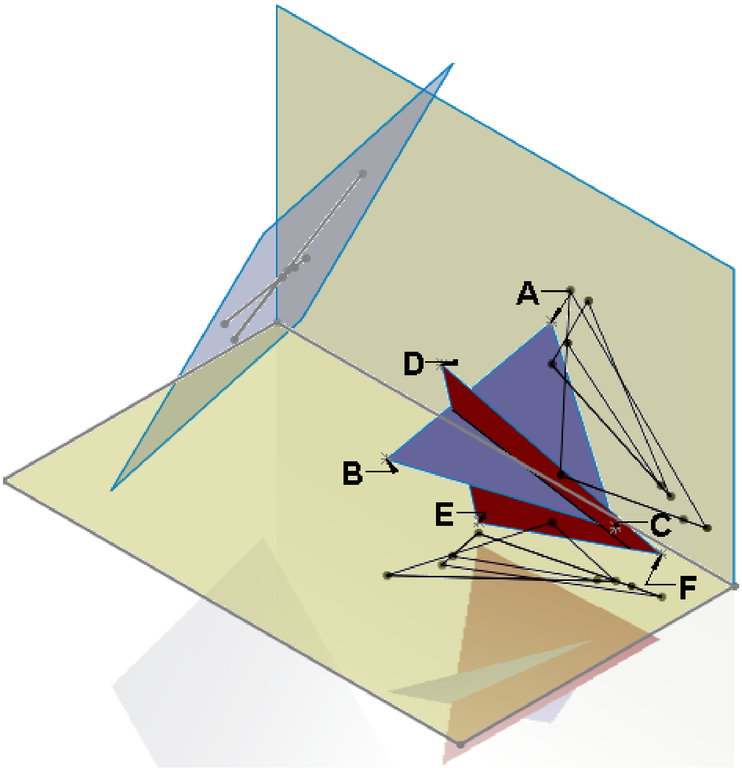
TECHNOLOGY SUBJECTS SUPPORT SERVICE

Intersecting Lamina



Prerequisite knowledge To complete this model you should have a working knowledge of Solidworks 2006/2009.

Focus of lesson This lesson focuses on using SolidWorks to solve a geometrical problem. The following **Surfaces** tools are used: **Planar Surface, Ruled Surface.**

Problem The horizontal and vertical coordinates for two intersecting planes **ABC** and **DEF** are given below.

A	=	170	---	95	---	20
B	=	215	---	25	---	30
C	=	150	---	55	---	90
D	=	235	---	20	---	25
E	=	155	---	5	---	45
F	=	160	---	95	---	70

(a) Draw the plan and elevation of the intersecting planes

(b) Determine the line of intersection between the planes

(c) Determine the dihedral angle between the planes

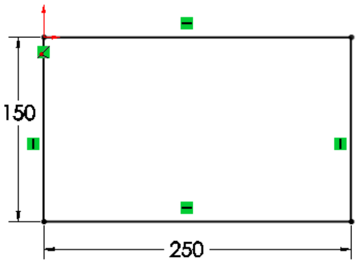
Getting started.

New File Create a new part file and save it as **Intersecting Lamina** in the desired location.

New Sketch We are going to begin by creating a sketch to represent the outline of portion of the **Horizontal Plane**.

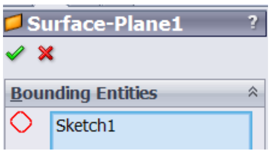
Create the sketch shown on the Top plane.

Smart Dimension as shown.



We want to transform this rectangle into a **Planar Surface.**

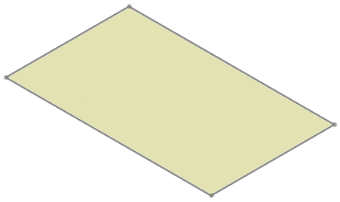
Planar Surface Select **Planar Surface** Planar Surface from the **Surfaces** toolbar.



