

QCAD

An Introduction to Computer-
Aided Design (CAD)

Andrew Mustun

Trademarks

All mentioned trademarks are trademarks of their respective holder.

Copyright © 2008-2016 by RibbonSoft, GmbH; Andrew Mustun

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission of the publisher.

Mustun, Andrew QCAD - An Introduction to Computer-Aided Design (CAD)

The author and publisher have taken care in the preparation of this book, but make no express 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 contained herein. RibbonSoft, GmbH reserves the right to revise and improve its products as it sees fit. This publication describes the state of QCAD at the time of its publication, and may not reflect the product at all times in the future.

Table of Contents

Part I: Introduction	7
Introduction	8
Target Audience	8
Structure of	9
How to use this Book	10
Prerequisites	10
From Manual Drafting to CAD	11
Part II: First Steps with QCAD	15
Introducing the QCAD Application	16
The First Start	16
The Application Window	16
Using CAD Tools	19
The CAD Toolbar	19
Starting Tools	20
Correcting Mistakes	21
The Neutral State of QCAD	21
Hands-on: Drawing a Rectangle	22
Hands-on: A Line through the Middle	24
Hands-on: Printing a Drawing	25
Closing QCAD	26
Part III: Basic CAD Concepts	27
Viewing	28
The Viewing Tools	28
Hands-on: Zooming in and out	28
Hands-on: Panning	30
Hands-on: Auto Zoom	31
Hands-on: Window Zoom	31
Notes	33
Exercises	34
Layers	35
What are Layers?	35
Layers, Groups and Blocks	36

Example Uses for Layers	37
The Layer List	38
Layers and Line	38
Hands-on: Using Layers	39
Precision	45
Precision in CAD	45
The Importance of Being Precise	45
Precision Techniques	46
Exercises	46
Snap Tools	47
What are Snap Tools?	47
Snap Restrictions	55
Exercises	57
Coordinates	58
The Cartesian Coordinate System	58
Absolute Cartesian Coordinates	60
Relative Cartesian Coordinates	60
Absolute Polar Coordinates	61
Relative Polar Coordinates	61
Notes	62
Hands-on: Drawing a Triangle from Three Absolute Coordinates	62
Notes for Advanced Users	63
Hands-on: Drawing a Shape Using Relative Coordinates	64
Hands-on: Drawing a Shape Using Absolute Polar Coordinates	65
Hands-on: Drawing a Rhombus Using Relative Polar Coordinates	67
Exercises	69
Part IV: Drawing and Editing with QCAD	71
Drawing Tools	72
Choosing a Drawing Tool	72
Preparations before Drawing	73
Line Tools	73
Arc Tools	84
Circle Tools	90

Ellipse Tools	96
Spline Tools	98
Polyline Tools	102
Shape Tools	109
Selection and Modification	114
Introduction	114
Modification Tools Which Operate on a Selection	114
Modification Tools Which Operate without a Selection	115
Basic Selection Tools	116
Advanced Selection Tools	119
Basic Modification Tools	125
Advanced Modification Tools	135
The Property Editor	166
Filtering Entity Types	169
Measuring Tools	172
Introduction	172
Texts	176
Texts in CAD	176
Fonts	176
Text Height	177
Creating Text Entities	177
Subscript and Superscript	179
Dimensions	181
What Are Dimensions?	181
The Parts of a Dimension	182
Dimension Preferences	183
Creating Dimensions	184
Choosing a Different Text Label	194
Moving the Text Label	198
Moving Reference Points	199
Stretching Dimensions	200
Hatches and Solid Fills	202
What Are Hatches?	202
What Are Solid Fills?	203
Creating Hatches and Solid Fills	203

Part V: Blocks	209
Creating and Using Blocks	210
What is a Block?	210
The Block List	212
Creating New Blocks	213
Inserting Blocks	215
Modifying Blocks	217
Deleting Blocks	219
Exploding Block References	220
Part VI: Import, Export and Printing	221
Import	222
Bitmap Import	222
SVG Import	224
Export	225
Exporting Drawings	225
Bitmap Export	225
SVG Export	227
PDF Export	228
DXF Export	229
Printing	230
Printing a Drawing	230
Printing a Drawing to Scale	232
Part VII: Projections	235
Orthographic Projections	236
Views of an Object	236
Local Standards	237
Drawing Techniques	239
Hands-on: Orthographic Projections	242
Exercises	253
Isometric Projections	255
What are Isometric Projections?	255
Creating Isometric Projections	256
The Scale of Isometric Projections	260

Part II

First Steps with QCAD

Alternatively, you can also click the right button of your mouse to return back to the neutral state step by step. Depending how far you have progressed with a tool, you might have to click the right mouse button more than once to fully return to the neutral state. The same can also be achieved by hitting the Escape key on your keyboard a multiple times.

