8 - Transforms - Move, Copy, Rotate, and Scale

Transforms change the location, rotation, number and shape of whole objects by moving, mirroring, arraying, rotating, scaling, shearing, twisting, bending, and tapering. The transform commands do not break the objects into pieces or cut holes in them.

Note: For all of the following exercises, the images were captured using **Shaded** mode display.

Move

Use the **Move** command when you want to move an object a certain distance or if you want to use object snaps to place an object accurately.

You can pick these locations on the screen or type coordinates at the command prompt.
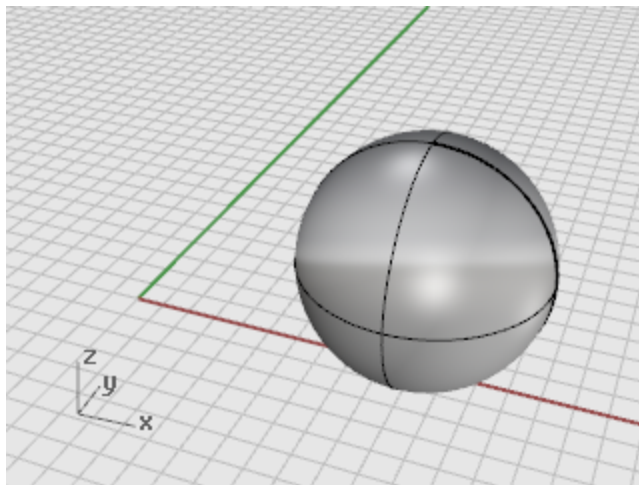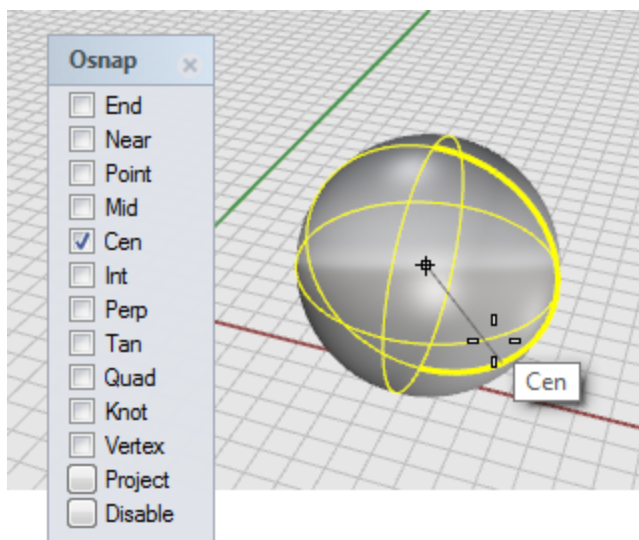
Practice moving objects

The object of this exercise is to move a sphere from the center of the sphere to the coordinate system origin at 0,0,0.

The **Move** command requires a *from* and *to* location.

1. Start a new model.
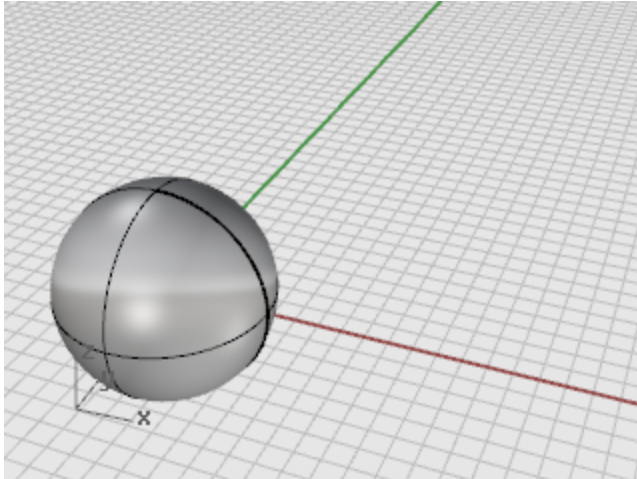
2. Draw a **Sphere** anywhere on the screen.

3. **Select** the sphere.

4. On the **Transform** menu, click **Move**.

   Optional: Press **F1** to review the Help topic for the Move command.

