

# AutoCAD<sup>®</sup> 2022 INSTRUCTOR

James A. Leach  
Shawna Lockhart



**Better Textbooks. Lower Prices.**  
[www.SDCpublications.com](http://www.SDCpublications.com)



**ACCESS CODE**  
UNIQUE CODE INSIDE

Visit the following websites to learn more about this book:



[amazon.com](https://www.amazon.com)

[Google books](https://books.google.com)

[BARNES & NOBLE](https://www.barnesandnoble.com)

---

# Table of Contents

---

<b>CHAPTER 1 GETTING STARTED.....</b>	<b>1</b>	<i>Qsave</i> .....	35
CONCEPTS.....	2	<i>Saveas</i> .....	35
Coordinate Systems .....	2	<i>Close</i> .....	37
The CAD Database .....	3	<i>Closeall</i> .....	37
Angles in AutoCAD.....	3	<i>Closeallother</i> .....	37
Draw True Size .....	3	<i>Exit</i> .....	37
Plot to Scale .....	5	<i>Quit</i> .....	38
STARTING AUTOCAD.....	5	<i>Partialopen</i> .....	38
THE AutoCAD DRAWING EDITOR.....	6	<i>Partiaload</i> .....	39
Beginning a Drawing .....	6	<i>Recover</i> .....	40
Drafting & Annotation Workspace .....	7	<i>Dwgprops</i> .....	40
Command Entry Using the Keyboard .....	11	<b>SAVETIME</b> .....	41
Accelerator Keys (Control Key Sequences) ..	12	AutoCAD Backup Files .....	42
Special Key Functions .....	12	Drawing Recovery .....	42
Mouse Buttons .....	12	AutoCAD Drawing File Management.....	43
COMMAND ENTRY.....	12	Using Other File Formats .....	43
Methods for Entering Commands.....	12	<b>CHAPTER 3 DRAW COMMAND CONCEPTS .</b>	<b>45</b>
Understanding the “Command Tables” in this		AutoCAD OBJECTS .....	46
Book .....	13	LOCATING THE DRAW COMMANDS .....	46
Command Entry Methods Practice.....	13	COORDINATE ENTRY .....	48
<i>Line</i> .....	13	Coordinate Formats and Types .....	48
DRAWING AIDS.....	15	Coordinate Formats.....	48
Status Bar.....	15	Coordinate Types .....	48
Function Keys.....	20	Typical Combinations .....	48
AutoCAD Text Window.....	20	Three Methods of Coordinate Input.....	48
Model Space and Layouts .....	21	Mouse Input.....	49
CUSTOMIZING THE AUTOCAD SCREEN .....	22	Dynamic Input .....	49
Toolbars.....	22	Command Line Input.....	50
Ribbon .....	23	<b>PRACTICE USING THE THREE COORDINATE</b>	
Clean Screen.....	24	<b>INPUT METHODS</b> .....	50
Options .....	25	<i>Line</i> .....	50
<b>CHAPTER 2 WORKING WITH FILES.....</b>	<b>27</b>	Using Mouse Input to Draw Lines and Circles ..	51
AutoCAD DRAWING FILES .....	28	<i>Circle</i> .....	51
Naming Drawing Files .....	28	Using Dynamic Input to Draw Lines and Circles...53	
Beginning and Saving a Drawing .....	28	Using Command Line Input to Draw Lines and	
Accessing File Commands.....	28	Circles .....	55
File Navigation Dialog Box Functions.....	29	Direct Distance Entry and Angle Override.....	57
Windows Right-Click Shortcut Menus .....	30	Dynamic Input Settings .....	57
<i>New</i> .....	31	<b>POLAR TRACKING AND POLAR SNAP .....</b>	<b>58</b>
AUTOCAD FILE COMMANDS .....	31	Polar Tracking .....	58
<i>Qnew</i> .....	32	Polar Tracking with Direct Distance Entry .....	59
<i>Open</i> .....	33	Polar Tracking Override .....	60
<i>Save</i> .....	35	Polar Snap.....	60

DRAWING LINES USING POLAR TRACKING . 61	<i>Snap</i> .....101
Using Polar Tracking and Grid Snap ..... 61	<i>Grid</i> .....103
Using Polar Tracking and Dynamic Input..... 62	Using Snap and Grid .....104
Using Polar Tracking, Polar Snap, and Dynamic Input ..... 63	<i>Dsettings</i> .....104
<b>CHAPTER 4 SELECTION SETS ..... 69</b>	INTRODUCTION TO LAYOUTS AND PRINTING ..105
MODIFY COMMAND CONCEPTS..... 70	Model Tab and Layout Tabs .....105
SELECTION SETS..... 70	Why Set Up Layouts Before Drawing? .....108
Selection Set Options..... 71	Printing and Plotting .....108
Selection Cycling..... 76	Setting Layout Options and Plot Options.....109
Select ..... 76	<b>CHAPTER 7 OBJECT SNAP AND OBJECT SNAP TRACKING.....113</b>
NOUN/VERB SYNTAX ..... 77	CAD ACCURACY ..... 114
SELECTION SETS PRACTICE..... 77	OBJECT SNAP.....114
Using Erase..... 78	OBJECT SNAP MODES ..... 115
<i>Erase</i> ..... 78	Acquisition Object Snap Modes ..... 118
Using Move..... 79	Object Snap Modifiers ..... 120
<i>Move</i> ..... 79	OBJECT SNAP SINGLE POINT SELECTION..121
Using Copy ..... 80	Object Snaps (Single Point) ..... 121
<i>Copy</i> ..... 80	OBJECT SNAP RUNNING MODE ..... 123
Noun/Verb Command Syntax Practice ..... 82	Running Object Snap Modes ..... 123
<b>CHAPTER 5 HELPFUL COMMANDS ..... 85</b>	<i>Osnap</i> ..... 123
CONCEPTS..... 86	Running Object Snap Toggle.....124
<i>Help</i> ..... 86	Running Object Snap Override ..... 124
<i>Oops</i> ..... 88	Object Snap Options ..... 124
<i>U</i> ..... 88	OBJECT SNAP TRACKING ..... 127
<i>Undo</i> ..... 88	To Use Object Snap Tracking:.....128
<i>Redo</i> ..... 90	Object Snap Tracking with Polar Tracking.....128
<i>Mredo</i> ..... 90	Object Snap Tracking Settings.....130
<i>Regen</i> ..... 91	<b>CHAPTER 8 DRAW COMMANDS I..... 137</b>
<b>CHAPTER 6 BASIC DRAWING SETUP ..... 93</b>	CONCEPTS.....138
STEPS FOR BASIC DRAWING SETUP ..... 94	Draw Commands—Simple and Complex .....138
STARTUP OPTIONS ..... 94	Draw Command Access .....138
DRAWING TEMPLATES..... 95	COMMANDS ..... 139
Table of Basic Settings for the ACAD (Inch) Templates..... 96	<i>Line</i> .....139
Table of Basic Settings for the ACADISO (Metric) Templates..... 96	<i>Circle</i> ..... 140
SETUP COMMANDS ..... 97	<i>Arc</i> .....142
<i>Units</i> ..... 97	Use Arcs or Circles?.....146
Keyboard Input of Units Values ..... 98	<i>Point</i> .....147
<i>Limits</i> ..... 99	<i>Ptype</i> .....147
	<i>Pline</i> .....148
	Pline Arc Segments.....150

