

# **ENGINEERING DRAWING**

## **SKKK 1021**

### **INTRODUCTION**

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# SURVEY

- **Do you have any basics in Engineering Drawing?**
- **Do you have any basics with CAD software?**
- **Do you know how to use computers?**

# LEARNING OUTCOMES

## INTRODUCTION TO ENG. DRAWING

*It is expected that students will be able to:*

- **Understand the basic theory of QCAD**
- **Draw using the QCAD software**



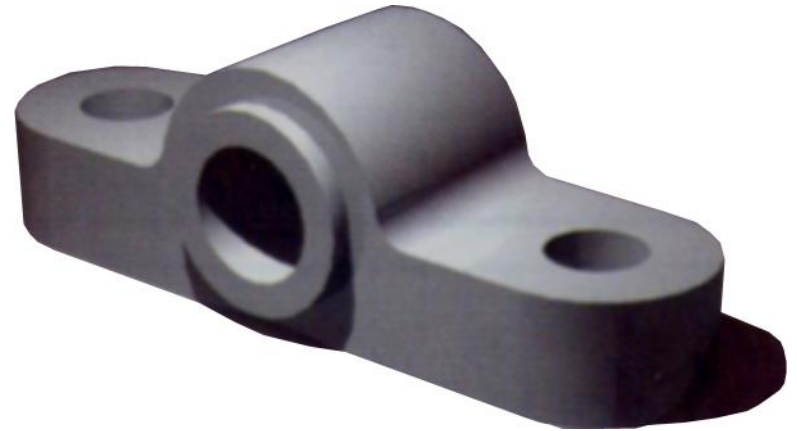
# INTRO TO ENG. DRAWING

- INTRODUCTION
- DRAWING TOOLS (QCAD SOFTWARE)
- BASIC THEORY OF QCAD
- STARTING THE QCAD
- COORDINATE SYSTEM
- QCAD COMMANDS
- EVALUATION/ASSESSMENT SYSTEM



# INTRODUCTION

1. Try to write a description of this object.
2. Test your written description by having someone attempt to make a sketch from your description.



*You can easily understand that ...*

The word languages are inadequate for describing the *size*, *shape* and *features* completely as well as concisely.

# INTRODUCTION (cont' d)

- The main purpose of engineering drawings is to **communicate** to other engineers, machinists, etc.
- Drawings do the communication best merely because *a picture is worth a thousand words*. Giving all of the **information needed** to make the product and being **accurate** in that information is the main goal.

# INTRODUCTION (cont' d)

- Accurately and **unambiguously** capture all the geometric features of a product or a component.
- The end goal of an engineering drawing is to convey all the required information that will allow a manufacturer to **produce that component.**

# INTRODUCTION (cont' d)

## Composition of Graphic Language

Graphic language in “engineering application” use *lines* to represent the *surfaces*, *edges* and *contours* of objects.

- The language is known as “*drawing*” or “*drafting*” .
- A drawing can be done using *freehand*, *instruments* or *computer* methods.



## DRAWING TOOLS (QCAD SOFTWARE)

- **CAD – Computer Aided Design**
- **Most man-made objects you see once started off as a drawing in a CAD program**
- **Drawings made in QCAD applications represent real-world objects in their exact original measures**
- **QCAD – simple 2D CAD system**
- **Everything you draw – projected on a plane**

# BASIC THEORY OF QCAD

- **ENTITIES**

- Entities are graphical objects in a CAD system.
- Typical entities which are supported by most CAD systems are: points, lines and circular and elliptical arcs.
- More complex and CAD specific entities include polylines, texts, dimensions, hatches and splines.

- **ATTRIBUTES**

- Every entity has certain attributes such as its color, line type and line width.

- **LAYERS**

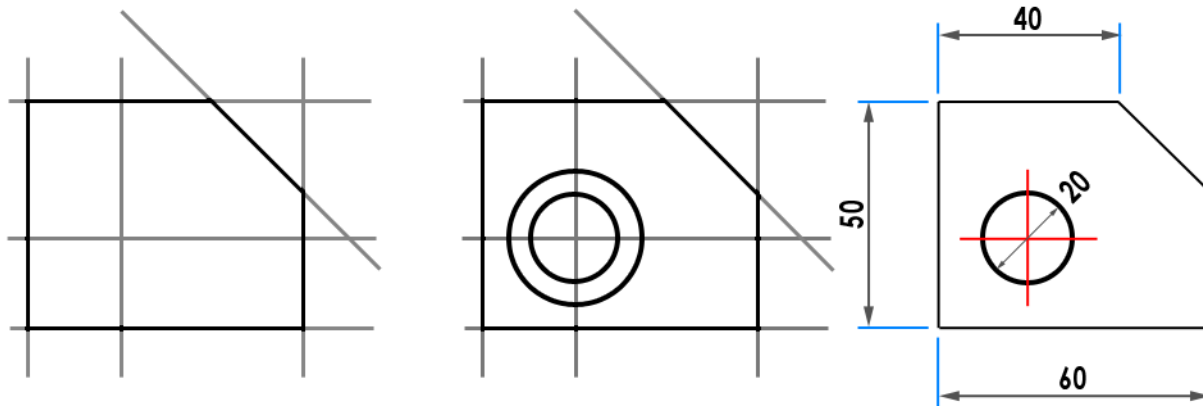
- A basic concept of computer aided drafting is the use of layers to organize and structure a drawing.
- Every entity of a drawing is on exactly one layer and each layer can contain any number of entities.
- Typically, all entities with a common 'function' or with common attributes are constructed on the same layer.

# BASIC THEORY OF QCAD (cont' d)

- Every layer has attributes (color, line width, line style) and the entities on a layer usually inherit their attributes from the layer they are placed on.
- **DRAFTING WITH CAD**
- In many ways, CAD is similar to traditional drafting. When drawing a plan or a view of an object on a paper, you would use tools such as a ruler to draw lines. CAD systems offer many tools to achieve the same goal.
- The big advantage of a CAD system is the fact that you can change every entity of your drawing easily after you have created it. This might be one of the more difficult things to learn when moving from paper to CAD.
- When working with a CAD system you will very often create lines that will not be on the final printout or which don't have the correct length and need to be trimmed later (see Figure 3).

# BASIC THEORY OF QCAD (cont' d)

- o A common mistake of CAD beginners is wanting to create the final drawing right away. Never hesitate to create an auxiliary construction if it helps you to define or verify a part of your drawing.



**Figure 3:** Three possible steps to quickly create a drawing using supportive constructions and the ability of a CAD system to change existing entities.

