

Lesson 2

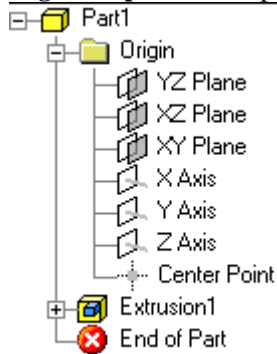
Work Features

Learning Objectives

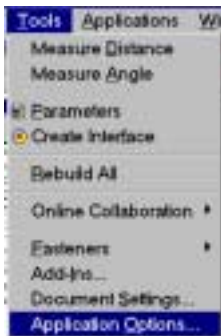
When you have completed this lesson, you will:

- ◆ Have an understanding of Work Planes, Work Axis, and Work Points
- ◆ Be able to create a Work Features
- ◆ Be able to modify a Work Features

In most 3-D geometric modelers, 3-D objects are located and defined in what is usually called **world space** or **global space**. This space is usually a 3-D **Cartesian coordinate system** that the user cannot modify.

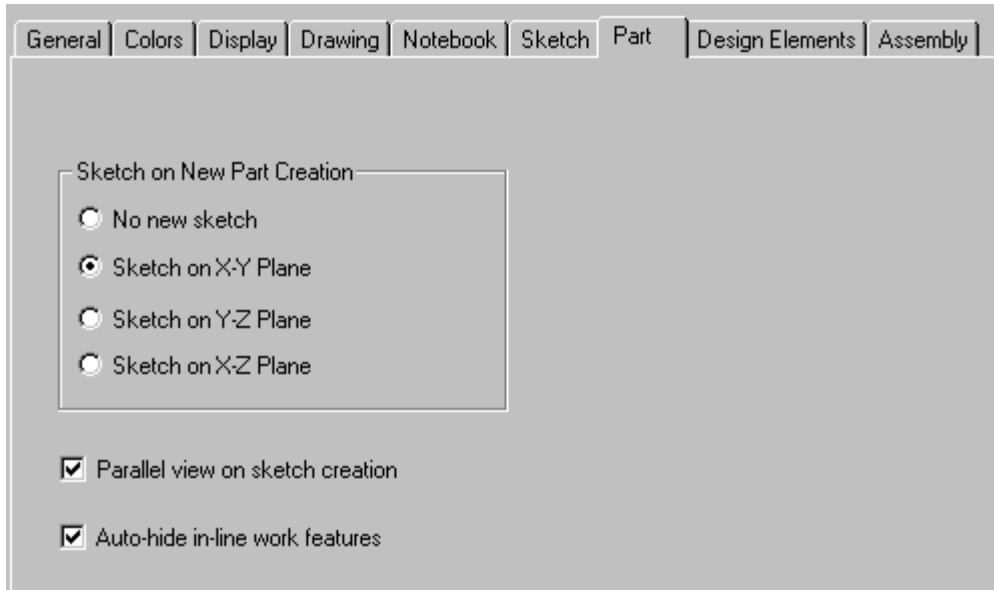


If we create a new part file in Inventor, we first look in the Browser area. There we see that Inventor automatically created an XY Plane, an XZ Plane, a YZ Plane, an X axis, a Y axis, a Z axis, and a Center Point.



To explore further, we go to the menu and select Tools->Application Options.

An Options Dialog box will appear.
Select the Part tab.



Note that we can select which plane we would like to start all new part creation. The default is to use the XY plane.



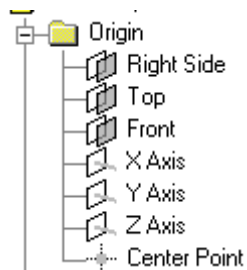
TIP: Enable the box that says 'Parallel view on sketch creation' to automatically switch to PLAN view when starting a sketch.

If we switch to Isometric View (right-click the mouse and select 'Isometric View'), then highlight each plane in the Browser; we see each plane highlighted in our Drawing Screen area.

The XY Plane should be considered the Front Plane. The XZ Plane should be considered the Top Plane. The YZ Plane should be considered the Right Side Plane.