Select **Sketch 1** as the **Bounding Entities.**

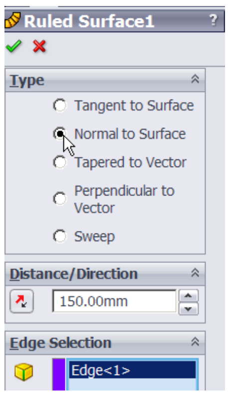
Select **OK**

Rename Feature Rename the feature as **Horizontal Plane.**



We have now created a portion of the horizontal plane. This planar surface has no thickness but can be used as a datum for measurements, a surface to project views onto, or a surface to sketch on.

The Vertical Plane To create the vertical plane we use **Ruled Surface.** **Ruled Surface** command Ruled Surface creates surfaces that extend out in a specified direction and distance from selected edges.

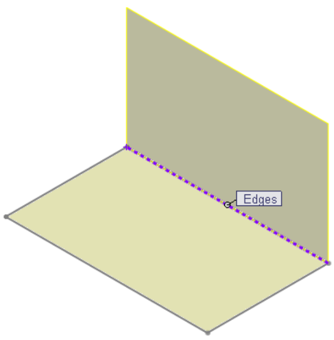


Ruled Surface Select **Ruled Surface** from the **Surfaces** toolbar.

Select **Normal to Surface** as the **Type**. This will create a ruled surface at 90 degrees to another surface at a specified edge.

Set the **distance** to 150mm. This will extend the surface out 150mm from the selected edge. The width of the surface will be determined by the length of the edge selected.

Select the edge of the **Horizontal Plane** shown as the edge to set up the ruled surface from.

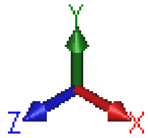


Select **OK.**

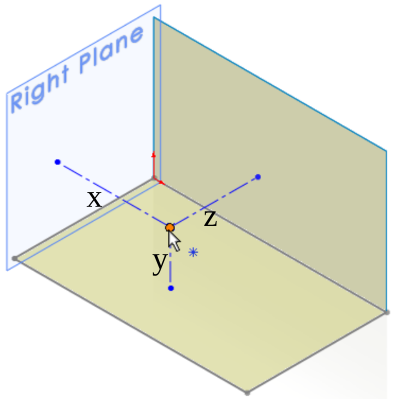
Rename Feature Rename the feature as **Vertical Plane**.

Positioning Co-Ordinates

In order to use the **XYZ** Co-ordinates to position the points **A, B** and **C**, select **3DSketch** from the **Sketch** toolbar.



The co-ordinates are positioned as follows:
The **X** value is the distance of the point from the **Origin** or the **Right Plane**.

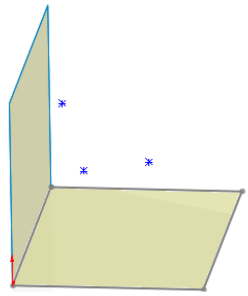


The **Y** value is the distance of the point from the **Horizontal Plane**.

The **Z** value is the distance of the point from the **Vertical Plane**.

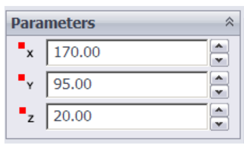
Using the **front view** we can see the **X** and **Y** values; using **top view** we can see the **X** and **Z** values; use the **right view** to see the **Y** and **Z** values.

Rotate the sketch as shown so that when the points are dropped in we can avoid making them coincident with the two planes.



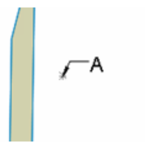
Using the **Point** command from the **Sketch** toolbar, drop **3** points into the sketch as shown. Select **OK** and press escape to exit the **Point** command.

We must now enter the coordinates of the points. Select one of the points to access its co-ordinates or **parameters**.

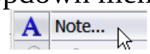


Enter the following values for the point .

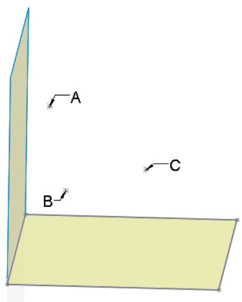
Select **OK.**



Labelling the Coordinates

From the **Insert** dropdown menu, select **Annotations, Note** 

Make the endpoint of the arrowhead coincident with the points as shown, select **Arial** as the text, and label the point **A**.



