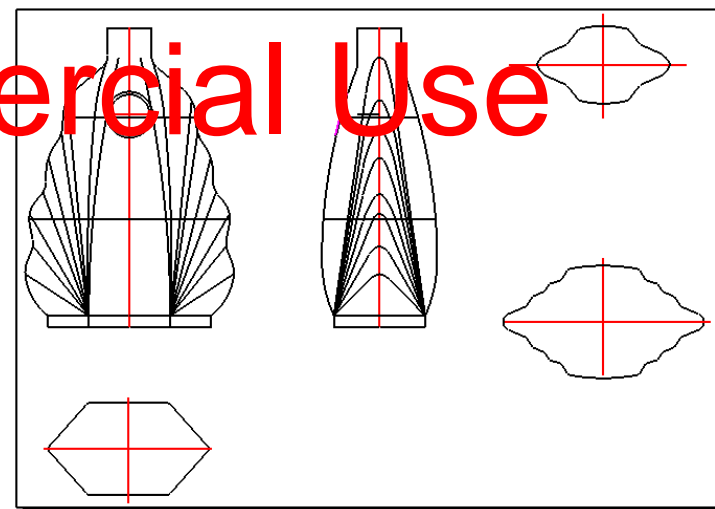


# CATIA V5 Surface-modeling

## (Tutorial 5-Perfume Bottle)

Not For Commercial Use



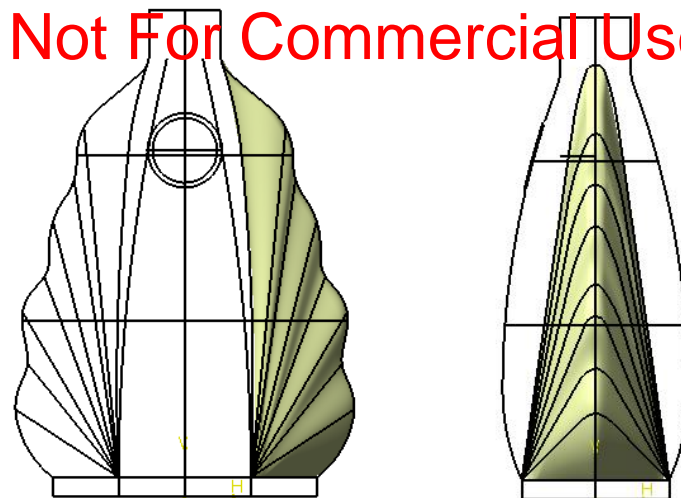
GSD (Surface-modeling)

A- 1

Not For Commercial Use

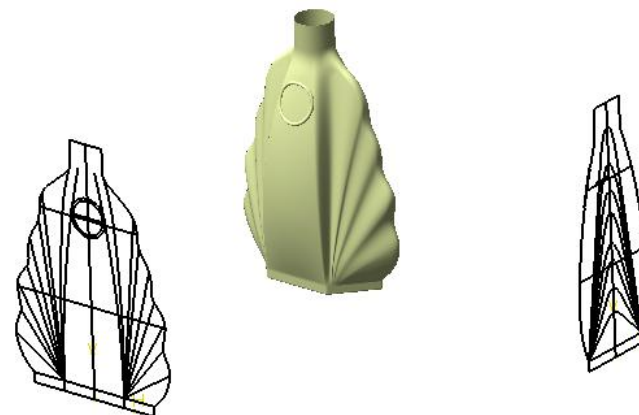
### Tutorial 5A

- Import a 2D outline drawing into Catia
- Build 3D curves based on the imported drawing
- Build the “right wing” of the perfume bottle (by Generative Shape Design)



### Tutorial 5B

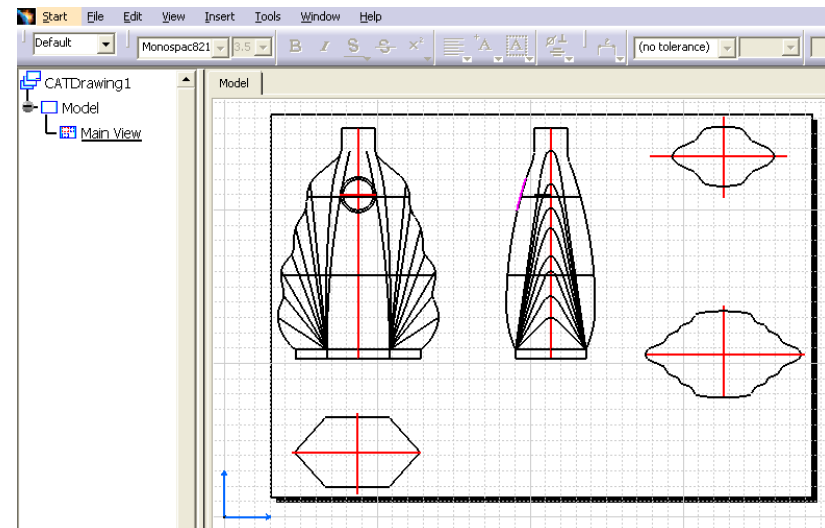
- Continue to build the remaining outer faces
- Close all the openings except the bottle mouth
- Apply a material texture



Please be reminded that this series of tutorials is designed to demonstrate a design approach with CATIA, rather than the command itself.

