

Kelly L. Murdock

# Autodesk® Maya® 2025

## BASICS GUIDE

TEXT AND VIDEO INSTRUCTION



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)

# Contents

<b>Contents</b> .....	<b>i</b>
<b>CHAPTER 1</b> .....	<b>1</b>
<b>Learning the Maya Interface</b> .....	<b>1</b>
Lesson 1.1: Work with Menus .....	2
Changing Menu Sets .....	2
Viewing Keyboard Hotkeys .....	2
Accessing Option Dialog Boxes .....	3
Using Tear-Off Menus .....	4
Understanding Tools versus Actions .....	4
Lesson 1.1-Tutorial 1: Use a Menu Command to Create a Polygon Sphere .....	5
Lesson 1.2: Use the Status Line Buttons .....	6
Using Pop-up Help .....	7
Watching for Cursor Clues .....	8
Expanding and Collapsing Icon Button Groups .....	8
Opening and Saving a Scene .....	8
Using the Home Screen .....	9
Opening Editors .....	10
Showing and Hiding Interface Elements .....	11
Lesson 1.2-Tutorial 1: Open a File .....	11
Lesson 1.2-Tutorial 2: Save a File .....	12
Lesson 1.2-Tutorial 3: Maximize the Workspace Interface .....	12
Lesson 1.3: Access the Shelf .....	13
Using the Shelf Menu .....	14
Creating and Deleting Shelves .....	14
Adding Icons and Menu Commands to a Shelf .....	14
Adding Layouts and Scripts to a Shelf .....	15
Using the Shelf Editor .....	15
Lesson 1.3-Tutorial 1: Create a New Shelf .....	16
Lesson 1.3-Tutorial 2: Populate a New Shelf .....	16
Lesson 1.4: Explore the Channel Box and Layer Editor .....	17
Selecting Attributes .....	18
Changing Attributes with the Mouse .....	18
Locking Attributes .....	18
Adding and Deleting Layers .....	19
Adding Objects to a Layer .....	20
Hiding All Layer Objects .....	20
Freezing All Layer Objects .....	20
Lesson 1.4-Tutorial 1: Change Channel Box Attributes .....	21
Lesson 1.4-Tutorial 2: Create and Rename a New Layer .....	22
Lesson 1.4-Tutorial 3: Add Objects to a New Layer .....	22
Lesson 1.5: Identify the Animation Controls, the Command Line, and the Help Line .....	22
Selecting an Animation Frame .....	23

Setting an Animation Range .....	23
Playing an Animation .....	23
Accessing the Animation Preferences .....	24
Using the Command Line.....	25
Viewing the Help Line.....	26
Lesson 1.5-Tutorial 1: Play an Animation .....	26
Lesson 1.5-Tutorial 2: Enter a Command .....	27
Lesson 1.6: Use the Toolbox .....	27
Selecting Objects .....	27
Using the Transform Tools .....	28
Understanding Manipulators .....	28
Lesson 1.6-Tutorial 1: Select Objects .....	29
Lesson 1.6-Tutorial 2: Transform an Object .....	30
Lesson 1.7: Discover the Marking Menus.....	31
Accessing the Marking Menus.....	31
Customizing Marking Menus.....	32
Using the Hotbox.....	33
Customizing the Hotbox .....	34
Lesson 1.7-Tutorial 1: Access a Marking Menu .....	34
Lesson 1.7-Tutorial 2: Use the Hotbox .....	34
Chapter Summary.....	35
What You Have Learned .....	35
Key Terms From This Chapter.....	36

**CHAPTER 2 ..... 37**

**Controlling the View Panel ..... 37**

Lesson 2.1: Change the View .....	37
Using the Tumble, Track, Dolly, and Camera Tools .....	37
Framing an Object .....	39
Moving Through Views.....	39
Tearing Off Panels .....	40
Using Heads-Up Displays .....	40
Accessing Grids.....	41
Opening Other Interfaces Within a Panel.....	41
Annotating with the Blue Pencil tools .....	42
Lesson 2.1-Tutorial 1: Change the Object’s View .....	44
Lesson 2.1-Tutorial 2: Mark Up the Scene .....	46
Lesson 2.2: Change Display Options .....	47
Changing Resolution.....	47
Changing Shading .....	48
Displaying Textures .....	49
Enabling Backface Culling and Improving Wireframes .....	49
Isolating Objects .....	50
Hiding and Showing Objects.....	50
Changing Object Name and Color .....	50
Lesson 2.2-Tutorial 1: Change the Object’s Resolution.....	52
Lesson 2.2-Tutorial 2: Change the Object’s Name and Color.....	53
Lesson 2.3: Change the Layout .....	53

Switching Layouts .....	53
Customizing Layouts .....	54
Resizing and Editing View Panels.....	54
Using the Outliner .....	55
Searching Commands, Tools and Scene Objects .....	56
Accessing Help .....	57
Lesson 2.3-Tutorial 1: Change the Interface Layout.....	57
Lesson 2.3-Tutorial 2: Search for a Command .....	58
Chapter Summary.....	59
What You Have Learned .....	60
Key Terms From This Chapter.....	60
<b>CHAPTER 3 .....</b>	<b>61</b>
<b>Starting with Primitive Objects .....</b>	<b>61</b>
Lesson 3.1: Use Polygon Primitives .....	61
Creating Polygon Primitives.....	62
Creating Gears .....	63
Creating Abstract Objects.....	64
Lesson 3.1-Tutorial 1: Create Polygon Primitives.....	65
Lesson 3.2: Learn the NURBS Primitives .....	66
Creating Spheres and Cubes.....	67
Creating Cylinders and Cones .....	68
Creating a Plane and a Torus.....	68
Inserting Isoparms .....	68
Lesson 3.2-Tutorial 1: Create a Candle from Primitives .....	69
Lesson 3.2-Tutorial 2: Add Isoparms .....	70
Lesson 3.3: Draw 2D Primitives .....	71
Creating Circles and Squares .....	71
Creating Arcs .....	72
Lesson 3.3-Tutorial 1: Create an Eye Using Arcs and Primitive Shapes.....	73
Lesson 3.4: Create 3D Type .....	74
Generating Text Curves .....	74
Changing Extrusion Depth .....	74
Creating Beveled Type.....	75
Lesson 3.4-Tutorial 1: Create and Bevel Text .....	76
Lesson 3.4-Tutorial 2: Create a Sign .....	76
Lesson 3.5: Use Construction Aid Objects .....	78
Placing Construction Planes .....	78
Placing Free Image Planes .....	78
Marking position with Locators .....	79
Annotating objects .....	79
Using the Measure Tools .....	79
Lesson 3.5-Tutorial 1: Test Pythagoras .....	79
Lesson 3.6: Access the Content Browser .....	80
Browsing the mesh categories .....	80
Loading meshes from the Content Browser.....	81
Lesson 3.6-Tutorial 1: Load a mesh from the Content Browser.....	81
Lesson 3.7: Import Objects .....	82