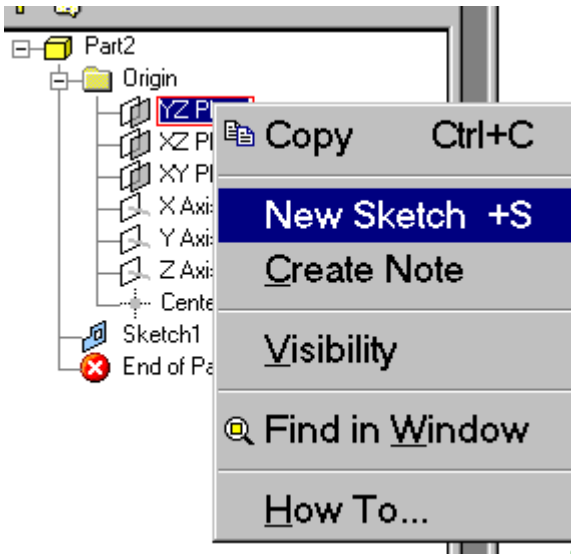
TIP: It may be helpful to beginners to change the names of the planes in your browser and save a part template file with the new names.



The names of the planes can be changed by left clicking on top of the text.



To draw a sketch on a specific plane, make sure 'Select' is enabled and Sketch is disabled in the Command Bar.



Highlight the desired plane in the Browser, then right-click the mouse to bring up the pop-up menu. Select 'New Sketch' and the sketch plane will automatically switch to that selected plane.

A work plane is an infinite construction plane that is parametrically attached to a part. Work planes can be placed at any orientation in space, offset from existing part faces, or rotated around an axis or edge in a part face. A work plane can be designated as a sketch plane and can be dimensioned or constrained to other features. Selecting different geometry combinations yields different work plane orientations. Each work plane has its own internal coordinate system. The order in which geometry is selected determines the origin and positive directions the coordinate system axes.

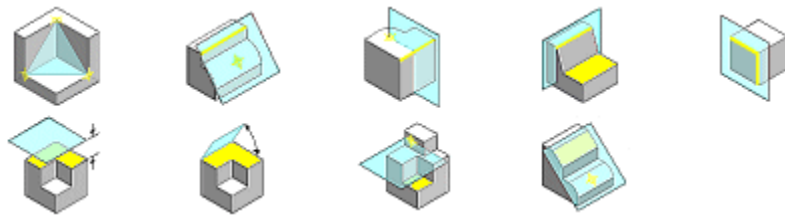
A work plane can be created in-line, while you are using another work feature command. You can create a work plane when the feature command expects you to select a point, line, or plane. When you activate the work plane tool in-line, to respond to the feature command, it terminates as soon as the work plane is created.



TIP: If shading is on, work planes are translucent; otherwise they are transparent



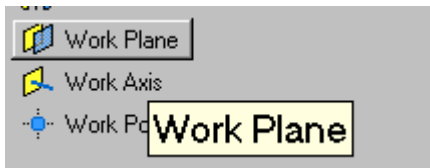
When you select any work feature tool, a right click will bring up a menu that allows the user to switch between work feature creation tools.



There are several different types of work plane options available in Inventor.

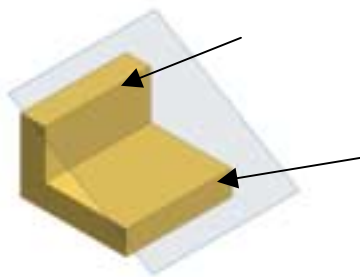
- ◆ 3 Point
- ◆ Tangent to a Face through an Edge
- ◆ Normal to an Axis through a Point
- ◆ Normal to a Face through an Edge
- ◆ Two Coplanar Edges
- ◆ Offset
- ◆ Face-Angle
- ◆ Parallel to a Face through a Point
- ◆ Tangent to a Curve Parallel to a Face

1. Open the lesson1.ipt file created in Lesson 1.

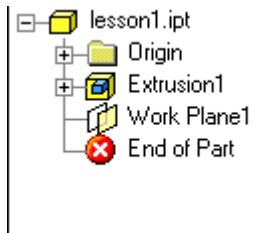


The Features toolbar needs to be visible to access the Work Plane tool. Refer to Lesson 1 on how to bring up the Feature toolbar.