<b>CHAPTER 9 MODIFY COMMANDS I.....</b>	<b>155</b>	<b>CHAPTER 11 LAYERS AND</b>	
<b>CONCEPTS.....</b>	<b>156</b>	<b>OBJECT PROPERTIES .....</b>	<b>219</b>
<b>COMMANDS .....</b>	<b>157</b>	<b>CONCEPTS.....</b>	<b>220</b>
<i>Erase</i> .....	157	Assigning Colors, Linetypes, Lineweights, and	
<i>Move</i> .....	158	Transparency .....	220
<i>Rotate</i> .....	159	Object Properties .....	221
<i>Scale</i> .....	161	Plot Styles .....	221
<i>Stretch</i> .....	162	<b>LAYERS AND LAYER PROPERTIES CONTROLS..</b>	<b>222</b>
<i>Lengthen</i> .....	163	Layer Drop-Down List.....	222
<i>Trim</i> .....	165	<i>Layer</i> .....	222
<i>Extend</i> .....	168	Layer Properties Manager Layer List .....	223
Trim and Extend Shift-Select Option .....	169	Color, Linetype, Lineweight,	
<i>Break</i> .....	169	and Other Properties.....	225
<i>Join</i> .....	171	Layer Filters.....	227
<i>Copy</i> .....	172	Displaying an Object's Properties	
<i>Mirror</i> .....	173	and Visibility Settings .....	229
<i>Offset</i> .....	174	<i>Laymcur</i> .....	230
<i>Array</i> .....	176	<i>Layerp</i> .....	230
<i>Arrayrect</i> .....	177	<i>Layerstate</i> .....	230
Creating and Editing Arrays Using Grips.....	178	<b>OBJECT-SPECIFIC PROPERTIES CONTROLS ..</b>	<b>233</b>
<i>Arraypolar</i> .....	178	<i>Linetype</i> .....	233
<i>Arraypath</i> .....	181	Linetype Drop-Down List .....	235
<i>Fillet</i> .....	183	<i>Lweight</i> .....	235
<i>Chamfer</i> .....	185	Lineweight Drop-Down List.....	236
<b>CHAPTER 10 VIEWING COMMANDS .....</b>	<b>199</b>	<i>Color</i> .....	237
<b>CONCEPTS.....</b>	<b>200</b>	Color Drop-Down List .....	238
<b>ZOOM AND PAN WITH THE MOUSE WHEEL .</b>	<b>201</b>	True Color and Color Books .....	238
Zoom and Pan .....	201	<i>Setbylayer</i> .....	239
Zoom with the Mouse Wheel .....	201	<b>CONTROLLING LINETYPE SCALE .....</b>	<b>240</b>
Pan with the Mouse Wheel .....	202	<i>LTSCALE</i> .....	240
<i>Zoom</i> .....	203	<i>CELTSCALE</i> .....	241
Pan .....	207	<b>CHANGING OBJECT PROPERTIES .....</b>	<b>242</b>
Zoom and Pan with Undo and Redo .....	208	Properties Panel.....	242
<i>Viewback</i> .....	208	<i>Properties</i> .....	243
<i>Viewforward</i> .....	208	<i>Matchprop</i> .....	243
<i>View</i> .....	208	<i>Laymch</i> .....	244
<i>Viewres</i> .....	210	<i>Laycur</i> .....	245
<i>Ucsicon</i> .....	211	<i>Layiso</i> .....	245
<i>Viewgo</i> .....	212	<i>Layuniso</i> .....	247
<i>Qvdrawing</i> .....	212	<i>Copytolayer</i> .....	247
<i>Vports</i> .....	213	<i>Laywalk</i> .....	248
		<i>Layfrz</i> .....	251
		<i>Laythw</i> .....	252
		<i>Layoff</i> .....	252

