

## Object Manipulation Tools

The object manipulation tools are used for scaling, rotation, and mirroring of objects, adding and deleting vertices, and cutting and filleting objects.

### The Scale Tool

The Scale tool is used to resize objects or groups of objects by a percentage amount. This can be done either proportionally (same scale factor in all axis) or non-proportionally (different scale factor in each of the axis).

An entire object can be scaled, or portions of an object can be scaled, depending on what exactly is selected. If only two vertices of a particular object are selected (not just visible) then those vertices and the adjoining splines will be the only things that will be scaled. If the entire object is selected, the whole thing will be scaled.

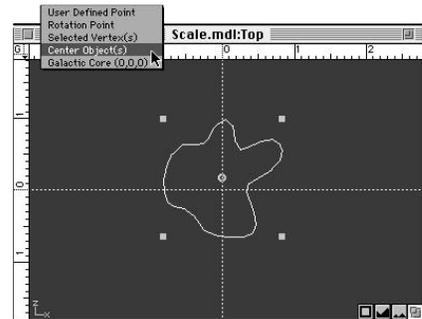
In all cases, the selected object(s) are scaled with reference to an anchor point. This user-defined point is fixed in space, and the rest of the object resizes about it. You can drag the object with the mouse to resize it, watching the graphic feedback on the screen, or enter a value for increment percentage in the Tool Info bar to control the scaling process numerically.

The Scale tool operates only in the Orthogonal view windows. It has no effect when used in the Angled View Window.

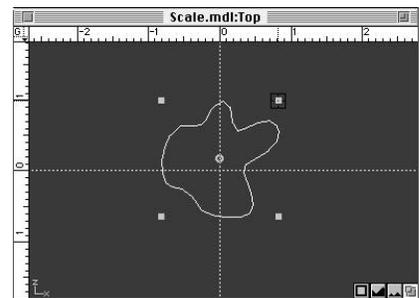
#### Using the Scale tool

- 1) Select the items you want to scale, whether they are individual vertices, complete objects, or groups of objects.
- 2) Choose the Scale tool from the Tool palette.
- 3) Indicate an anchor point by selecting a choice from the pop-up menu of anchor options that appears in the Tool Info bar. After having made a choice here, a small circle will appear on the screen to indicate where the anchor point is.
- 4) Grab a selected point(s) of the object(s) and drag that point to a new location to resize the object.

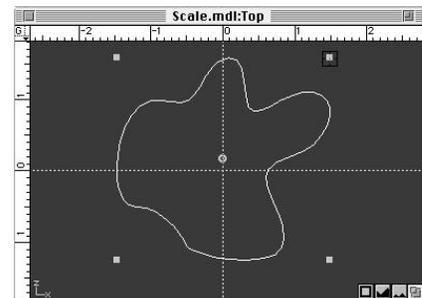
Objects or vertices that are visible will not be scaled. They must be selected.



Indicate anchor point.



Grab point on object.



Drag to desired scale.

### To intuitively scale an object (as a whole) proportionally

- 1) Select the Object (use **⌘**-Option). The bounding box corners will show.
- 2) Select the Scale tool and determine the Anchor point, then click-drag the upper-right (or lower-left) bounding box corner while holding the Shift key.

### To intuitively scale an object (as a whole) in one dimension

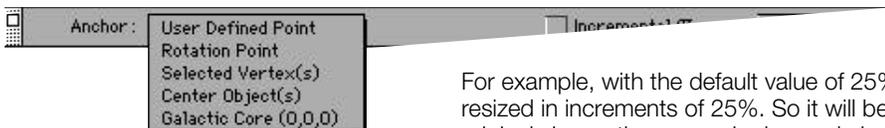
- 1) Select the Object (use **⌘**-Option). The bounding box corners will show.
- 2) Select the Scale tool and determine the Anchor point, then click-drag the upper-left (or lower-right) bounding box corner while holding the Shift key.

**Note:** The snap modes work with this anchor-point-defining click. To snap the anchor point to a vertex of an object, click on the Vertex option in the snap palette or hit the "V" key on the keyboard, and then click near the desired vertex of the object..

