

ACKNOWLEDGMENTS	xvii
ABOUT THE AUTHOR	xix
PREFACE	xxi

LEVEL 1 • Chapters 1–10.....1

CHAPTER 1 AutoCAD Fundamentals Part I.....3

1.1 Introduction and Basic Commands	4
1.2 The AutoCAD Environment	5
1.3 Interacting with AutoCAD	9
Method 1. Type in the Commands on the Command Line.....	9
Method 2. Select the Commands from the Drop-down Cascading Menus	10
Method 3. Use Toolbar Icons to Activate the Commands.....	10
Method 4: Use the Ribbon Tabs, Icons, and Menus	11
1.4 Practicing the Create Objects Commands.....	13
Line	13
Circle.....	14
Arc	15
Rectangle.....	16
1.5 View Objects	19
Zoom	19
Pan	19
Regen	19
1.6 Practicing the Edit/Modify Objects Commands.....	20
Erase.....	20
Move	20
Copy.....	21
Rotate.....	22
Scale	23
Trim	24
Extend.....	25
Offset	26
Mirror.....	27
Fillet	28
1.7 Selection Methods.....	29
1.8 Drawing Accuracy—Part 1	30
Ortho (F8).....	30
1.9 Drawing Accuracy—Part 2	30
OSNAPs	30
1.10 Osnap Drafting Settings	32
Summary.....	33

CHAPTER 2	AutoCAD Fundamentals Part II	41
2.1	Grips	42
2.2	Units and Scale	43
2.3	Snap and Grid	44
	To Set Snap	44
	To Set Grid	45
2.4	Cartesian Coordinate System	45
2.5	Geometric Data Entry	46
	Dynamic Input	46
	Manual Input	49
2.6	Inquiry Commands	50
	Area	51
	Distance	51
	List	52
	ID	53
	Radius and Angle	54
2.7	Additional Drafting Commands	54
	Explode	55
	Polygon	55
	Ellipse	57
	Chamfer	58
	Templates	59
	Limits	60
	Save	60
	Help Files	60
	Tangent OSNAP	63
	Time	64
	Summary	65
SPOTLIGHT ON: ARCHITECTURE		71
CHAPTER 3	Layers, Colors, Linetypes, and Properties	77
3.1	Introduction to Layers	78
	What Are Layers?	78
	Why Use Them?	78
	Creating and Deleting Layers	78
	Making a Layer Current	79
	Assigning Layer Colors	79
	Layer Freeze/Thaw and On/Off	82
	Layer Lock/Unlock	82
3.2	Introduction to Linetypes	83
3.3	Introduction to Properties	84
	Properties Palette	85
	Match Properties	86
	Layers Toolbar	86
3.4	In-Class Drawing Project: Floor Plan Layout	87
	Basic File Preparation	88
	Starting the Floor Plan	89
	Drawing the Inner Wall Geometry	90
	Drawing the Doors and Windows	91
	Summary	93