Hands-on: Drawing a Rectangle

The following instructions guide you through the complete procedure of drawing a simple rectangle. You will probably not yet understand all steps involved but it is crucial that you successfully complete these steps since all CAD tools work in a similar way like the rectangle tool.

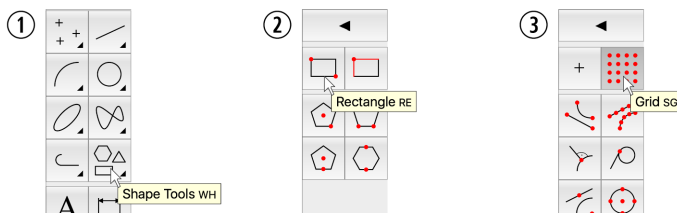


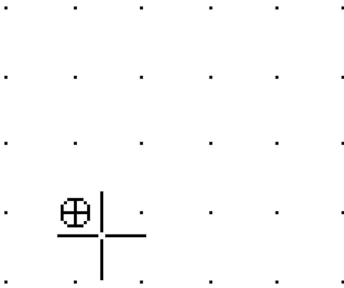
Figure 3-3: Choosing the CAD tools for drawing rectangles and activating the *Snap to grid* tool.

1. Launch QCAD if it is not already running. QCAD shows its application window and creates a new, empty drawing.
2. Before you start drawing anything, save this empty drawing to a file on your disk. To do so, choose the menu *File - Save As...*
The dialog for saving a drawing is shown. The dialog automatically suggests a location for your file. This location is usually not a bad place to start with. You might want to use a sub-folder *drawings* in this location instead, but to keep things simple the following steps assume that you use this default location for saving your drawing.
3. Type the filename *example* into the input field with the label *File name*, then click the *Save* button to save the empty drawing. The dialog window closes and you are now ready to start drawing.
Although it is not necessary to first save the empty drawing, it is good practice to do so as it forces you to think about where you want to store the file before you start drawing.
4. Move your mouse cursor to the shape button as shown in Figure 3-3 at the left (1). Click the left mouse button to show the shape tools (2).
5. Click the button with a rectangle on it as shown in Figure 3-3 (2). QCAD now knows that you intend to draw a rectangle and shows the CAD toolbar with the snap tools.
6. Click the button with a grid on it as shown in Figure 3-3 (3).
7. Move the mouse cursor around in the drawing area. There are two things to notice:
 - The mouse cursor has changed its shape and is now shown as a pair of cross hairs.
 - There is a small yellow circle that follows the mouse cursor around whenever you move it. This circle is not positioned exactly under the mouse cursor. It ‘snaps’ always to the grid point in the drawing area that is the closest to the mouse cursor.

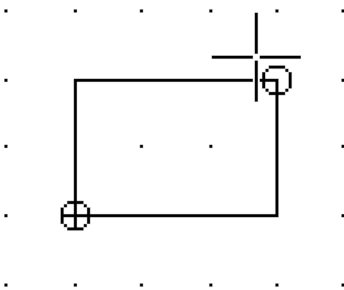
This yellow circle indicates what position QCAD is currently working with. The exact position of the crosshair mouse cursor is irrelevant to QCAD as long as the

yellow circle is in the correct place. In the previous step you have chosen to use the grid for positioning (*Snap to grid*). QCAD is now automatically restricting the options for choosing a position to the grid points.

8. Click somewhere into the drawing area. A little red circle with a cross appears at the closest grid point as shown here:

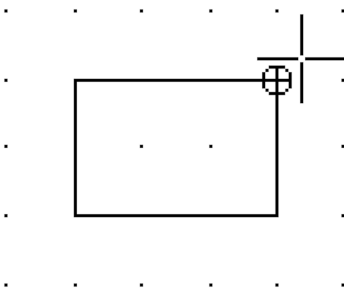


You have now set the first corner of the rectangle you are about to draw. If you move the mouse cursor around in the drawing area, you will see that QCAD draws a rectangle from the chosen position to the grid point that is closest to the mouse cursor as shown below:



Note that this rectangle is not yet part of your drawing and keeps changing whenever you move the mouse. This is called a *preview*. QCAD uses these previews to show you what *would* be drawn if you would click the mouse button at this point.

9. Move the mouse cursor until the rectangle that is shown is three grid spacings wide and two grid spacings high. Your rectangle should look like that one in the figure above.
10. Click the left mouse button to set the second corner of the rectangle. This leaves you with a drawing that looks like this:



The rectangle that is shown now, is a part of your drawing.