# STARTING THE QCAD

## USING WINDOWS OPERATING SYSTEMS

- Switch on your computer
- Go to  **start** > All Programs > QCAD or you can click to the  **qcad.exe** icon on the desktop to begin

# COORDINATE SYSTEM

- **ORIGIN**

- o The point where the X and Y axis cross each other.
- o The absolute point of the drawing

- **RELATIVE ZERO POINT**

- o Can be moved to any location by the user as a temporary reference for a local construction

# COORDINATE SYSTEM (cont' d)

- **CARTESIAN COORDINATES**
- ❖ Position of a point can be described by its distance from 2 axes, X and Y
- ❖ Usually written in a format: *x-ordinate, y-ordinate*
- ❖ Example: Coordinate 30, 40 is located 30 units to the right and 40 units to the top of the origin

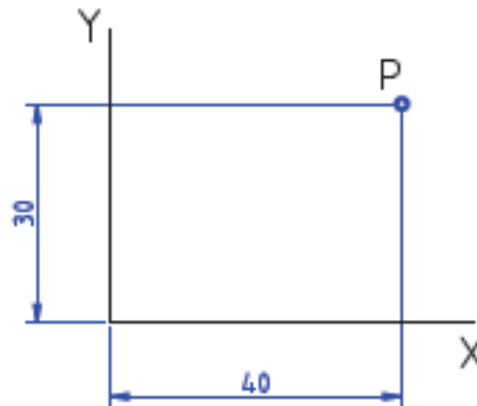


Figure 4: Absolute Cartesian coordinate 40,30.

# COORDINATE SYSTEM (cont' d)

- ❖ Can also originate in a position different from origin
- ❖ In QCAD the notation for this relative Cartesian coordinate: *@x-ordinate, y-ordinate*

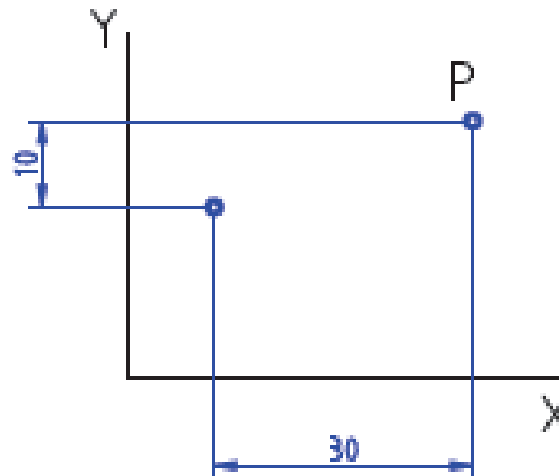


Figure 5: Relative Cartesian coordinate @30,10.



# COORDINATE SYSTEM (cont' d)

- **POLAR COORDINATES**

- ❖ Use a distance & an angle to describe the position of a point.
- ❖ The angle 0 – pointing right on your screen
- ❖ In QCAD, polar coordinates are noted in the format *distance<angle* and *@distance<angle*

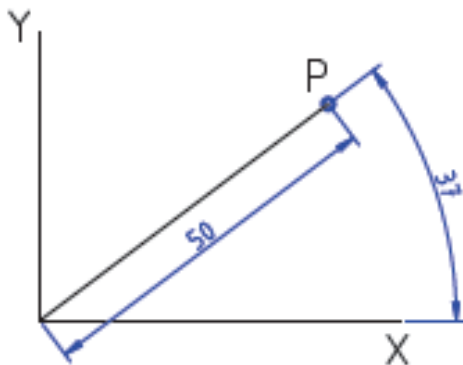


Figure 6: Absolute Polar coordinate 50<37.

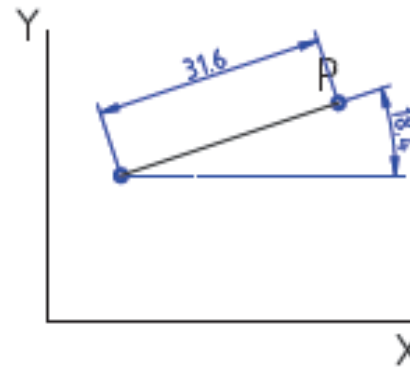


Figure 7: Relative Polar coordinate @31.6<18.4

# QCAD COMMANDS

## • USER INTERFACE

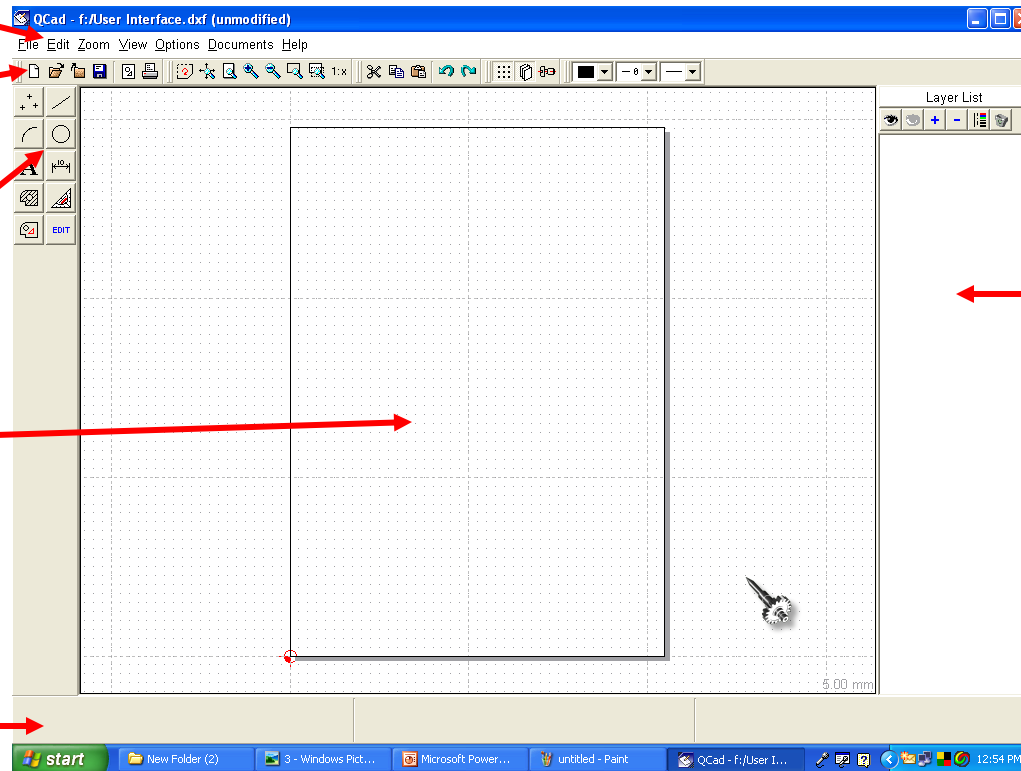
Menu bar

Toolbars

CAD Toolbar

Drawing Area

Status bar



Layer List

# QCAD COMMANDS (cont' d)

## • BASICS

### 4.1 Documents

QCAD can open more than one document. Use the menu "Documents" to switch between the different loaded documents.