Creating Edge/Edge Work Plane

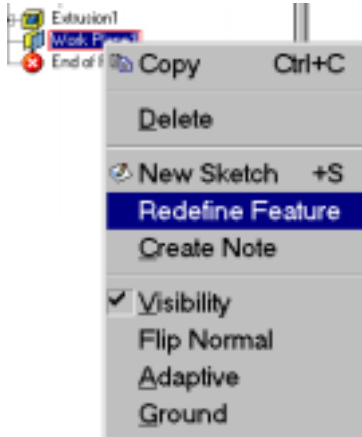


Select the Work Plane tool. Pick the two edges indicated. Use the messages shown in the Message bar to aid you in construction of the work plane.



You will see the new Work Plane defined in the Browser.

Modifying a Work Plane



Some modeling software packages require the user to delete work planes that are improperly defined. Inventor allows the user to redefine work planes easily.

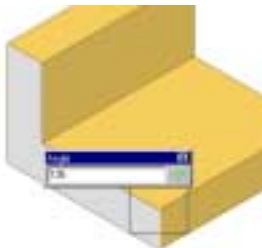
Highlight the Work Plane in the Browser. Right click and select 'Redefine Feature.'

Creating Edge/Angle Work Plane

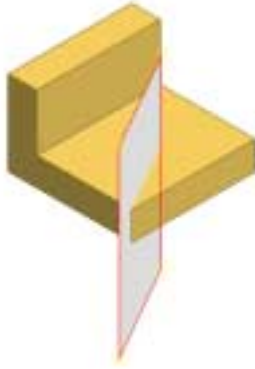


Click to create Plane by Line and Angle to Plane

Select the edge shown. Click twice to see the message displayed.



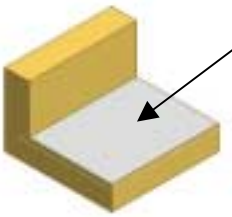
An Angle edit box appears. Type in different values, i.e. 135, 45, 25, and 30. Observe how the plane updates as each value is entered. Type in 60 and then press the green check mark to end the definition.



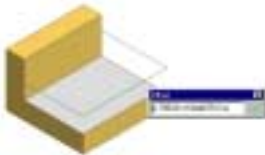
Select the plane created by placing the mouse over the work plane and holding down the left mouse button. Move the mouse up and down and observe how the plane moves along with the mouse.

When the plane is positioned to your satisfaction, release the left mouse button.

Creating an Offset Work Plane



Highlight the Work Plane in the Browser. Right click and select 'Redefine Feature.' Select the plane indicated. With the left mouse button held down, move the work plane up.



An Offset edit box appears. You have the option of using the mouse to place the work plane or entering a value in the edit box. Type various values in the edit box and observe how the work plane automatically updates. Finish by typing the value '2' and clicking the green check mark.





Work Axis

A work axis is a construction line of infinite length that is parametrically attached to a part. Access: Click the Work Axis tool on the Feature toolbar.

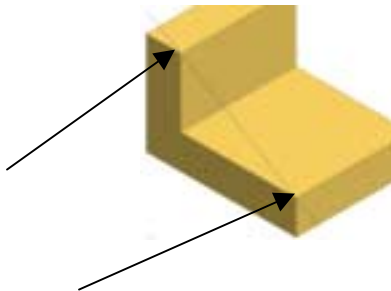
A work axis can be created in-line, while you are using another work feature command. You can create a work axis when the feature command expects you to select a point, line, or plane. When you activate the work axis tool in-line to respond to the feature command, the work axis tool terminates as soon as the axis is created.



A work axis can be created using the following methods:

- ◆ Through a revolved or cylindrical feature
- ◆ Two points
- ◆ Two intersecting planes
- ◆ Perpendicular to a point

To create a work axis using two points:



Select the Work Axis tool. Pick two points. The points will highlight to aid in selection.