CHAPTER 4 Text, Mtext, Editing, and Style99

4.1 Introduction to Text and Mtext.....100

4.2 Text100

Editing Text..... 101

4.3 Mtext.....102

Formatting Mtext..... 103

4.4 Style107

4.5 Spell Check108

4.6 In-Class Drawing Project: Adding Text and Furniture to Floor Plan Layout.....110

NEArest OSNAP 112

Summary.....113

CHAPTER 5 Hatch Patterns119

5.1 Introduction to Hatch.....120

5.2 Hatch Procedures121

Step 1. Pick the Hatch Pattern you Want to Use 121

Step 2. Indicate Where you Want the Pattern to Go 122

Step 3. Fine-Tune the Pattern by Adjusting Scale and Angle (If Necessary) 124

Step 4. Preview the Pattern and Accept it if OK 125

5.3 Working with Hatch Patterns126

Exploding Hatch Patterns 126

Hatch Pattern Layers and Colors..... 127

Advanced Hatch Topics..... 127

5.4 Gradient and Solid Fill.....129

Solid Fill 129

5.5 In-Class Drawing Project: Adding Hatch to Floor Plan Layout132

Summary.....133

SPOTLIGHT ON: MECHANICAL ENGINEERING.....139

CHAPTER 6 Dimensions143

6.1 Introduction to Dimensions144

6.2 Types of Dimensions144

Linear Dimensions..... 145

Aligned Dimension..... 146

Diameter Dimension..... 147

Radius Dimension 148

Angular Dimension 149

Continuous Dimensions 150

Baseline Dimensions 151

Leader and Multileader..... 152

Secondary Dimensions..... 156

6.3 Editing Dimensions157

6.4 Customizing Dimensions158

Dimstyle 158

6.5 In-Class Drawing Project: Adding Dimensions to Floor Plan Layout.....163

Summary.....164

CHAPTER 7 Blocks, Wblocks, Dynamic Blocks, Groups, and Purge.....169

7.1 Introduction to Blocks170

Difference between Blocks and Wblocks.....170

Creating a Block.....170

7.2 Insert	173
7.3 Purge	174
7.4 Wblocks	175
Inserting Wblocks	176
7.5 Dynamic Blocks	176
7.6 Groups	179
Summary	183

CHAPTER 8 Polar, Rectangular, and Path Arrays189

8.1 Polar Array	190
Steps in Creating a Polar Array	190
Additional Operations with Polar Array	192
Legacy Polar Array (Pre-AutoCAD 2012)	195
8.2 Rectangular Array	195
Steps in Creating a Rectangular Array	196
Additional Operations with Rectangular Array	197
Legacy Rectangular Array (Pre-AutoCAD 2012)	198
8.3 Path Array	199
Steps in Creating a Path Array	199
Additional Operations with Path Array	201
8.4 In-Class Drawing Project: Mechanical Device	202
Summary	205

SPOTLIGHT ON: ELECTRICAL ENGINEERING209

CHAPTER 9 Basic Printing and Output.....213

9.1 Introduction to Printing and Plotting	214
9.2 The Essentials	214
What Printer or Plotter to Use	214
What Paper Size to Use	215
What Area to Plot	215
At What Scale to Plot	216
What Pen Settings to Use	216
What Orientation to Use	217
What Offset to Use	217
Miscellaneous	217
9.3 The Plot Dialog Box	217
Preview	219
9.4 Page Setup Manager	219
Summary	221

CHAPTER 10 Advanced Output—Paper Space225

10.1 Introduction to Paper Space	226
What is Paper Space?	226
10.2 Paper Space Concepts	227
Layouts	227
Viewports	233
Scaling	236
Layers	239
Text and Dims	243
Annotation	246
Summary	248

LEVEL 1 • Answers to Review Questions.....	253
LEVEL 2 • Chapters 11–20.....	259
CHAPTER 11 Advanced Linework	261
11.1 Introduction to Advanced Linework.....	262
11.2 Pline (Polyline)	262
Pedit.....	262
Exploding a Pline.....	264
Additional Pline Options	264
11.3 Xline (Construction Line)	265
11.4 Ray	267
11.5 Spline.....	268
11.6 Mline (Multiline)	270
Modifying the Mline	271
Mlstyle (Multiline Style).....	271
Mledit (Multiline Edit)	275
Other Mline Properties	276
11.7 Sketch	276
Applications of Sketch	278
11.8 Level 2 Drawing Project (1 of 10): Architectural Floor Plan.....	278
Summary 279	
CHAPTER 12 Advanced Layers	283
12.1 Introduction to Advanced Layers	284
12.2 Script Files.....	284
12.3 Layer State Manager.....	285
12.4 Layer Filtering.....	289
12.5 Level 2 Drawing Project (2 of 10): Architectural Floor Plan.....	291
Summary.....	293
SPOTLIGHT ON: INTERIOR DESIGN	295
CHAPTER 13 Advanced Dimensions.....	299
13.1 Introduction to Advanced Dimensions	300
13.2 Dimension Style Manager.....	300
Lines Tab	301
Symbols and Arrows Tab	302
Text Tab	302
Fit Tab	304
Primary Units Tab	305
Alternate Units Tab	306
Tolerances Tab	307
13.3 Introduction to Constraints	309
13.4 Geometric Constraints	310
Types of Geometric Constraints	310
Adding Geometric Constraints.....	311
Hiding, Showing, and Deleting Geometric Constraints	312
13.5 Dimensional Constraints	313
Working with Dimensional Constraints.....	315
13.6 Dimension-Driven Design.....	316
13.7 Level 2 Drawing Project (3 of 10): Architectural Floor Plan.....	317
Summary.....	318