### 4.2 Undo / Redo

You can undo most functions of QCAD. There are at least 200 undo steps available. Due to this, QCAD can slow-down if you've had a giant amount of objects and delete them. You can free the undo memory to get the maximum performance by saving the drawing.

### 4.3 Important Mouse Functions

QCAD uses the mouse for most operations. For the beginner it's important to know that the right mouse button is used for going back one step in the construction or manipulation process. When no process is active, **the right mouse button is used for going back to the last toolbar menu.**

### 4.4 Working With Drawing Versions

QCAD supports at least 200 undo steps. This means you can take back the last 200 actions you've made with the drawing. However, if you save the drawing, the undo information gets deleted. For that reason I recommend to work with different drawing versions. Whenever your drawing reaches a usable state or you decide to make major changes on the drawing, save the drawing under a new name. This way you can go back to a previous version when something goes wrong with the new manipulations.

### 4.5 Working With Layers

To work with layers can save you a lot of time. I recommend to use different layers at least for the contours, dimensionings, auxiliary objects and the border of the drawing. Objects on the same layer can get modified together as the selecting of a whole layer is much easier than selecting all the single objects on it. Please refer also to the chapter [Working With Layers](#) for more information.

# QCAD COMMANDS (cont' d)

## 4.6 Zero Points

There are two different zero points in Qcad: The absolute and the relative zero point. The bigger one is the absolute zero point. It stays at the same place unless you move it using the editing function. The relative zero point moves always to the last used construction or reference point. This can be very useful - imagine that you want to draw a line from point (70/60) with an angle of 30° and a length of 50. To do this, you can click or type the first point and then choose the angular positioning function, activate the relative mode and type the angle (30) and the distance (50). During the whole procedure there's no need to move the relative zero manually as it moves to the first point of the line as soon as you've defined it.

## 4.7 Snapping Functions


Another very important feature of a CAD system are the snapping functions. If you want to draw a line from the endpoint of an arc to a grid point, you can simply activate the desired snap function and then click somewhere in the region where the point you want to catch is. A small red circle shows you the exact position of the point while you're moving the mouse cursor. Due to the inaccuracy of computer monitors, drawings may look incorrect, but if you've used snapping functions you can be sure that it is correct. The snapping functions are documented in chapter [Snapping Functions](#).

## 4.8 Input Fields

There are many input fields in Qcad which expect values. You can type plain values in them like "1.25" or as well mathematical expressions like "2.5/2" or "sin(15)\*4". The expression parser also recognizes "pi" and "e" as constants.

In other input fields you can type any string you like (for example if you construct a text or specify the label for a dimension object). In these text boxes you can also enter special characters by using the following key combinations:

Character	Key Combination
° (Degree)	Ctrl + Shift + D
⌀ (Diameter)	Ctrl + Shift + O
μ (Mycro)	Ctrl + Shift + U
± (Plus/minus)	Ctrl + Shift + "+"
&divide; (Division)	Ctrl + Shift + "."



# QCAD COMMANDS (cont' d)

- **FILE HANDLING**

- **Creating new files**
- **Opening existing files**
- **Saving Drawings with a new name**
- **Saving drawings**
- **Closing loaded drawings**

# QCAD COMMANDS (cont' d)

## • VIEWING DRAWING

### 6.1 Redrawing

**Menu:** Zoom - Redraw

**Hot key:** R

This function will redraw the current view. This can be useful if the drawing looks "damaged" after deleting objects or using the undo function.



### 6.2 Autozoom

**Menu:** Zoom - Autozoom

**Hot key:** A

Use this to show the drawing with all objects visible.



### 6.3 Increasing The Viewing Factor

**Zoom - Increase**

**Hot key:** +

Click to increase the zoom by factor 1.5.



### 6.4 Decreasing The Viewing Factor

**Zoom - Decrease**

**Hot key:** -

Click to decrease the zoom by factor 1.5.



### 6.5 Show A Range

**Zoom - Window**

**Hot key:** W

After choosing this function, you can specify a range to view. Click the first edge of the range, drag to the second edge and release the mouse button there.



### 6.6 Pan Zoom

**Zoom - Pan**

**Hot key:** Shift-P

Use the pan zoom to move the current range. After choosing the function you can set the new center of the view.



### 6.7 Selection Zoom

**Zoom - Tagged**

**Hot key:** -

This function is similar to the auto zoom function. The only difference is, that it zooms only to the tagged objects (selection) of the drawing.



# QCAD COMMANDS (cont' d)

## • WORKING WITH LAYERS

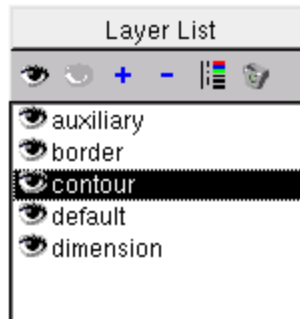


Fig. 3: The layer list shows the layers of the current drawing.

I recommend to use layers for your drawing. If you put different parts of the drawing on different layers you can do the same action (e.g. moving) with those objects much faster. Further, it's possible to hide some layers for shortening the refresh process and getting a clearer overview of the drawing.

If you create new objects, they get constructed on the current layer. The current layer is the one which you've clicked at last. It's highlighted with black background and white text. If no layer is selected, the current layer is layer "default".

### 8.1 Layer Attributes

Layers have default attributes for the elements created on them. You can speed up your work much if you create different layers for the contour, auxiliary lines, hatches, texts and dimensions. For example you might want to create a layer "CONTOUR" with a line width of 2, Black color and the line style "solid". Further you can create a layer "AUXILIARY" with a line width of 1, Red color and the line style "dash-dotted". During construction you can just switch the layer "AUXILIARY" if you want to create an auxiliary line and switch it back to contour to proceed drawing a contour.

### 8.2 Showing / Hiding The Layer List



Click this button in the toolbar at the top or choose the menu "View" -> "Show layer list" to show the layer list or hide it, if it's already visible. The layer list offers some tools and of course it shows a list of all layers in the drawing. You can show / hide a single layer by double-clicking on its name.

### 8.3 Showing All Layers



Click to show all layers of the drawing.

