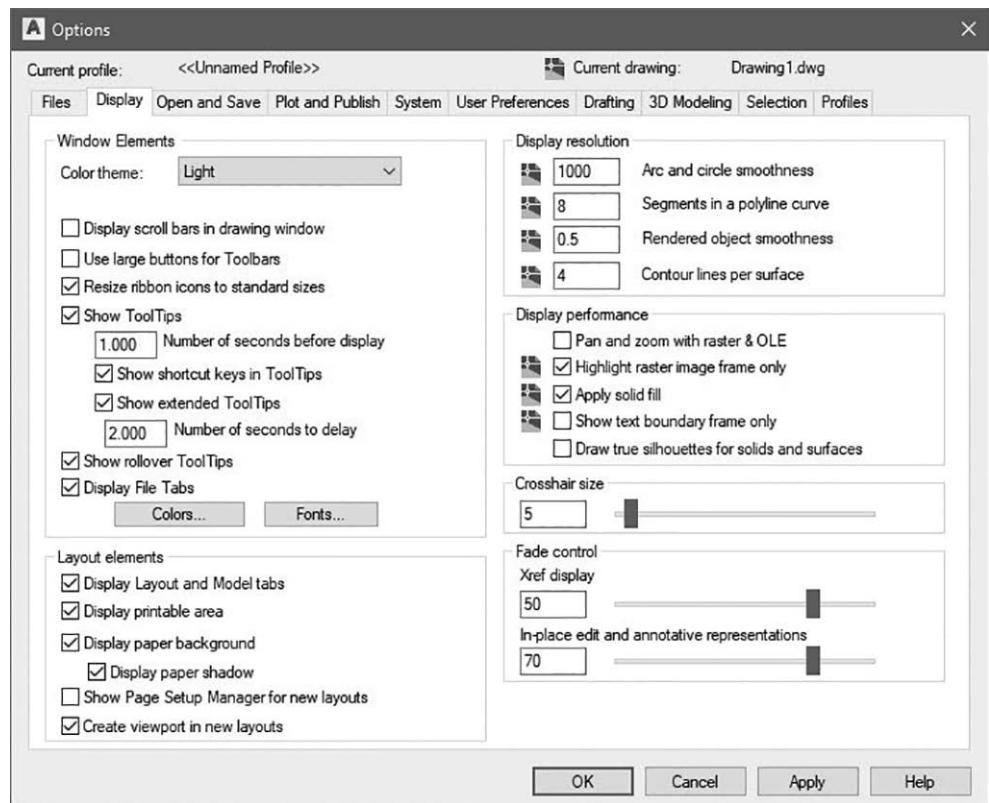


Figure 1-5
Options dialog box—Display tab

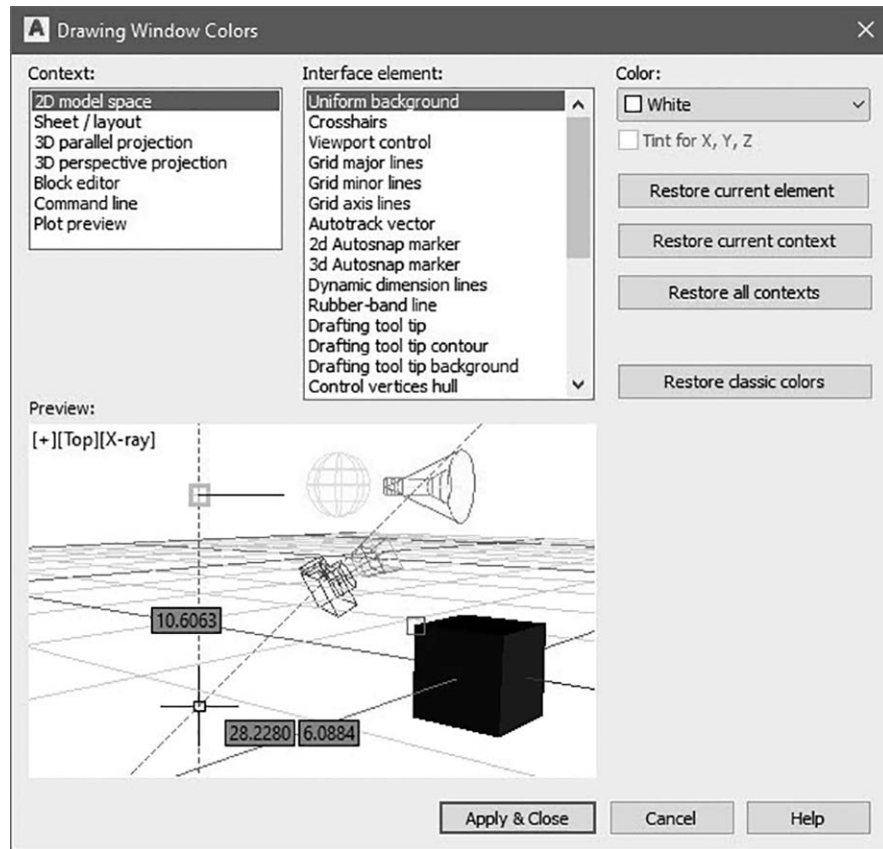


Figure 1-6
Drawing Window Colors dialog box

Application Menu Button

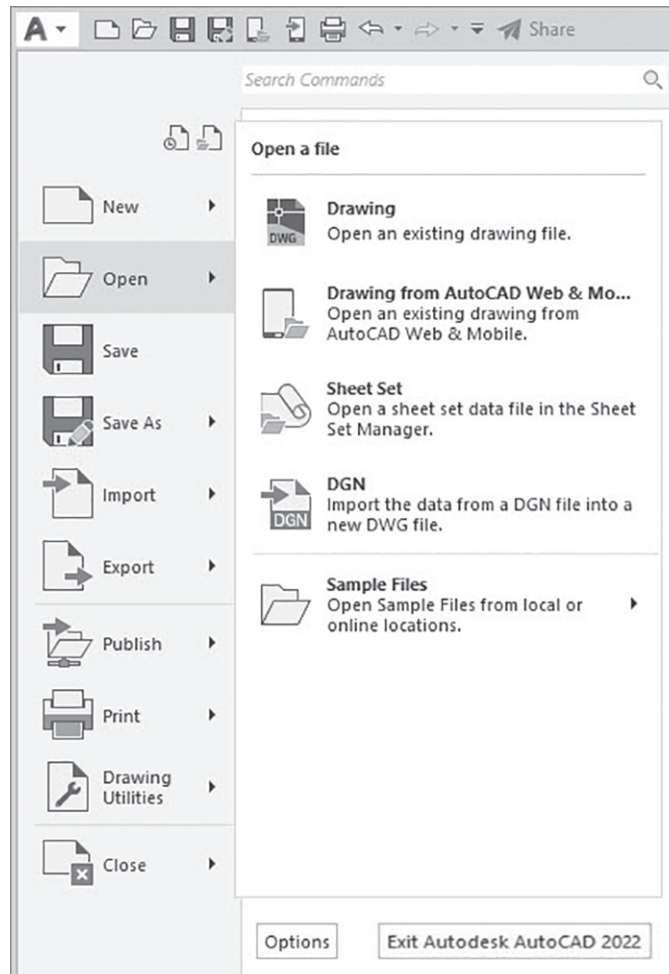
When you click (quickly press and release the left mouse button) on the **Application** menu button, the application menu opens. The application menu commands (Figure 1-7) can be used to

- Create a new drawing
- Open an existing drawing
- Save a drawing
- Save a drawing as another format
- Import a PDF, Microstation DGN drawing, or numerous other file formats
- Export your drawing to a different format
- Publish or share a drawing
- Print or plot a drawing
- Access tools to maintain your drawing
- Close a drawing

At the top of the application menu, you can enter key words in the text box to search for additional menu items.