<i>Layon</i> .....	252	<b>CHAPTER 14 PRINTING AND PLOTTING</b> .....	309
<i>Laylck</i> .....	253	CONCEPTS.....	310
<i>Layulk</i> .....	253	TYPICAL STEPS TO PLOTTING.....	310
<i>Layvpi</i> .....	253	PRINTING, PLOTTING, AND SAVING PAGE	
<i>Laymrg</i> .....	254	SETUPS.....	311
<i>Laydel</i> .....	255	<i>Plot</i> .....	311
<b>CHAPTER 12 ADVANCED DRAWING SETUP</b> ..	261	- <i>Plot</i> .....	316
CONCEPTS.....	262	<i>Viewplotdetails</i> .....	316
STEPS FOR DRAWING SETUP.....	262	<i>Pagesetup</i> .....	317
USING AND CREATING TEMPLATE DRAWINGS ..	266	Should You Use the Plot Dialog Box or the	
Using Template Drawings.....	266	Page Setup Manager?.....	319
Table of Standard AutoCAD Templates .....	267	PLOTTING TO SCALE.....	320
Creating Template Drawings.....	268	<i>Preview</i> .....	320
Additional Advanced Drawing Setup Concepts..	269	Standard Paper Sizes.....	321
Steps for Drawing Setup Using Annotative		Calculating the Drawing Scale Factor.....	321
Objects.....	269	Guidelines for Plotting Model Space to Scale...	322
<b>CHAPTER 13 LAYOUTS AND VIEWPORTS</b> ...273		Guidelines for Plotting Layouts to Scale .....	322
CONCEPTS.....	274	TABLES OF LIMITS SETTINGS.....	323
Paper Space and Model Space.....	274	Examples for Plotting to Scale.....	329
Layouts.....	274	CONFIGURING PLOTTERS AND PRINTERS .	330
Viewports.....	275	Plotting Components.....	330
Layouts and Viewports Example .....	277	<i>Plottermanager</i> .....	330
Guidelines for Using Layouts and Viewports..	280	Add-A-Plotter Wizard.....	331
<i>Layoutwizard</i> .....	281	Plotter Configuration Editor .....	332
<i>Layout</i> .....	283	<b>CHAPTER 15 DRAW COMMANDS II</b> .....	337
Inserting Layouts with AutoCAD DesignCenter ..	285	CONCEPTS.....	338
Setting Up the Layout.....	285	COMMANDS.....	338
<i>Options</i> .....	286	<i>Xline</i> .....	338
<i>Pagesetup</i> .....	287	<i>Ray</i> .....	340
<i>Psetupin</i> .....	288	<i>Polygon</i> .....	341
USING VIEWPORTS IN PAPER SPACE.....	289	<i>Rectang</i> .....	342
<i>Vports</i> .....	289	<i>Donut</i> .....	343
<i>Qvlayout</i> .....	292	<i>Spline</i> .....	344
Scaling the Display of Viewport Geometry ...	293	<i>Ellipse</i> .....	346
Locking Viewport Geometry .....	295	<i>Divide</i> .....	348
Linetype Scale in Viewports—PSLTSCALE .	295	<i>Measure</i> .....	349
<i>Vpmax</i> .....	296	<i>Mline</i> .....	350
<i>Vpmin</i> .....	297	Multiline Style Dialog Box.....	352
<i>Scalelistedit</i> .....	297	<i>Mlstyle</i> .....	352
<i>Chspace</i> .....	298	Multiline Style Dialog Box.....	353
Advanced Applications of Paper Space		Multiline Styles Example .....	354
Viewports .....	299	Editing Multilines .....	355
		<i>Sketch</i> .....	355



<i>Solid</i> .....	357	<i>Time</i> .....	413
<i>Boundary</i> .....	357	<i>Setvar</i> .....	414
<i>Region</i> .....	358	<i>Sysvarmonitor</i> .....	415
<i>Wipeout</i> .....	360	<i>Massprop</i> .....	416
<i>Revcloud</i> .....	360		
<b>CHAPTER 16 MODIFY COMMANDS II</b> .....	<b>367</b>	<b>CHAPTER 18 TEXT AND TABLES</b> .....	<b>419</b>
CONCEPTS .....	368	CONCEPTS .....	420
COMMANDS .....	368	TEXT CREATION COMMANDS .....	422
Considerations for Changing Basic Properties of Objects .....	369	<i>Text</i> .....	422
<i>Properties</i> .....	370	<i>Mtext</i> .....	425
<i>Dbclckedit</i> .....	373	Bullets and Lists .....	432
<i>Matchprop</i> .....	374	Creating Stacked Text .....	432
Object Properties Drop-Down Lists .....	375	Creating Columns .....	433
Quick Properties .....	376	Calculating Text Height for Scaled Drawings ..	434
<i>Chprop</i> .....	376	<i>Spacetrans</i> .....	435
<i>Change</i> .....	376	<i>Txt2mtxt</i> .....	436
<i>Explode</i> .....	377	<i>Style</i> .....	437
<i>Align</i> .....	378	Annotative Text .....	440
<i>Pedit</i> .....	379	Importing External Text into AutoCAD .....	443
Vertex Editing .....	382	Using an External Text Editor for Multiline Text ..	443
Editing Plines with Grips .....	384	Format Codes for Creating Multiline Text in External Text Editors .....	444
Editing Spline Fit Data Points .....	385	<i>Textedit</i> .....	446
<i>Splinedit</i> .....	385	<i>Mtextedit</i> .....	446
Editing Spline Control Vertices .....	387	<i>Properties</i> .....	446
Editing Splines with Grips .....	388	<i>Spell</i> .....	447
<i>Reverse</i> .....	389	<i>Find</i> .....	448
<i>Blend</i> .....	389	Find/Replace in the Text Editor tab .....	450
<i>Arrayedit</i> .....	390	<i>Scaletext</i> .....	450
<i>Mledit</i> .....	392	<i>Justifytext</i> .....	452
<i>Overkill</i> .....	396	<i>Qtext</i> .....	453
Boolean Commands .....	397	<i>TEXTFILL</i> .....	454
<i>Union</i> .....	398	Substituting Fonts .....	454
<i>Subtract</i> .....	398	TEXT FIELDS AND TABLES .....	455
<i>Intersect</i> .....	399	Text Fields .....	455
Modifying Revclouds .....	400	<i>Field</i> .....	456
<b>CHAPTER 17 INQUIRY COMMANDS</b> .....	<b>407</b>	Creating and Editing Tables .....	457
CONCEPTS .....	408	<i>Updatefield</i> .....	457
COMMANDS .....	408	<i>Table</i> .....	458
<i>Status</i> .....	408	<i>Tablestyle</i> .....	459
<i>List</i> .....	409	The Table Cell Editor .....	461
<i>Measuregeom</i> .....	410	<i>Tabledit</i> .....	461
<i>Id</i> .....	413	Editing Tables with Grips .....	463
		Editing Tables with the Properties Palette ..	463