# QCAD COMMANDS (cont' d)

## 8.4 Hiding All Layers



Click to hide all layers of the drawing.

## 8.5 Adding A Layer



You can add new layers to the drawing with this function. The appearing dialog allows you to choose a name for the new layer and to define the default attributes for the objects on the layer.

## 8.6 Removing Layers



This will remove the current (selected) layer. If there are objects on the current layer, you get asked if you're sure that you want to delete all these objects on it.

**Note:** You can't undo this function.

## 8.7 Changing Layer Attributes



Select the Layer, you want to rename or change its attributes and click this button. The same dialog appears as if you add new layers. You can change the attributes and type a new name for the layer.

## 8.8 Removing Empty Layers



This function is provided for convenience. It allows you to remove all empty layers of the drawing. **Note:** Layers may look empty but don't get removed because they contain deleted objects in the undo memory. You can still delete these layers with the remove function.



# QCAD COMMANDS (cont' d)

## • CREATING OBJECTS

### 9.1 Creating Points



Click this button from the toolbar to show the "Points" toolbar.

#### 9.1.1 Creating Single Points



Use this tool to create points in the drawing.

### 9.2 Creating Lines



Click this button from the toolbar to show the "Lines" toolbar.

#### 9.2.1 Creating Lines



Create lines by clicking the start point and the endpoint.

#### 9.2.2 Creating Lines With Given Angles



Create lines by typing the angle and clicking the position. The line gets constructed on to the borders of the screen. This is thought for later trimming.

#### 9.2.3 Creating Horizontal Lines



This tool draws horizontal lines on to the borders of the screen. Trim the lines to the desired length afterwards.

#### 9.2.4 Creating Vertical Lines



The same as horizontal lines just vertical.

#### 9.2.5 Creating Rectangles

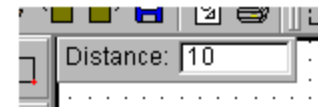


Create rectangles by clicking two diagonal edges.

#### 9.2.6 Creating Parallels



Create lines parallel to existing lines. You can specify the distance in the box appearing at the top left of the window.



This tool works for arcs and circles as well.

# QCAD COMMANDS (cont' d)

## 9.2.7 Creating Bisectors



Create lines in the half angle between two existing lines. You can specify the length in the box appearing at the top left of the window.



The bisector appears between the two lines and at the same side of the lines where the mouse cursor was located while clicking the objects.

## 9.2.8 Creating Tangents From Points To Circles



Choose the point and then the circle or arc. The tangent gets drawn to the circle. As there are two possibilities, the one is drawn, which is next to the mouse cursor while clicking the circle.

## 9.2.9 Creating Tangents From Circles To Circles



Choose the circles. The tangent gets drawn between the circles. As there are four possibilities, the one is drawn, which is next to the mouse cursor while clicking the second circle.

## 9.2.10 Creating Orthogonal Lines

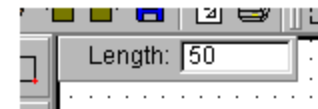


Choose the base element and set the position. A line gets created perpendicular to the base element.

## 9.2.11 Creating Lines With Relative Angles



Choose the base element, type an angle and set the position.



A line gets created with the given relative angle to the base element.

## 9.3 Creating Arcs



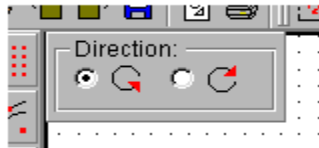
Click this button from the toolbar to show the "Lines" toolbar.

### 9.3.1 Creating Arcs (C,P,A)



This can be used to draw arcs with a given center, circle line and the start / end angles. Click the center, a point on the circle line and then a point on the imaginary line from the center to the start point of the arc and a point on the imaginary line from the center to the end point of the arc. During one of these operations you can choose the direction of the arc in the box appearing at the top left of the window:

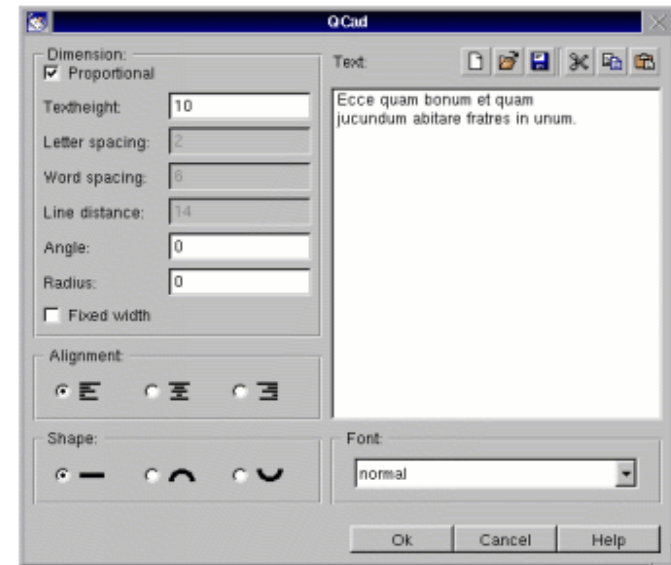
# QCAD COMMANDS (cont' d)



Click this button from the toolbar to create texts.



The text dialog box appears:



Tick the "Proportional" check box to automatically adjust the values "Letter spacing", "Word spacing" and "Line distance" to the "Textheight". If you don't tick "Proportional" you can adjust these values individually.

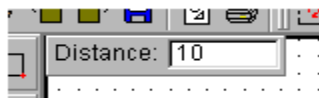
You can create texts with a fixed letter width by ticking the check box "Fixed width". This can be useful for inserting ASCII files which are formatted with spaces (lists, tables). For such purposes it's recommended to use the font "courier".

## 9.3.2 Creating Arcs (SP,P,EP)

With this tool you can create arcs with three points given: The start point a point somewhere between on the arc and the endpoint. Click the start point first, then a point between and at last the endpoint.

## 9.3.3 Creating Parallel Arcs

Create arcs parallel to existing ones. You can type the distance of the arc in the box appearing at the top left of the window.



This tool works for lines as well.

## 9.4 Creating Circles

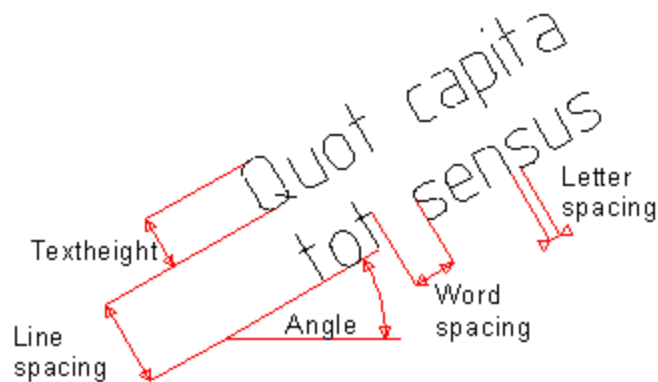
Click this button from the toolbar to show the "Circles" toolbar.