CHAPTER 14	Options, Shortcuts, CUI, Design Center, and Express Tools	321
14.1	Options	322
	Files Tab	322
	Display Tab	324
	Open and Save Tab	326
	Plot and Publish Tab	328
	System Tab	330
	User Preferences Tab	330
	Drafting Tab	332
	3D Modeling Tab	333
	Selection Tab	333
	Profiles Tab	335
	Online Tab	336
14.2	Shortcuts	336
	PGP File	336
	Altering the PGP File	337
14.3	Customize User Interface	338
14.4	Design Center	342
14.5	Express Tools	345
	Blocks	346
	Text	347
	Layout Tools	348
	Dimension	348
	Selection Tools	348
	Modify	348
	Draw	349
	File Tools	350
	Web Tools	350
	Tools	350
	Layer Express Tools	351
14.6	Level 2 Drawing Project (4 of 10): Architectural Floor Plan	354
	Summary	355
CHAPTER 15	Advanced Design and File Management Tools	357
15.1	Introduction to Advanced Design and File Management Tools	358
15.2	Align	358
15.3	Action Recording	360
15.4	Audit and Recover	362
15.5	Blend	363
15.6	Break and Join	364
	Break, Method 1	364
	Break, Method 2	365
	Join	365
15.7	CAD Standards	366
15.8	Calculator	367
15.9	Defpoints	370
15.10	Divide and Point Style	370
15.11	Donut	371
15.12	Draw Order	371
15.13	eTransmit	372
15.14	Filter	374
15.15	Hyperlink	376
15.16	Lengthen	377

15.17	Object Tracking (Otrack)	378
15.18	Overkill	379
15.19	Point and Node	380
15.20	Publish	380
15.21	Raster	381
15.22	Revccloud	382
15.23	Sheet Sets	383
15.24	Selection Methods	386
15.25	Stretch	388
15.26	System Variables	388
15.27	Tables	389
15.28	Tool Palette	392
15.29	UCS and Crosshair Rotation	394
	Method 1	394
	Method 2	395
15.30	Window Tiling and Tabs	396
	Window Tiling	396
	Tabs	397
15.31	Wipeout	398
15.32	Level 2 Drawing Project (5 of 10): Architectural Floor Plan	401
	Summary	402
SPOTLIGHT ON: CIVIL ENGINEERING		405
CHAPTER 16 Importing and Exporting Data		409
16.1	Introduction to Importing and Exporting Data	409
16.2	Importing and Exporting to and from MS Office Applications	410
	Word into AutoCAD	410
	AutoCAD into Word	411
	Excel into AutoCAD	411
	AutoCAD into Excel	412
	PowerPoint into AutoCAD	412
	AutoCAD into PowerPoint	412
16.3	Screen Shots	413
16.4	JPGs	413
16.5	PDFs	413
16.6	Other CAD Software	415
16.7	Exporting and the Save as Feature	417
16.8	Inserting and OLE	419
16.9	Level 2 Drawing Project (6 of 10): Architectural Floor Plan	420
	Summary	422
CHAPTER 17 External References (Xrefs)		423
17.1	Introduction to Xrefs	424
	What Is an Xref?	424
	Why Do We Need an Xref? What Is the Benefit?	424
17.2	Using Xrefs	425
17.3	Layers in Xrefs	428
17.4	Editing and Reloading Xrefs	429
17.5	Multiple Xrefs	431
17.6	Ribbon and Xrefs	432
17.7	Level 2 Drawing Project (7 of 10): Architectural Floor Plan	432
	Summary	433

