

## Defining Odd--Angled 3D Work Planes

There are two ways to define odd-angled 3D work planes. If you can see at least three known points in the drawing that rest directly in the proposed new plane, use the **3-Point Plane** command or the **Define Plane** command (both in the 3D menu) to define the new Work Plane.

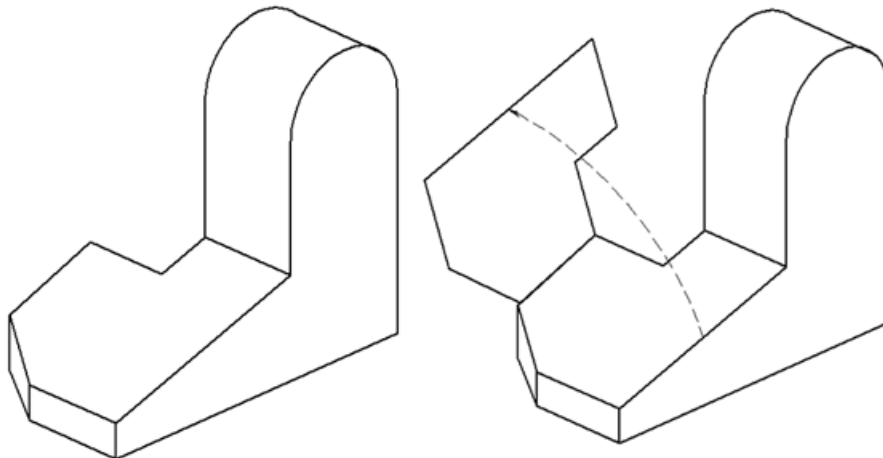
Occasionally you will not have any useful points in the drawing to define this new plane; if all you have showing on the part is a vector that is perpendicular to the desired plane, you have two solutions.

The first is to use the **3-Point Plane** command once to generate a TempPlane whose **X** or **Y** axis is parallel to this known line. Then use the **3-Point Plane** command again to redefine the TempPlane so that the **Z**-axis winds up parallel to the known line.

This method is quick and it works in most situations. The Temporary Work Plane will go away the next time you use the **3-Point Plane** command unless you rename the plane. This method also relies on points other than the known line, which may not exist in all cases.

The second method takes this known line and uses it as a *line-of-sight* vector for a new View. It defines an imaginary Viewing Plane that is perpendicular to this *line-of-sight*. If you look at the part from this new view, and then **Set Plane to Screen** (from the 3D menu), you get a Work Plane that is parallel to the Viewing Plane. This new Work Plane has its **Z**-axis parallel to the *line-of-sight*.

The second method gives you complete control of the definition of the new Work Plane. It creates a permanent Work Plane that relies on the endpoints of the known line. It takes a few more steps than the **3-Point Plane** method and it is a little harder to learn.



The example part is shown above. What you want to do is open the sloped face like a door, using the left side of the face as a hinge. You are actually rotating this sloped face about its left edge, using the left edge as an axis of rotation. To do this, you need to define a new Work Plane that is perpendicular to the hinge line.


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### The 3-Point Plane method.

1. Show Triad from the 3D menu.

*This is a critical step, since you need to see the Triad to keep track of the Work Plane and the X, Y and Z-axis. For this example, assume that the Triad comes up with the Work Plane set to TOP.*