5. At the **Point to move from** prompt, with the **Center (Cen)** object snap on, move the mouse around the edge of the sphere until the **Cen** tooltip displays and click.

6. At the **Point to move to** prompt, type **0,0,0**.

   The center of the sphere moves to the 0,0,0 coordinate point.

   Tip: Simply typing **0** is a shortcut for the coordinates **0,0,0**.

Move objects by dragging

The quickest way to move objects is to click the object and drag it. Rhino provides tools for accuately dragging objects. You can drag objects in any viewport. Object snaps help align objects to each other.
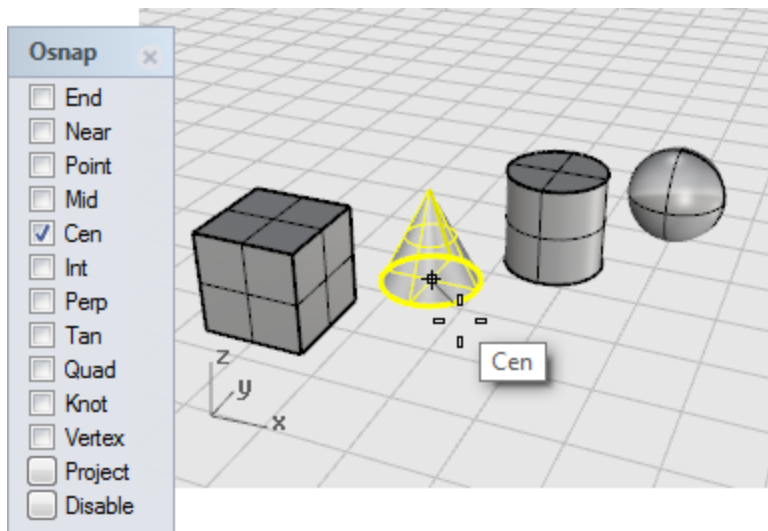
Practice dragging objects

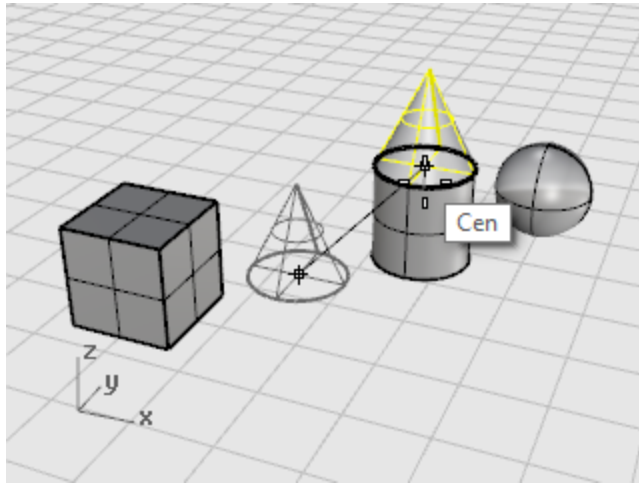1. Open the tutorial model **Drag Objects.3dm**.

   (Help menu > Learn Rhino > Tutorials and Samples > User's Guide > Drag Objects)

2. In the **Osnap** control, turn on the **Center (Cen)** object snap.

3. In the **Perspective** viewport, move the mouse cursor close to the cone's bottom edge, hold down the left mouse button until the **Cen** object snap tooltip displays.

4. Drag the cone to the top edge of the cylinder, the **Cen** object snap tooltip displays.

5. Release the mouse button to place the cone.

   Note: Dragging with accuracy like this can be tricky. Keep your eye on the object snap tooltips.

Move objects using elevator mode

You can press the **Ctrl** key to move objects in the z-direction. This is called *elevator mode*. See *Chapter 5, Accurate Modeling, Elevator mode*.

Elevator mode is similar to **Ortho**, except the movement is vertical to the active construction plane.

To practice using elevator mode to move vertically, you are going to move the box to a location five units above the center of the sphere.