11. QCAD is ready to draw the next rectangle and waits for the first corner of the next rectangle. Since we don't want to draw more rectangles, we will terminate this tool now. To do so, click the right mouse button twice. If you don't have a right mouse button, press the *Escape* or *Esc* key on your keyboard twice. The mouse cursor is back to normal and the CAD toolbar shows the same tools as it did after starting QCAD. Your

rectangle should still be visible. If that is not the case, you did something wrong and you need to carefully repeat the steps 4 to 10.

12. Save your drawing by choosing the menu *File - Save*.

In the example you have just completed, you have used a tool called *Snap to grid*. As a result, the corners of the rectangle are exactly aligned to the grid points. Snap tools are a central concept of any CAD system and there are many other snap tools you will get to know later in this book.

Hands-on: A Line through the Middle

To emphasize the importance of snap tools, we will now extend our drawing with a vertical line that separates the rectangle in two equal halves.

Vertical means that the line extends from a first point to another point directly under or above it. In our case, the line starts in the middle of the top line of the rectangle and ends in the middle of the bottom line. The top and bottom lines of the rectangle are *horizontal*, that means they extend from left to right. You can easily remember what *horizontal* means by thinking that the *horizon* at the seaside looks *horizontal*.

Note that there are no grid dots at the center of the top and the bottom line of the rectangle. For this line we will have to use a different snap tool.

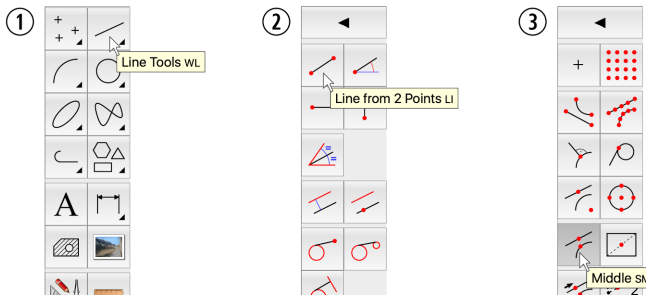


Figure 3-4: Choosing the CAD tool for drawing lines with two points and changing the snap tool to *Snap to middle points*.

1. Choose the *Line Tools* button again from the CAD toolbar as shown in Figure 3-4 (1).
2. This time, select the tool *Line from 2 Points* (2).
3. Click the button *Middle* (3). This activates the snap tool to snap to middle points of lines and arcs. Note that only one snap tool can be active at any time.
4. Move the mouse cursor around in the drawing area like we did before with the grid snaptool. As you can see, the yellow circle no longer jumps from grid point to grid point. Instead it now only shows up in four different positions which are the middle points of the four lines that form the rectangle. One such possibility is shown here:

Chapter 8

Coordinates

Objective

In this chapter, you will

- learn what coordinates are,
 - get to know the different types of coordinates QCAD supports,
 - learn how to define positions by entering coordinates.
-

The Cartesian Coordinate System

In the previous chapters you have already seen and used the drawing area of QCAD. Like a sheet of paper, the drawing area is a flat area onto which you can draw something.

When working with a CAD system, you will often be confronted with the coordinate system of the drawing area. A coordinate system uniquely defines each point in the drawing area and in your drawing. If you point with a pen to any position in the drawing area, that position has a unique coordinate that defines where this point is in the drawing.

By far the most commonly used coordinate system is the *Cartesian coordinate system*. A coordinate system is not something that is given by nature. Coordinate systems were defined once by someone (in this case René Descartes in 1637) to define a standard for specifying the position of a point on a two dimensional surface. The Cartesian coordinate system is not only used in CAD applications but in many areas of mathematics, physics and engineering.

The Cartesian coordinate system is based on two axes that are at right angles (orthogonal) to each other. The horizontal axis is commonly called the *X-axis* while the vertical one is called the *Y-axis* as shown in Figure 8-1.

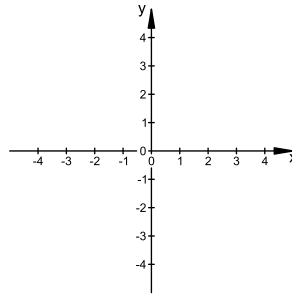


Figure 8-1: The coordinate axes of the Cartesian coordinate system.

The *origin* of the coordinate system is the point where the X and the Y axes cross each other. This point is also referred to as the *absolute zero point* or just *absolute zero*.

Both axes have a direction. The X-axis is directed to the right and the Y-axis upwards. This is not necessarily a logical choice, it was simply defined this way. As you can see in Figure 8-1, the axes are divided into smaller sections, each one unit long.