### 9.4.1 Creating Circles

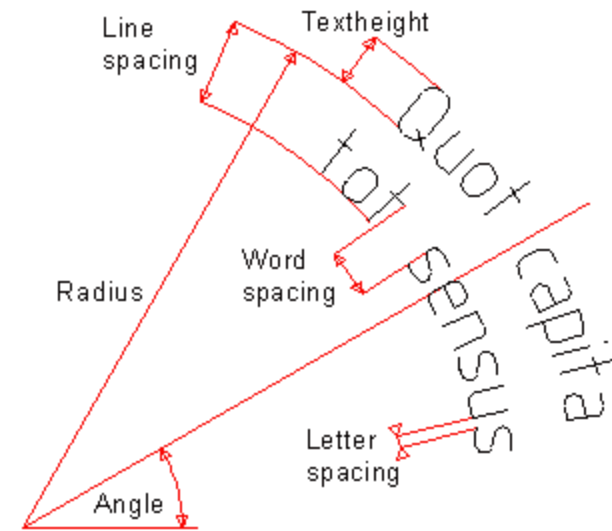
Create circles with a given center and a point on the circle line. Click the center and then the point on the circle line.

# QCAD COMMANDS (cont' d)

Type the values for "Textheight", "Letter spacing", "Word spacing", "Line distance", "Angle" and "Radius". The following sketches give you an idea about the meaning of these parameters:



**Fig. 4:** Parameters for straight texts.



**Fig. 5:** Parameters for rounded texts.

Choose the alignment and the text shape by clicking on the icons to activate the radio buttons. The following table gives you an overview of the possible combinations:

# QCAD COMMANDS (cont' d)

Choose the alignment and the text shape by clicking on the icons to activate the radio buttons. The following table gives you an overview of possible combinations:

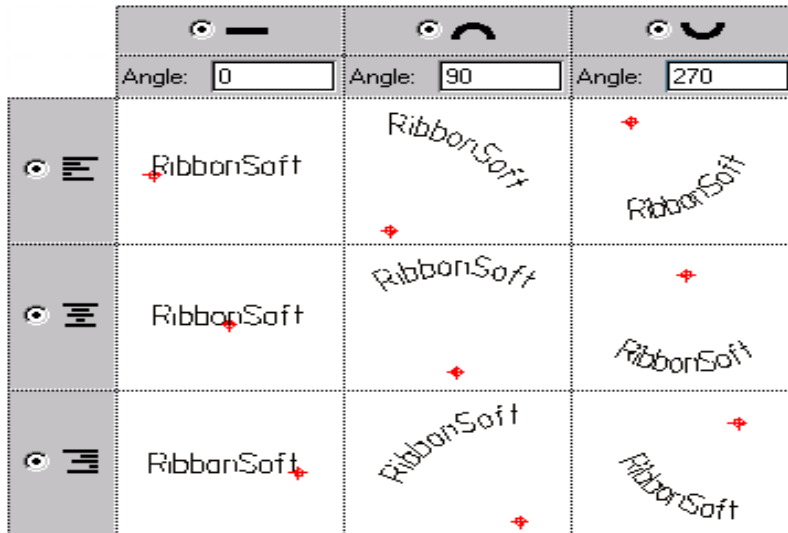








Fig. 6: The different text shapes.

Type the text in the text area or load an existing text field into the area. You can also paste a text which you have copied in another application.

There are some other functions available for the text area in the text dialog:

-  Click to erase the text area.
-  Click to open an existing file into the text area.
-  Click to save the current text into a file.
-  Click to cut the selected text to the clipboard.
-  Click to copy the selected text to the clipboard.
-  Click to paste the text on the clipboard to the text area.

## Creating Your Own Fonts

QCAD allows you to create your own fonts or change the existing fonts. You may for example be interested to add letters you're missing to a font.

Choose a font from the "Font" combo box. Possible fonts are:

ISO normal    *normal*

ISO cursive    *cursive*

Courier    *courier*

# QCAD COMMANDS (cont' d)

## 9.6 Creating Dimensions

### 9.6.1 The dimension options panel

Most dimensioning tools show a panel at the top left of the graphic window. This panel allows you to configure the label of the current dimension.

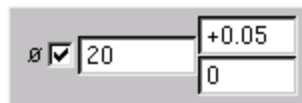


Fig. 7: The dimension panel is used for adjusting the dimension's label.

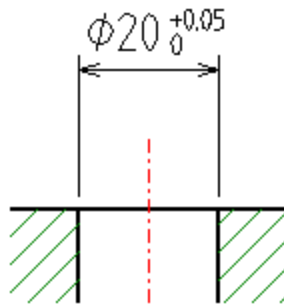


Fig. 8: A dimension created with the settings shown above.

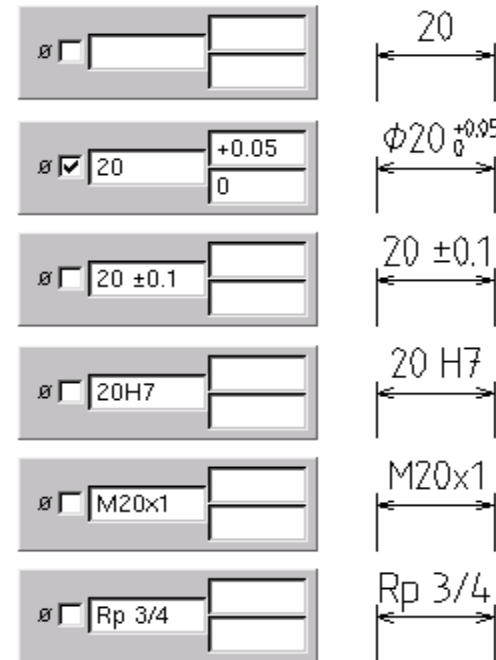


Fig. 9: Some more examples for dimensioning labels.



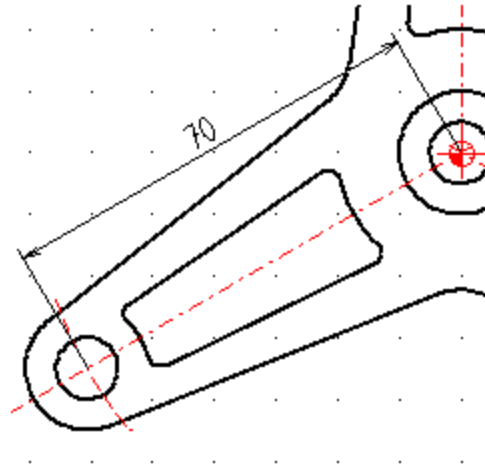
Click this button from the toolbar to show the "Dimensions" toolbar.