Using elevator mode to move objects vertically lets you work in the **Perspective** viewport more often.
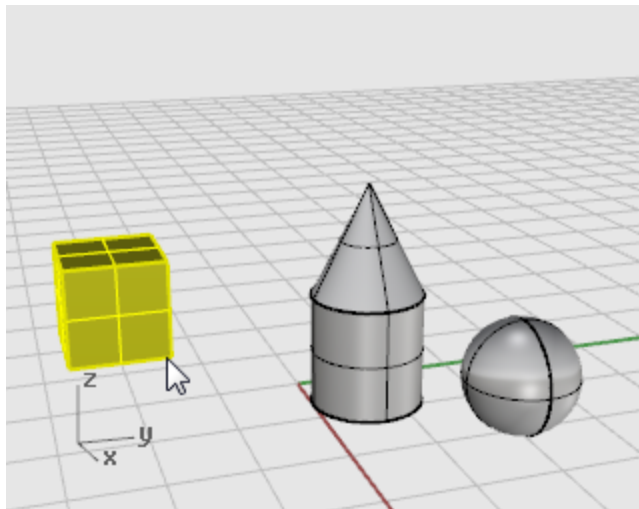
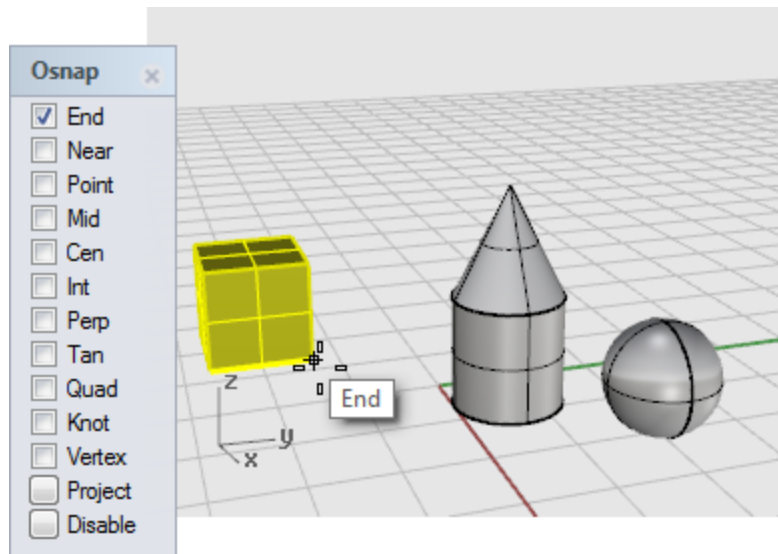 **Move the box with reference to another object**

Note: For the following images, the Display Mode **Shade-highlight selected surfaces and polysurfaces** option has been turned on.

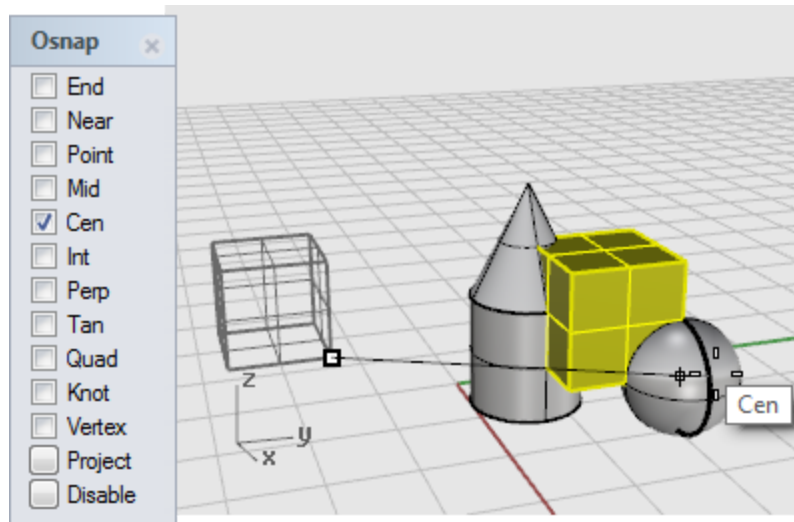(*Tools menu > Options > View > Display Modes > Shaded > Objects > Selection*)