# Tutorial 5A

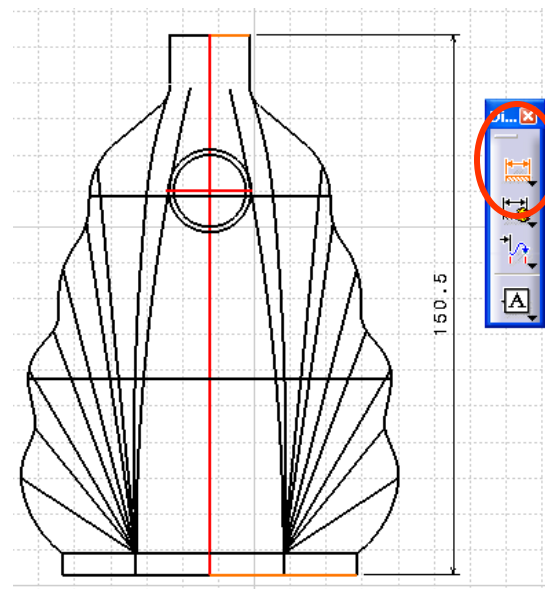
- Download **perfume\_outline.dxf** via <http://www.youtube.com/dicksham>
- Create a new project folder and copy this drawing file **perfume\_outline.dxf** into the folder
- Enter CATIA by double-clicking its icon on the desktop
- (If the license menu pops up, select **ED2** and close CATIA. Then reopen again)
- By default, an empty “Product” file is created. But now, you don’t need this, just select “**File/Close**” on the menu bar
- Select “**File/Open**” on the menu bar and select the drawing (**perfume\_outline.dxf**)



# Tutorial 5A

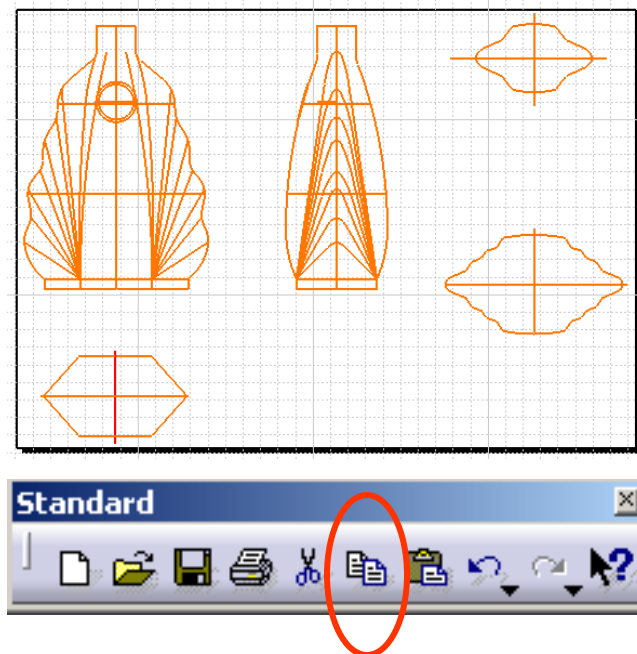
**To confirm that the size of the drawing is correct:-**

- Click “**Dimensions**” icon;
- Click the highest line and then the lowest line on the front view to measure the height;
- Check if the displayed dimension is 150.5mm; If not, we need to enlarge or shrink the drawing into the correct size.



**To copy and paste the drawing into 3D space:-**

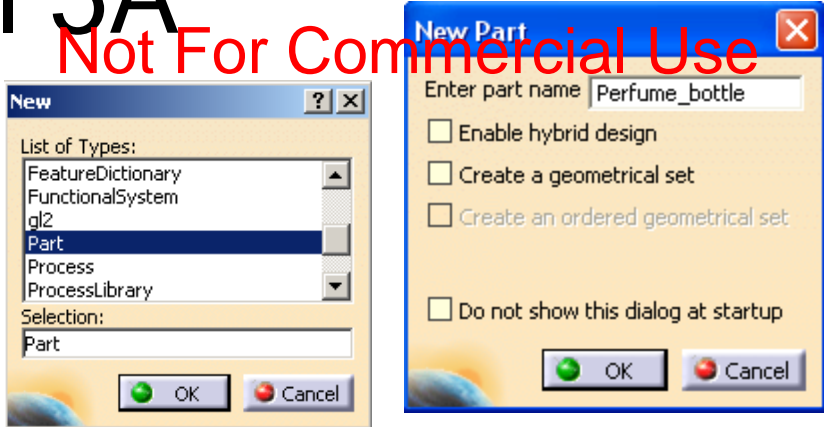
- Multi-select all entities on the drawing;
- Click “**Copy**” icon (or “Ctrl C” on keyboard).



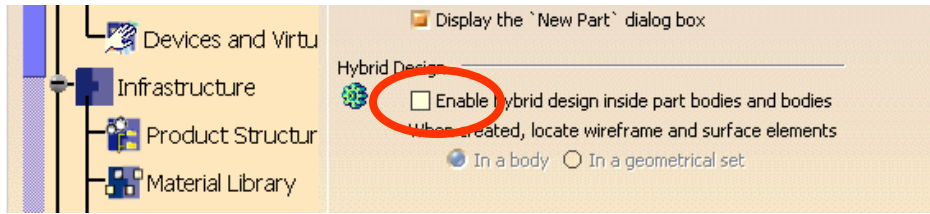
# Tutorial 5A

Not For Commercial Use

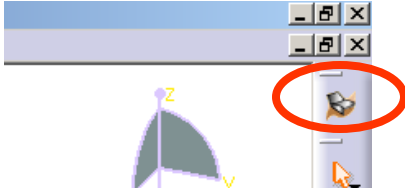
- Select **“File/New”** on the menu bar;
- Select **“Part”** as the Type;
- Enter **“Perfume\_bottle”** as part name;
- Leave the two options **“Enable hybrid design”** & **“Create a geometrical set”** unchecked; now a new empty part is created.



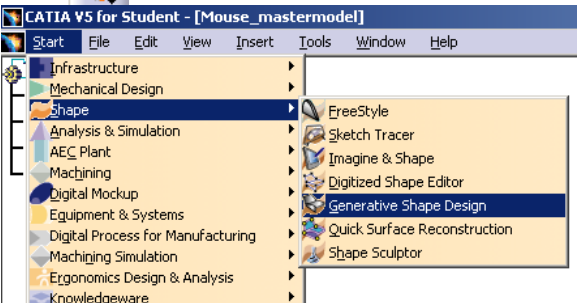
- (To confirm that Hybrid Design is not activated), select **Tools/Options/infrastructure/Part Infrastructure...** then confirm that **the option “Enable Hybrid Design inside part bodies and bodies” is NOT SELECTED.**



- Check if the current workbench has been **“Generative Shape Design”**. You can see the workbench icon at the upper right-hand corner.