Importing and Exporting Tables.....	464	<b>CHAPTER 21 BLOCKS, DESIGNCENTER, AND TOOL PALETTES .....</b>	<b>513</b>
Table Breaks.....	465	CONCEPTS.....	514
Text Fields and Calculations in Tables.....	465	COMMANDS .....	515
Text Attributes.....	468	<i>Block</i> .....	516
<b>CHAPTER 19 GRIP EDITING.....</b>	<b>475</b>	Block Color, Linetype, and Lineweight Settings ..	517
CONCEPTS.....	476	<i>Insert</i> .....	518
GRIPS FEATURES.....	476	– <i>Insert</i> .....	519
Activating Grips on Objects .....	477	<i>Minsert</i> .....	520
Cold and Hot Grips.....	477	– <i>Insert with *</i> .....	521
GRIPS System Variable Settings .....	478	<i>Explode</i> .....	521
Grips Menus .....	478	<i>Xplode</i> .....	522
Grip Editing Options .....	479	<i>Wblock</i> .....	523
Shift to Turn on Ortho .....	481	Redefining Blocks and the Block Editor.....	525
Auxiliary Grid .....	481	<i>Base</i> .....	525
Editing Dimensions.....	481	<i>Bedit</i> .....	526
Multifunctional Grips.....	482	Blocks Search Path .....	528
GUIDELINES FOR USING GRIPS.....	482	<i>Purge</i> .....	528
GRIPS SETTINGS .....	483	<i>Rename</i> .....	530
Point Specification Precedence .....	484	<i>Setbylayer</i> .....	531
More Grips.....	485	DesignCenter Options .....	532
<b>CHAPTER 20 ADVANCED SELECTION SETS ..</b>	<b>489</b>	<i>Adcenter</i> .....	532
CONCEPTS.....	490	To Open a Drawing from DesignCenter.....	537
SELECTION SET VARIABLES.....	490	To Insert a Block Using DesignCenter.....	537
Changing the Settings .....	490	TOOL PALETTES .....	539
<i>Options</i> .....	491	<i>Toolpalettes</i> .....	540
OBJECT SELECTION TOOLS AND FILTERS ..	493	Creating and Managing Tool Palettes.....	542
<i>Selall</i> .....	493	COUNTING BLOCKS .....	544
<i>Selectsimilar</i> .....	493	<i>Count</i> .....	544
<i>Hideobjects</i> .....	494	<b>CHAPTER 22 BLOCK ATTRIBUTES AND DATA LINKS .....</b>	<b>551</b>
<i>Unisolateobjects</i> .....	495	CONCEPTS.....	552
<i>Isolateobjects</i> .....	495	CREATING ATTRIBUTES .....	552
<i>Qselect</i> .....	495	Steps for Creating and Inserting Block At- tributes .....	552
<i>Filter</i> .....	498	<i>Attdef</i> .....	553
OBJECT GROUPS.....	501	Saving the Attributed Block .....	557
<i>Group</i> .....	502	Inserting Attributed Blocks.....	557
<i>Groupedit</i> .....	503	The ATTDIA Variable .....	558
<i>Ungroup</i> .....	503	The ATTREQ Variable .....	558
Group Examples.....	504	DISPLAYING AND EDITING ATTRIBUTES .....	558
<i>Classicgroup</i> .....	505	<i>Attdisp</i> .....	558
Changing Properties of a Group .....	507		

<i>Attedit</i> .....	559	<i>Publish</i> .....	604
Multiple <i>Attedit</i> .....	560	IMPORTING .PDF FILES .....	607
<i>Eattedit</i> .....	560	<i>Import</i> .....	607
<i>Properties</i> .....	561	<i>Pdfimport</i> .....	610
<i>Find</i> .....	562	Importing SHX Fonts from .PDF Files .....	611
<i>-Attedit</i> .....	563	<i>PDFSHXTEXT</i> .....	611
Global and Individual Editing Example.....	565	Suggested Steps for Scaling and Importing .PDF Files .....	612
<i>Battman</i> .....	569	Considerations for Importing and Exporting .PDF Files .....	613
<i>Attredif</i> .....	571	VIEWING .DWF AND .PDF FILES .....	614
Refedit, Properties, and Refclose.....	572	Autodesk Design Review.....	614
The Block Editor .....	573	DWF Underlay and PDF Underlay in AutoCAD ..	616
Grip Editing Attribute Location.....	574	<i>Dwfattach</i> .....	616
EXTRACTING ATTRIBUTES.....	574	<i>Dwfclip</i> .....	618
<i>Attsync</i> .....	574	To Detach a DWF or PDF Underlay .....	619
<i>Eattext</i> .....	575	Viewing URLs (Hyperlinks) in a DWF Image..	619
Updating Attribute Data .....	579	<i>Dwflayers</i> .....	619
<i>Datalink</i> .....	580	COLLABORATING AND MARKUP TOOLS.....	620
Data Link Examples .....	581	The Markup Tools .....	620
<i>Datalinkupdate</i> .....	583	The Markup Process .....	620
<b>CHAPTER 23 INTERNET TOOLS AND COLLABORATION.....</b>	<b>589</b>	Shared Views .....	621
CONCEPTS.....	590	<i>Shareview</i> .....	621
<i>Browser</i> .....	591	Marking Up a Shared View .....	624
Autodesk App Store (formerly Autodesk Exchange).....	592	Markups from Autodesk Design Review.....	625
<i>Inetlocation</i> .....	592	<i>Opendwfmarkup</i> .....	625
USING HYPERLINKS .....	594	<i>Markup</i> .....	625
<i>Open from/Save to Web &amp; Mobile</i> .....	594	<i>Share</i> .....	626
<i>Hyperlink</i> .....	594	DRAWING COMPARE.....	627
Hyperlinkbase.....	596	<i>Trace</i> .....	627
<i>Selecturl</i> .....	596	<i>Compare</i> .....	627
Transmitting Drawings .....	597	DRAWING HISTORY .....	628
<i>Etransmit</i> .....	597	<i>DWGHISTORY</i> .....	628
Transmittal Setups.....	598	<b>CHAPTER 24 MULTIVIEW DRAWING .....</b>	<b>633</b>
Modify Transmittal Setup Dialog Box .....	598	CONCEPTS.....	634
CREATING .DWF AND .PDF FILES.....	600	PROJECTION AND ALIGNMENT OF VIEWS ..	634
Raster Files and Vector Files.....	601	Using Ortho and Object Snap to Draw Projection Lines .....	634
Creating .DWF and .PDF Files with ePlot and Export.....	601	Using Polar Tracking to Draw Projection Lines..	635
<i>Exportpdf</i> .....	602	Using Object Snap Tracking to Draw Projection Lines Aligned with Object Snap Points .....	636
<i>Exportdwf</i> .....	603	Using Xline and Ray for Construction Lines..	638
ePlot Options.....	604	Using Offset for Construction of Views .....	638
Creating .DWF and .PDF Files with Publish...	604		