1. Turn **Ortho off**.

2. On the **Transform** menu, click **Move**.

3. In the **Perspective** viewport, rotate the view so the sphere is toward the front.
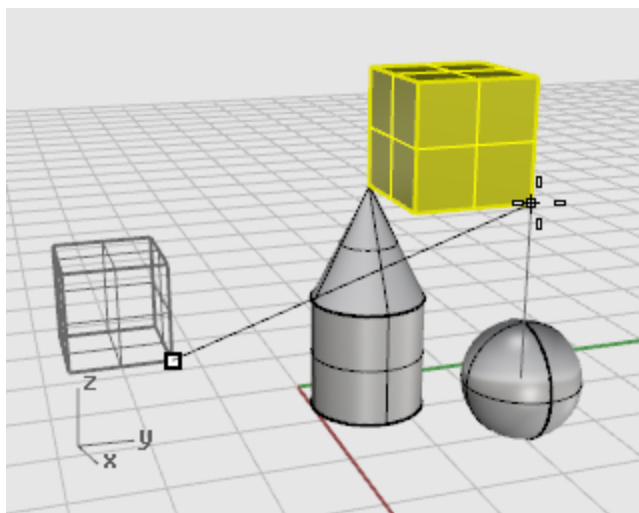
4. **Select** the box.

5. At the **Point to move from...** prompt, turn on the **End** object snap and click the lower right corner of the box.

6. At the **Point to move to** prompt, turn on the **Cen** object snap.

Drag the box around the equator of the sphere until the **Cen** tooltip displays.

7. Hold down the **Ctrl** key, and click at the center of the sphere.

8. Release the mouse button and the **Ctrl** key, and start to drag the box.

The box can now move only up and down in the z-direction.

9. At the command prompt, type **5**, and press **Enter**.

   The box will be placed so that the selected end of the box is 5 units in the z-direction from the center of the sphere.
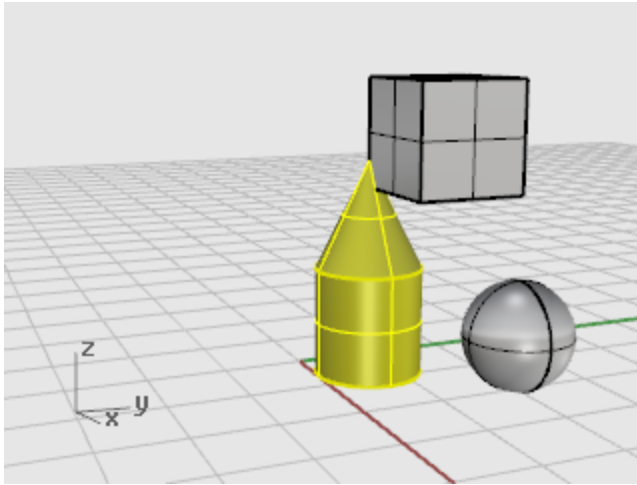
Copy objects

The **Copy** command makes copies of objects. Like the **Move** command, the **Copy** command requires a *from* and *to* location.
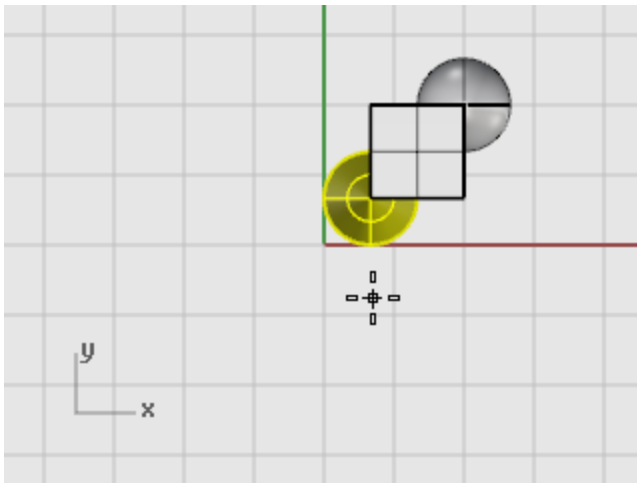
Practice copying objects

1. On the **Transform** menu, click **Copy**.

   Optional: Press **F1** to review the Help topic for the Copy command.