### 9.6.2 Creating Aligning Dimensions



This tool will create a dimension which is parallel to an imaginary line between two given points. The extension lines are drawn to the two points.

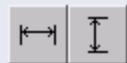
# QCAD COMMANDS (cont' d)



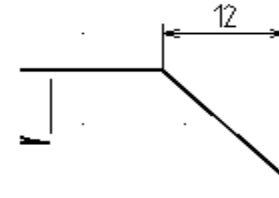
**Fig. 10:** For this example, the two center points of the circles were chosen as references.

After setting the reference points, you must also set the location of the dimension line.

## 9.6.3 Creating Horizontal / Vertical Dimensions



These often used dimensioning tools allows you to create horizontal / vertical dimensions. The two reference points don't have to be on the same horizontal / vertical line.



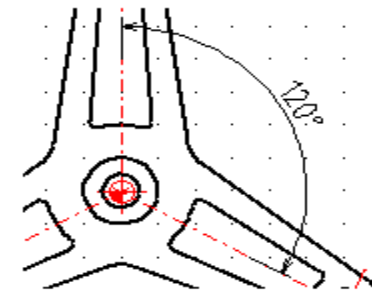
**Fig. 11:** The reference points for this dimension are the endpoints of the bevel.

## 9.6.4 Creating Angle Dimensions



With this tool, it's possible to create angle dimensions between two lines. If you need to dimension an angle but don't have two lines, I recommend to construct two auxiliary lines first. You can delete these lines after doing the dimensioning, if you like.

First you have to click the two lines which define the angle (counter-clockwise). Then you can set the dimensioning line location and afterwards the endpoints of the extension lines.



**Fig. 12:** A typical angle dimension.

# QCAD COMMANDS (cont' d)

## 9.6.5 Creating Diameter Dimensions



For dimensioning diameters of circles, you can use this tool. Simply click the circle, set the angle and the location of the dimension line.

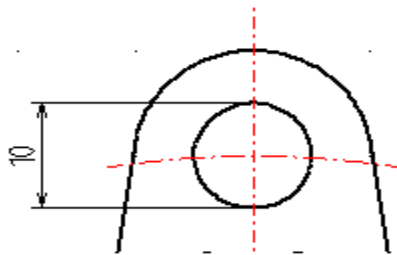


Fig. 13: Diameter dimension.

## 9.6.6 Creating Radius Dimensions



Click the angle or circle and set the location of the dimension endpoint respectively the position of the measuring text.

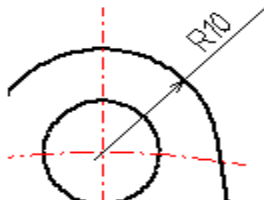


Fig. 14: Radius dimension.

## 9.6.7 Creating Arrows



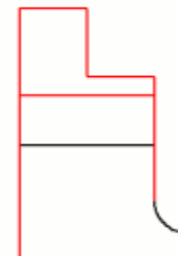
This tool allows you to draw arrows by defining the start and the end point. The second point is the point where the arrow appears. The arrow gets drawn without any text besides.

## 9.7 Creating Hatches

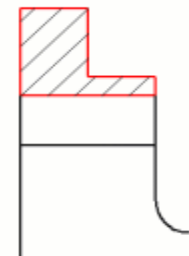


After choosing this function you must select the elements of one or more **closed** contours. The elements should be connected properly. Otherwise the result is undefined. If you select two overlapping contours, however, every other area gets hatched. Qcad currently can't hatch contours given by not connected but intersected bounding objects. Please cut these objects at the edges and select only the closed contour then, like shown in the figure below.

False:



Right:



If you've chosen the contours, click the arrow button at the bottom of the selecting toolbar. The hatching dialog box appears:



# QCAD COMMANDS (cont' d)



In the left combobox, you can choose a pattern and in the right one the factor for the pattern. Currently there are these patterns available as defaults:



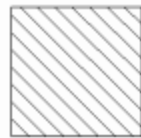
0



45



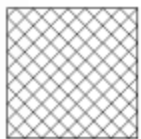
90



135



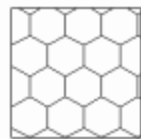
concrete



plastic



sand



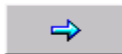
honeycomb

# QCAD COMMANDS (cont' d)

## • TRANSFORMING OBJECTS

Click this button to show the transforming tools of QCad.

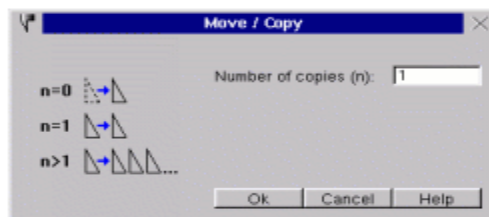
For some transforming functions you must select the objects which you want to transform. QCad offers various different methods for selecting objects. If a transforming function needs selected object, you have the possibility to change the current selection as a first step of the transforming function. After selecting the objects, click this button to proceed with the transforming function:



However, you can always change the selection without calling a transforming function but by choosing the according menu button. Please refer to chapter [Selecting Objects](#) for further information.

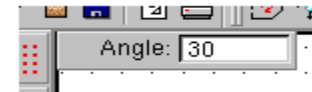
### 10.1 Moving / Copying Objects

Select the objects which you want to move. Set the reference point and afterwards the target point. The following dialog appears:



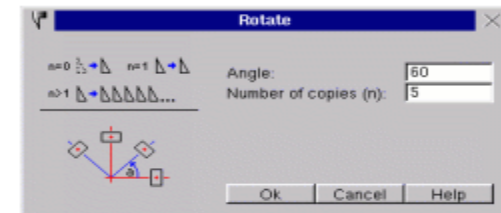
Type the number of copies or type "0" for moving the objects.

**Hint:** You can rotate the object which are moving directly around the reference point by typing the rotation angle in the appearing box at the top left of the graphic:



### 10.2 Rotating Objects

Select the objects which you want to rotate. Set the center point of the rotation. The following dialog appears:

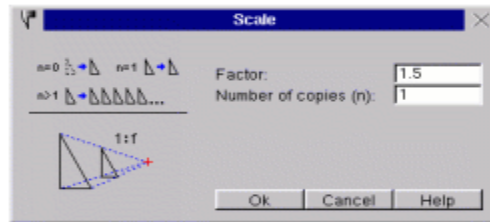


Type the rotating angle and the number of copies or type "0" for moving the objects.