Repeat this procedure for points **B** and **C** entering the co-ordinates as given at the beginning of the exercise.

N.B. to change the values of the coordinates you must first hide the **annotations**. This is done from the ***heads up toolbar***. Select **hide/show items**, de-select **annotations display.**

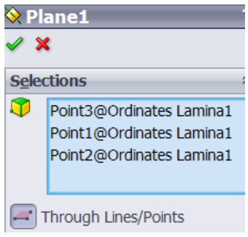
Rename Feature

Rename the **3DSketch** as **Ordinates Lamina ABC**.

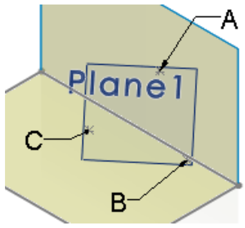
Insert Plane

We now want to create a lamina containing all three points. In order to do this we must create a **Plane** which contains all three points.

Select **reference geometry, plane**



Choose **through lines/points** as entities for selection.
Select the three points **A,B** and **C.**

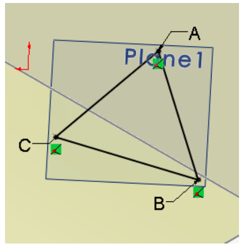


Select **OK.**

Creating the Lamina

We can now create the lamina on this plane. Using the **line** command, create the following sketch on **Plane1**.

(Note the automatic relations)

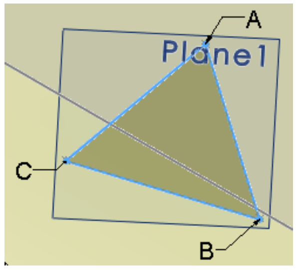


Rename Sketch

Rename the sketch as **sketch abc**.

Planar Surface

Select **Planar Surface** from the **Surfaces** toolbar. We use **planar surface** so that if needs be we can sketch on it or project lines/points onto it.



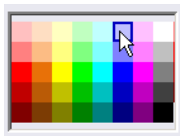
Select **sketch abc** as **bounding entities**.

Rename Feature

Rename the feature as **ABC**

Select **OK.**

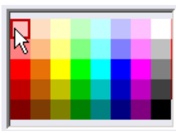
Hide **Plane1.**



Set the colour of **ABC** as shown.

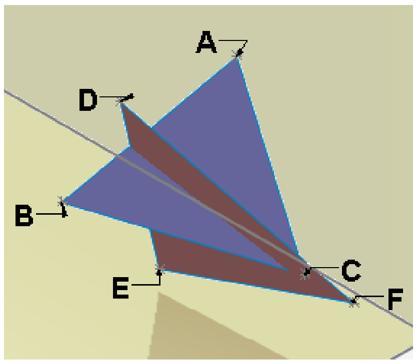
Lamina DEF

Create **Lamina DEF** following the same steps, and using its coordinates as given at the beginning of the exercise.



Set the colour of **DEF** as shown.

We have now created the intersecting lamina.

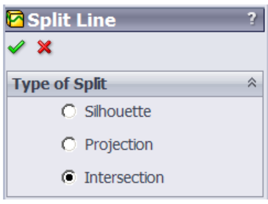


Line of Intersection

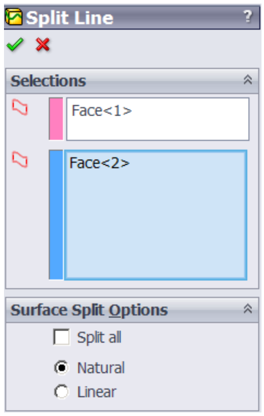
To determine the line of intersection between the two planes we use the **Splitline** command. When using **Splitline** in this situation we select one lamina as the **cutting plane** and the other as the **cut plane**.

From the **Surfaces** toolbar select **Curves**, **Splitline**.