2. In the **Perspective** viewport, **select** the cone and the cylinder.

3. At the **Point to copy from...** prompt, click anywhere in the **Top** viewport.

4. At the **Point to copy to...** prompts, click where you want the copies.

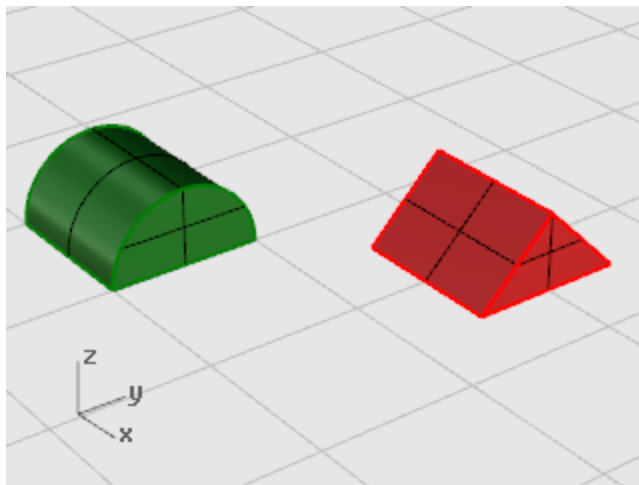5. When you have enough copies, press **Enter** or right-click the mouse to end the command.

Rotate

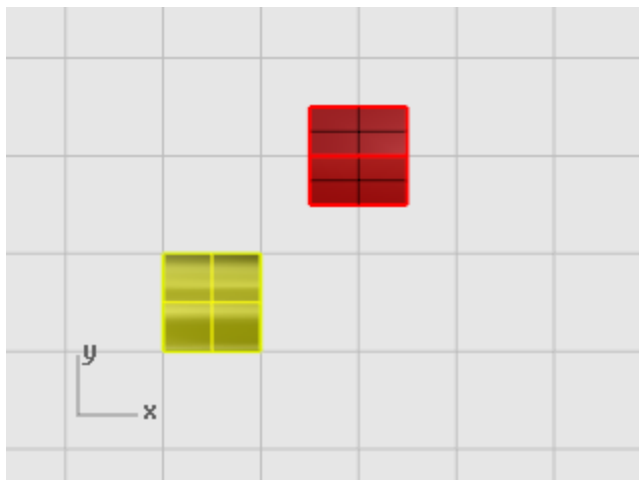The **Rotate** command rotates an object around a center point.

Rotate an object

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1. Open the tutorial model **Rotate-Scale.3dm**.

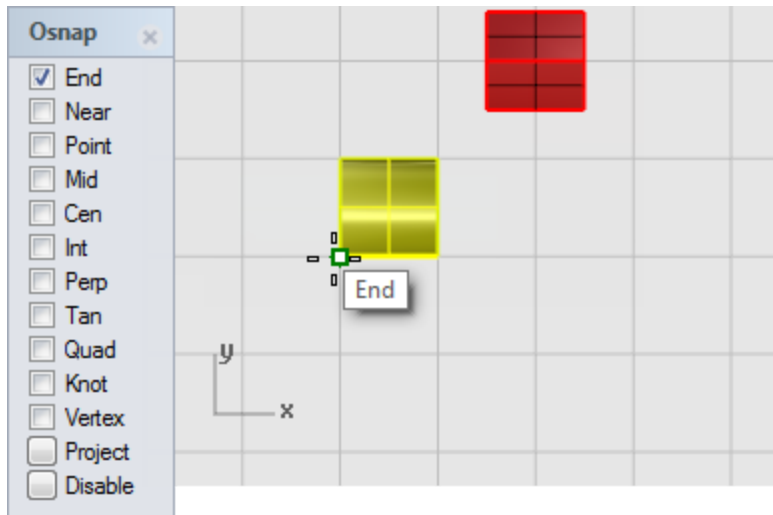   *(Help menu > Learn Rhino > Tutorials and Samples > User's Guide > Rotate-Scale)*

2. **Select** the green half-cylinder as shown in the illustration below.