Importing 3D meshes .....	82
Importing 2D.....	82
Creating 3D meshes from 2D outlines.....	83
Lesson 3.7-Tutorial 1: Import a 3D mesh .....	83
Lesson 3.7-Tutorial 2: Import Adobe Illustrator content .....	84
Lesson 3.7-Tutorial 3: Import SVG content .....	85
Chapter Summary.....	86
What You Have Learned .....	86
Key Terms From This Chapter.....	87
<b>CHAPTER 4 .....</b>	<b>89</b>
<b>Working with Objects .....</b>	<b>89</b>
Lesson 4.1: Select Objects .....	89
Selecting Multiple Objects.....	90
Understanding the Key Object .....	90
Using Selection Masks .....	91
Selecting by Menu .....	92
Saving a Selection Set .....	92
Lesson 4.1-Tutorial 1: Select Multiple Objects.....	92
Lesson 4.2: Select Components .....	93
Switching to Component Mode.....	94
Selecting Components.....	95
Growing and Shrinking Selections .....	95
Selecting Edges .....	95
Lesson 4.2-Tutorial 1: Select Components.....	96
Lesson 4.3: Transform, Group, and Parent Objects.....	97
Understanding Pivot Points.....	97
Transforming Objects Along an Axis.....	98
Transforming Objects Within a Plane.....	98
Constrained Rotations.....	99
Uniform and Non-Uniform Scaling .....	100
Grouping Objects Together .....	101
Parenting Objects .....	102
Viewing Hierarchy in the Outliner .....	102
Using Undo, Redo, and Repeat.....	103
Lesson 4.3-Tutorial 1: Move Pivot Point .....	104
Lesson 4.3-Tutorial 2: Transform Car Wheels .....	105
Lesson 4.3-Tutorial 3: Parent an Object.....	106
Lesson 4.4: Snap and Align Objects .....	107
Using Grids.....	107
Duplicating with Transform .....	108
Replacing Objects .....	108
Snapping Objects.....	108
Snapping to a Live Object .....	109
Aligning Objects.....	109
Aligning Points .....	110
Snapping Surfaces Together .....	110
Lesson 4.4-Tutorial 1: Snap Objects to Grid Points .....	111

Lesson 4.4-Tutorial 2: Snap to a Curve .....	112
Lesson 4.4-Tutorial 3: Snap to a Live Object .....	113
Lesson 4.4-Tutorial 4: Align Letters .....	114
Lesson 4.5: Understand Nodes and Attributes .....	115
Understanding the Various Node Types .....	116
Viewing Nodes in the Attribute Editor .....	117
Viewing construction history .....	119
Deleting construction history .....	120
Editing Attributes .....	120
Working with Nodes .....	121
Viewing Dependency with Node Editor .....	121
Adding Nodes .....	122
Connecting Nodes .....	123
Lesson 4.5-Tutorial 1: Explore Dependent Nodes .....	123
Lesson 4.5-Tutorial 2: Delete Construction History .....	125
Lesson 4.5-Tutorial 3: Building Node Dependency .....	125
Chapter Summary .....	127
What You Have Learned .....	127
Key Terms From This Chapter .....	127

## **CHAPTER 5 .....** 129

### **Creating and Editing Polygon Objects.....** 129

Lesson 5.1: Learn Normals and Manually Create Polygons .....	130
Understanding Normals .....	130
Determining Normal Direction .....	130
Showing Normals .....	130
Reversing and Controlling Normals .....	131
Softening and Hardening Edges .....	131
Using the Vertex Normal Edit Tool .....	131
Creating Polygon Objects by Hand .....	132
Appending to a Polygon .....	132
Combining Polygons .....	133
Mirroring Polygon Objects .....	133
Using In-View Editors .....	133
Cleaning Up and Reducing Polygons .....	134
Lesson 5.1-Tutorial 1: Conform Normals .....	135
Lesson 5.1-Tutorial 2: Create a Polygon .....	135
Lesson 5.1-Tutorial 3: Append to a Polygon .....	136
Lesson 5.1-Tutorial 4: Mirror an Object .....	137
Lesson 5.2: Edit Polygons .....	138
Selecting Polygon Components .....	138
Subdividing and Splitting Polygon Faces .....	140
Cutting Faces .....	141
Merging Vertices .....	142
Merging and Collapsing Edges .....	143
Bridging Edges .....	144
Deleting Components .....	145
Lesson 5.2-Tutorial 1: Create a Mushroom .....	145