Under **Type of Split** choose **Intersection.**

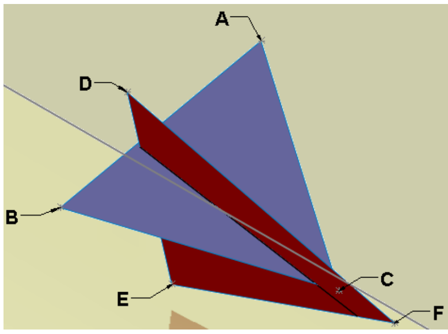


Choose **Lamina ABC** as the cutting or ***Splitting plane,*** and **Lamina ADE** as the ***Plane to be split.***



In the **Surface Split Options,** choose ***Natural.***

Choose **OK**

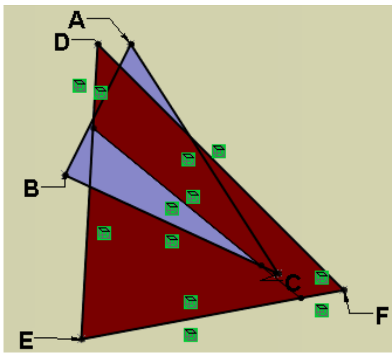


Rename Feature

Rename the feature as **Line of Intersection.**

Creating the Orthographic Views

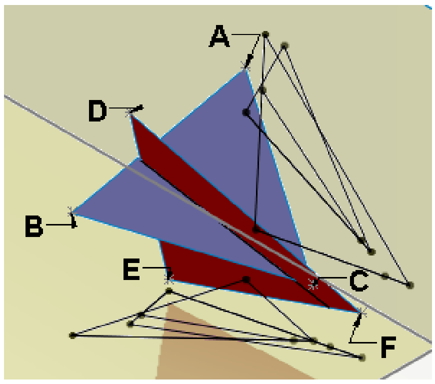
The orthographic projection of the intersecting lamina can be created using the **Convert Entities** command.



We must first of all create a new sketch on the **Vertical plane**. Select a **front** view.

Hold down the **Ctrl** key and select all of the lines on the sketch, including the line of intersection. Now select **Convert Entities.** The elevation is created on the vertical plane.

Confirm the sketch.



Rename Sketch

Rename the sketch as **Elevation.**

Repeat the process for the **plan** view, creating the sketch on the **horizontal plane** this time.

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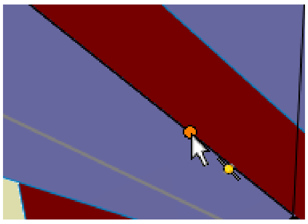
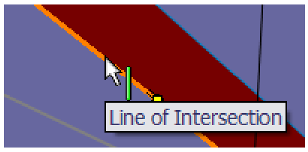
Finding the Dihedral Angle

In order to find the dihedral angle, i.e. the angle between the two lamina we must take a point view of the **Line of Intersection**. In order to capture this view we must set up a plane perpendicular to the **Line of Intersection**.

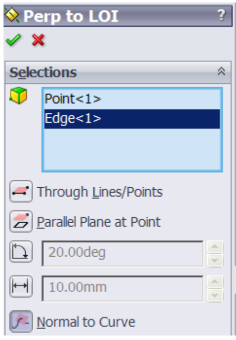


Choose **reference geometry, plane**

Select the **midpoint** of the **Line of intersection** as one of the selections. We do this so that if we enter different values for the coordinates, the plane will always set up on the midpoint of the **line of intersection.**
N.B. this plane is for construction only. We will set up the plane required for the auxiliary view parallel to this.



Select the **Line of Intersection** as the other selection.

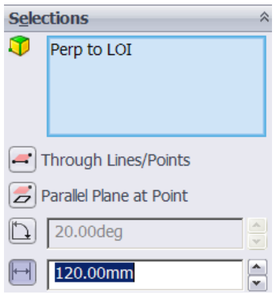


Choose **normal to curve** so that the plane will be perpendicular to the **Line of Intersection.**

Rename Feature

Rename the plane as **Perp. to LOI**.

We now have the construction plane set up. The next step is to set up the plane onto which the auxiliary view will be projected.