### Scale Tool with Increment Option

- 1) Select the items you want to scale, whether they are individual vertices, complete objects, or groups of objects.
- 2) Choose the Scale tool from the Tool palette.
- 3) Indicate an anchor point by selecting a choice from the pop-up menu of anchor options that appears in the Tool Info palette. After having made a choice here, a small circle will appear on the screen to indicate where the anchor point is.
- 4) Click on the check box next to the word "Incremental %" in the Tool Info bar to indicate that you want to use the value that appears in the associated data field.
- 5) Enter a value for Incremental % if you want.
- 6) Grab another point of the object(s) and drag that point to a new location to resize the object.

The number that appears here fixes the percentage by which the object(s) will scale up or down. It acts as a multiplier, which is to say that ModelPro will scale the object by integer multiples of the value.



Scale Tool Info palette

For example, with the default value of 25%, ModelPro will allow the object to be resized in increments of 25%. So it will be resized to 75%, 50% or 25% of its original size as the mouse is dragged closer to the anchor point. And, of course, it will be resized to 125%, 150%, 175%, and so on as the mouse is dragged away from the anchor point.

Another example: If you want to scale an object to exactly 41.8% of it's previous size, simply enter that value into the Incremental % data box and make sure the check box has an "X" in it. Then when you resize the object, the first scaling increment that it jumps to will be exactly 41.8%. Release the mouse to finish.

### Understanding Anchor Options

**Free Origin Point:** This option allows the user to click a specific location that is to be used as an anchor. When using this option, the steps for using the Scale tool are as follows:

- 1) Select the item(s) you want to scale.
- 2) Choose the Scale tool from the Tool palette.
- 3) Indicate an anchor point by clicking on the screen where you want the anchor point to be. A small circle will appear on the screen to indicate where the anchor point is.
- 4) Grab another point of the object(s) and drag that point to a new location to resize the object.

**Rotation Point:** Every object created in ModelPro has a Rotation Point automatically defined as one of its attributes. By default, the Rotation Point is automatically defined to be at the center of the object. But the user has the option to change this at any time. (This is done by double-clicking on the object and changing the values for Rotation Point in the resulting dialog box.) So, when this option is picked to define the anchor point for the Scale tool, the anchor point will go to the current Rotation Point for that object or group.

**Selected Vertices:** It is possible to want to scale only certain vertices of an object. That is to say, some of the vertices are selected, but the entire object as a whole is not selected. If this option is picked, the geometric center of all the selected vertices will be used as the anchor point.

**Center Object(s):** When this option is picked, the geometric center of all the selected geometry will be used as the anchor point.

**Galactic Core (0,0,0):** In this case, the absolute origin of the workspace will be used as the Anchor point.

**Marker 1:** When you have defined one or more markers in the model space, they will appear in the pop-up list. You can select one of them from this list and that point will automatically be designated by ModelPro as the anchor point for the scaling operation.

### Other Scale Tool Functions

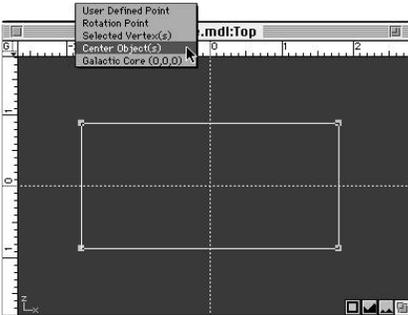
If you hold the Shift key while dragging a point on the object(s) to resize it, the stretching of the object will lock onto the horizontal or vertical axis allowing it to be resized one axis at a time. It will also pay attention to an invisible 45 degree snap line so that you can resize the object(s) proportionally.

If you hold the Option Key while dragging a point on the object(s) to resize it, a copy will be created and resized. The original object will be untouched.

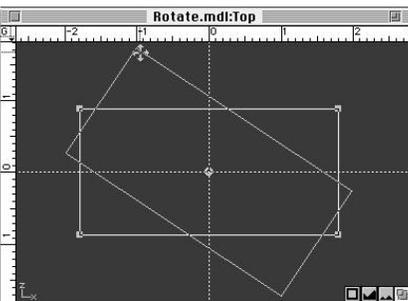
**Note:** All of the Standard Keyboard Modifiers are in effect. See the description of these functions earlier in this chapter.



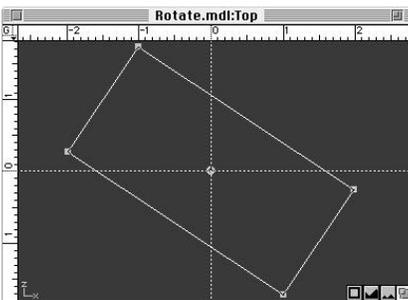
**Note:** The Rotate tool can be selected directly by typing "r".