### 10.3 Scaling Objects

Select the objects which you want to scale. Set the reference point. The following dialog appears:

# QCAD COMMANDS (cont' d)

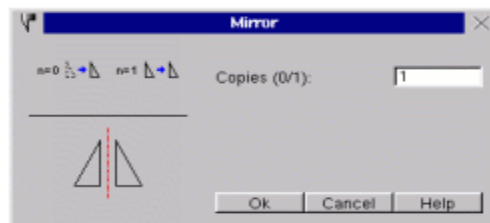


Type the number of copies or type "0" for moving the objects.

## 10.4 Mirroring Objects



Select the objects which you want to mirror. Set the start point and the endpoint of the mirroring line. The following dialog appears:



Type "1" for copying the objects to the number of copies or type "0" for moving the objects.

## 10.5 Moving And Rotating Objects



This tool allows you to move and rotate objects in one step. The objects get moved by a given amount and rotated by a given angle. For example, if you move an object 50mm to the right and give an angle of 30 degrees, the first copy at the position 50mm at the right of the original object gets rotated by an angle of 30 degrees while the second gets rotated by 60 degrees and so on.

Select the objects which you want to move and rotate. Set the reference point for the movement. Click the reference point for the rotation. This point moves with the movement of the objects. It is relative. Set the target point for the movement. The following dialog appears:



Type the angle for the rotation and the number of copies in the dialog box.

# QCAD COMMANDS (cont' d)

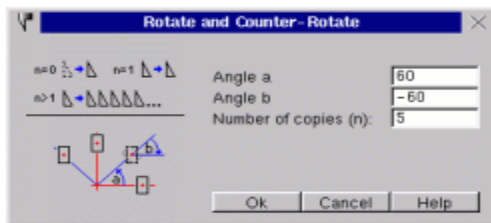


**Fig. 15:** For this example, the center of the contour was taken as reference point for the moving and the rotation. The rotating angle is  $10^\circ$  and the number of copies 4.

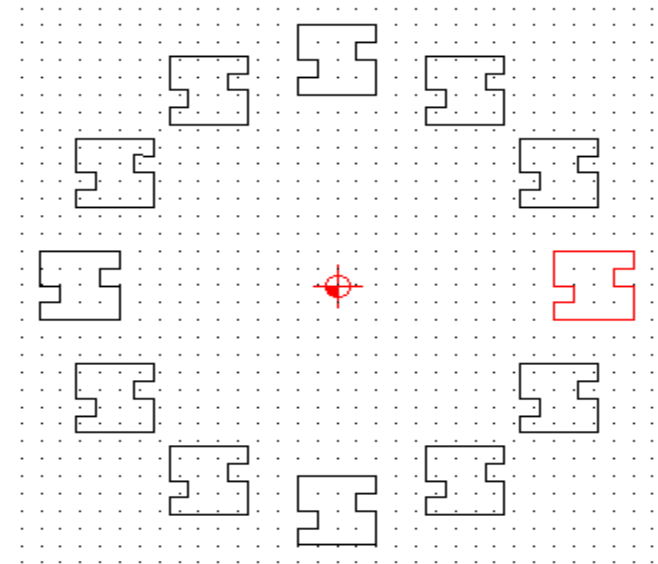
## 10.6 Rotating Objects Around Two Centers

This tool allows you to rotate objects around two centers in one step. The objects get rotated by a given angle and the result of this rotation gets rotated around another center. For example: If you rotate an object by 60 degrees counter-clockwise around an absolute center and rotate it by  $-60$  degrees around a relative center, the result is an object which moves around the absolute center but holds its direction.

Select the objects which you want to rotate. Set the reference point for the absolute rotation. Click the reference point for the relative rotation. This point rotates with the rotation of the objects around the absolute reference point. The following dialog appears:



Type the angle for the two rotations and the number of copies.



**Fig. 16:** For this example, the absolute zero was taken as reference point of the absolute rotation. The center of the contour was taken as reference point for the relative rotation. The rotating angle a is  $30^\circ$ , the rotating angle b  $-30^\circ$  and the number of copies is 11.

## 10.7 Trimming Objects



Click the object which you want to trim on the part which should be still visible after trimming. Click the object where you want the other object to trim to. If there are more than one possibilities, the one which has its intersection next to the current position of the mouse cursor is taken.

# QCAD COMMANDS (cont' d)

## 10.8 Trimming Two Objects



Click the first object which you want to trim. Click it on the part which should be still visible after trimming. Click the second object which you want to trim. The first object gets trimmed to the second and vice versa. If there are more than one possibilities, the one which has its intersection next to the current position of the mouse cursor is taken.

## 10.9 Trimming Objects By A Given Amount



Type the trimming amount in the panel at the top left of the drawing window. Click the element which you like to trim near the end you wish to change. Positive values will make the element longer, negative ones shorter.

## 10.10 Dividing Objects



Click the object which you want to divide into two parts. Click the cutting point. It must be on the chosen object.

## 10.11 Stretching Contours



Stretching means moving all endpoints in a given range. This can be very useful if a length of a contour should be changed.

Click the two edges of the range in a way that all endpoints of the stretching part are inside the range. Click the reference point for the moving and afterwards the target point.

## 10.12 Rounding Corners



Type the radius of the rounding in the box shown at the top left of the drawing view and chose if you want to trim the corner objects or not:



Click the first object of the corner at the part which should stay after trimming. This may be a line or an arc. Click the second object of the corner. As there are more than one possibilities to do the rounding now, you must choose the rounding by clicking a position next to the one you need.

**Note:** Circles can be rounded to other objects but they don't get trimmed.

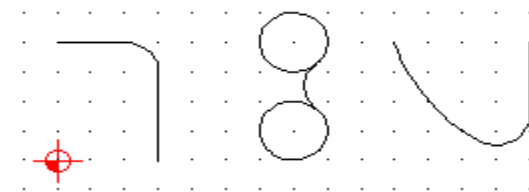


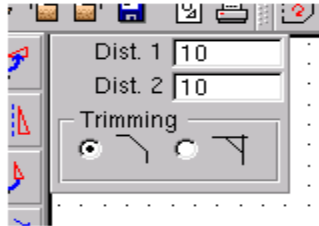
Fig. 19: Some different rounding possibilities.

## 10.13 Beveling Corners



Type the two beveling distances in the box shown at the top left of the drawing view and chose if you want to trim the corner objects or not:

# QCAD COMMANDS (cont' d)



Click the first object of the corner at the part which should stay after trimming. This may be a line or an arc. Click the second object of the corner.