CHAPTER 18	Attributes.....	435
18.1	Introduction to Attributes.....	435
18.2	Creating the Design.....	436
18.3	Creating the Attribute Definitions.....	437
18.4	Creating the Attribute Block.....	439
18.5	Attribute Properties and Editing.....	440
	Exploding Attributes.....	441
	Inserting Attributes.....	441
18.6	Attribute Extraction.....	441
18.7	Invisible Attributes.....	446
18.8	Level 2 Drawing Project (8 of 10): Architectural Floor Plan.....	447
	Summary.....	448
	SPOTLIGHT ON: AEROSPACE ENGINEERING.....	451
CHAPTER 19	Advanced Output and Pen Settings.....	455
19.1	Introduction to Advanced Output and Pen Settings.....	456
19.2	Setting Standards.....	456
19.3	The CTB File.....	457
	Step 1.....	458
	Step 2.....	460
	Step 3.....	461
19.4	Additional CTB File Features.....	461
19.5	The LWT Option.....	462
19.6	Level 2 Drawing Project (9 of 10): Architectural Floor Plan.....	464
	Summary.....	465
CHAPTER 20	Isometric Drawing.....	467
20.1	Introduction to Isometric Perspective.....	468
	Why Use Isometric Perspective Instead of 3D?.....	468
	When Not to Use Isometric Perspective.....	468
20.2	Basic Technique.....	468
20.3	Ellipses in Isometric Drawing.....	471
20.4	Text and Dimensions in Isometric Drawing.....	472
20.5	Level 2 Drawing Project (10 of 10): Architectural Floor Plan.....	473
20.6	Summary.....	476
LEVEL 2 •	Answers to Review Questions.....	481
LEVEL 3 •	Chapters 21–30.....	487
CHAPTER 21	3D Basics.....	489
21.1	Axes, Planes, and Faces.....	490
21.2	3D Workspaces, Ribbon, Toolbars, and 3D Options.....	491
21.3	Entering and Exiting 3D.....	492
21.4	Projecting Into 3D.....	495
21.5	3D Dynamic Views.....	500
21.6	Extrude.....	500
21.7	Visual Styles: Hide and Shade.....	502
21.8	View Cube and Navigation Bar.....	507
	Summary.....	509

CHAPTER 22	Object Manipulation.....	513
22.1	Introduction to Object Manipulation	514
	Rotate3D.....	514
	3Drotate (Gizmo).....	515
	Mirror3D	517
	3D array.....	519
	3Dscale	522
	3Dmove.....	523
	Fillets and Chamfers in 3D.....	524
	Summary.....	527
SPOTLIGHT ON: CHEMICAL ENGINEERING	531	
CHAPTER 23	Boolean Operations and Primitives	535
23.1	Introduction to Boolean Operations	536
	Union.....	536
	Subtract.....	537
	Intersect	539
23.2	Introduction to Primitives.....	543
	Box	544
	Wedge	544
	Cone	545
	Sphere.....	545
	Cylinder.....	546
	Torus	547
	Pyramid	547
23.3	Applying Primitives	548
	Summary.....	548
CHAPTER 24	Solid Modeling	553
24.1	Introduction to Solid Modeling.....	554
	Revolve.....	554
	Shell	558
	Taper	560
	Loft.....	563
	Path Extrusion.....	568
	Sweep.....	570
	Summary.....	572
CHAPTER 25	Advanced Solids, Faces, and Edges	577
25.1	Introduction to Advanced Solids, Faces, and Edges	578
	Polysolid.....	578
	Helix	580
	3D Path Array.....	581
	3Dalign.....	582
25.2	Working with Faces	584
	Delete Faces.....	585
	Move Faces.....	586
	Copy Faces.....	587
	Offset Faces.....	588
	Rotate Faces	588
	Color Faces	589

25.3 Working with Edges	590
Color Edges	590
Copy Edges	590
Summary.....	593
 SPOTLIGHT ON: BIOMEDICAL ENGINEERING.....	 599
 CHAPTER 26 Surfaces and Meshes	 603
26.1 Introduction to Surfaces and Meshes.....	604
26.2 Surfacing Commands	604
Planar Surface.....	604
Region	606
Rulesurf.....	606
Tabsurf	608
Revsurf	610
Edgesurf	611
3Dface and 3Dmesh	613
26.3 Smooth Mesh Primitives	614
Mesh Modification 1. Smoothness	616
Mesh Modification 2. Filters and Gizmos	616
Mesh Modification 3. Additional Tools	618
Summary.....	618
 CHAPTER 27 Slicing, Sectioning, Layouts, and Vports	 621
27.1 Introduction to Slicing, Sectioning, Layouts, and Vports	622
27.2 Slicing and Sectioning	622
Slice.....	623
Section	624
27.3 Layouts and Details	625
Viewbase Establishes the Base (Parent) View	626
Viewsection Creates Section Views.....	628
Viewdetail Creates Detail Views	631
Additional Layout Options.....	632
27.4 Flatten and Flatshot.....	632
Flatten	633
Flatshot	633
27.5 Vports	635
Summary.....	638
 CHAPTER 28 Advanced UCS, Views, Text, and Dimensions in 3D	 643
28.1 Introduction to Advanced UCS, Views, Text, and Dimensions in 3D	644
28.2 Advanced UCS	644
UCS.....	645
World	645
UCS Previous.....	646
Face UCS.....	646
Object	646
View	647
Origin	647
Z-Axis Vector.....	648
3 Point	648
X, Y, and Z	650
Named UCS.....	650