Any particular position can be described by its distance from the origin in X-direction and in Y-direction. For example the position of the point *P* in Figure 8-2 is 3 units away from the origin in X-direction and 2 units away from the origin in Y-direction. Or, to use the correct notation, the point *P* is located at (3,2). This notation in brackets indicates the location of a point as a pair of an X-distance and a Y-distance (X,Y).

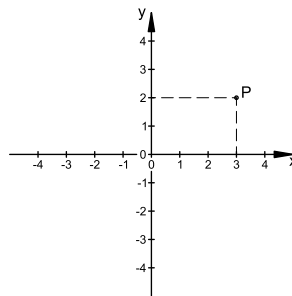


Figure 8-2: The location of the point *P* can be noted as (3,2) where 3 is the distance to the origin in X-direction and 2 is the distance to the origin in Y-direction.

If a point is located left of the origin, its X-coordinate turns negative. If it is located below the origin, its Y-coordinate turns negative. Figure 8-3 shows some points in the Cartesian coordinate system and their (X,Y) notation. The (X,Y) notation for the origin is (0,0).

Preparations before Drawing

Before you draw anything you should set up the layers of your drawing as described in a previous chapter. The drawing tools of QCAD always draw all objects on the layer that is currently active. After creating a new empty drawing, spend some time to think about the layers you will be using for your drawing and create them. Whenever you are about to draw something, have a look at the layer list at the right to make sure that you are on the correct layer. It can be helpful to assign different colors to different layers, so you immediately realize that something is wrong if you draw on the wrong layer.

Line Tools

Menu: Draw > Line
Keycode: WL



QCAD offers a variety of tools for drawing lines. They are all available in the CAD toolbar of QCAD after clicking the line button shown in Figure shows the CAD toolbar with the various tools for drawing lines.

Note that you can click the button at the top with the left arrow to return to the main menu.

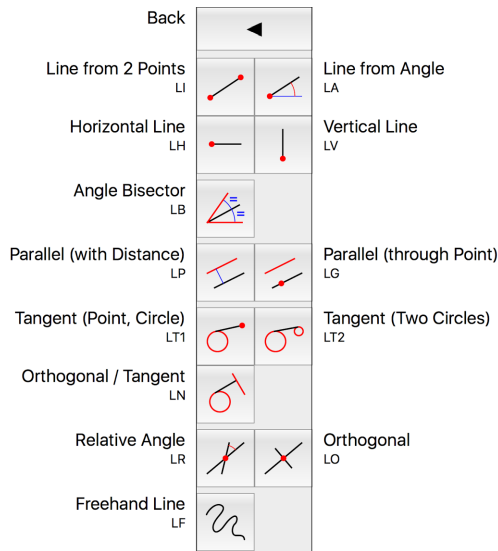


Figure 9-2: The CAD toolbar showing the drawing tools for drawing lines.

Line from two Points

Menu: Draw > Line > Line from 2 Points
Keycode: LI



With this tool you can draw a single line by directly defining its start point and end point. It is also possible to draw a series of connected lines.

Drawing a single line

1. Click the start point of the line.
2. Click the end point of the line.
3. Terminate the tool by clicking the right mouse button twice or by pressing the Escape key on your keyboard twice.

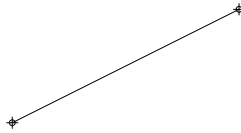


Figure 9-3: Example for drawing a single line with startpoint and endpoint.

Drawing a series of connected lines

1. Click the start point of the first line.
2. Click the end point of the first / next line. Repeat this until you have drawn all connected lines you want to draw.
3. Terminate the tool by clicking the right mouse button twice or by hitting the Escape key on your keyboard twice.

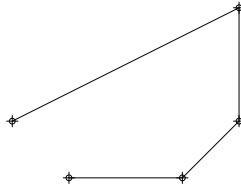


Figure 9-4: Example for drawing a series of connected lines.

Drawing a series of disconnected lines

1. Click the start point of the first / next line.
2. Click the end point of the first / next line.
3. Click the right mouse button once or hit the Escape key on your keyboard once.
4. Repeat steps 1-3 until you are finished with drawing lines.
5. Terminate the tool by clicking the right mouse button twice or by hitting the Escape key on your keyboard twice.

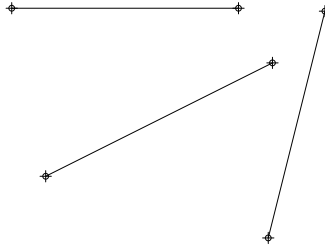


Figure 9-5: Example for drawing a series of disconnected lines.