Indicate rotation point.



Rotate object



Release the mouse to display a rotated object.

## The Rotate Tool

The Rotate tool is used to change the angular orientation of objects or groups of objects within the workspace. This can either be done at freely-defined angles or at user-specified angles.

The Rotate Tool carries out a 2-D operation. The rotation is done in the plane of the orthogonal view that is used. The Rotate tool operates only in the Orthogonal view windows. It has no effect in the Angled View Window.

An entire object can be rotated, or portions of an object can be rotated, depending on what exactly is selected. If only two vertices of a particular object are selected (not just visible), then those vertices and the adjoining splines will be the only things that will be rotated. If the entire object is selected, the whole thing will be rotated.

In all cases, the selected object(s) are rotated with reference to a “center” point. This user-defined point is fixed in space, and the rest of the object rotates about it. You can drag the object with the mouse to rotate it, watching the graphic feedback on the screen, or enter a value for incremental degrees in the Tool Info bar to control the rotating process numerically.

### Using the Rotate Tool

- 1) Select the items you want to rotate, whether they are individual vertices, complete objects, or groups of objects.

Objects or vertices that are visible will not be rotated. They must be selected.

- 2) Choose the Rotate tool from the Tool palette.
- 3) Indicate a center-of-rotation point by selecting a choice from the pop-up menu of center options that appears in the Tool Info bar. After having made a choice here, a small circle will appear on the screen to indicate where the center point is.
- 4) Grab another point of the object(s) and drag that point to a new location to rotate the object.

## Rotate tool with Increment Option

- 1) Select the items you want to rotate, whether they are individual vertices, complete objects, or groups of objects.
- 2) Choose the Rotate tool from the Tool palette.
- 3) Indicate a center-of-rotation point by selecting a choice from the pop-up menu of center options that appears in the Tool Info bar. After having made a choice here, a small circle will appear on the screen to indicate where the center point is.
- 4) Click on the check box next to the word "Incremental Degrees" in the Tool Info bar (make sure it has an "x" in it.) This indicates that you want to use the value that appears in the associated data field.
- 5) Enter a value for Incremental Degrees.
- 6) Grab another point of the object(s) and drag that point to a new location to rotate the object.

**Note:** Objects or vertices that are visible will not be rotated. They must be selected.

The number that appears here fixes the amount of rotation through which the object(s) will be taken. It acts as a multiplier, which is to say that ModelPro will rotate the object by integer multiples of the value. To allow free rotation, take the "X" out of the check box by clicking on it.



For example, with the default value of 15°, ModelPro will allow the object to be rotated in increments of 15°. So it will be rotated to 15°, 30°, 45° and so on from its original orientation as the mouse is dragged away from the starting point.

**Note:** The snap modes work with this center-point-defining click. To snap the center point to a vertex of an object, click on the Vertex option in the snap palette or hit the "V" key on the keyboard, and then click near the desired vertex of the object.

Another example: If you want to rotate an object to exactly 116.7° from its previous orientation, simply enter that value into the Incremental Degrees data box and make sure the check box has an "X" in it. Then when you rotate the object, the first rotation increment that it jumps to will be exactly 116.7°. Release the mouse to finish.

## Understanding Center Options

**User Defined Point:** This option allows the user to click a specific location that is to be used as a center of rotation. When using this option, the steps for using the Rotate tool are as follows:

- 1) Select the item(s) you want to rotate.
- 2) Choose the Rotate tool from the Tool palette.
- 3) Indicate a center-of-rotation point by clicking on the screen where you want the center point to be. A small circle will appear on the screen to indicate where the center point is.
- 4) Grab another point of the object(s) and drag that point to a new location to rotate the object.



---

**Rotation Point:** Every object created in ModelPro has a Rotation Point automatically defined as one of its attributes. By default, the Rotation Point is automatically defined to be at the center of the object. But the user has the option to change this at any time. (This is done by double-clicking on the object and changing the values for Rotation Point in the resulting dialog box.) So, when this option is picked to define the center point for the Rotate tool, the center point will go to the current Rotation Point for that object or group.

**Selected Vertices:** It is possible to want to rotate only certain vertices of an object. That is to say, some of the vertices are selected, but the entire object as a whole is not selected. If this option is picked, the geometric center of all the selected vertices will be used as the center point.

**Center Object(s):** When this option is picked, the geometric center of all the selected geometry will be used as the center point.