Realignment of Views Using Polar Snap and Polar Tracking .....	639	Origin Panel.....	683
USING CONSTRUCTION LAYERS .....	639	Options Panel .....	683
USING LINETYPES .....	640	Hatch and Gradient Dialog Box .....	685
Drawing With Hidden and Center Linetypes..	641	Gradient Hatches .....	686
Managing Linetypes, Lineweights, and Colors...	642	-Hatch Command Line Options .....	687
ASSOCIATIVE CENTERLINES & CENTERMARKS..	644	Creating Tool Palettes.....	691
Drawing Associative Centerlines & Centermarks ..	644	<i>Toolpalettes</i> .....	691
<i>Centerline</i> .....	644	EDITING HATCH PATTERNS AND BOUNDARIES ..	693
<i>Centermark</i> .....	645	<i>Hatchedit</i> .....	693
Modifying Centerlines and Centermarks .....	646	Using Grips with Hatch Patterns .....	694
Grips.....	646	Using Trim with Hatch Patterns .....	694
<i>Properties</i> .....	647	Object Selection Features of Hatch Patterns ..	694
<i>Centerdisassociate</i> .....	648	Solid Hatch Fills.....	695
<i>Centerreassociate</i> .....	648	<i>Draworder</i> .....	696
Centermark and Centerline System Variables ..	649	<i>Texttofront</i> .....	696
<i>Centerreset</i> .....	649	<b>CHAPTER 27 AUXILIARY VIEWS .....</b>	<b>703</b>
CREATING FILLETS, ROUNDS, AND RUNOUTS..	651	CONCEPTS.....	704
GUIDELINES FOR CREATING A TYPICAL		CONSTRUCTING AN AUXILIARY VIEW .....	704
THREE-VIEW DRAWING .....	653	Setting Up the Principal Views .....	704
<b>CHAPTER 25 PICTORIAL DRAWINGS .....</b>	<b>661</b>	Using Snap Rotate and Ortho .....	705
CONCEPTS.....	662	Rotating Snap Back to the Original Position..	706
Types of Pictorial Drawings .....	662	Using Polar Tracking .....	708
Pictorial Drawings Are 2D Drawings.....	663	Using the Offset Command .....	709
ISOMETRIC DRAWING IN AUTOCAD .....	664	<i>Offset</i> .....	710
<i>Snap</i> .....	664	Using the Xline and Ray Commands.....	711
Isometric Ellipses .....	666	<i>Xline</i> .....	711
<i>Ellipse</i> .....	666	<i>Ray</i> .....	711
Creating an Isometric Drawing .....	668	Constructing Full Auxiliary Views .....	712
Dimensioning Isometric Drawings in AutoCAD ..	670	Reorienting the User Coordinate System.....	713
OBLIQUE DRAWING IN AUTOCAD.....	670	<b>CHAPTER 28 DIMENSIONING .....</b>	<b>717</b>
Isometric Drawing.....	672	CONCEPTS.....	718
Oblique Drawing .....	674	Dimension Components .....	718
<b>CHAPTER 26 SECTION VIEWS .....</b>	<b>675</b>	Dimension Placement .....	718
CONCEPTS.....	676	Associativity.....	719
DEFINING HATCH PATTERNS AND HATCH		Accessing Dimension Commands .....	719
BOUNDARIES .....	676	DIMENSION DRAWING COMMANDS.....	720
Steps for Creating a Section View Using the		<i>Dim</i> .....	720
Hatch Command .....	677	<i>Dimlinear</i> .....	720
<i>Hatch</i> .....	678	<i>Dimaligned</i> .....	723
Pattern Panel.....	679	<i>Dimbaseline</i> .....	724
Properties Panel.....	680	<i>Dimcontinue</i> .....	725
Boundaries Panel (Selecting the Hatch Area)..	681	<i>Dimspace</i> .....	726