Line with fixed Angle

Menu: Draw > Line > Line from Angle
Keycode: LA



This tool lets you draw lines at a fixed angle. The length of the line can be specified and you can choose if you want to position the line by defining its start point, middle point or end point.

When you are using this tool, you will often find that the length of the line is irrelevant at first and can be better adjusted later using a trim tool.


Usage

1. Enter the angle of the line in the options toolbar. Type a length for the line and choose how you want to position it.
2. Click the position of the line. You can also repeat this to place more than one line with the same angle or change the angle in the options toolbar at any time.
3. Terminate the tool by clicking the right mouse button twice or by hitting the Escape key on your keyboard twice.

Table 9-1 shows three example uses of this tool.

Tool options	Click point and constructed line
Angle: 30 Length: 20 Snap Point: Start	
Angle: 45 Length: 30 Snap Point: Middle	
Angle: 60 Length: 20 Snap Point: End	

Rounding Corners (Fillet)

<i>Menu:</i>	Modify > Round	
<i>Keycode:</i>	RN	

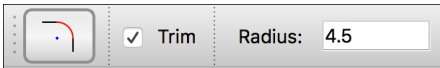
This tool is used to round corners. It works very similarly to the chamfering tool.

Usage

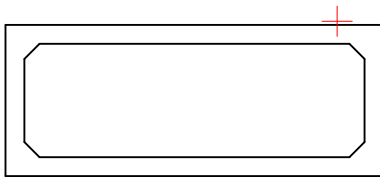
1. Start the round tool.



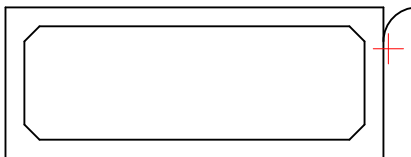
2. Enter the radius of the rounding in the options toolbar. Make sure that the *Trim* check box is ticked if you want to automatically trim the corner lines to the rounding. For this example, we want to create a rounding with a radius of 4.5 units with trimming enabled:



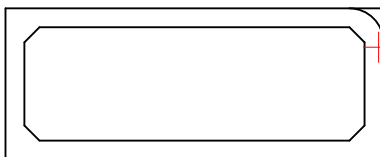
3. Pick the first entity that forms the corner you want to round. In our example, we click the top line of the rectangle as the first line of the top right corner which we want to round:



4. Move the mouse cursor to the second line of the corner. QCAD shows a preview of the rounding you are about to create. At this point it is important to place the mouse cursor at the correct side of the line since there are two roundings possible. If you place the mouse cursor somewhat to the right of the vertical line, an alternative rounding is shown:

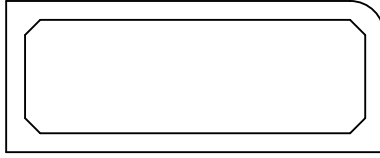


Move the mouse cursor somewhat to the left of the vertical line to show the rounding we want to create:

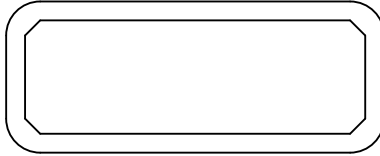


5. Click the left mouse button when the preview shows the correct rounding.


- 6. QCAD creates an arc that is tangential to the two chosen lines and trims the lines to the arc as shown here:



- 7. The other corners can be rounded in the same way:



Dividing Entities

<i>Menu:</i>	Modify > Divide	
<i>Keycode:</i>	DI	

This tool divides (or cuts) an entity at a given point. You can for example divide a line into two parts. The division point must be on the entity and is in most cases an intersection point with another entity.

Entities often have to be divided to change the line style in the middle of an entity or to form closed contours for hatching or solid fills.

In the example in Figure , the original shape of a mechanical part before bending is shown with a dash-dot-dot line in the view at the bottom.

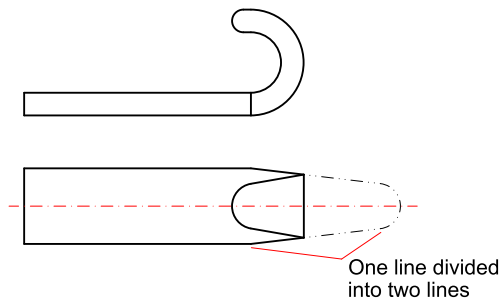


Figure 10-14: Lines often need to be divided to apply different layers or line styles to the two separate parts.