**Galactic Core (0,0,0):** In this case, the absolute origin of the workspace will be used as the center point.

**Marker 1:** When you have defined one or more markers in the model space, they will appear in the pop-up list. You can select one of them from this list and that point will automatically be designated by ModelPro as the center point for the Rotation operation.

#### **Other Rotate Tool Functions**

If you hold the Shift key while dragging a point on the object(s) to rotate it, the rotation of the object will automatically snap to increments of 45 degrees. Note: Holding the Shift key will override the “Incremental Degrees” check box in the Tool Info palette.

If you hold the Option Key while dragging a point on the object(s) to rotate it, a copy will be created and rotated. The original object will be untouched.

All of the Standard Keyboard Modifiers are in effect. See the description of these functions earlier in this chapter.

## The 3-D Rotate Tool

The 3-D Rotate tool allows the user to rotate an object or group (or a collection of vertices) freely in 3-D space in a “trackball” sort of manner.

The 3-D Rotate tool operates in all of the view windows, Orthogonal and Angled.

An entire object can be rotated, or portions of an object can be rotated, depending on what exactly is selected. If only two vertices of a particular object are selected (not just visible), then those vertices and the adjoining splines will be the only things that will be rotated. If the entire object is selected, the whole thing will be rotated.

In all cases, the selected object(s) are rotated with reference to a “center” point. This user-defined point is fixed in space, and the rest of the object rotates about it. You can drag the object with the mouse to rotate it, watching the graphic feedback on the screen.

### Using the 3-D Rotate Tool

- 1) Select the items you want to rotate, whether they are individual vertices, complete objects, or groups of objects.
- 2) Choose the 3-D Rotate tool from the Tool palette.
- 3) Indicate a center-of-rotation point by selecting a choice from the pop-up menu of center options that appears in the Tool Info bar. After having made a choice here, a small circle will appear on the screen to indicate where the center point is.
- 4) Grab another point of the object(s) and drag that point to a new location to rotate the object.



**Note:** The 3-D Rotate tool is on the Rotate tool pop-up.

**Note:** Objects or vertices that are visible will not be rotated. They must be selected.

**Note:** Refer to the previous section (Rotate Tool) for discussion regarding Increment Options.

### Other 3-D Rotate Tool Functions

Holding the Shift key has no effect when held down during the use of the 3-D Rotate tool.

Holding the Control key while the 3-D Rotate tool is in effect causes the object to “bank” within that window when dragging a point on the object(s) to rotate it. That is, the object rotates about an axis that is perpendicular to the screen of the computer that goes through the “center” point. To remind you that this special functionality is in effect, a different cursor appears that has two semi-circular arrows chasing each other in a circle.

This “banking” function while holding the Control key works in the Angled view as well. The difference is that the object will always rotate about the “Y” axis unless the view of the Angled view window is set to Front or Right via the pop-up view menu in the title bar.

If you hold the Option key while rotating or “banking” an object in any window, a copy of the object will be created and that copy will be rotated, leaving the original untouched.

All of the Standard Keyboard Modifiers are in effect. See the description of these functions earlier in this chapter.

## The Mirror Tool

The Mirror tool allows the user to reflect an object or group of objects across a user-defined axis. This is useful when working with shapes that have symmetry. Only the common elements need to be drawn, and the reflected or reversed copies of those elements can be automatically generated with the Mirror tool. Only entire objects can be mirrored. Portions of objects, or vertices cannot be mirrored.

The selected object(s) are reflected with reference to a “mirror line.” The mirror axis line is always perpendicular to the orthogonal view in which you are working. That is, the mirror line is coming straight out of the view, and therefore it is represented in the orthogonal view by a point. This line is positioned in space by the user, and the object is mirrored or “reversed” across it, and rotated about it. The Mirror tool appears to behave much like the Rotate tool, but the important difference is that the Mirror tool “reverses” the object across an invisible vertical line which passes through the mirror axis point. You can drag the object with the mouse to mirror it, watching the graphic feedback on the screen, and observe the progress of the rotation in the Tool Info palette.

### Using the Mirror Tool

- 1) Select the items you want to mirror.
- 2) Choose the Mirror tool from the Tool palette.
- 3) Indicate a mirror line point by pressing and holding the mouse at the desired location and then dragging away to rotate the reflection of the object.