## 10.17 Moving The Layer Of Objects



Select the objects to move to an other layer. A dialog box appears with a combo box. Choose an existing layer or type a name for a new layer.

## 10.18 Moving The Zero Point



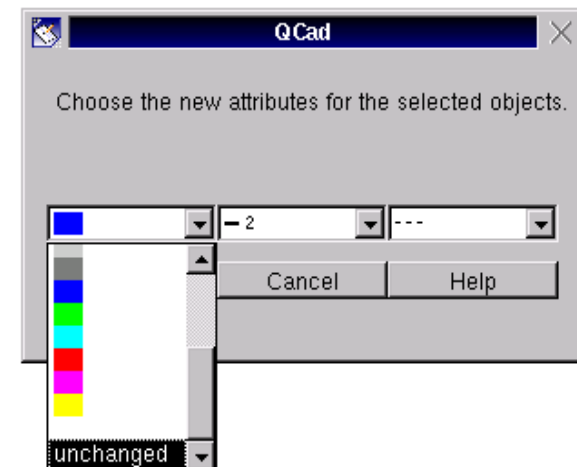
Click the new position of the zero point.

## 10.19 Changing Attributes



This function changes the attributes of objects. Attributes are the line width, color and style.

Choose the objects. The following dialog box appears:



## 10.14 Converting Texts To Objects



This function is provided for a better compatibility of the DXF file format. If you have troubles importing texts in DXF files produced with QCad into an other program, try to convert the texts in your drawing to single objects with this function. **Note:** Texts which are converted to objects can't get changed in the text editor anymore. After the conversion they appear like they were constructed using lines and arcs.

To use the function, simply select the text objects which you want to convert. Selected objects which are no texts don't get changed.

## 10.15 Editing Existing Texts



Use this tool to change existing texts in the graphic. You can change the contents as well as the shape, the attributes and the alignment. Click the texts you want to change.

## 10.16 Deleting Objects

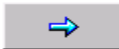


Select the objects which you want to delete.


# QCAD COMMANDS (cont' d)

## • SELECTING OBJECTS

For some editing functions, you must select the objects which you want to use for the action. QCad offers many powerful selecting tools. You can use all of them for one selection and proceed with the editing function afterwards by clicking on the "Enough" button:




### 11.1 Deselecting All Objects




Click to deselect all objects of the drawing.

### 11.2 Selecting All Objects




Click to select all objects of the drawing.

### 11.3 Selecting Single Objects




Choose this tool to select single objects by clicking on them. If the object you click is already selected, the object gets deselected.

### 11.4 Selecting Closed Contours




This tool makes it easy to select closed contours. Click an object of the contour and the whole contour gets selected. If the object you click is already selected, the contour gets deselected.

### 11.5 Deselecting Rectangular Areas




Click the two corners of the area. All objects which are **completely** inside the area get deselected.

### 11.6 Selecting Rectangular Areas




Click the two corners of the area. All objects which are **completely** inside the area get selected.

### 11.7 Deselecting Intersected Objects




After choosing this tool you must click the start and the endpoint of a line. All objects intersected by this line get deselected.

### 11.8 Selecting Intersected Objects




After choosing this tool you must click the start and the endpoint of a line. All objects intersected by this line get selected.

### 11.9 Inverting The Selection




This will invert the current selection.

### 11.10 Selecting Layers



Click to select whole layers. The layer of the object you click gets selected. If the object you click is already selected, the layer gets deselected.

### 11.11 Selecting Double Objects



This selects all objects which exist twice in the drawing. You can use this function to delete double objects from the drawing. If a line goes from point A to point B and another from point B to point A, one line gets selected.

# QCAD COMMANDS (cont' d)

## • SNAPPING FUNCTIONS

### 12.1 Free Positioning

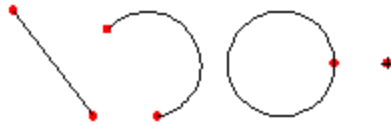
Click to switch off all snapping functions.

### 12.2 Snapping To Grid Points

Click to snap to grid points.

### 12.3 Snapping To Endpoints

Click to snap to endpoints.



### 12.4 Snapping To Center Points

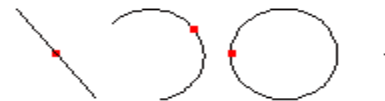
Click to snap to center points.



### 12.5 Snapping To Middle Points



Click to snap to middle points.



### 12.6 Snapping To Intersections (A)

Click to snap automatically to visible intersection points.



### 12.7 Snapping To Intersections (M)

Click to snap manually to intersection points. With this function you can snap invisible intersections; that means that the intersection can be outside of the objects.



To define the point, you must click both objects which are part of the intersection.



# QCAD COMMANDS (cont' d)

## 12.8 Snapping To Distance Points



Click to snap to points with a given distance to the endpoint.



An input panel appears at the top left of the graphic view. Type the distance there.

## 12.9 Snapping To Points On Objects



Click to snap to the closest point on an object.



## 12.10 Inputting Cartesian Coordinates



Click to define the coordinate by keyboard. An input panel appears at the top left of the graphic view. Type the x and the y value to specify the coordinate. You can also choose if the reference point is absolute or relative.

# QCAD COMMANDS (cont' d)

## • MEASURING FUNCTIONS



Click this button to show the measuring tools of Qcad.

Measuring functions are thought for getting information from the drawing. The results of each function are shown in the right part of the status panel at the bottom of the application window.

### 13.1 Distance Between Two Points



Click to measure the distance between two points.

### 13.2 Distance Between A Line And A Point



Click to measure the distance between a point and a line or arc.

### 13.3 Distance Between Two Lines



Click to measure the distance between two lines. The lines must be parallel.

### 13.4 Angle Between Two Lines



Click to measure the angle between two lines. The lines must not be parallel.

### 13.5 Coordinates



Click to list the coordinates of an element. The coordinates are shown in a dialog after choosing an element. You can also change the coordinates and edit the element this way.

# EVALUATION/ASSESSMENT SYSTEM

- **COMPLETION OF THE DRAWING**
  - ✓ Incomplete
  - ✓ Complete with a number of errors
- **SMOOTHNESS & TIDINESS OF THE DRAWING**
  - ✓ If lines are not connected as it should be
  - ✓ Wrongly drawn circles or intersections
- **DECEPTION**
  - ✓ Cheating, copying, exchanging works, making noise/disturbance in class
  - ✓ All work submitted must be your own.

# THANK YOU !!!

**END  
OF  
CHAPTER 1**