Lesson 5.2-Tutorial 2: Bridge Edges .....	146
Lesson 5.2-Tutorial 3: Merge Vertices and Edges .....	147
Lesson 5.3: Use Polygon Operations .....	148
Duplicating Faces.....	148
Extruding Components.....	149
Using Smart Extrude.....	151
Chamfer a Vertex.....	152
Beveling an Edge .....	153
Poking a Face.....	154
Creating a Wedge.....	155
Using Symmetry.....	156
Lesson 5.3-Tutorial 1: Offset Faces .....	156
Lesson 5.3-Tutorial 2: Extrude Cube Vertices .....	157
Lesson 5.3-Tutorial 3: Extrude Cube Edges and Faces .....	158
Lesson 5.3-Tutorial 4: Use Smart Extrude .....	159
Lesson 5.3-Tutorial 5: Chamfer Vertices .....	160
Lesson 5.3-Tutorial 6: Bevel Table Corners .....	161
Lesson 5.3-Tutorial 7: Poke Faces .....	162
Lesson 5.3-Tutorial 8: Wedge Faces.....	163
Lesson 5.3-Tutorial 9: Symmetrical Editing.....	164
Lesson 5.4: Retopology and Smooth Polygon Edges .....	165
Retopologizing a Mesh .....	165
Smoothing Polygons with Subdivisions .....	166
Creating a Smooth Proxy .....	167
Adding a Crease to a Smoothed Polygon .....	167
Smoothing Polygons with Vertex Averaging .....	168
Unsmoothing a Dense Mesh .....	168
Lesson 5.4-Tutorial 1: Retopologize Mesh .....	168
Lesson 5.4-Tutorial 2: Smooth Faces.....	169
Lesson 5.4-Tutorial 3: Smooth Proxy Turtle .....	170
Lesson 5.4-Tutorial 4: Smooth Faces with Vertex Averaging .....	171
Lesson 5.5: Use Polygon Booleans and Triangulate Polygons .....	172
Combining Polygon Objects.....	174
Finding the Difference Between Objects.....	175
Creating an Intersection Object.....	175
Slicing and Punching Holes.....	175
Using Cut Out and Split Edges .....	175
Triangulating Polygon Faces .....	176
Switching Polygon Faces to Rectangles .....	176
Flipping Triangle Edges.....	176
Lesson 5.5-Tutorial 1: Create a Button from Booleans .....	176
Lesson 5.5-Tutorial 2: Change Boolean.....	177
Lesson 5.5-Tutorial 3: Triangulate Non-Planar Polygons .....	178
Lesson 5.6: Create Holes in Polygons .....	179
Detaching a Vertex .....	179
Detaching Faces.....	180
Using the Make Hole Tool .....	181
Filling Holes .....	182
Lesson 5.6-Tutorial 1: Add Holes to a Cube .....	182



Lesson 5.7: Work with Edge Loops, Rings, and Borders .....	183
Selecting Edge Loops, Rings, and Borders .....	184
Converting Selections .....	184
Using the Insert Loop Tool.....	184
Creating Custom Edge Loops .....	185
Lesson 5.7-Tutorial 1: Add Edge Loops to a Face .....	186
Lesson 5.8: Learn the Modeling Toolkit.....	187
Selecting Components.....	188
Setting Constraints .....	189
Using Soft Selection.....	189
Using Polygon Tools.....	189
Using the Target Weld Tool.....	190
Making Shapes with the Connect Tool.....	190
Lesson 5.8-Tutorial 1: Modeling with Constraints and Soft Select.....	191
Lesson 5.8-Tutorial 2: Adding Arms to a Torso .....	192
Lesson 5.9: Model with the Quad Draw Tool .....	193
Creating Polygons with the Quad Draw Tool.....	195
Moving Components with the Quad Draw Tool.....	195
Relaxing Components with the Quad Draw Tool .....	195
Adding Edge Loops with the Quad Draw Tool.....	196
Extending Edges with the Quad Draw Tool .....	196
Deleting Components with the Quad Draw Tool .....	197
Accessing the Quad Draw Tool Options .....	197
Lesson 5.9-Tutorial 1: Adding Arms to a Torso .....	198
Chapter Summary.....	199
What You Have Learned.....	200
Key Terms From This Chapter.....	200
<b>CHAPTER 6 .....</b>	<b>203</b>
<b>Working with NURBS Surfaces .....</b>	<b>203</b>
Lesson 6.1: Edit NURBS Surfaces .....	204
Selecting Components.....	204
Using the Surface Editing Tool.....	205
Using the Sculpt Geometry Tool.....	205
Simplifying Surfaces.....	206
Breaking and Smoothing Tangents.....	206
Lesson 6.1-Tutorial 1: Edit NURBS Components .....	206
Lesson 6.1-Tutorial 2: Use the Surface Editing Tool.....	207
Lesson 6.1-Tutorial 3: Use the Sculpt Geometry Tool.....	208
Lesson 6.1-Tutorial 4: Create a Hard Edge .....	209
Lesson 6.2: Apply Surface Operators.....	210
Attaching and Detaching Surfaces.....	210
Aligning Surfaces .....	211
Closing and Opening NURBS Surfaces .....	212
Extending Surfaces .....	213
Offsetting a Surface .....	213
Filleting Surfaces.....	213
Blending Surfaces .....	214