28.3 Views and View Manager	651
28.4 Text and Dimensions in 3D	653
Summary.....	655
 SPOTLIGHT ON: DRAFTING, CAD MANAGEMENT, TEACHING, AND CONSULTING	 659
CHAPTER 29 Dview, Camera, Walk and Fly, and Path Animation.....	665
29.1 Dynamic View	666
Camera.....	667
Target.....	667
Distance	667
POints.....	668
PAn.....	669
Zoom	669
Twist.....	669
CLip	669
Hide.....	671
Off.....	671
Undo.....	671
29.2 Cameras.....	671
29.3 Walk and Fly.....	674
29.4 Path Animation.....	678
29.5 Summary	681
 CHAPTER 30 Lighting and Rendering	 683
30.1 Introduction to Lighting and Rendering	684
30.2 Lighting.....	684
Point Light.....	685
Spotlight.....	688
Distant Light.....	690
Shadows, Sun, and Sky	691
30.3 Materials and Rendering	695
Materials	695
Rendering	698
Summary.....	701
 LEVEL 3 • Answers to Review Questions.....	 703
Appendices	709
 APPENDIX A Additional Information on AutoCAD.....	 711
Who Makes Autocad?.....	711
What is AutoCAD LT?.....	711
How is Autocad Purchased and How Much Does it Cost?	712
Are there Significant Differences Between Autocad Releases?	713
Is there an Autocad for the Mac?	713
A Brief History of Autodesk and AutoCAD	715
AutoCAD Releases	716
Major Autodesk Products.....	717
Autocad-Related Websites	718
 APPENDIX B Other CAD Software Design and Analysis Tools and Concepts	 721
MICROSTATION	721
ARCHICAD	721

TURBOCAD	722
Other Design Software	722
APPENDIX C File Extensions	727
Autocad Primary Extensions	727
Autocad Secondary Extensions	728
Miscellaneous Software Extensions	728
APPENDIX D Custom Linetypes and Hatch Patterns	729
Linetype Definitions (Basic)	729
Linetypes (String Complex and Shape Complex)	730
Hatch Pattern Definitions (Basic)	731
APPENDIX E Principles of CAD Management	733
Part 1. Know the Seven Golden Rules of AutoCAD	733
Part 2. Know the Capabilities and Limitations of AutoCAD	734
Part 3. Maintain an Office CAD Standard	736
Part 4. Be an Effective Teacher and Hiring Manager	737
Part 5. Stay Current and Competent	738
APPENDIX F AutoLISP Basics and Advanced Customization Tools	739
Overview 1. Autolisp	739
Overview 2. Visual Lisp	739
Overview 3. Vba, .Net, Active X, and Objectarx	740
Autolisp Fundamentals	740
Variables and Comments	743
Advanced Features and the Vlide Command	743
APPENDIX G PC Hardware, Printers/Plotters, Networks, and the Cloud	745
PC HARDWARE	745
Printers and Plotters	746
Networks	747
The Cloud	748
APPENDIX H What Are Kernels?	749
APPENDIX I Lighting, Rendering, Effects, and Animation	751
APPENDIX J AutoCAD Certification Exams	753
APPENDIX K AutoCAD Employment	755
APPENDIX L AutoCAD Humor, Oddities, Quirks, and Easter Eggs	757
Real AutoCAD Users	757
The Autocad Monkey Joke that Never Goes Away	758
Oddities and Quirks	758
Easter Eggs	758
INDEX	761