2. Pick the 3-Point Plane command from the 3D menu.

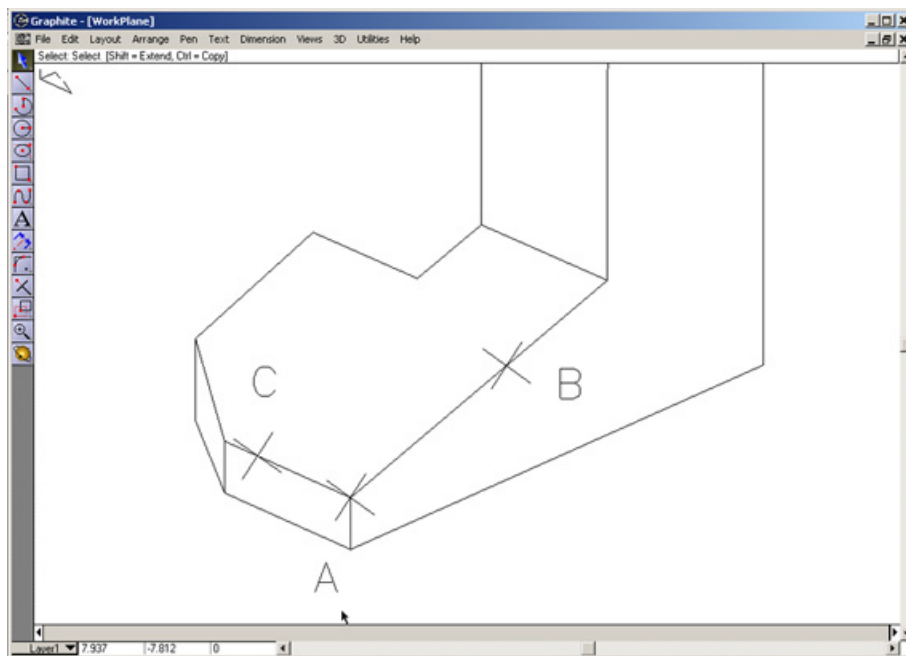
*The cursor changes to a little X and Y-axis-looking object. The Message Line asks you to Pick Origin.* 

3. Click at point A to indicate the new Origin.

*It is Zoomed in to make things easier to see.*

4. Click at point B to indicate a point on the new X-axis.

*It does not matter where you click along the length of that line. You are just defining a vector for the new X-axis that starts at point A and ends at this point that you pick.*