3. On the **Transform** menu, click **Rotate**.

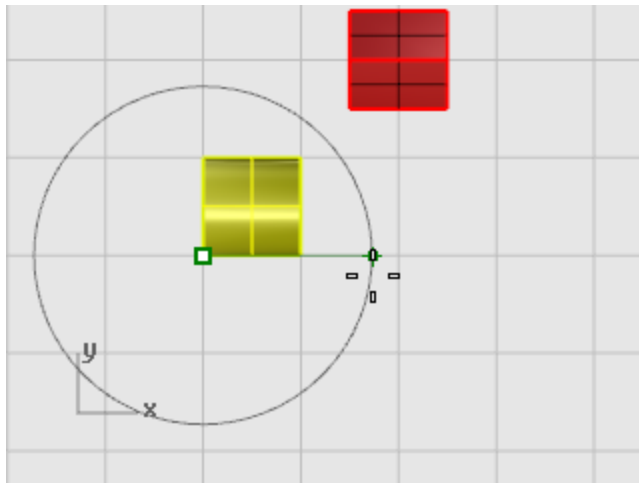   *Optional:* Press **F1** to review the Help topic for the Rotate command.

4. in the Top viewport at the **Center of rotation...** prompt, with the **End** object snap on, click the lower left corner of the half-cylinder as shown in the illustration below.
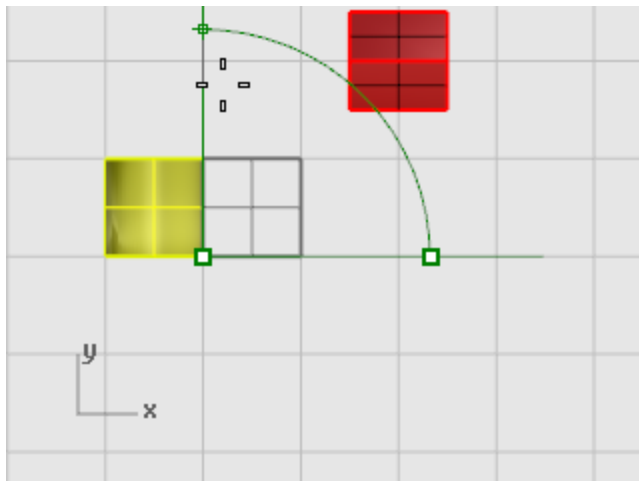

5. In the status bar turn **Ortho** on.

6. At the **Angle or first reference point...** prompt, drag the cursor to the right as shown in the illustration below, and click.

    This establishes the base angle for the rotation.

7. At the **Second reference point...** prompt, drag the cursor up as shown in the illustration below, and click.

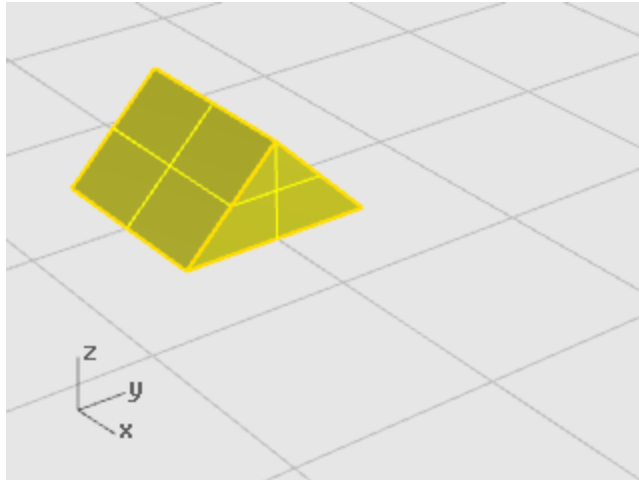   The half cylinder rotates 90 degrees counter-clockwise.

Scale

The **Scale** commands give you control over the direction of the scale. You can re-size objects uniformly in one, two, or three directions, or scale an object with a different scale factor in each direction.