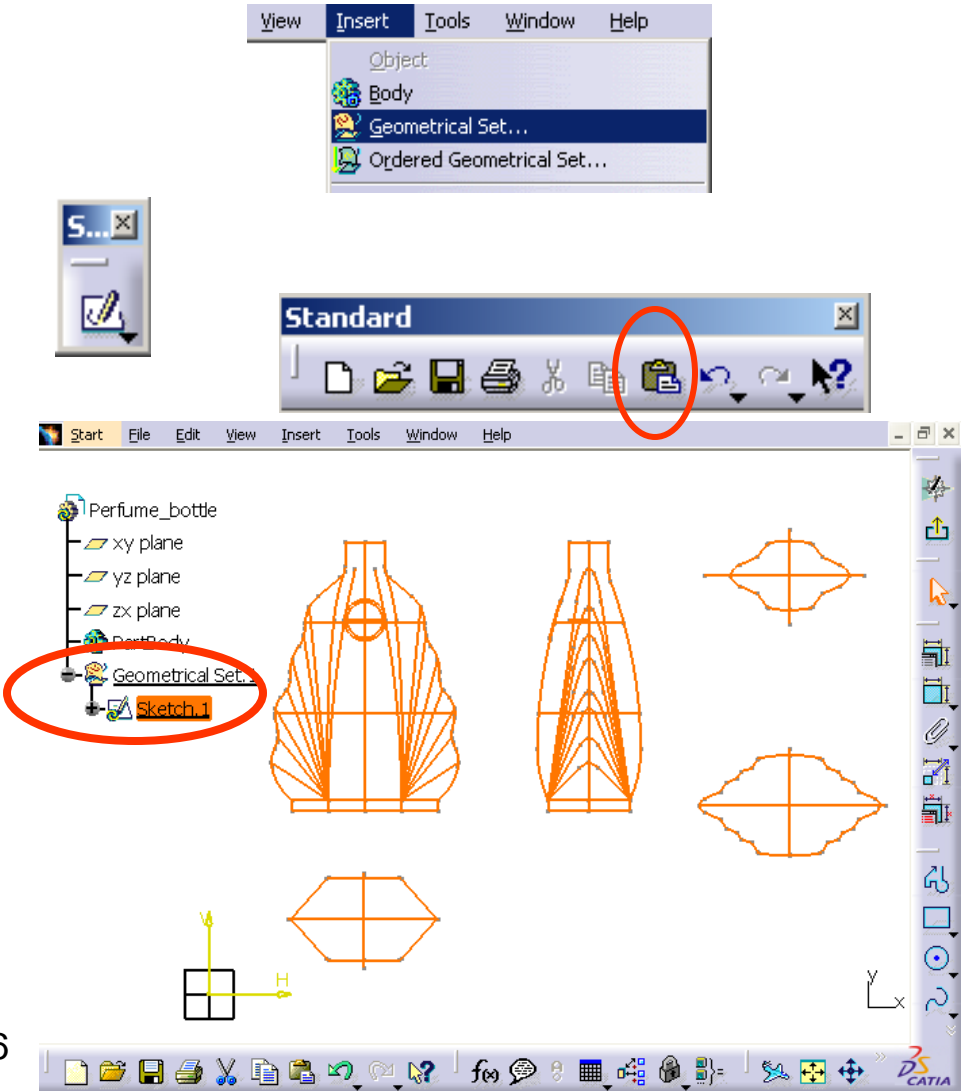


- If the current workbench is **“Part Design”** for example, select **“Start/Shape/Generative Shape Design”** on the menu bar.



# Tutorial 5A

- Select “**Insert/Geometrical Set...**” on the menu bar; then click ok to confirm; (This geometrical set is going to store all five reference views of the perfume bottle).
- Click “**Sketch**” icon and select **xy plane**;
- Click “**Paste**” icon to paste the drawing onto the xy plane;
- Click “**Exit**” icon to exit the sketcher mode. (Now “Sketch.1” is stored in “Geometrical Set.1”)



# Tutorial 5A

**To split the drawing into five individual views and then position them:-**

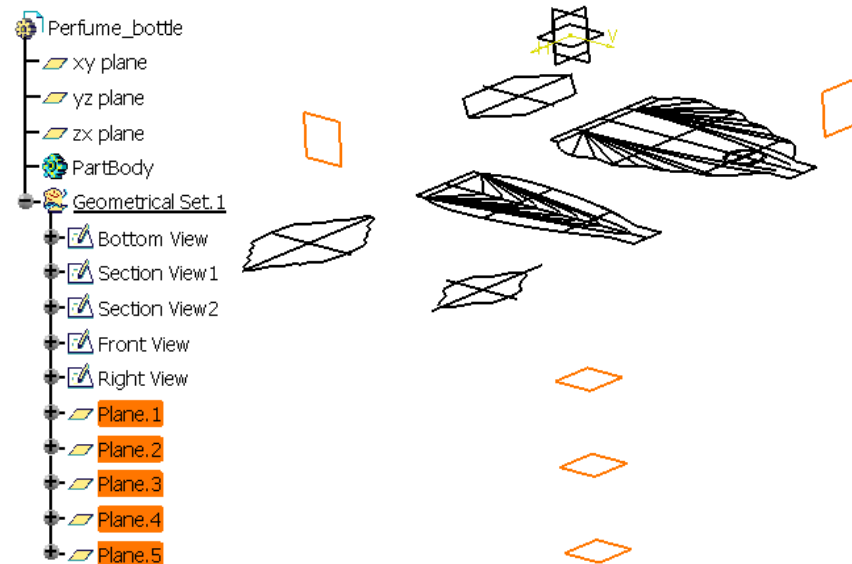
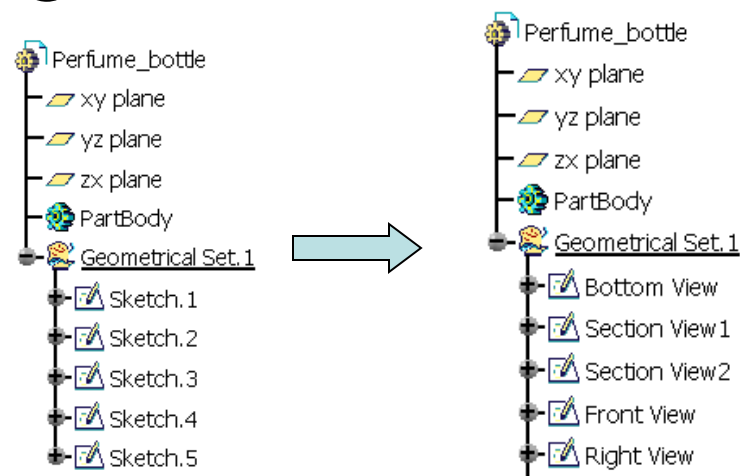
- Duplicate FOUR more “Sketch.1” by copy-and-paste;
- Rename them as “Bottom View”, “Section View1”, “Section View2”, “Front View” & “Right View”.