<i>Dimangular</i> .....	727	<b>CHAPTER 29 DIMENSION STYLES</b>	
<i>Dimdiameter</i> .....	728	<b>AND VARIABLES</b> .....	779
<i>Dimradius</i> .....	729	CONCEPTS.....	780
<i>Dim</i> .....	731	Dimension Variables.....	780
<i>Dimjogline</i> .....	735	Dimension Styles.....	781
<i>Dimjogged</i> .....	736	Dimension Style Families.....	781
<i>Dimarc</i> .....	736	Dimension Style Overrides.....	782
<i>Dimcenter</i> .....	737	DIMENSION STYLES.....	783
<i>Dimbreak</i> .....	738	<i>Dimstyle</i> or <i>Ddim</i> .....	783
<i>Leader</i> .....	739	- <i>Dimstyle</i> .....	787
<i>Qleader</i> .....	740	DIMENSION VARIABLES.....	788
<i>Mleader</i> .....	743	Changing Dimension Variables Using the	
<i>Mleaderstyle</i> .....	744	Dialog Box Method.....	789
<i>Mleaderedit</i> .....	747	Lines Tab.....	789
<i>Mleaderalign</i> .....	748	Dimension Lines Section (Lines Tab).....	789
<i>Mleadercollect</i> .....	749	Extension Line Section (Lines Tab).....	791
<i>Dimordinate</i> .....	750	Symbols and Arrows Tab.....	792
<i>Qdim</i> .....	752	Arrowheads Section	
<i>Tolerance</i> .....	755	(Symbols and Arrows Tab).....	792
Editing Feature Control Frames.....	757	Other Sections (Symbols and Arrows Tab)..	793
Basic Dimensions.....	757	Text Tab.....	794
GDT-Related Dimension Variables.....	758	Text Appearance Section (Text Tab).....	795
Geometric Dimensioning and Tolerancing		Text Placement Section (Text Tab).....	796
Example.....	758	Text Alignment Section (Text Tab).....	797
<i>Diminspect</i> .....	762	Fit Tab.....	797
EDITING DIMENSIONS.....	763	Scale for Dimension Features Section (Fit Tab)..	798
Grip Editing Dimensions.....	763	Fit Options Section (Fit Tab).....	798
Multifunctional Grips.....	765	Text Placement Section (Fit Tab).....	800
Exploding Associative Dimensions.....	766	Fine Tuning Section (Fit Tab).....	800
Dimension Editing Commands.....	766	Primary Units Tab.....	801
<i>Dimtedit</i> .....	766	Linear Dimensions Section (Primary Units Tab) ...	802
<i>Dimedit</i> .....	767	Measurement Scale Section (Primary Units Tab) .	803
<i>Properties</i> .....	768	Zero Suppression Section (Primary Units Tab) ..	804
Customizing Dimensioning Text.....	769	Angular Dimensions Section (Primary Units Tab) .	804
Associative Dimensions.....	770	Alternate Units Tab.....	804
<i>Dimreassociate</i> .....	772	Alternate Unit Section (Alternate Units Tab)..	805
<i>Dimdisassociate</i> .....	773	Zero Suppression Section (Alternate Units Tab) .	806
DIMENSIONING VARIABLES INTRODUCTION...774		Placement Section (Alternate Units Tab).....	806
<i>Dimregen</i> .....	774	Tolerances Tab.....	806
		Tolerance Format Section (Tolerances Tab) .	806
		Alternate Unit Tolerance Section (Tolerances Tab)...	808
		<i>DIMCONTINUEMODE</i> .....	808

Changing Dimension Variables			
Using the Command Line Format .....	808		
Dim... (variable name) .....	808		
DIMASSOC (Associative Dimensions) .....	809		
MODIFYING EXISTING DIMENSIONS.....	810		
Modifying a Dimension Style .....	810		
Creating Dimension Style Overrides			
and Using -Dimstyle, Apply (Update) .....	811		
<i>Properties</i> .....	811		
- <i>Dimstyle</i> .....	811		
<i>Apply</i> .....	811		
<i>Dimoverride</i> .....	812		
<i>Matchprop</i> .....	813		
Dimension Right-Click Menu .....	814		
GUIDELINES FOR NON-ANNOTATIVE			
DIMENSIONING IN AUTOCAD .....	815		
Strategy 1. Dimensioning a Single Drawing ..	815		
Strategy 2. Creating Dimension Styles			
as Part of Template Drawings .....	817		
Optional Method for Fixed Dimension Text			
Height in Template Drawings.....	817		
DIMENSIONING IN PAPER SPACE LAYOUTS.....	818		
When to Dimension in Paper Space.....	819		
Procedure for Dimensioning in Paper Space.....	819		
DIMENSIONING ISOMETRIC DRAWINGS .....	823		
<b>CHAPTER 30 XREFERENCES</b>	<b>831</b>		
CONCEPTS.....	832		
An Xref Example .....	836		
CREATING AND USING XREFS .....	838		
<i>Xref or External-references</i> .....	839		
Dependent Objects and Names .....	844		
Evaluating New Layers .....	846		
<i>VISRETAIN/VISRETAINMODE/XREFOVERRIDE</i> ..	848		
Evaluating and Reconciling Layers .....	849		
<i>Xattach</i> .....	849		
<i>Xbind</i> .....	849		
<i>Adcenter</i> .....	850		
<i>Xclip</i> .....	852		
<i>XCLIPFRAME</i> .....	853		
Demand Loading .....	854		
<i>INDEXCTL</i> .....	855		
<i>XLOADCTL</i> .....	856		
<i>XLOADPATH</i> .....	856		
<i>XREFOVERRIDE</i> .....	857		
EDITING FOR XREFS AND BLOCKS .....	858		
<i>Xopen</i> .....	858		
In-Place Xref and Block Editing .....	859		
<i>Refedit</i> .....	860		
Using -Refedit at the Command Line .....	862		
<i>Refset</i> .....	862		
<i>Refclose</i> .....	863		
<i>XEDIT</i> .....	863		
<i>XFADECTL</i> .....	864		
<i>XREFNOTIFY</i> .....	864		
<i>PROJECTNAME</i> .....	865		
Reference Manager.....	867		
<i>XREFCTL</i> .....	867		
<b>CHAPTER 31 OBJECT LINKING</b>			
<b>AND EMBEDDING (OLE) .....</b>	<b>875</b>		
CONCEPTS.....	876		
Cut and Paste Between AutoCAD Drawings ..	876		
Cut and Paste Between AutoCAD and Other			
Windows Applications (OLE).....	877		
The Windows Clipboard .....	879		
OLE RELATED COMMANDS.....	880		
<i>Copyclip</i> .....	881		
<i>Copybase</i> .....	882		
<i>Copylink</i> .....	882		
<i>Cutclip</i> .....	883		
<i>Pasteclip</i> .....	883		
<i>Pasteorig</i> .....	885		
<i>Pasteblock</i> .....	885		
<i>Pastespec</i> .....	886		
<i>Insertobj</i> .....	888		
<i>Pasteashyperlink</i> .....	889		
MANAGING OLE OBJECTS .....	890		
<i>Olelinks</i> .....	890		
OLE Right-Click Shortcut Menu .....	891		
<i>Olescale</i> .....	891		
<i>Oleopen</i> .....	891		
Other AutoCAD Commands with OLE Objects ..	892		
OLE-RELATED SYSTEM VARIABLES.....	893		
<i>MSOLESCALE</i> .....	893		
<i>OLEHIDE</i> .....	893		
<i>OLEQUALITY</i> .....	893		
<i>OLESTARTUP</i> .....	893		