Step 2. Click the application menu button with your left mouse button to open it. Hold your cursor over each command to see the brief descriptions of the command options. Press the **<Esc>** key to exit the application menu (Figure 1-7).

Figure 1-7
Application menu



Inputting or Selecting a Command

AutoCAD provides four major ways to input or select a command:

- 1** Select a command icon from the **ribbon**.
- 2** Type a full command name or command alias (for example, **L** for **line**) at the **command line window**.
- 3** Use the **Quick Access** toolbar customization button to show the menu bar. You can then select an icon/command from the **menu bar**.
- 4** Use the **Tools** menu on the menu bar to access the AutoCAD toolbars. You can then select a command icon from a **toolbar**.

Ribbon

The ribbon displays the commands used to make a drawing. If you right-click (quickly press and release the right mouse button) on any menu tab, you will get a right-click menu (Figure 1-8) that has commands to hide or

ribbon: The user interface below the **Quick Access** toolbar that comprises tabs and panels with flyouts used to access the commands for both 2D drawing and annotation and 3D modeling, viewing, and rendering.

command line window: The text area above the status bar used for keyboard input and prompts, and where AutoCAD displays messages.

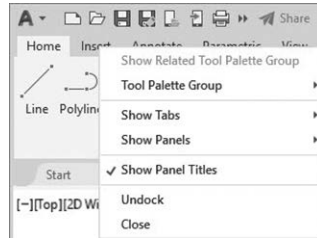
menu bar: The bar containing menus displayed using the **Quick Access** toolbar customization button; contains commonly used commands.

toolbar: A graphical interface containing icons that represent commands.

show tabs, panels, and panel titles. This right-click menu also has commands to close the ribbon or undock it. If you close the ribbon, type **RIBBON <Enter>** at the command prompt to reopen it.

Figure 1-8

Display the right-click menu by right-clicking on a ribbon tab



When you undock the ribbon, you can drag it to display as horizontal, vertical, or floating.

You can also drag individual panels of the ribbon into your drawing window and float them. You can drag them back into the ribbon, or you can click on **Return Panels to Ribbon** in the upper-right corner grab bar (Figure 1-9) to return the panel to the ribbon.

Step 3. Click each menu tab—**Home**, **Insert**, **Annotate**, **Parametric**, **View**, **Manage**, **Output**, and **Express Tools**—in the ribbon to view the commands available.

Expanded Panels

Panels with an arrow to the immediate right of the panel title can be expanded to display additional commands. When you left-click on the arrow, the panel will expand. When the panel is expanded, you can use the pushpin icon to the left of the panel title to keep the panel expanded (Figure 1-10). A few panels also display a down-to-the-right arrow at the far-right end of the panel label. This arrow is called the **Dialog Box Launcher**. Click the arrow to display the appropriate dialog box.

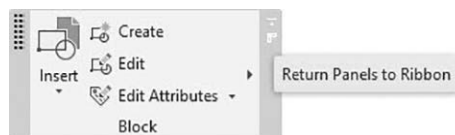


Figure 1-9

Return Panels to Ribbon option in the upper right corner of a floating panel

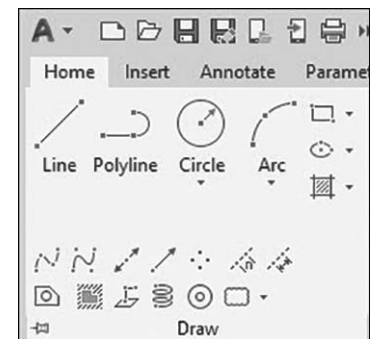


Figure 1-10

Expanded panel

Dialog Boxes and Palettes

Panels with a diagonal arrow in the lower-right corner of the panel title can open dialog boxes or palettes. When you left-click on the diagonal arrow, a dialog box or palette appears, as shown in Figure 1-11.