Lesson 6.2-Tutorial 1: Attach Surfaces .....	215
Lesson 6.2-Tutorial 2: Detach Surfaces .....	216
Lesson 6.2-Tutorial 3: Open and Close a Surface .....	217
Lesson 6.2-Tutorial 4: Offset Surface .....	218
Lesson 6.2-Tutorial 5: Add a Circular Fillet.....	219
Lesson 6.2-Tutorial 6: Blend Two Surfaces.....	220
Lesson 6.3: Trim NURBS Surfaces .....	221
Drawing Curves on a NURBS Surface.....	221
Projecting Curves onto a NURBS Surface .....	222
Marking Intersecting Surfaces.....	222
Trimming a Surface.....	223
Lesson 6.3-Tutorial 1: Draw and Trim a Surface .....	224
Lesson 6.3-Tutorial 2: Project and Trim a Curve .....	225
Lesson 6.4: Use Boolean Tools .....	226
Combining Surfaces with the Union Tool .....	227
Removing Surface Parts with the Difference Tool.....	227
Creating a Surface Intersection with the Intersect Tool.....	227
Lesson 6.4-Tutorial 1: Create Boolean Union Surfaces .....	227
Lesson 6.4-Tutorial 2: Create Boolean Difference Surfaces .....	228
Lesson 6.4-Tutorial 3: Create Boolean Intersect Surfaces.....	229
Lesson 6.5: Stitch Surfaces Together .....	230
Applying Global Stitch .....	231
Stitching Surface Points Together .....	231
Stitching Surface Edges Together .....	231
Lesson 6.5-Tutorial 1: Apply Global Stitch.....	231
Lesson 6.6: Convert Objects .....	232
Converting NURBS to Polygons .....	233
Converting to Subdivision Surfaces .....	233
Converting Subdivision Surfaces to NURBS and Polygons.....	233
Lesson 6.6-Tutorial 1: Convert NURBS to Polygons .....	234
Lesson 6.6-Tutorial 2: Convert NURBS to Polygons and Back.....	235
Chapter Summary.....	236
What You Have Learned .....	236
Key Terms From This Chapter.....	237

**CHAPTER 7 ..... 239**

**Drawing and Editing Curves ..... 239**

Lesson 7.1: Create Curves.....	240
Creating Smooth Curves.....	240
Creating Straight Line Curves .....	240
Drawing Freehand Curves .....	241
Simplifying and Smoothing Curves .....	241
Lesson 7.1-Tutorial 1: Draw and Compare CV, EP, and Freehand Curves.....	242
Lesson 7.1-Tutorial 2: Simplify Freehand Curves .....	243
Lesson 7.2: Edit Curve Details.....	245
Using the Edit Curve Tool .....	245
Altering Tangents .....	246
Adding Sharp Points to a Curve .....	246

Adding Points to the End of a Curve.....	247
Closing and Opening Curves.....	247
Lesson 7.2-Tutorial 1: Create and Edit a Star Shape.....	248
Lesson 7.2-Tutorial 2: Use the Edit Curve Tool.....	249
Lesson 7.2-Tutorial 3: Create Sharp Points.....	250
Lesson 7.2-Tutorial 4: Close a Curve.....	251
Lesson 7.3: Modify Curves.....	252
Locking Length.....	252
Straightening Curves.....	252
Smoothing Curves.....	252
Curling and Bending Curves.....	253
Scaling Curvature.....	254
Lesson 7.3-Tutorial 1: Curl a Curve.....	254
Lesson 7.4: Apply Curve Operators.....	256
Attaching Curves.....	257
Aligning Curves.....	258
Detaching and Cutting Curves.....	259
Finding Curve Intersections.....	259
Offsetting Curves.....	259
Filleting Curves.....	259
Lesson 7.4-Tutorial 1: Connect Cursive Letters.....	260
Lesson 7.4-Tutorial 2: Align Flower Petals.....	261
Lesson 7.4-Tutorial 3: Offset Curves.....	262
Lesson 7.4-Tutorial 4: Fillet Curves.....	263
Lesson 7.5: Create Sweep Mesh Objects.....	264
Changing the cross-section.....	265
Creating a group of sweeps.....	265
Adding twist and taper.....	266
Optimizing a sweep mesh.....	266
Applying to multiple curves.....	266
Lesson 7.5-Tutorial 1: Sweep a bugle.....	266
Lesson 7.6: Create Simple Surfaces from Curves.....	267
Revolving a Curve.....	268
Lofting a Set of Curves.....	268
Creating Planar Curves.....	269
Creating a Surface from Boundary Curves.....	269
Extruding Curves.....	269
Using the Birail Tools.....	270
Lesson 7.6-Tutorial 1: Revolve a Baseball Bat.....	270
Lesson 7.6-Tutorial 2: Loft a Banana.....	271
Lesson 7.6-Tutorial 3: Create a Planar Surface.....	272
Lesson 7.6-Tutorial 4: Extrude a Circle.....	273
Lesson 7.6-Tutorial 5: Create a Birail Surface.....	274
Chapter Summary.....	275
What You Have Learned.....	275
Key Terms From This Chapter.....	276

<b>CHAPTER 8 .....</b>	<b>277</b>
<b>Using Deformers.....</b>	<b>277</b>
Lesson 8.1: Use nonlinear deformers .....	277
Bending objects .....	277
Flaring objects .....	278
Squashing objects.....	279
Twisting objects.....	280
Adding waves.....	281
Lesson 8.1-Tutorial 1: Bending a hammer .....	282
Lesson 8.1-Tutorial 2: Adding a wave to a table .....	283
Lesson 8.2: Working with Deformers .....	284
Adding object density.....	284
Using manipulator handles.....	285
Removing the deformer .....	286
Making the changes permanent.....	286
Transforming the manipulator .....	286
Applying multiple deformers.....	286
Painting Deformer Weights .....	287
Lesson 8.2-Tutorial 1: Work with Multiple Deformers.....	287
Lesson 8.2-Tutorial 2: Painting Deformer Weights .....	288
Lesson 8.3: Modifying with the Lattice and Wire Deformers .....	289
Using the Lattice deformer.....	289
Using the Wire deformer.....	290
Lesson 8.3-Tutorial 1: Using a Lattice deformer .....	291
Lesson 8.3-Tutorial 2: Using a Wire deformer .....	292
Lesson 8.4: Conforming with the ShrinkWrap Deformer .....	293
Lesson 8.4-Tutorial 1: Wrapping a road to a terrain .....	295
Lesson 8.5: Deforming Components.....	296
Using Component Tags.....	296
Moving component groups with the Cluster deformer .....	297
Preventing movement with the Solidify deformer.....	298
Smoothing with the Delta Mush deformer .....	299
Lesson 8.5-Tutorial 1: Carving a river through a terrain. ....	300
Lesson 8.6: Creating Softbody Objects .....	301
Lesson 8.6-Tutorial 1: Creating a softbody.....	302
Lesson 8.7: Use the Texture deformer .....	303
Lesson 8.7-Tutorial 1: Deforming with a texture. ....	304
Chapter Summary.....	305
What You Have Learned .....	306
Key Terms From This Chapter.....	306
 <b>CHAPTER 9 .....</b>	 <b>309</b>
<b>Assigning Materials and Textures .....</b>	<b>309</b>
Lesson 9.1: Apply Materials.....	310
Applying New Materials .....	310
Applying Standard Surface Presets.....	311
Renaming Materials.....	312