<b>CHAPTER 32 ADVANCED LAYOUTS, ANNOTATIVE OBJECTS, AND PLOTTING.....</b>	897	<i>Stylesmanager</i> .....	936
CONCEPTS.....	898	Editing Plot Styles .....	937
ADVANCED LAYOUTS .....	898	Assigning Named Plot Styles to Objects .....	939
Layer Visibility for Viewports .....	899	<i>Plotstyle</i> .....	941
<i>Layer</i> .....	900	Named Plot Style Table Example .....	942
<i>Vplayer</i> .....	902	<i>Convertpstyles</i> .....	944
Layer Property Overrides .....	905	PLOT STAMPING.....	945
Linetype Scale in Viewports .....	908	<i>Convertctb</i> .....	945
<i>Pslltscale</i> .....	908	<i>Plotstamp</i> .....	945
Dimensioning in Paper Space .....	910	<b>CHAPTER 33 3D BASICS, NAVIGATION, AND VISUAL STYLES .....</b>	957
The “Reverse Method” for Calculating Drawing Scale Factor .....	912	SETTING UP AUTOCAD TO DRAW IN 3D .....	958
Steps for Calculating the Drawing Scale Factor by the “Reverse Method” .....	913	Setting Up a Workspace .....	958
ANNOTATIVE OBJECTS .....	914	Activating the ACAD3D or ACADISO3D Drawing Template .....	959
Setting Annotation Scale and Viewport Scale ..	914	TYPES OF 3D MODELS .....	960
Creating and Displaying Annotative Objects in Multiple Viewports .....	916	Wireframe Models .....	960
<i>SELECTIONANNODISPLAY</i> .....	918	Surface Models.....	961
Adding and Deleting Scale Representations for Annotative Objects .....	918	Solid Models.....	962
<i>Objectscale</i> .....	918	3D COORDINATE ENTRY .....	963
Adjusting Positions for Individual Annotative Object Scale Representations .....	920	3D Coordinate Entry Formats.....	964
<i>ANNOALLVISIBLE</i> .....	922	COORDINATE SYSTEMS.....	969
<i>Annoreset</i> .....	922	The World Coordinate System (WCS) and WCS Icon .....	970
<i>Annoupdate</i> .....	923	User Coordinate Systems (UCS) and Icons...	970
<i>SAVEFIDELITY</i> .....	924	The Right-Hand Rule.....	972
Linetype Scales for Annotative Drawings .....	924	<i>Ucsicon</i> .....	972
<i>MSLTSCALE</i> .....	925	3D NAVIGATION AND VIEW COMMANDS .....	974
Applications for Multiple Viewports.....	926	<i>Pan</i> .....	975
Using Two Layouts to Plot the Same Geometry at Different Scales .....	926	<i>Zoom</i> .....	976
Using Two Viewports to Display the Same Geometry at Different Scales .....	928	<i>Navvcube</i> .....	976
Using One Layout to Plot <i>Xref</i> Drawings in Multiple Viewports at Different Scales .....	930	3D Orbit Commands.....	980
PLOT STYLE TABLES AND PLOT STYLES .....	931	<i>3Dorbit</i> .....	981
What is the Difference between a Plot Style and a Plot Style Table? .....	932	<i>3Dforbit</i> .....	982
Color-Dependent and Named Plot Style Tables...	934	<i>3Dcorbit</i> .....	984
Attaching a Plot Style Table to a Layout .....	935	<i>PERSPECTIVE</i> .....	984
Creating a Plot Style Table .....	936	<i>3Ddistance</i> .....	985
		View Presets .....	986
		<i>View</i> .....	988
		Adjusting the Amount of Perspective.....	990
		<i>3Dclip</i> .....	991
		<i>Camera</i> .....	992
		Editing Camera Settings.....	994