TIP: A work axis created with two points will have its positive direction oriented in the direction from the first point selected to the second point.

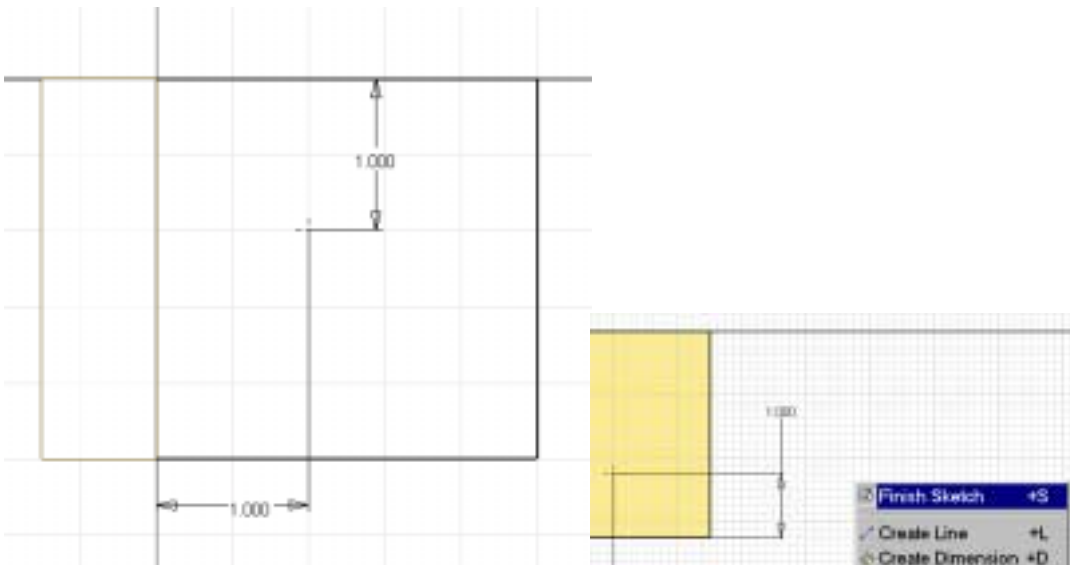
To create a work axis through a point:



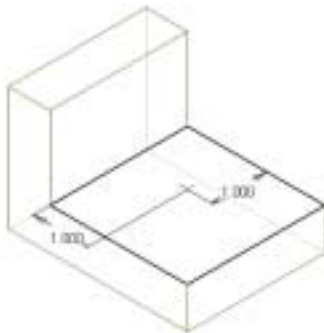
Select the top plane of the bracket by picking on it with the left mouse button. Right click and select 'New Sketch' from the pop up menu to create a 'New Sketch'.



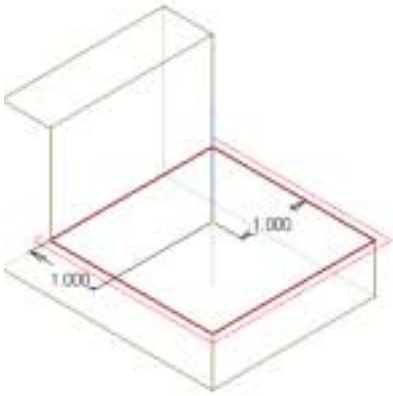
Select the Point tool and locate a point as shown.



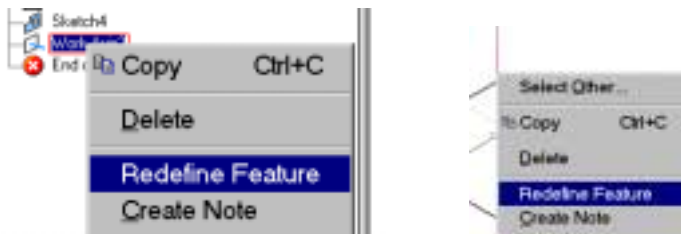
Right click and select 'Done'. Right click again and select 'Finish Sketch'. Switch back to an Isometric View by right clicking and selecting 'Isometric View.'