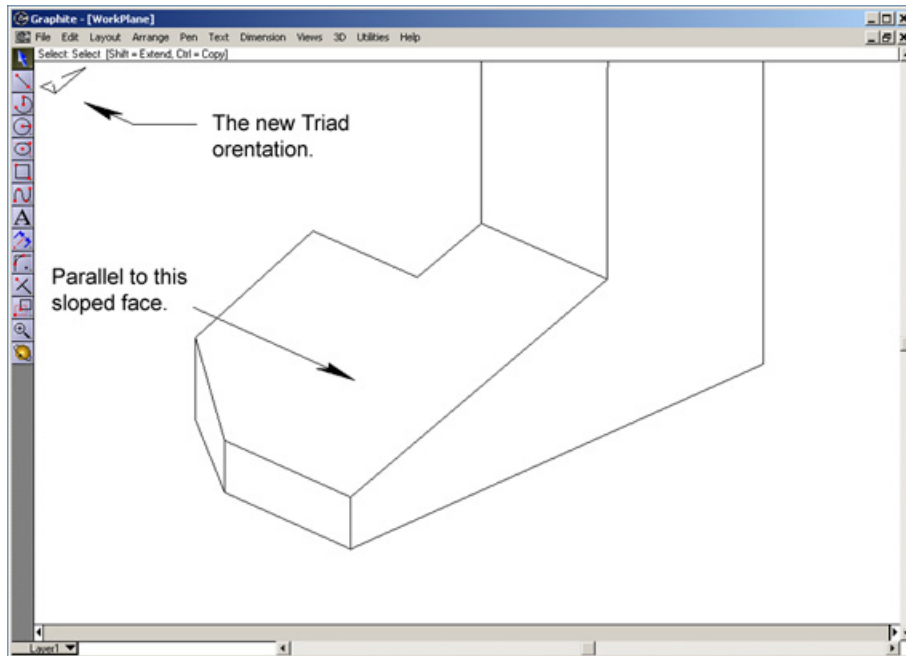


5. Click at point C to indicate a point on the new Y-axis.

*Again, it does not matter where you click on this line.*

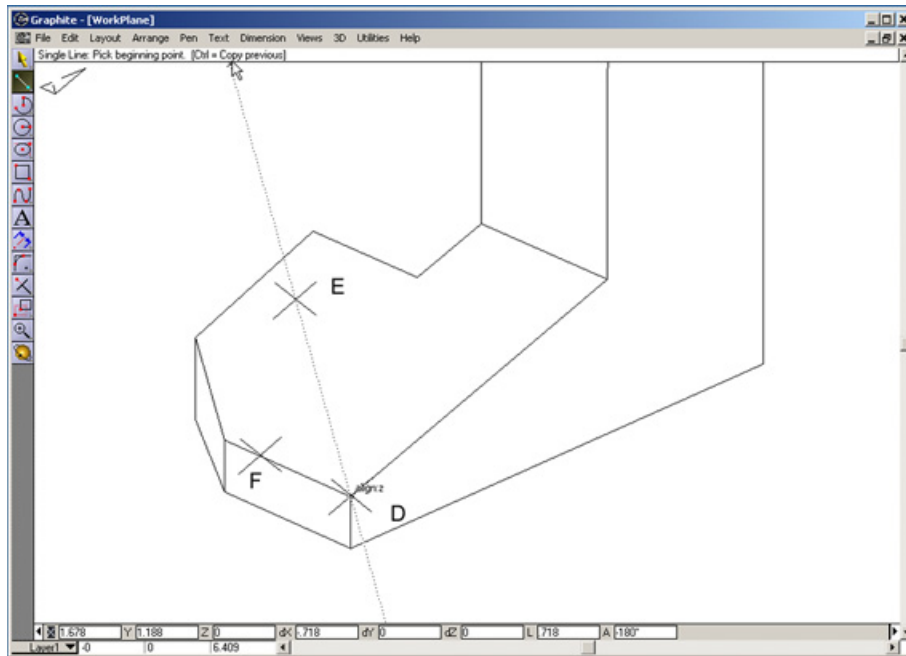
After this third click, the Triad changes its orientation so that it parallels the sloped face. The X and Y-axis have changed their directions as well, to match the lines in the drawing. There is also a new Plane in the **3D>Planes** Menu called TempPlane. Every time you use the **3-Point Plane** command, a new TempPlane gets created. Any new

TempPlane replaces the previous TempPlane from before. There is only one TempPlane.



You created a new Work Plane that is parallel to the sloped face, but you want one that is perpendicular to the sloped face. Specifically perpendicular to its left edge (the hinge-line). Right now the X-axis is facing the same direction as the hinge-line. You need to get the Z-axis facing that way also. To do this, use the **3-Point Plane** command again to define a new Work Plane where the new X-axis points the same way as the current Z-axis. Let the new Y-axis point in the same direction as it currently does.