<i>3Dswivel</i> .....	995	<b>CHAPTER 35 SOLID MODELING</b>	
<i>Navswheel</i> .....	995	<b>CONSTRUCTION</b> .....	<b>1051</b>
SteeringWheel Shortcut Menu .....	996	CONCEPTS .....	1052
SteeringWheel Navigation Tools .....	997	Solid Model Construction Process .....	1052
SteeringWheel Settings .....	999	Solid Primitives Commands .....	1052
<i>-Vpoint</i> .....	1000	Dynamic User Coordinate Systems .....	1053
<i>Vpoint</i> .....	1001	Commands to Move, Rotate, Mirror,	
<i>Plan</i> .....	1002	and Scale Solids .....	1053
<i>Grid</i> .....	1002	Boolean Operations .....	1053
<i>Vports</i> .....	1003	<b>SOLID PRIMITIVES COMMANDS</b> .....	<b>1055</b>
<b>VISUAL STYLES</b> .....	<b>1005</b>	<i>Box</i> .....	1056
Default Visual Styles .....	1006	<i>Cone</i> .....	1057
<i>Vscurrent</i> .....	1006	<i>Cylinder</i> .....	1059
Face Settings .....	1010	<i>Wedge</i> .....	1060
Shadow Settings .....	1012	<i>Sphere</i> .....	1061
Edge Effects .....	1013	<i>Torus</i> .....	1062
<i>Visualstyles</i> .....	1014	<i>Pyramid</i> .....	1063
Named Views and Viewports .....	1019	<i>Polysolid</i> .....	1064
Graphics Performance Tuning .....	1021	<i>Extrude</i> .....	1066
Shade, SHADEDIF, SHADEDGE .....	1023	<i>Revolve</i> .....	1068
<i>Render</i> .....	1023	<i>Sweep</i> .....	1069
Printing 3D Models .....	1023	<i>Loft</i> .....	1071
<b>CHAPTER 34 USER COORDINATE SYSTEMS</b> ..	<b>1033</b>	<b>DYNAMIC USER COORDINATE SYSTEMS</b> ..	<b>1074</b>
CONCEPTS .....	1034	<b>COMMANDS TO MOVE, ROTATE, MIRROR,</b>	
CREATING AND MANAGING USER COORDI-		<b>AND SCALE SOLIDS</b> .....	<b>1075</b>
NATE SYSTEMS .....	1034	<i>Move</i> .....	1076
<i>Ucs</i> .....	1035	<i>3Dalign</i> .....	1077
<i>Dducsp</i> .....	1041	<i>3Dmove</i> .....	1078
<i>Ucsman</i> .....	1042	<i>3Dscale</i> .....	1080
ViewCube UCS Drop-Down List .....	1043	<i>3Drotate</i> .....	1080
<b>UCS SYSTEM VARIABLES</b> .....	<b>1044</b>	<i>Mirror3D</i> .....	1082
<i>Ucsbase</i> .....	1044	<i>3Darray</i> .....	1084
<i>Ucsview</i> .....	1044	<b>BOOLEAN OPERATION COMMANDS</b> .....	<b>1087</b>
<i>UcsOrtho</i> .....	1044	<i>Union</i> .....	1087
<i>Ucsfollow</i> .....	1046	<i>Subtract</i> .....	1088
<i>Ucsvp</i> .....	1046	<i>Intersect</i> .....	1089
<i>UCS3DPERPDISPLAYSETTING</i> .....	1047	<i>Chamfer</i> .....	1090
<i>UCS3DPARADISPLAYSETTING</i> .....	1047	<i>Fillet</i> .....	1092
<i>UCSSELECTMODE</i> .....	1047	<b>DESIGN EFFICIENCY</b> .....	<b>1093</b>
<i>Ucsaxisang</i> .....	1047		
<b>USER COORDINATE SYSTEMS AND</b>			
<b>3D MODELING</b> .....	<b>1048</b>		
Dynamic User Coordinate Systems .....	1048		



<b>CHAPTER 36 SOLID MODEL EDITING.....</b>	<b>1105</b>		
CONCEPTS.....	1106		
EDITING PRIMITIVES USING THE			
PROPERTIES PALETTE .....	1106		
Editing Properties of Individual Primitives ..	1106		
Composite Solid Subobject Selection .....	1108		
Editing Properties of Composite Solids.....	1109		
EDITING SOLIDS USING GRIPS AND GIZMOS ..	1109		
Move, Rotate, and Scale Gizmos .....	1115		
Grip Editing Composite Solids.....	1117		
Subobjects and Selection.....	1118		
Grip Editing Faces, Edges, and Vertices ....	1119		
Selecting Overlapping Subobjects .....	1123		
History Settings .....	1123		
SOLIDS EDITING COMMANDS .....	1125		
<i>Solidedit</i> .....	1126		
Face Options .....	1127		
Edge Options.....	1134		
Body Options.....	1135		
<i>Slice</i> .....	1138		
<i>Presspull</i> .....	1139		
<i>Sectionplane</i> .....	1141		
Sectionplane Contextual Tab .....	1145		
Section Settings Dialog Box .....	1147		
<i>Interfere</i> .....	1147		
<i>Imprint</i> .....	1149		
<i>Massprop</i> .....	1150		
USING SOLIDS DATA .....	1150		
<i>Stlout</i> .....	1151		
<i>3Dprint</i> .....	1152		
<i>Acisin</i> .....	1152		
<i>Acisout</i> .....	1152		
<b>CHAPTER 37 2D DRAWINGS</b>			
<b>FROM 3D MODELS .....</b>	<b>1159</b>		
CONCEPTS.....	1160		
COMMANDS .....	1161		
<i>Viewbase</i> .....	1161		
Viewbase Options .....	1165		
<i>Viewedit</i> .....	1167		
Drawing View Editing.....	1168		
<i>Viewproj</i> .....	1169		
		<i>Viewstd</i> .....	1170
		<i>Viewsection</i> .....	1171
		Section View Examples .....	1173
		<i>Viewsectionstyle</i> .....	1177
		Modify Section View Style and New Section	
		View Style Dialog Boxes.....	1178
		Section View Style and Detail View Style	
		Issues.....	1181
		<i>Viewcomponent</i> .....	1182
		<i>Viewdetail</i> .....	1183
		<i>Viewdetailstyle</i> .....	1185
		Modify Detail View Style and New Detail	
		View Style Dialog Boxes.....	1186
		<i>Viewupdate</i> .....	1188
		<i>Viewupdateauto</i> .....	1190
		<i>Viewsymbolsketch</i> .....	1190
		Creating Auxiliary Views Using Viewsection ...	1191
		Dimensioning a Documentation Drawing ...	1193
		<b>APPENDIX A.....</b>	<b>1201</b>
		AutoCAD 2022 Command Alias List	
		Sorted by Command .....	1202
		<b>APPENDIX B.....</b>	<b>1207</b>
		BUTTONS AND SPECIAL KEYS .....	1208
		Mouse and Digitizing Puck Buttons.....	1208
		Function (F) Keys .....	1208
		Control Key Sequences (Accelerator Keys) ..	1209
		Special Key Functions .....	1210
		List of Drawing Exercise File Names.....	1228