Applying Existing Materials .....	312
Applying Materials to Selected Faces .....	312
Changing Material Attributes .....	312
Moving Between Nodes .....	314
Rendering Materials .....	314
Lesson 9.1-Tutorial 1: Apply a Material .....	315
Lesson 9.1-Tutorial 2: Apply a Material to Face Selection .....	316
Lesson 9.1-Tutorial 3: Apply and Render a Texture .....	317
Lesson 9.2: Use the Hypershade.....	318
Using the Create Bar.....	319
Using the tabbed panes.....	320
Using the Work Area .....	321
Working with Nodes.....	322
Connecting Nodes .....	322
Using the Material Viewer.....	323
Dragging Materials to Objects.....	324
Lesson 9.2-Tutorial 1: Create a Custom Material.....	324
Lesson 9.2-Tutorial 2: Create a Custom Cloth Material .....	325
Lesson 9.3: Work with Materials .....	326
Learning the Surface Materials.....	326
Changing Material Color.....	327
Changing Material Transparency.....	328
Using Other Material Attributes.....	328
Layering Materials .....	328
Using the Ramp Shader .....	330
Using the Shading Map.....	330
Lesson 9.3-Tutorial 1: Change Color and Transparency .....	331
Lesson 9.3-Tutorial 2: Layer Materials .....	332
Lesson 9.3-Tutorial 3: Use a Shading Map .....	333
Lesson 9.4: Work with Textures .....	334
Connecting Texture Nodes .....	335
Applying Textures as Color .....	335
Mapping Textures to Attributes .....	336
Using Bump Maps.....	336
Loading File Textures.....	337
Layering Textures .....	338
Lesson 9.4-Tutorial 1: Apply Textures .....	338
Lesson 9.4-Tutorial 2: Load an Image Texture .....	339
Lesson 9.5: Position Textures .....	340
Using Default Mapping.....	340
Using Projection Mapping .....	341
Placing 2D Textures .....	342
Placing 3D Textures .....	342
Lesson 9.5-Tutorial 1: Position 2D Textures.....	343
Lesson 9.5-Tutorial 2: Position 3D Textures.....	344
Lesson 9.6: Use Displacement Maps .....	345
Bump Maps vs. Displacement Maps .....	345
Adding Relief with Displacement Maps.....	346
Converting Displacement Maps to Geometry.....	348

Lesson 9.6-Tutorial 1: Use a Displacement map .....	348
Lesson 9.6-Tutorial 2: Convert a Displacement map.....	349
Lesson 9.7: Use Utilities Nodes.....	350
Using the General Utilities.....	350
Using the Color Utilities.....	351
Using the Switch Utilities.....	351
Lesson 9.7-Tutorial 1: Blend Colors .....	351
Lesson 9.8: Paint in 3D.....	352
Assigning a Paint Texture .....	352
Selecting a Brush .....	353
Applying Color .....	354
Using Different Paint Operations .....	354
Painting Other Attributes .....	355
Lesson 9.8-Tutorial 1: Use the 3D Paint Tool .....	356
Lesson 9.9: Edit UVs.....	357
Understanding UVs.....	357
Accessing the UV Editor.....	357
Selecting and Editing UV Components .....	358
Working with UVs and Shells.....	359
Using Different Mappings.....	360
Unfolding UV Shells .....	361
Cutting and Sewing UVs .....	362
Arranging UV Shells .....	363
Generating a UV Snapshot .....	364
Lesson 9.9-Tutorial 1: Edit UVs.....	364
Lesson 9.9-Tutorial 2: Work with UV Shells .....	366
Chapter Summary.....	368
What You Have Learned .....	368
Key terms From This Chapter .....	369
<b>CHAPTER 10 .....</b>	<b>371</b>
<b>Adding Paint Effects .....</b>	<b>371</b>
Lesson 10.1: Use the Preset Brushes.....	371
Accessing the Paint Effects Panel .....	372
Using the Paint Effects Tool.....	372
Using Preset Brushes.....	372
Introducing the Content Browser.....	373
Blending Presets .....	374
Redrawing the View .....	375
Clearing the View.....	375
Lesson 10.1-Tutorial 1: Use a Paint Effects Brush .....	375
Lesson 10.1-Tutorial 2: Use a Content Browser Brush.....	376
Lesson 10.1-Tutorial 3: Blend Brushes .....	377
Lesson 10.2: Create Custom Brushes.....	378
Changing Template Brush Settings.....	378
Using the Various Brush Types .....	379
Changing Brush Size.....	381
Changing Brush Color .....	382