- Click “Plane” icon;
- Select “offset from plane” as type;
- Pick “XY plane” as reference;
- Enter **-200mm** as offset value;
- Click ok to confirm.



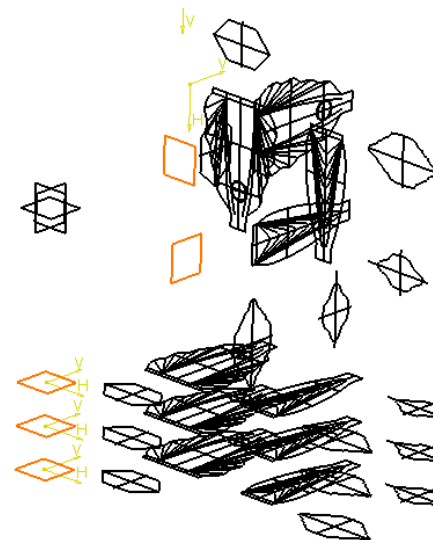
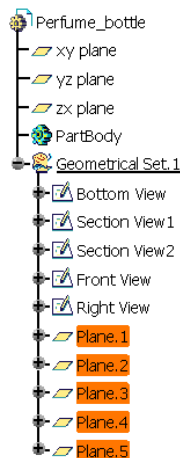
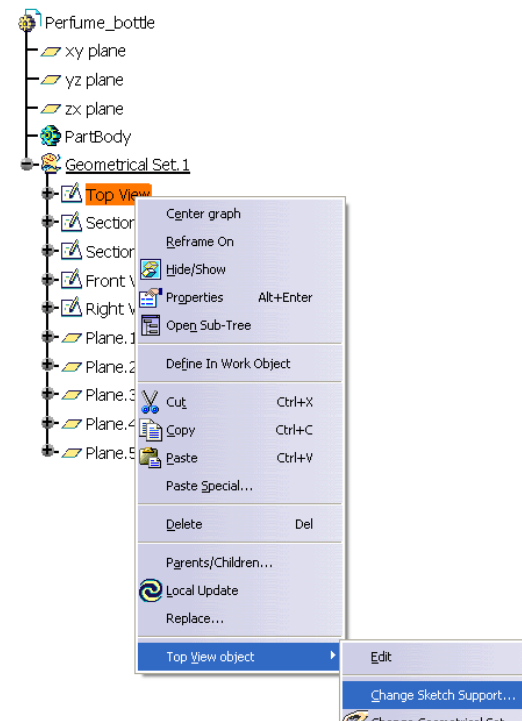
- Create an offset plane, -250mm from **XY plane**;
- Create an offset plane, -300mm from **XY plane**;
- Create an offset plane, 200mm from **YZ plane**;
- Create an offset plane, 200mm from **ZX plane**;

A- 7



# Tutorial 5A

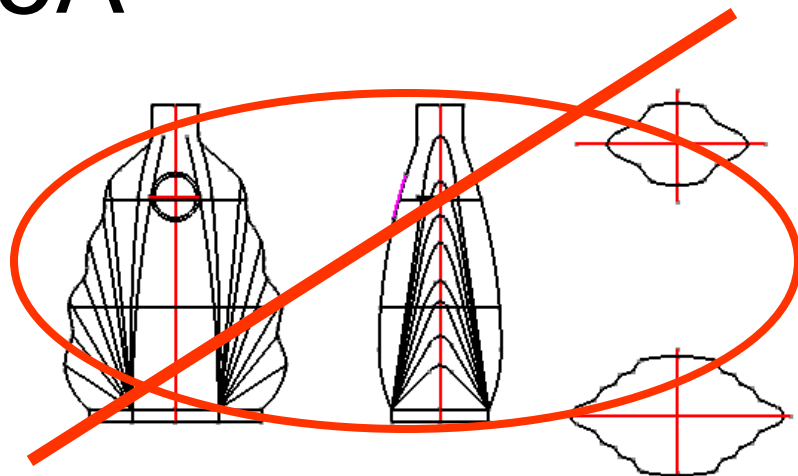
- Right-click on “**Bottom View**” on the tree and select “**Top View object/ Change Sketch Support**”;
- Select “**Plane.1**”;
- Click ok to confirm.
  
- Similarly, right-click “**Section View1**” and select “**Change Sketch Support**”;
- Select “**Plane.2**”;
- Click ok to confirm.
  