Usage

- 1. Start the dividing tool:



Index

Symbols

45 degree line 251
@ 60

A

Absolute Cartesian coordinates 60
Absolute polar coordinates 61
Absolute zero point 58
Accuracy 11
 definition 45
 vs. precision 45
Add layer 39
Add node 104
Advanced modification tools 135
Align 164
Aligned dimension 185
Angle
 direction 61
 measuring 174
Angle between lines 174
Angle dimension 193
Append node 105
Application window 16
Arc
 3 points 87
 center, point, angles 85
 concentric 88,89
 offset 89
 tangential 89
 two points and angle 86
 two points and radius 85
Arc tools 84
Architectural 184
Architectural ticks 184
Area
 measuring 174
Arrowheads 182,183
Attributes 39,44
Auto snap 245
Auto zoom 31
Automatic Zoom
 after loading 28
Automation 12
Autosnap 48
Auxiliary lines 13,245
Axes 58

B

B-Splines 98
Bamboo 10
Basic modification tools 125
Bevel 154
Bézier splines 98
Bisector 76

Bitmap Export 225
Bitmaps 222
Block
 break up 220
 change 217
 creation 213
 delete 219
 edit 217
 explode 220
 inserting 215
 list 212
 modify 217
 remove 219
Block insert 210
Block List 212
Block reference 210
Blocks 36,210
BMP
 export 225
 import 222
Boundary of a hatch 203
Break out segment 158
Break out Segment 243
Break up 160
Break up block reference 220
Break up reference 220

C

CAD
 generic CAD 8
 in general 8
 vs. manual drafting 11
CAD toolbar 19
 drawing tools 72
Cartesian coordinate system 58
Cartesian coordinates 48,60
Chair example 236
Chamfer 154
Change block 217
Circle
 3 points 94
 center, point 91
 center, radius 92
 concentric 94,95
 offset 95
 two opposite points 93
 two points and radius 92
 with center, point 245
Circle tools 90
Circumference
 measuring 174
Clockwise 61
Closed shape
 selection of 122
Closing QCAD 26
Color 39
Command line
 hiding of 18
Concentric 89,95
Construction 72
Construction lines 13

- Contour
 - selection of 122
- Control points 98
- Coordinate entry 46
- Coordinate system 58
 - absolute Cartesian coordinates 60
 - absolute polar coordinates 61
 - absolute zero 58
 - angle 61
 - axes 58
 - Cartesian coordinates 60
 - negative coordinates 60
 - origin 58
 - polar coordinates 61,61
 - relative Cartesian coordinates 60
 - relative polar coordinates 61
 - relative zero point 60,61
- Coordinates 48,58
- Copy 125,135
- Copy and rotate 143
- Correcting mistakes 21
- Counter-clockwise 61
- Creating Block 213
- Creating drawing objects 72
- Cut 125,157
- Cut segment 158

- D**
- Decimal 184
- Degree
 - of spline 98
- Degrees 61
- Delete 125
 - polyline nodes 105
 - polyline segments 106
- Delete block 219
- Delete small entities 163
- Deselect
 - area 121,121
 - closed shape 122
 - connected entities 122
 - contour 122
 - intersected 123
 - layer 124
 - polygon 121
 - polygonal area 121
 - rectangular area 121
 - window 121
- Deselect all 120
- Deselect everything 120
- Detect zero length entities 163
- Diameter dimension 192
- Diameter symbol 195
- Dice example 238
- Dimension
 - aligned 185
 - angle 193
 - architectural 184
 - architectural ticks 184
 - arrowheads 183
 - arrows 184
 - custom text 194
 - decimal 184
 - diameter 192
 - diameter symbol 195
 - dimension line 182
 - drawing of 184
 - engineering 184
 - extension lines 183
 - fixed text label 195
 - format 184
 - fractional 184
 - horizontal 188
 - label 182
 - leader 190
 - linear 186
 - moving reference points 199
 - moving text label 198
 - option toolbar 194
 - ordinate 188
 - precision 184
 - preferences 183,184
 - prefix 195
 - radius 191
 - symbols 196
 - text 182,194
 - tolerances 196
 - tools 184
 - vertical 188
- Dimensions 181
 - and precision 11
 - arrowheads 182
 - parts of 182
 - text 182
- Direction of angles 61
- Distance
 - measuring 173,173
- Distance between points 173
- Distance to entity 173
- Divide 157
- Divide 2 158
- Draw
 - arc 84
 - circle 90
 - dimension 181
 - ellipse 96,96
 - ellipse arc 97
 - line 22,24,73
 - polyline 102,103
 - shape 109
 - spline 98
- Drawing
 - area 58
 - preparations 73
- Drawing area 17
- Drawing preferences
 - dimension settings 183
- Drawing scale 12,230
- Drawing tools 72
- Duplicate entities 163
- DXF export 229