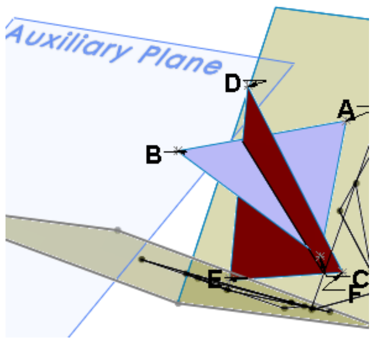


Once again select **reference geometry, plane**

Select **Perp to LOI** as the reference plane, set the distance to **120mm.**

Choose **OK.**

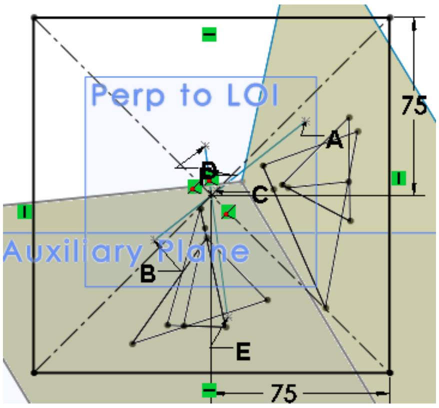
We now have the auxiliary plane that will Contain the required view. You will notice that the plane produced can be to the right or left of the initial plane, but it remains parallel to the plane. In order that the projected view will appear directly on the auxiliary plane we will create a portion of the auxiliary plane which has its centrepoint **coincident** with the **Line of Intersection**.



Therefore if we want to change the coordinates to suit another similar problem, the auxiliary plane will always have its centrepoint coincident with the point view of the line of intersection.

Sketch

Create a sketch on the **Auxiliary Plane**. Select **Normal to.** We are now looking at a point view of the **line of Intersection**.



Select **Centre Rectangle** and make its centre Coincident with the point view of the **line of Intersection.** Note the relations.

Smart Dimension as indicated.

If the coordinates of the lamina are changed to suit another problem, this portion of the auxiliary plane will always have the point view of the line intersection coincident with its centrepoint.

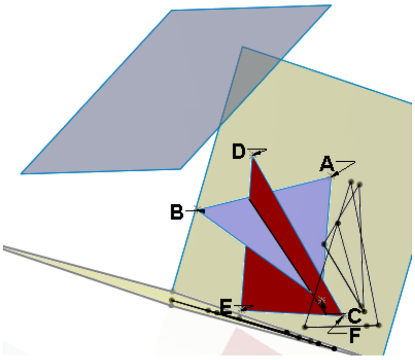
Confirm the sketch.

Rename Sketch

Rename the sketch as **sketch of portion of AP**

Planar Surface

Select **Planar Surface** from the **surfaces** toolbar.



Choose **sketch of portion of AP** as the **Bounding entities**.

Hide **Auxiliary Plane** and **Perp to LOI**

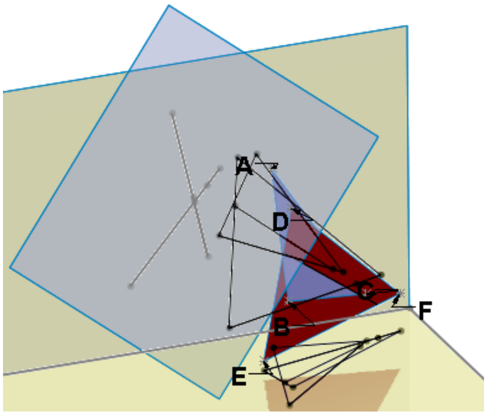
Choose **OK.**

Rename Feature

Rename the feature as **Portion of AP.**

Auxiliary View

Create the auxiliary view on the **Portion of AP** using **Convert Entities** as in the **Orthographic Views**.



We can now see the angle between the **Lamina ABC** and **DEF**.

Rename Sketch

Rename the sketch as **Dihedral Angle.**

This model can now be used to solve similar problems involving intersecting lamina.

Exercise complete!