Enabling Illumination and Shadows .....	383
Enabling Glows .....	384
Creating and Saving Custom Brushes .....	385
Lesson 10.2-Tutorial 1: Change Brush Size.....	386
Lesson 10.2-Tutorial 2: Change Brush Color .....	386
Lesson 10.2-Tutorial 3: Add Shadows .....	387
Lesson 10.2-Tutorial 4: Add a Glow.....	388
Lesson 10.3: Paint in 2D.....	389
Introducing the Paint Effects Canvas.....	389
Changing the Canvas Size .....	390
Creating Seamless Textures.....	391
Saving Textures.....	391
Undoing the Last Stroke .....	391
Saving the Alpha Channel.....	391
Lesson 10.3-Tutorial 1: Create a Seamless Texture .....	392
Lesson 10.3-Tutorial 2: Save an Image and Alpha Channel.....	393
Lesson 10.4: Paint on 3D Objects .....	395
Painting in a View Panel .....	395
Painting on Objects.....	396
Auto-Painting an Object .....	397
Saving Depth as a Grayscale Map.....	398
Lesson 10.4-Tutorial 1: Paint on Objects.....	398
Lesson 10.4-Tutorial 2: Auto-Paint on Objects.....	399
Lesson 10.5: Edit Paint Effects.....	400
Selecting Strokes .....	400
Editing Strokes.....	401
Converting Strokes to Polygons.....	401
Changing the Default Light .....	402
Lesson 10.5-Tutorial 1: Select and Edit Strokes .....	402
Lesson 10.5-Tutorial 2: Convert Paint Effects to Polygons.....	403
Chapter Summary.....	403
What You Have Learned .....	403
Key Terms From This Chapter.....	404
<b>CHAPTER 11 .....</b>	<b>405</b>
<b>Using Cameras and Lights .....</b>	<b>405</b>
Lesson 11.1: Work with Cameras .....	406
Creating Cameras .....	406
Changing Camera Settings.....	406
Selecting a Camera .....	407
Positioning Cameras .....	407
Looking Through a New Camera .....	407
Setting View Guidelines.....	408
Changing the Depth of Field .....	409
Lesson 11.1-Tutorial 1: Create a Camera .....	410
Lesson 11.1-Tutorial 2: Aim a Camera.....	411
Lesson 11.1-Tutorial 3: Create a Depth-of-Field Effect .....	412
Lesson 11.2: Create a Background.....	413

Setting the Background Color .....	413
Adding an Image Plane .....	414
Creating a Textured Background .....	414
Loading a Background Image.....	415
Positioning the Background.....	416
Lesson 11.2-Tutorial 1: Change Background Color .....	416
Lesson 11.2-Tutorial 2: Change Background Texture.....	417
Lesson 11.2-Tutorial 3: Add and Position a Background Image .....	418
Lesson 11.3: Create and Position Lights .....	419
Using Default Lights.....	419
Understanding the Light Types.....	419
Creating Lights .....	420
Manipulating Lights .....	420
Manipulating Spot Lights.....	421
Lesson 11.3-Tutorial 1: Create and Manipulate a Light .....	422
Lesson 11.4: Change Light Settings.....	424
Changing Light Color.....	424
Changing Light Intensity and Decay .....	424
Enabling Shadows.....	425
Viewing All Scene Lights .....	426
Lesson 11.4-Tutorial 1: Change Light Color and Intensity.....	427
Lesson 11.4-Tutorial 2: Enable Shadows .....	427
Lesson 11.5: Create Light Effects .....	428
Creating Light Fog.....	428
Creating Glows and Halos.....	429
Creating Lens Flares.....	430
Lesson 11.5-Tutorial 1: Enable Light Fog.....	431
Lesson 11.5-Tutorial 2: Enable a Halo Light Effect .....	433
Chapter Summary.....	433
What You Have Learned .....	434
Key Terms From This Chapter.....	434
<b>CHAPTER 12 .....</b>	<b>437</b>
<b>    Animating with Keyframes .....</b>	<b>437</b>
Lesson 12.1: Set Keyframes .....	437
Setting Keys .....	438
Using Auto Key .....	438
Selecting Keys .....	439
Adding Bookmarks to the Time Slider .....	440
Copying Keys.....	441
Deleting Keys .....	441
Snapping Keys.....	441
Lesson 12.1-Tutorial 1: Set Keys.....	441
Lesson 12.1-Tutorial 2: Use Auto Key.....	442
Lesson 12.1-Tutorial 3: Move Keys.....	443
Lesson 12.2: View an Animation.....	444
Previewing Animation .....	444
Setting Frame Rate .....	445



Looping an Animation .....	445
Accessing Animation Preferences .....	445
Enabling Ghosting.....	446
Creating Motion Trails .....	448
Moving Motion Trail Keys.....	450
Enabling Cached Playback .....	451
Using Playblast.....	451
Lesson 12.2-Tutorial 1: Preview an Animation.....	452
Lesson 12.2-Tutorial 2: Edit Motion Trail .....	453
Lesson 12.2-Tutorial 3: Use Playblast.....	454
Lesson 12.3: Animate Using Motion Paths .....	455
Creating Motion Path Keys.....	455
Drawing a Motion Path.....	456
Attaching an Object to a Motion Path.....	456
Adjusting an Attached Motion Path .....	457
Deforming an Object as it Follows a Motion Path .....	458
Lesson 12.3-Tutorial 1: Create a Motion Path .....	459
Lesson 12.3-Tutorial 2: Draw a Motion Path and Attach an Object.....	460
Lesson 12.4: Edit Animation Curves .....	461
Using the Graph Editor .....	461
Framing Curves.....	462
Editing Keys .....	462
Adding and Removing Keys .....	463
Rescaling Multiple Keys .....	463
Reducing and Smoothing Curves.....	464
Sculpting Curves .....	465
Setting Infinity Conditions .....	465
Working with Tangents .....	466
Lesson 12.4-Tutorial 1: Edit Animation Curves .....	466
Lesson 12.4-Tutorial 2: Repeat Motion.....	467
Lesson 12.5: Control Animation Timing and Add Sound .....	468
Using the Dope Sheet .....	468
Selecting, Moving, and Scaling Keys .....	468
Muting and Locking Keys.....	469
Defining Channel Sets.....	469
Inserting Keys .....	470
Adding Sound .....	471
Lesson 12.5-Tutorial 1: Use the Dope Sheet .....	471
Lesson 12.5-Tutorial 2: Add Sound.....	472
Chapter Summary.....	473
What You Have Learned .....	473
Key Terms From This Chapter.....	474
<b>CHAPTER 13 .....</b>	<b>475</b>
<b>Working with Characters .....</b>	<b>475</b>
Lesson 13.1: Build a Skeleton .....	475
Creating Joints .....	476
Inserting a Joint .....	476