### Other Mirror Tool Functions

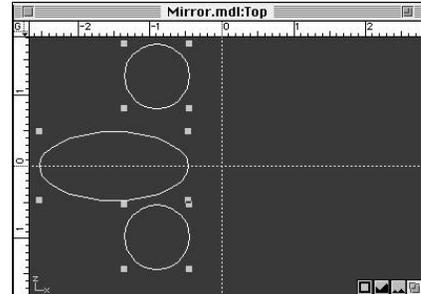
If you hold the Shift key while dragging the reflected object to rotate it, the rotation will automatically snap to increments of 45 degrees. This is the simplest way to generate a horizontal or vertical axis orientation.

If you hold the Option Key while dragging a point on the object(s) to mirror it, a copy will be reflected and rotated. The original object will be untouched.

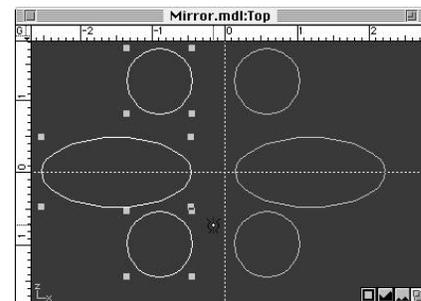
All of the Standard Keyboard Modifiers are in effect. See the description of these functions earlier in this chapter.



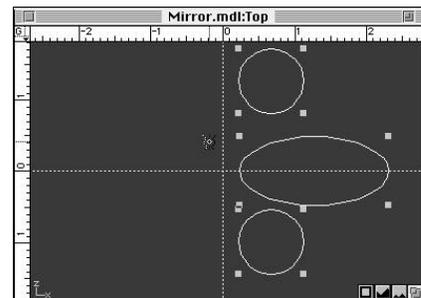
**Note:** This tool will be “grayed-out” in the tool palette if nothing is selected on the screen.



Select items to mirror.



Drag to new position.



Release mouse to complete mirror.

**Hint:** You can use the snap modes to help specify a location for the mirror line point. Activate one of the snap modes, then click near the desired snap point.



**Note:** This tool will be “grayed-out” in the tool palette if nothing is selected on the screen.

## The Add Vertex Tool

The Add Vertex tool puts a new vertex on the currently selected object at the location where the mouse is clicked. After the new vertex is added, it can be moved or modified just like any other.

If the new vertex is added onto a straight segment, then the new vertex does not have any control handles. If the new vertex is added onto a segment that is curved, then the new vertex has two tangent control handles.

This tool works on multi-line and spline mesh objects. The tool does not have any effect on primitives (Cones, Spheres, etc.). If the primitive is converted to a spline mesh, then the Add Vertex tool will work.

The object must be selected with its vertices visible. Selecting it as an object with its bounding box corners showing will not allow the Add Vertex tool to do its job.

All of the Standard Keyboard Modifiers are in effect. See the description of these functions earlier in this chapter.



**Note:** This tool is on the Add Vertex tool pop-up. It will be “grayed-out” in the tool palette if nothing is selected on the screen.

## The Delete Vertex Tool

The Delete Vertex tool removes a vertex from the currently selected object when you click on that vertex with the mouse. When a visible or selected vertex is clicked on with this tool, that vertex is eliminated and the two vertices on either side of it act to control the curvature of the object. The object will likely change shape as a result of the missing vertex. This tool is used when the desire is to simplify or smooth-out a spline curve.

This tool works on multi-line and spline mesh objects. The tool does not have any effect on primitives (Cones, Spheres, etc.). This is because primitives do not have “vertices” that can be made visible, and therefore there is nothing to delete. If the primitive is converted to a spline mesh, then the Delete Vertex tool will work.

The object must be selected with its vertices visible. Selecting an object with its bounding box corners showing will not allow the Delete Vertex tool to do its job.

All of the Standard Keyboard Modifiers are in effect. See the description of these functions earlier in this chapter.

## The Scissors Tool

The Scissors tool cuts an object at a location defined by a mouse click. Each time the Scissors tool is used, the selected object receives a single cut. If you want to make more than one cut on an object then you must use the Scissors tool again on the object.

If you cut a closed object (like a circle or polygon) it just becomes an open object. If you cut an open object (like a line or spline) then it divides into two objects, and therefore a new object appears in the Group palette. If you cut an object right at a vertex, then the object will separate at that point, leaving two vertices right on top of each other.

Only a single object at a time can be cut. If two selected objects are overlapping and the cut point is clicked at an intersection of the two objects, only one of them will get cut. The location of the cut can be defined exactly with the help of the snap modes.