Scale the prism

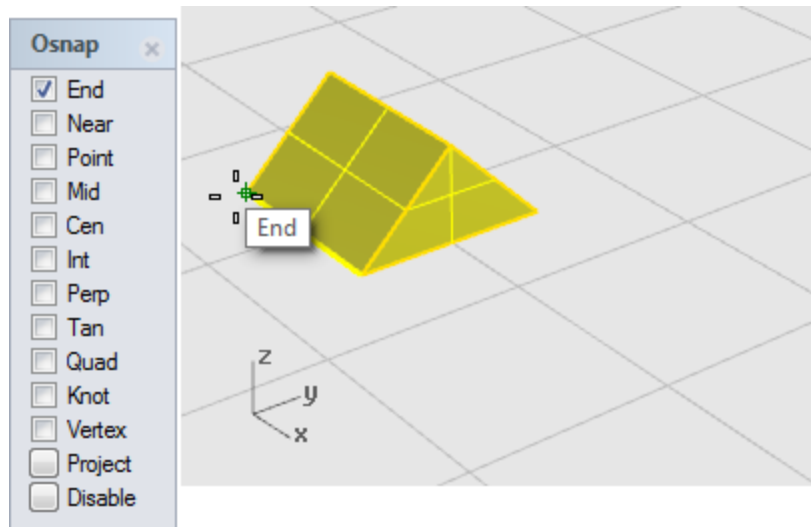1. In the same Rotate-Scale model, **select** the red prism shape.

2. On the **Transform** menu, click **Scale**, and then click **Scale 3-D**.

   Optional: Press **F1** to review the Help topic for the Scale command.

3. At the **Base point...** prompt, with the **End** object snap on, click the left corner of the prism as shown in the illustration below.
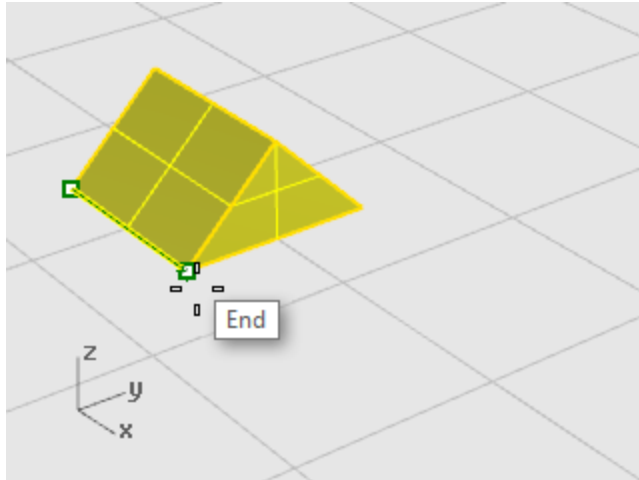
   This sets the base point from which the object will grow or shrink.
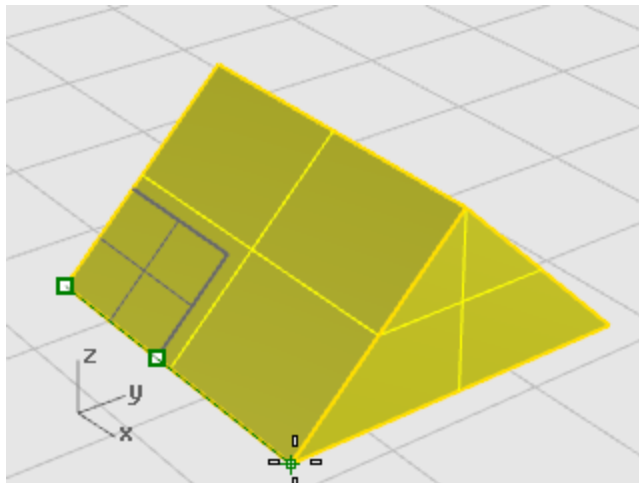

   Note: In this simple example, you will first show the object's original size by picking two points, a base point and a first reference point. Then you will show the object's new size by picking a second reference point.

4. At the **Scale factor or first reference point...** prompt, click the right corner of the prism as shown in the illustration below.

   The distance between the base point and the first reference point sets the original size for the scale operation.

5. At the **Second reference point...** prompt, drag the cursor to the right.

   The object grows as you drag the cursor.

6. Click to set the new object size as shown in the illustration below.

Enter a number to set the scale factor

- ▶ To make the object twice its original size, at the **Scale factor...** prompt, type **2**.
- ▶ To make the object half its original size, at the **Scale factor...**prompt, type **.5**.