E

Edit

- bevel 154
- break out segment 158,243
- break up 160
- bring to front 162
- chamfer 154
- copy 125,135
- copy and rotate 143
- cut 125,157
- cut segment 158
- delete 125
- divide 157
- divide 2 158
- explode 160
- fillet 156
- flip 141
- lengthen 151
- mirror 141
- move 133,135
- move and rotate 143
- move object grip 130
- move object handle 130
- move reference point 130
- paste 125
- polar duplicate 145
- redo 21
- remove 125
- reset 21
- rotate 138
- rotate and counter-rotate 145
- rounding 156
- scale 140
- send to back 162
- split 160
- stretching 152
- text 161
- translate 135
- translate and rotate 143
- trim 147
- trim both 150
- undo 21

Edit block 217

Editing

- advanced 135
- basic 125

Efficiency 13

Ellipse 96

Ellipse arc 97

Ellipse tools 96

Engineering 184

Equal parts 160

Equidistant polyline 107

Escape 22

Examples

- chair 236
- dice 238

Explode 160

Explode block reference 220

Explode reference 220

Export 225

Bitmaps 225

BMP 225

DXF 229

JPEG 225

PDF 228

PNG 225

SVG 227

Extend 147,151,243

Extension lines 183

F

File

dialog 22

open 28

PDF export 228

quit 26

save 22

save as 22

Fillet 156

First-angle projection 237

Fit points 98

Fit to page 230

Flip 141

Format of dimension text 184

Fractional 184

Freehand line 83

Front View 245

G

GIF

import 222

Graphics tablet 10

Grid 22

dots 17

Grips 130

of dimensions 199

Groups 36,210

GUI 17

application window 16

H

Handles 130

of dimensions 199

Hardware

mouse 10

requirements 10

screen 10

Hatch

tool 203

Hatches 202

boundary 203

creation of 203

Hide all layers 250

Horizontal dimension 188

Horizontal lines 251

I

Images 222
 Import
 bitmaps 222
 Info 172
 angle 174
 circumference 174
 distance 173,173
 length 174
 total length 174
 Insert 210
 Insert block 215
 Introduction 8
 Invert selection 121
 ISO standard
 first-angle projection 237
 Isometric projections 255

J

JPEG
 export 225
 import 222

K

Knots 98

L

Label of dimensions 182
 Landscape 230
 Layer
 add 39
 attributes 39,44
 color 39
 linetype 39
 name 39
 select 124
 width 39
 Layer attributes 44
 Layer list
 hiding of 18
 Layer selection 124
 Layers 35
 hide all 250
 preparing 73
 show all 251
 Leader 190
 Length
 measuring 174
 Lengthen 151,243
 Line
 45 degree 251
 auxiliary 13
 bisector 76
 freehand 83

 from two points 73
 horizontal 76,251
 offset 77,78
 orthogonal 81
 parallel 77,78
 point, tangent to circle 245
 polygon 110,111
 rectangle 22
 relative angle 82
 tangent 79,80
 tools 22
 vertical 76
 with angle 75,251
 with two points 24
 Line tools 73
 Linear dimension 186
 Linetype 39
 Linetypes 38
 Local standards 237

M

Mac OS X
 mouse 10
 Manual drafting 11
 Measuring
 angle 174
 area 174
 circumference 174
 distance 173,173
 length 174
 total length 174
 Measuring tools 172
 Menu
 usage 18
 Middle mouse button 30
 Mirror 141
 Mistakes
 correction of 21
 Model
 scale 12
 Modification 114
 CAD vs. manual drafting 11
 properties 166
 Modification tools
 advanced 135
 basic 125
 Modify 125,135
 align 164
 bevel 154
 break out segment 158,243
 break up 160
 bring to front 162
 chamfer 154
 copy 135
 copy and rotate 143
 cut 157
 cut segment 158
 delete 125
 Detect Duplicates 163
 Detect Zero-Length Entities 163
 divide 157

- divide 2 158
- explode 160
- extend 243
- fillet 156
- flip 141
- lengthen 151,243
- mirror 141
- move 133,135
- move and rotate 143
- Offset 107
- polar duplicate 145
- remove 125
- reverse 161
- rotate 138
- rotate and counter-rotate 145
- round 245
- rounding 156
- scale 140
- send to back 162
- split 160
- stretching 152
- text 161
- translate 135
- translate and rotate 143
- trim 147
- trim both 150