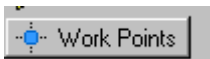
Select the Work Axis tool.



Select the point and a Work Axis will be placed.



To modify or delete the work axis, simply select the work axis in the browser or in the drawing window; right click and select the desired option.



Work Points

A work point is a parametric construction point that can be placed anywhere on part geometry or in 3D space. A work point can be created in-line, while you are using another feature command. You can create a work point when you need to select a point, line, or plane. When you create a work point in-line, to respond to the feature command, it terminates as soon as the work point is created.

When you create work points independent of a feature command, you can create multiple work points.

You can move the cursor over the model to highlight valid work point locations.

Click one of the following geometric elements of the active part or feature to place the work point:

- Midpoint of a curve or an edge
- Endpoint of a curve or an edge
- Center of an arc, circle, or ellipse
- Planar face or work plane



Work points can be created using the following methods:

- ◆ Intersection of three planes
- ◆ Offset from two edges
- ◆ Projected from a plane
- ◆ Two projected edges
- ◆ Intersection of any plane and edge
- ◆ Intersection of any two edges
- ◆ Intersection of any three planes
- ◆ Projected intersection of two coplanar edges, (linear or curved)

Save the file as 'lesson2.ipt' using the 'Save Copy As' option under File.



TIP: When you use 'Save Copy As' your current file's name does not change nor is the current file saved. You are saving a copy of the current file under a new name.

Review Questions

1. Inventor automatically creates all of the following features EXCEPT:
 - A. XY Plane
 - B. XZ Plane
 - C. Origin
 - D. Z axis
2. When creating a new part, the default sketch plane is:
 - A. XY Plane
 - B. XZ Plane
 - C. YZ Plane
 - D. There is no default sketch plane.
3. To have the view automatically switch to PLAN view when starting a sketch:
 - A. Enable 'Parallel view on Sketch Creation' under the Part tab in the Options dialog
 - B. Use the 'Look At' tool.
 - C. Use the '3D Rotate' tool.
 - D. Type '9'.
4. To sketch on a the XZ plane:
 - A. Highlight the XZ plane in the browser, right click and select 'New Sketch'.
 - B. You can only sketch on the XZ plane if there is a feature located on that plane.
 - C. Delete all existing features, start a new part file and set the default sketch plane to XZ Plane.
 - D. Go to Options and select XZ Plane.
5. Work Planes are visible when:
 - A. Visibility is turned ON and Hidden mode is ENABLED.
 - B. Visibility is turned OFF and Shaded mode is ENABLED.
 - C. Visibility is turned ON and Wire Frame mode is ENABLED.
 - D. Visibility is turned ON and Shaded mode is ENABLED.
6. When placing a work feature, such as Work Plane, the user can switch to create a Work Axis by:
 - A. Select the Work Axis tool.
 - B. Press the space bar.
 - C. Press the tab key.
 - D. Right click and select Work Axis from the menu.
7. Work Planes can be created in all the ways listed below EXCEPT:
 - A. 3 Point
 - B. Projected two offset planes
 - C. Offset
 - D. Face-Angle

8. The Work Features tools are located on:
 - A. The Sketch Toolbar
 - B. The Assembly Toolbar
 - C. The Features Toolbar
 - D. The Drawing Annotation Toolbar
9. To modify a Work Feature:
 - A. Select the Work Feature in the browser, right click and select 'Edit'.
 - B. Select the Work Feature in the drawing window, right click and select 'Edit'.
 - C. Select the Work Feature in the browser or the drawing window, right click and select 'Redefine Feature'.
 - D. Select 'Modify' from the menu and then select the work feature.
10. A work axis created with two points:
 - A. Has the positive direction oriented in the direction from the first point to the second point.
 - B. Has the positive direction oriented in the direction from the second point to the first point.
 - C. Has the positive direction oriented in the direction of the Z axis.
 - D. Has no positive/negative direction. It's an axis.

ANSWERS: 1) C; 2) A; 3) A; 4) A; 5) D; 6) D; 7) B; 8) C; 9) C; 10) A

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