Connecting a Joint Chain .....	477
Removing and Disconnecting Joints .....	478
Mirroring Joints .....	478
Resetting the Root Joint .....	479
Naming Joints .....	479
Lesson 13.1-Tutorial 1: Create a Skeleton.....	479
Lesson 13.1-Tutorial 2: Add a Tail to the Skeleton.....	480
Lesson 13.2: Edit Joint Attributes .....	482
Inheriting Transforms .....	482
Orienting Joints.....	483
Labeling Joints .....	483
Showing and Hiding Labels.....	484
Limiting Joints.....	484
Displaying Joints .....	485
Lesson 13.2-Tutorial 1: Label Joints .....	486
Lesson 13.2-Tutorial 2: Limit Joint Motion.....	487
Lesson 13.3: Add Inverse Kinematics.....	488
Using the Create IK Handle Command .....	488
Using the Create IK Spline Handle Command .....	489
Posing the IK Handles .....	490
Switching Between FK and IK .....	491
Lesson 13.3-Tutorial 1: Add IK to a Skeleton.....	491
Lesson 13.3-Tutorial 2: Add IK Spline to the Skeleton Tail.....	492
Lesson 13.4: Skin a Character .....	493
Creating Effective Skin.....	493
Positioning a Skeleton .....	494
Using X-Ray Mode .....	494
Binding Skin .....	494
Binding Interactive Skin.....	495
Returning to Default Pose .....	496
Unbinding Skin.....	496
Animating Joints .....	496
Lesson 13.4-Tutorial 1: Position a Skin.....	496
Lesson 13.4-Tutorial 2: Bind Skin .....	497
Lesson 13.4-Tutorial 3: Create a Walk Cycle .....	498
Lesson 13.5: Edit a Skin.....	499
Adding Influence Objects .....	499
Understanding Skin Weights .....	500
Using the Interactive Bind Skin Tool.....	501
Painting and Smoothing Skin Weights.....	502
Mirroring Skin Weights.....	503
Resetting Skin Weights .....	503
Lesson 13.5-Tutorial 1: Add Influence Object .....	503
Lesson 13.5-Tutorial 2: Paint Weights.....	504
Lesson 13.6: Automatic Rigging.....	505
Creating a Rig with One-Click .....	505
Creating a Step-by-Step Rig .....	506
Controlling the Human IK Rig .....	507
Animating with Motion Capture data.....	508

Lesson 13.6-Tutorial 1: Create a Quick Rig.....	509
Lesson 13.6-Tutorial 1: Animate with Motion Capture.....	509
Lesson 13.7: Add Hair and Fur.....	510
Adding preset hair to an object.....	510
Creating hair.....	511
Style hair.....	512
Making hair dynamic.....	512
Creating and editing hair attributes.....	513
Rendering hair and fur.....	514
Creating Hair with XGen.....	515
Opening the XGen Editor.....	515
Sculpting Hair with Modifiers.....	516
Lesson 13.7-Tutorial 1: Add hair.....	517
Lesson 13.7-Tutorial 1: Add XGen grass.....	518
Chapter Summary.....	519
What You Have Learned.....	519
Key Terms From This Chapter.....	520

## **CHAPTER 14 ..... 523**

### **Animating with Dynamics ..... 523**

Lesson 14.1: Use Particles.....	524
Viewing Particle Examples.....	524
Creating Particles.....	524
Creating Surface Particles.....	525
Viewing Particle Attributes and Count.....	526
Setting Particle Lifespan.....	527
Changing Particle Render Type.....	527
Using Instances.....	528
Cycling Instances.....	529
Lesson 14.1-Tutorial 1: Add Clouds to a Sphere.....	530
Lesson 14.1-Tutorial 2: Use an Instance.....	531
Lesson 14.1-Tutorial 3: Cycle Instances.....	532
Lesson 14.2: Create an Emitter.....	533
Using an Emitter.....	533
Using a Directional Emitter.....	534
Using a Volume Emitter.....	535
Using an Object as an Emitter.....	536
Changing Emitter Attributes.....	537
Lesson 14.2-Tutorial 1: Create an Omni Emitter.....	538
Lesson 14.2-Tutorial 2: Create a Directional Emitter.....	539
Lesson 14.2-Tutorial 3: Create an Object Emitter.....	540
Lesson 14.3: Create Fields and Goals.....	541
Understanding Fields.....	541
Connecting Objects to a Field.....	542
Changing Field Attributes.....	542
Regulating Field Forces.....	543
Establishing Goals.....	544
Lesson 14.3-Tutorial 1: Create a Vortex Field.....	545