Modify block 217

Mouse 10

- middle button 30

Mouse cursor 22

Mouse wheel 10,28

Move 133,135

Move and rotate 143

N

- Negative coordinates 60
- Neutral state 21
- NURBS 98

O

- Object grips 130
 - of dimensions 199
- Object handles 130
 - of dimensions 199
- Object snap 47
- Offset 107
 - arc 89
 - circle 95
 - line 77,78
- Offset polyline 107
- Oops 21
- Open drawing 28
- Ordinate dimension 188
- Origin 58
- Orthogonal 81
- Orthographic projections 236
 - drawing techniques 239

P

- Pan zoom 30
- Panning 30
- Parallel 77,78
- Paste 125
- PDF export 228
- Pen 10
- Photographs 222
- Planning 14
- PNG
 - export 225
 - import 222
- Polar coordinates 48,61,61
- Polar duplicate 145
- Polygon 110,111,112,112
 - center, side 112
 - side, side 112
- Polyline
 - add node 104
 - append node 105
 - delete node 105
 - delete segments 106
 - draw 103
 - equidistant 107
 - from segments 104
 - offset 107
 - trim segments 107
- Polyline tools 102
- Portrait 230
- Precision 11,45
 - angle entry 46
 - coordinate entry 46
 - definition 45
 - distance entry 46
 - factor entry 46
 - snap tools 46
 - techniques 46
 - vs. accuracy 45
- Prefix 195
- Preparations
 - before drawing 73
- Prerequisites 10
- Preview 22
- Print preview 230
- Printing 25,230
- Projections
 - first-angle projection 237
 - isometric 255
 - orthographic 236
 - third-angle projection 237
- Properties 166
- Property editor 166
- Proportional scaling 140

Q

- QCAD
 - application window 16
 - download 10

getting QCAD 10
web site 10

R

Radius dimension 191
Raster files 222
Rectangle 22,109
Rectangle with Size 110
Red circle 60
Redo 21
Reference 210
Reference points 130
 of dimensions 199
Relative Cartesian coordinates 48,60
Relative polar coordinates 48,61
Relative zero point 60,61
Remove block 219
Repetitive work 12
Requirements 10
Reset 21
Reverse 161
Right mouse button 22
Rotate 138
Rotate and counter-rotate 145
Rotational symmetry 12
Rounding 156,245

S

Save 22
Save as 22
Scale 140
 of a drawing 12
 printing 12
 proportional 140
Scripting
 automation with 12
Scroll bars 30
Select
 area 121,121
 closed shape 122
 connected entities 122
 contour 122
 deselect all 120
 deselect everything 120
 intersected 123
 invert selection 121
 layer 124
 polygon 121
 polygonal area 121
 rectangular area 121
 select all 120
 select everything 120
 window 121
Select invert 121
Selection 114,116
 advanced 119
 in neutral state 116
Selection tools 116
Shape

 polygon 112,112
 polygon (center, side) 112
 polygon (side, side) 112
 rectangle 109
 rectangle with size 110
Shape tools 109
Shorten 147,151
Show all layers 251
Side view 250
Snap
 auto 48,245
 center 48
 center of selection 48
 coordinate 48
 distance 48
 distance manual 48
 end 48
 free 48
 grid 22,48
 intersection 48
 intersection manual 48
 middle 24,48
 middle manual 48
 on entity 48
 orthogonal 48
 perpendicular 48
 polar coordinate 48
 reference 48
 selection center 48
 tangential 48
Snap tools 24,46
Snap Tools 47
Solid Fills 202
Spline tools 98
Split into equal parts 160
Stretching 152
Styles 38
SVG
 import 222
SVG Exports 227
Symbols 195

T

Tablet 10
Tangent 79,80,245
Target audience 8
Terminate tool 22
Text
 edit 161
Text of dimensions 182
Texts 176
Third-angle projection 237
Ticks 184
TIFF
 import 222
Tolerances 196
Toolbar
 lines 22
Toolbars
 CAD 19
Tools

Index

- arcs 84
- circles 90
- ellipses 96
- lines 73
- modification 125,135
- polylines 102
- shapes 109
- splines 98
- Tooltips 19,20
- Top view 243
- Total length 174
- Trim 147
 - polyline segments 107
 - when rounding corner 245
- Trim Both 150
- Trim Two 150

U

- Undo 21
- User interface
 - drawing area 17
 - menus 18

V

- Vertical dimension 188
- View
 - auto zoom 31
 - of an object 236
 - pan zoom 30
 - window zoom 31
 - zoom in 28
 - zoom out 28

W

- Wacom 10
- Width 39
- Window
 - application window 16
- Window zoom 31

X

- X-axis 58

Y

- Y-axis 58

Z

- Zero point
 - relative 60
- Zoom factor 30
- Zoom in 28