Scale an object to a specific size

- ▶ To make the prism in this example 2.35 units along the original side, at the **Second reference point**... prompt, type **2.35**.
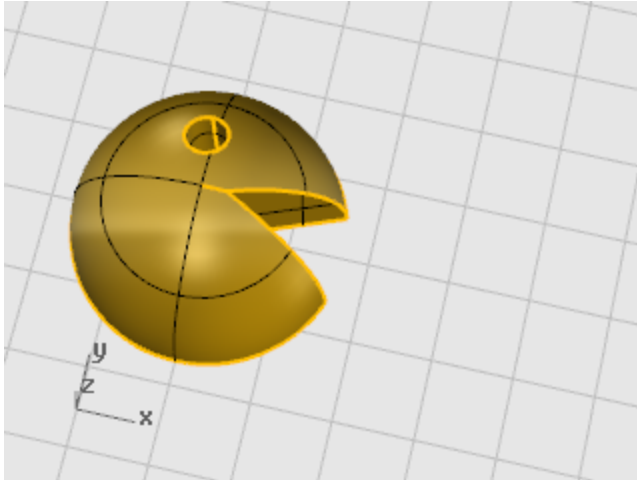
Mirror

In this exercise, you are going to practice another basic editing command: **Mirror**. The **Mirror** command makes a reverse-image copy of the object. Objects are mirrored across a line that you draw in a viewport.

 Mirror an object

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1. Open the tutorial model **Mirror Objects.3dm**.

   (Help menu > *Learn Rhino* > *Tutorials and Samples* > *User's Guide* > *Mirror Objects)*
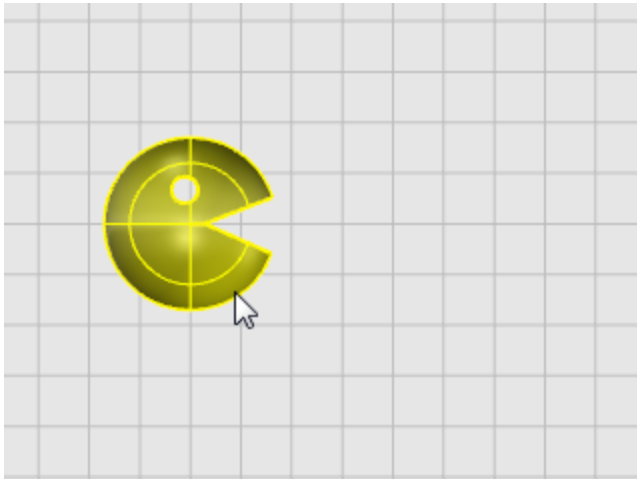

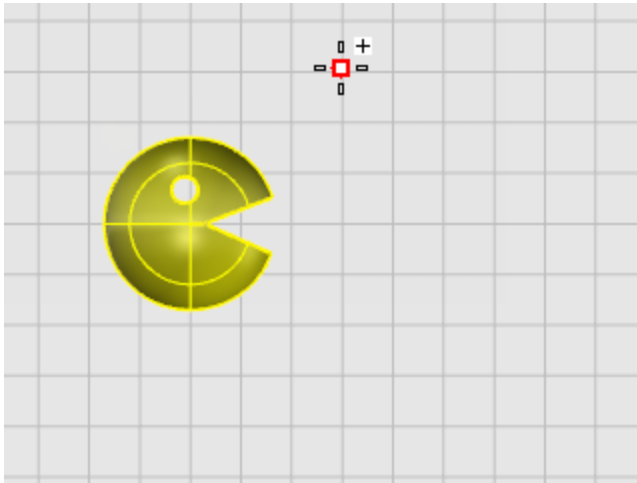2. On the **Transform** menu, click **Mirror**.

   Optional: Press **F1** to review the Help topic for the Mirror command.

3. On the status bar, turn **Ortho on**.

4. **Select** the object.

5. At the **Start of mirror plane...** prompt, in the **Top** viewport, click to the right of the face as shown in the illustration below.

6. At the **End of mirror plane...** prompt, drag the cursor toward the bottom of the screen, and click to end the mirror line.

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