6. Pick the 3-Point Plane command once more from the 3D menu.



7. Click at point D to indicate the new Origin.

8. Click at point E to indicate a point on the new X-axis.

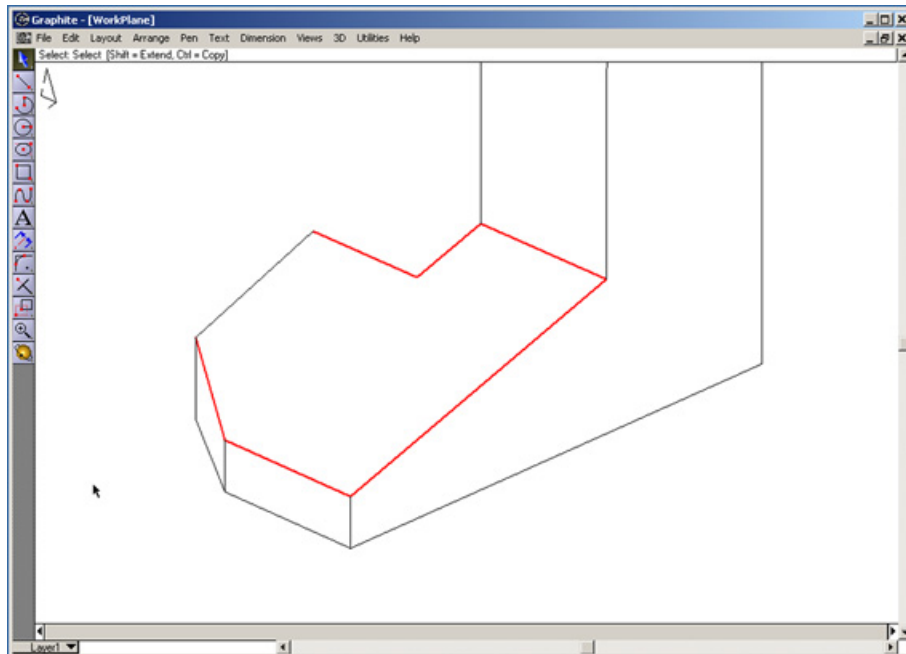
*Before you click, bring your cursor up above the part in the general region where you expect the click point to be. Move the cursor around a little until the Drafting Assistant puts up a Construction Line through point D with the words **align-z** next to point D and your cursor sits right on this Construction Line. You are defining a point that is up above the sloped face, directly along the Z-axis. As soon as you have this Construction Line and the **align-z** alignment through point D, click the mouse at point E anywhere along the Construction Line.*

9. Click at point F to indicate a point on the new Y-axis.

*This puts the Y-axis facing the same way it did before. Again, it does not matter where you click on this line.*

After this third click, the Triad changes its orientation again so that it is perpendicular to the sloped face and the Z-axis faces the same direction as the left edge of this face.

Now you are ready to open the sloped face like a door, using the left edge like a hinge.



10. Select all the lines that make up the sloped face, except for the hinge-line itself.



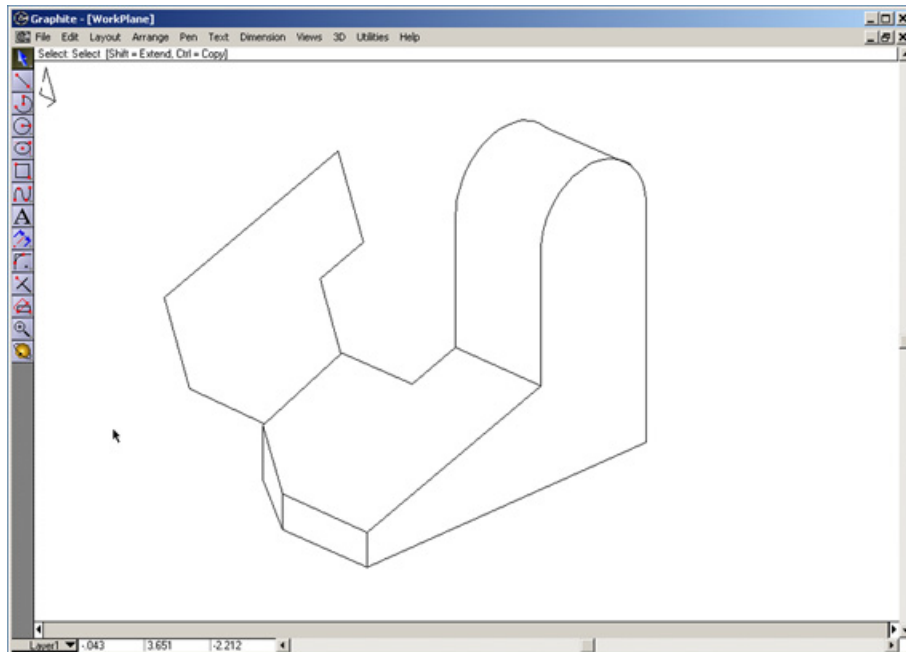
11. Pick the Rotate tool.