- Similarly,
- “**Section View2**” → “**Plane.3**”
- “**Front View**” → “**Plane.4**”
- “**Right View**” → “**Plane.5**”



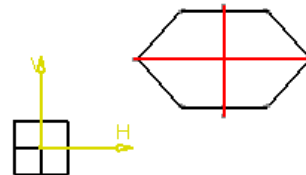


# Tutorial 5A

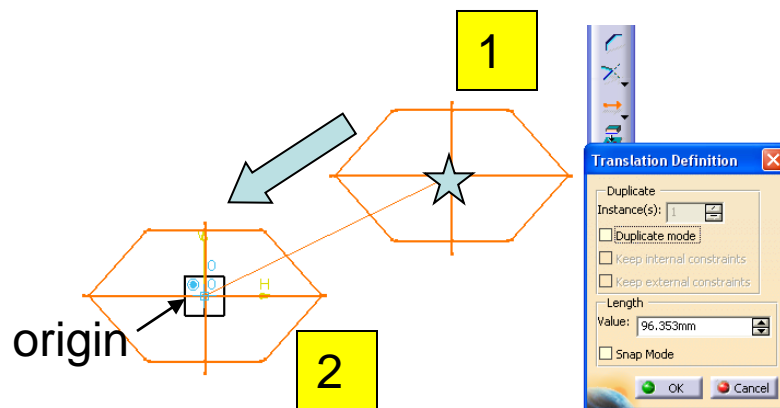
- Double-click “**Bottom View**” sketch on the tree to edit;
- Select and delete the curves not related to the bottom view;
- (After deletion, you can still see curves at the same position, but they belong to the other sketches “Section View1” & Section View2”.)



- Select all elements of the profile and then click “**Translate**” icon;



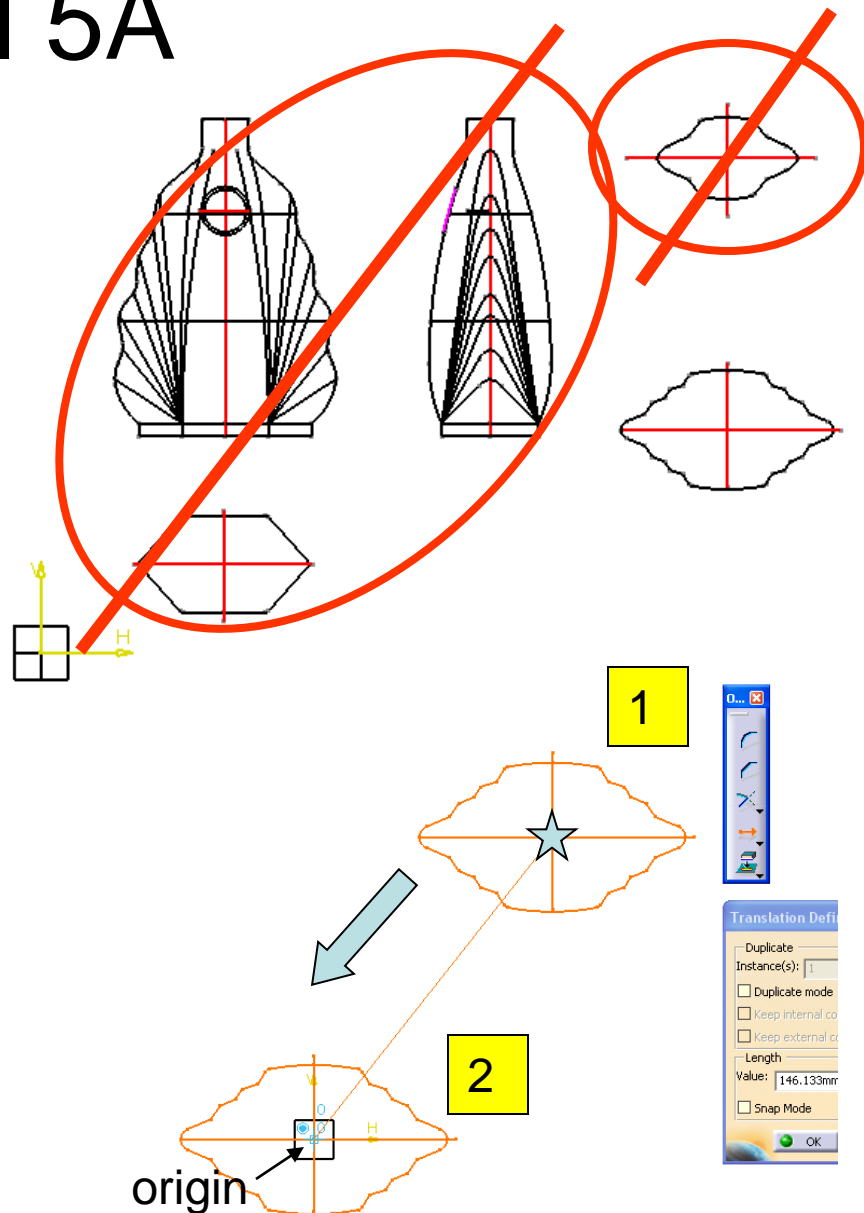
- Leave “Duplicate mode” unchecked;
- Click the intersection point ☆ ;
- Then Click the origin of the sketch. (Now the bottom view is relocated at the origin);
- Click “**Exit**” to complete.



# Tutorial 5A



Similarly, we can modify “Section View1”...