Lesson 14.3-Tutorial 2: Create a Goal .....	546
Lesson 14.4: Animating Rigid Body Collisions.....	547
Adding rigid body objects.....	547
Adding Passive body objects .....	548
Adding a force .....	548
Seeing the collisions .....	548
Using MASH Dynamics.....	549
Creating a MASH Network.....	549
Opening the MASH Editor and enabling dynamics.....	549
Adding collision objects and fields .....	551
Lesson 14.4-Tutorial 1: Enable rigid body collisions.....	551
Lesson 14.4-Tutorial 1: Using MASH dynamics .....	552
Lesson 14.5: Manage Particle Collisions .....	553
Enabling Particle Collisions .....	553
Enabling Particle Collisions .....	554
Setting Particle Attributes .....	554
Defining New Events .....	555
Assigning a Solver .....	556
Creating Soft Body Objects.....	556
Lesson 14.5-Tutorial 1: Enable Particle Collisions .....	556
Lesson 14.5-Tutorial 2: Add a Collision Event .....	557
Lesson 14.5-Tutorial 3: Filling a Container with Particles .....	558
Lesson 14.5-Tutorial 4: Create Soft Body Objects .....	559
Lesson 14.6: Use Cloth.....	560
Viewing Cloth Examples .....	560
Creating Cloth.....	561
Creating a Cloth Collision Object .....	562
Setting Cloth Object Properties .....	563
Lesson 14.6-Tutorial 1: Drape a Tablecloth.....	564
Lesson 14.7: Constrain Motion.....	565
Adding Constraints .....	565
Creating Component Constraints .....	566
Locking Components in Space .....	567
Creating Springs.....	567
Lesson 14.7-Tutorial 1: Constrain a Flag to a Pole .....	567
Lesson 14.8: Use Fluids.....	568
Creating a Fluid Container .....	569
Creating a Fluid Emitter.....	569
Changing Fluid Properties.....	569
Creating Oceans and Ponds.....	570
Lesson 14.8-Tutorial 1: Fill a Container.....	570
Lesson 14.8-Tutorial 2: Create a Pond with Ripples.....	571
Lesson 14.9: Create Effects.....	572
Creating Fire and Smoke.....	572
Creating Fireworks.....	574
Creating Lightning.....	574
Shattering Objects .....	575
Flowing Along a Curve .....	576
Lesson 14.9-Tutorial 1: Create a Fire Effect .....	577

Lesson 14.9-Tutorial 2: Create Fireworks.....	578
Lesson 14.9-Tutorial 3: Create Lightning.....	579
Lesson 14.9-Tutorial 4: Create Curve Flow.....	580
Chapter Summary.....	581
What You Have Learned.....	581
Key Terms From This Chapter.....	582
<b>CHAPTER 15 .....</b>	<b>585</b>
<b>Rendering a Scene .....</b>	<b>585</b>
Lesson 15.1: Configure the Render Process .....	586
Choosing a Renderer .....	587
Saving Render Presets .....	587
Changing a File Name .....	587
Changing File Format.....	587
Changing Camera View and Resolution.....	587
Using render layers.....	588
Lesson 15.1-Tutorial 1: Set Render Settings.....	588
Lesson 15.1-Tutorial 2: Change the Rendering Path .....	588
Lesson 15.2: Use Special Rendering Features.....	589
Adjusting Render Quality.....	589
Enabling Raytracing .....	591
Enabling Motion Blur.....	591
Lesson 15.2-Tutorial 1: Change the Render Quality.....	592
Lesson 15.2-Tutorial 2: Enable Raytracing .....	592
Lesson 15.2-Tutorial 3: Enable Motion Blur .....	593
Lesson 15.2-Tutorial 4: Add Environment Fog .....	594
Lesson 15.3: Use the Render View Window .....	595
Opening the Render View .....	595
Rendering a Region.....	596
Using Interactive Photorealistic Rendering (IPR).....	597
Saving Rendered Images .....	597
Lesson 15.3-Tutorial 1: Render a Region.....	597
Lesson 15.3-Tutorial 2: Use IPR Rendering .....	598
Lesson 15.4: Create a Final Render.....	599
Rendering a Single Frame .....	599
Rendering an Animation Sequence .....	600
Viewing Animations in the Render View Window.....	600
Rendering to an Animation Format.....	600
Lesson 15.4-Tutorial 1: Render an Animation.....	600
Lesson 15.5: Render with Maya Vector .....	603
Using Maya Vector .....	603
Lesson 15.5-Tutorial 1: Render Using Vectors .....	605
Lesson 15.6: Render with Arnold.....	606
Selecting the Arnold Renderer .....	606
Changing the Arnold Render Settings.....	607
Using the Arnold RenderView window.....	609
Lesson 15.6-Tutorial 1: Render with Arnold.....	610
Lesson 15.7: Working with the Arnold Standard Surface Shader .....	612

Using Arnold Materials .....	612
Converting Legacy Materials to Arnold .....	613
Lesson 15.7-Tutorial 1: Use the Standard Surface Shader .....	613
Lesson 15.7-Tutorial 2: Convert Legacy Shaders to Arnold.....	615
Lesson 15.8: Using Arnold Lights and Physical Sky .....	616
Using Area Lights .....	617
Creating a Skydome Light .....	617
Adding an HDRI Image to a Skydome .....	618
Adding Physical Sky .....	619
Lesson 15.8-Tutorial 1: Use Arnold Area Lights .....	621
Lesson 15.8-Tutorial 2: Render Skydome.....	622
Lesson 15.8-Tutorial 3: Render Physical Sky .....	624
Chapter Summary.....	625
What You Have Learned .....	625
Key Terms From This Chapter.....	626
<b>CHAPTER 16 .....</b>	<b>629</b>
<b>Using MEL Scripting .....</b>	<b>629</b>
Lesson 16.1: Use the Command Line.....	629
Using MEL in the Command Line.....	629
Repeating Command Line Commands .....	630
Using the MEL Scripting Commands.....	630
Lesson 16.1-Tutorial 1: Enter MEL Commands in the Command Line .....	631
Lesson 16.2: Use the Script Editor .....	632
Executing Script Commands .....	633
Viewing Interface Commands .....	633
Reusing Interface Commands.....	633
Saving Scripts.....	634
Adding Scripts to the Shelf .....	634
Lesson 16.2-Tutorial 1: Use the Script Editor .....	635
Lesson 16.2-Tutorial 2: View Interface Commands and Save a Script .....	635
Lesson 16.2-Tutorial 3: Execute a Custom Script .....	636
Chapter Summary.....	637
What You Have Learned .....	637
Key Terms From This Chapter.....	638