12. Click anywhere on the hinge-line to fix the center of rotation.

*It does not matter where you click on this line since every point of the line rests directly on the Z-axis. Every point of that line works equally well as a pivot point.*

13. In the Status Line, type 90, hold the Ctrl (PC) or Option (Mac) key to get a copy and press Enter.

The sloped face will rotate up 90 degrees. If you had typed -90 (negative 90), the face would have rotated down, because of the Right-Hand-Rule.



### The Views Method.

1. Show Triad, set the Planes to Top and set the Views to Trimetric.

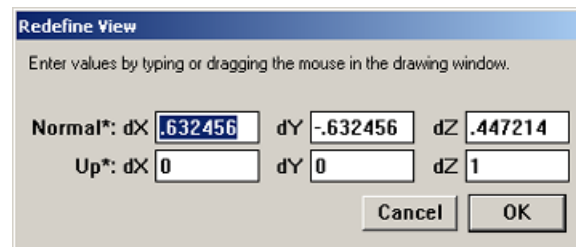
*This gives a common starting point.*

2. Choose the Define View command in the Views Menu.

*This brings up the Define View dialog box.*

3. Click on the New button in this dialog box.

*This brings up the Redefine View dialog box.*



In this dialog box, there are three data fields for **Normal** and three data fields for **Up**. These data fields need *delta* values to define vectors. The first data fields define the Normal vector, which is a *line-of-sight* at the end of which is an imaginary viewing plane. The Normal vector or line-of-sight, is perpendicular to the imaginary viewing plane.

The Up data fields define a vector that appears to be pointing straight up. Depending on how the observer tilts his head while looking down this line-of-sight, different things will appear to be up.

You can completely define a View in Graphite by giving a line-of-sight vector and an Up vector.

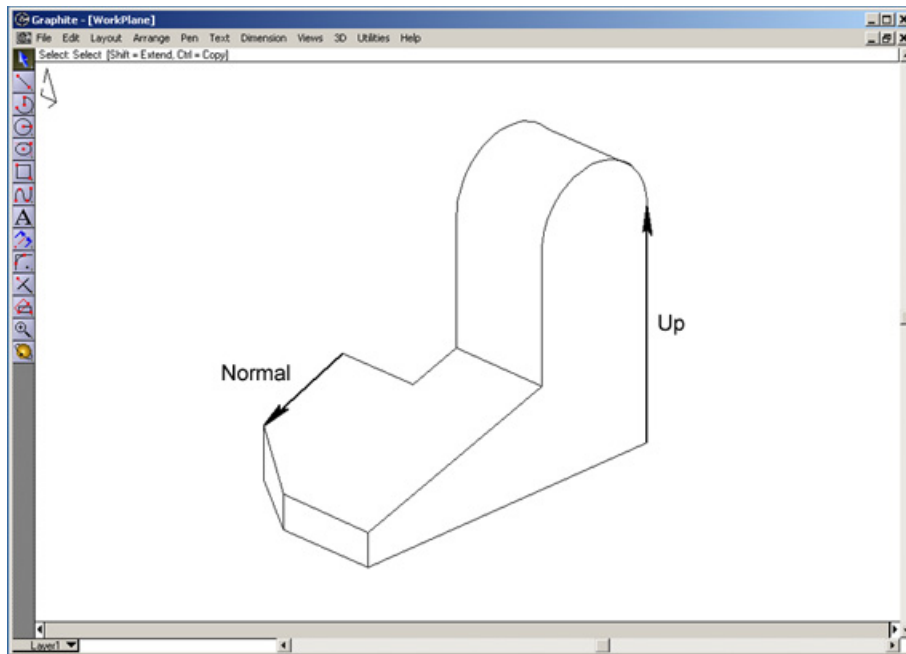
By defining a View using a Normal Vector, you wind up with a Viewing Plane that is perpendicular to that vector. This is like the Work Plane you want with the Z-axis perpendicular to it. If you make the Work Plane equal to the Viewing Plane, you get the Z-axis equal to the line-of-sight vector.