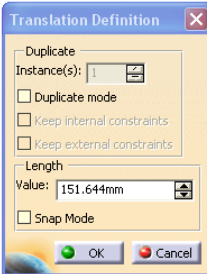
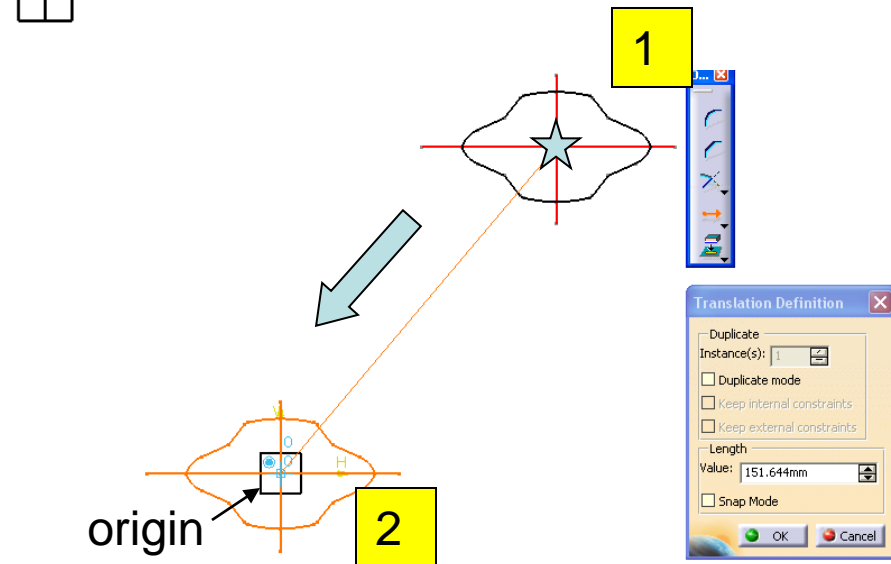
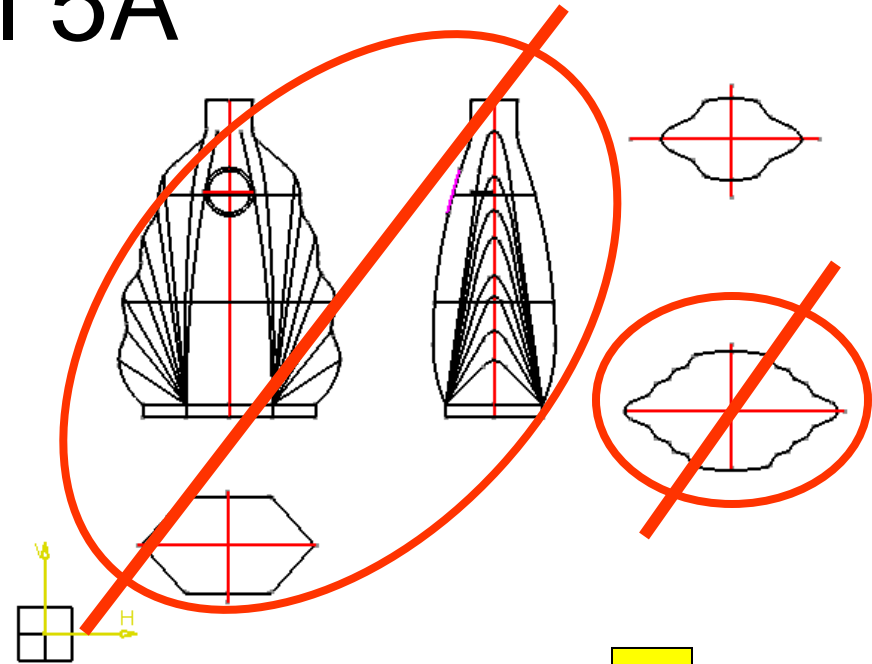
- Double-click “Section View1” sketch on the tree to edit;
- Select and delete the curves not related to this view;
- Select all elements and then click “Translate” icon;
- Leave “Duplicate mode” unchecked;
- Click the intersection point ☆;
- Then Click the origin of the sketch. (Now the “section view1” is relocated at the origin);
- Click “Exit” to complete.



# Tutorial 5A



Similarly, we can modify “Section View2”...

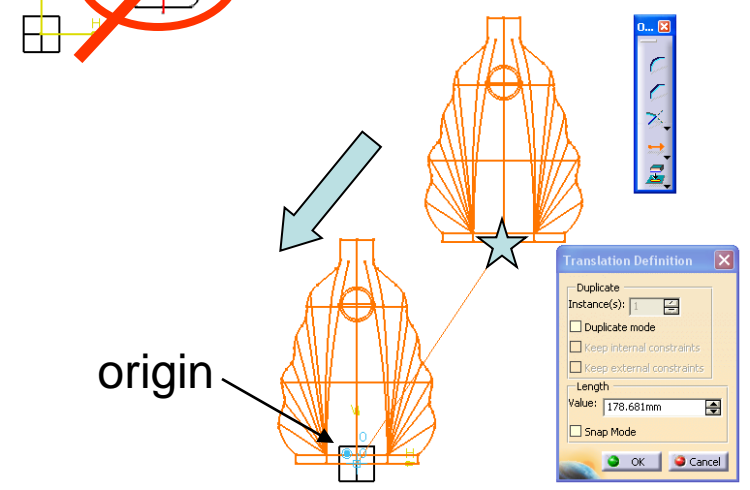
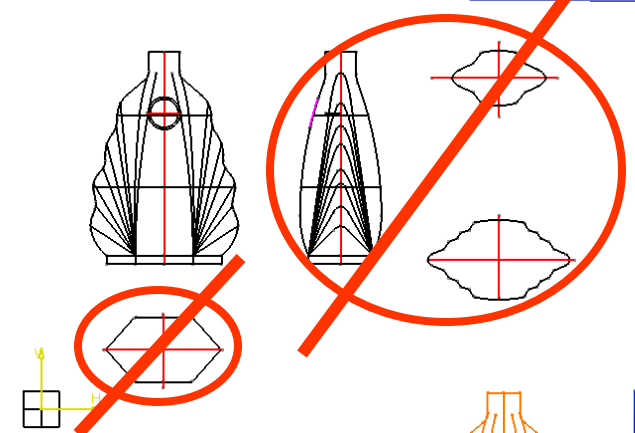
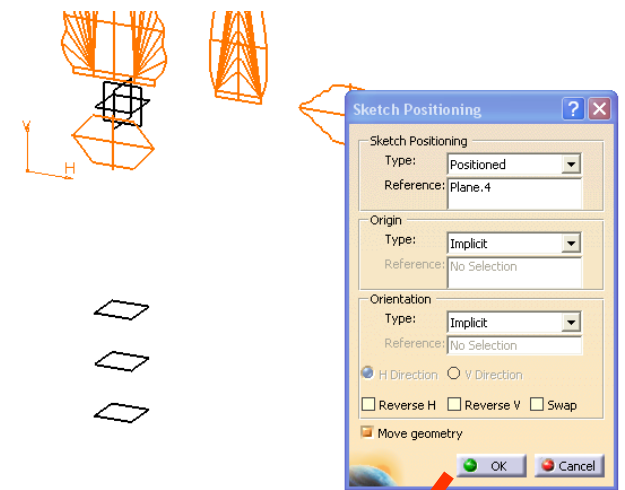
- Double-click “Section View2” sketch on the tree to edit;
- Select and delete the curves not related to this view;
- Select all elements and then click “Translate” icon; 
- Leave “Duplicate mode” unchecked;
- Click the intersection point ☆;
- Then Click the origin of the sketch. (Now the “section view2” is relocated at the origin);
- Click “Exit” to complete. 