### Using the Scissors tool

- 1) Select the item you want to cut by clicking on the object in any one of the windows.

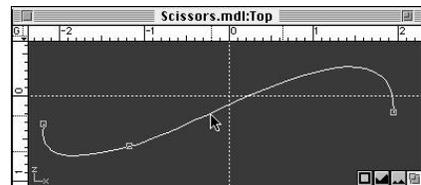
You must select the object so that its vertices are visible. The Scissors tool will not work if the object's bounding box corners are visible.

- 2) Choose the Scissors tool from the Tool palette. (Or press "k" on the keyboard.)
- 3) Indicate a cut point by clicking on the selected object.

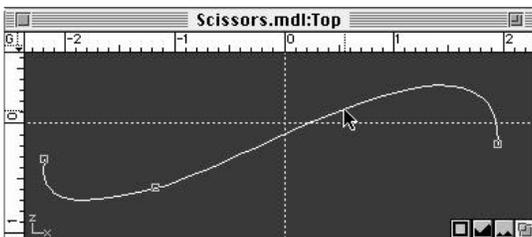
You can use the snap modes to help specify a location for the mirror line point. Activate one of the snap modes, then click near the desired snap point.



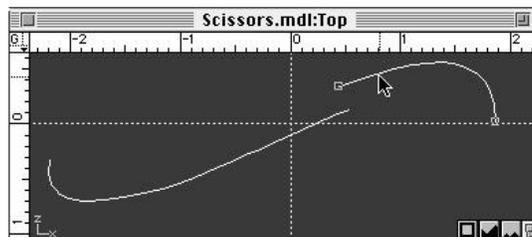
**Note:** The Scissors tool is on the Add Vertex tool pop-up. It can be selected directly by typing "k."



Select point to cut.



Cut Spline



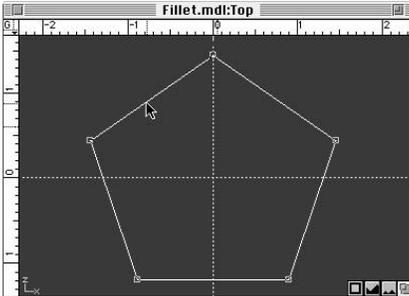
Separate segments



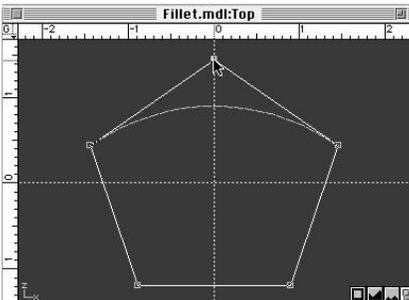
## The Fillet Tool

The Fillet tool is used to create an arc at a corner of two connected lines. It trims off the excess part of the two lines and leaves a tangent curve. You can specify the radius of the fillet by typing a value into the “Radius” field in the Tool Info palette.

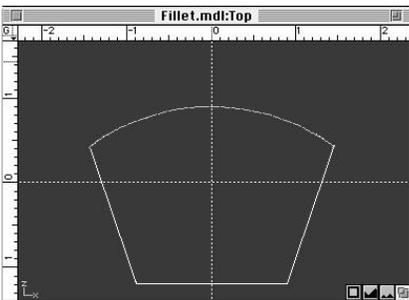
The Fillet tool works where two straight segments of splines come together at a common point, and on vertices of closed polygons. A fillet cannot be placed at a vertex where one or more curved segments come together. Finally, the vertex cannot be the endpoint of two separate objects. The two straight segments that come together at the vertex must belong to the same object. If they are two separate objects, they must be “joined” before filleting.



Select the vertex to fillet.



Fillet radius displayed.



Fillet completed.

### Using the Fillet tool

- 1) Select the item you want to fillet by clicking on the object in one of the windows.

You must select the object so that its vertices are visible. The Fillet tool will not work if the object's bounding box corners are visible.

- 2) Choose the Fillet tool from the Tool palette.
- 3) Click on a vertex where you want to put a fillet. Notice that a sample fillet is displayed. The radius of that sample fillet is listed in the Tool Info palette.
- 4) Type in a value for “radius” in the Tool Info palette.
- 5) When the fillet looks right, hit the “Fillet” button on the Tool Info Palette. The arc will be placed, and the excess of each corner will be trimmed off.