By defining a new View whose line-of-sight is right along the hinge-line, the Viewing Plane is exactly where you want the new Work Plane to be.

The numbers that appear in the six data fields of the **Redefine View** dialog box when it first comes up define the **Normal** and **Up** vectors for the current View. Since your current View is the Isometric View, these numbers are the delta offsets that define these two vectors for the Isometric View.

4. Use the bulls-eye cursor to drag a vector along the line of sight that you want to use.

*The direction you drag this vector will point AT the observer. Note that the first data field in the Normal line must first be highlighted.*



5. Drag another vector to define what is Up in the resulting View.

*Note that the first data field in the "Up" line must first be highlighted. You could have used any of the vertical lines in this part since they all will appear to be up in the resulting View. But we could also have used one of the lines that currently appear to be more horizontal in this View as an Up Vector. Then, in the new View, the whole part would appear to be rotated.*

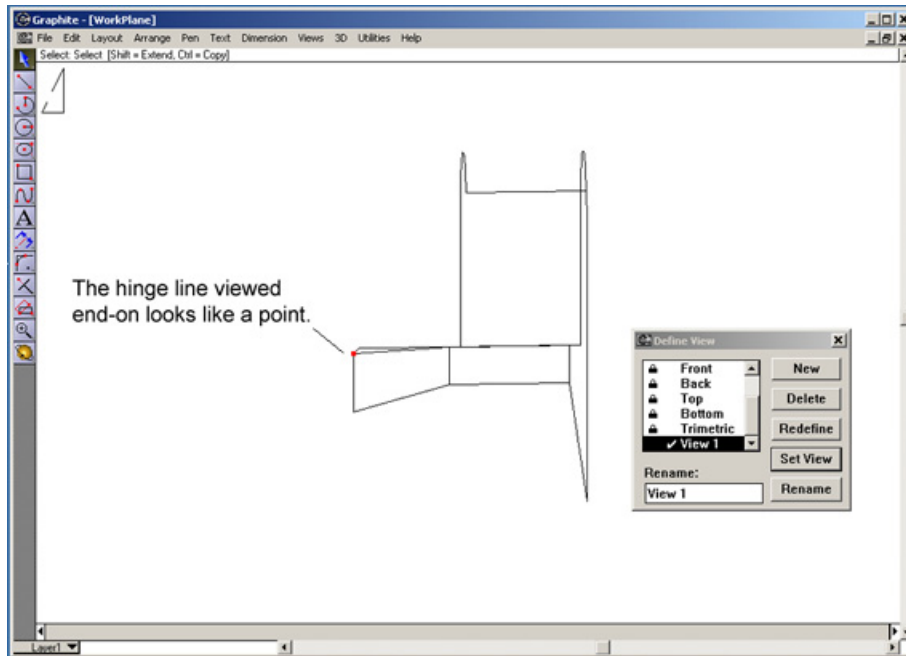
6. Click OK.

*A new View called **View 1** will appear in the Define View dialog box.*

7. Click on this new View 1 in the Define View dialog box and click the Set View button.

*You will see the part as if you were looking right along the hinge-line.*

8. Close the Define View dialog box.



9. Give the command Set Plane to screen from the 3D menu.

*This will set the Work Plane to coincide with the current Viewing plane. The Triad will change so that the Z-axis points right out of the screen. Graphite defines this as a TempPlane in the 3D>Planes sub-menu. Make this temporary plane permanent by renaming it.*

10. Choose Define Plane from the 3D menu.

*In the list that appears in the resulting dialog box there is a new plane called TempPlane with a check mark next to it. This plane was created by the Set Plane to Screen command.*

11. Click on TempPlane. Its name will appear in the Rename data field.

12. Replace the name TempPlane with a new name of your choosing and press the Rename button.

*You have defined a new Work Plane that you can pick at any time from the Planes list in the 3D menu. When you pick this plane, the Triad turns so that the Z-axis faces exactly along the hinge-line.*