# Tutorial 5A

## Similarly, we can modify “Front View”...

- Right-click the “Front View” sketch on the tree and select “**Change Sketch Support**”;
  - Select “**Positioned**” as Type of sketch positioning;
  - (Select “**Implicit**” as both Origin Type & Orientation Type);
  - Click **ok** to confirm.
- 
- Double-click “**Front View**” sketch on the tree to edit;
  - Select and delete the curves not related to this view;
- 
- Select all elements and then click “**Translate**” icon;
- 
- Leave “Duplicate mode” unchecked;
  - Click the intersection point  ;
  - Then Click the origin of the sketch. (Now the “Front View” is relocated at the origin);
  - Click “**Exit**” to complete. 

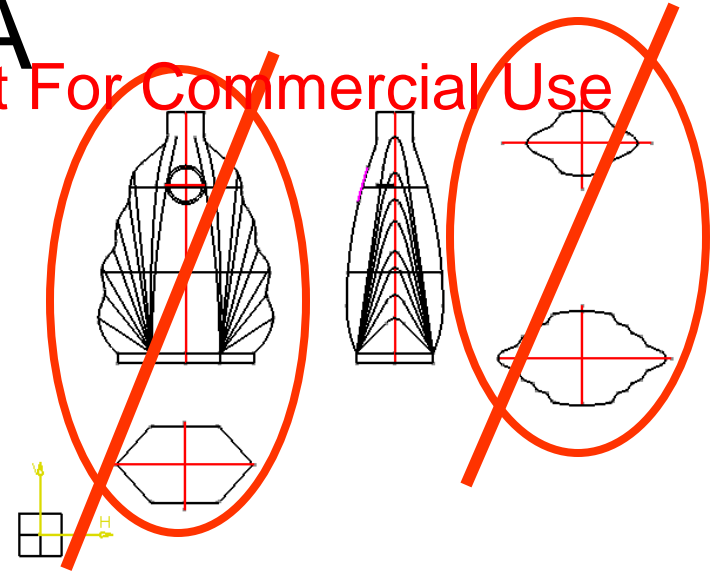



# Tutorial 5A

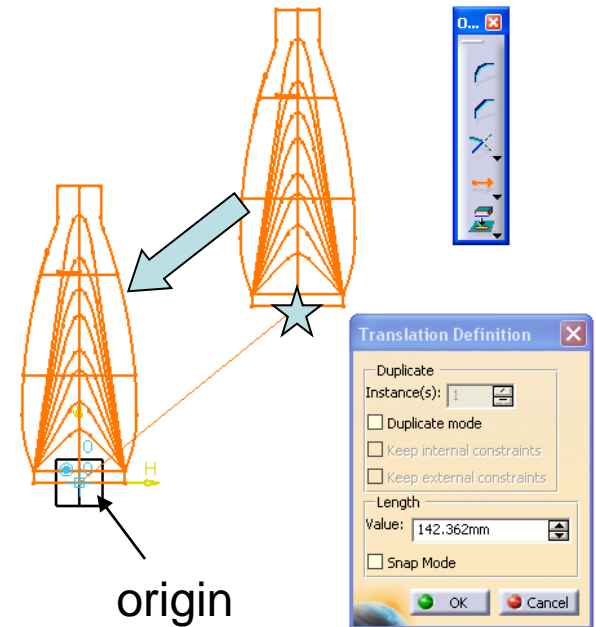
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## Similarly, we can modify “Right View”...

- Right-click the “Right View” sketch on the tree and select “**Change Sketch Support**”;
- Select “**Positioned**” as Type of sketch positioning;
- (Select “**Implicit**” as both Origin Type & Orientation Type);
- Click **ok** to confirm.

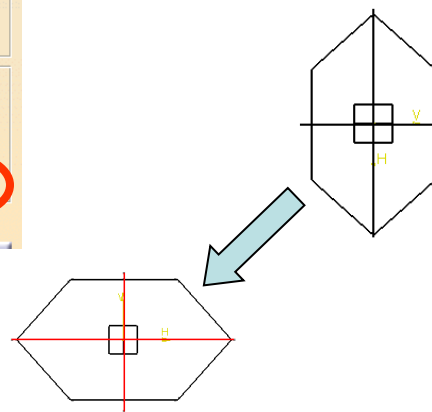
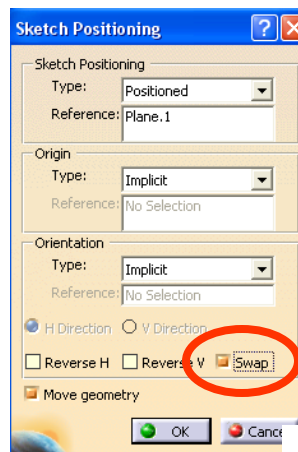
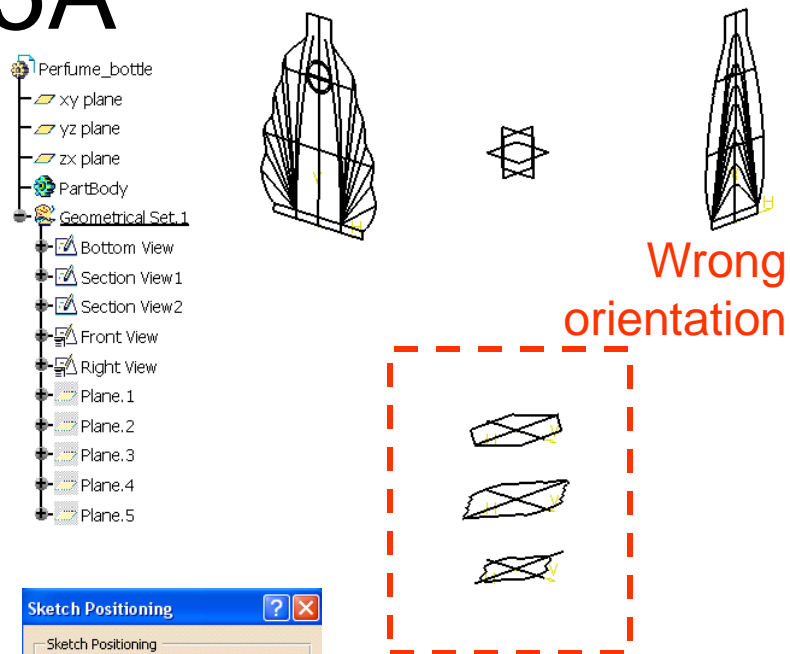


- Double-click “**Right View**” sketch on the tree to edit;
- Select and delete the curves not related to this view;
- Select all elements and then click “**Translate**” icon;
- Leave “Duplicate mode” unchecked;
- Click the intersection point ☆ ;
- Then Click the origin of the sketch. (Now the “Right View” is relocated at the origin);
- Click “**Exit**” to complete. 



# Tutorial 5A

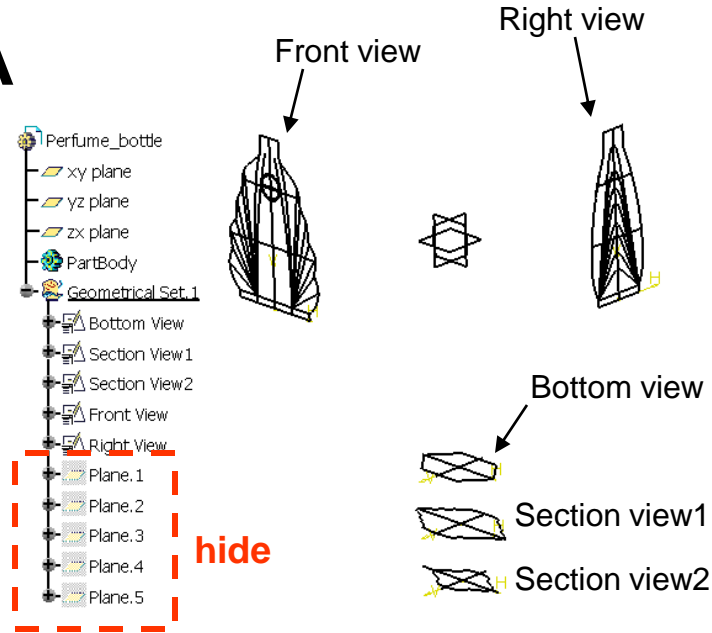
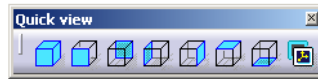
- (At this moment, we can see that “Bottom View”, “Section View1” & “Section View2” are at wrong orientation.)
- Right-click the “Bottom View” sketch on the tree and select “**Change Sketch Support**”;
- Select “**Positioned**” as Type of sketch positioning;
- (Select “**Implicit**” as both Origin Type & Orientation Type);
- Select “**Swap**”
- Click **ok** to confirm.
  
- Similarly, “**Swap**” **H-V axis** for “Section View1” & “Section View2” respectively.



# Tutorial 5A

- (Now we have positioned the five views at the correct places. These will be a good reference for us to build the 3D in the middle of the screen.)

- (You can click any standard view icon to change viewing direction so that you can compare your working 3D with the reference at a specific viewpoint.)



- **Hide “Plane1”, “Plane2”, “Plane3”, “Plane4” & “Plane5”.**

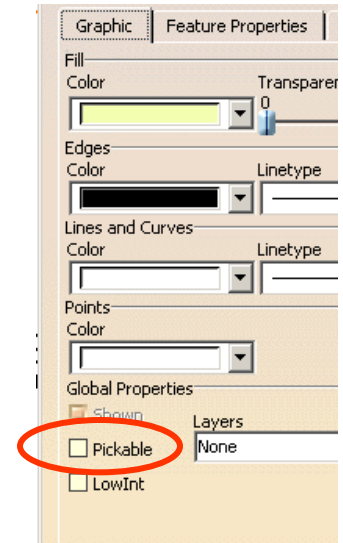
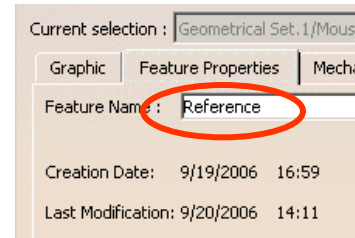
- Right-click “Geometrical Set.1” on the tree and select “Properties”;

- Enter “**Reference**” as Feature Name;

- **Deselect “Pickable”** option (We treat them as the background images only);

- Click ok to confirm.

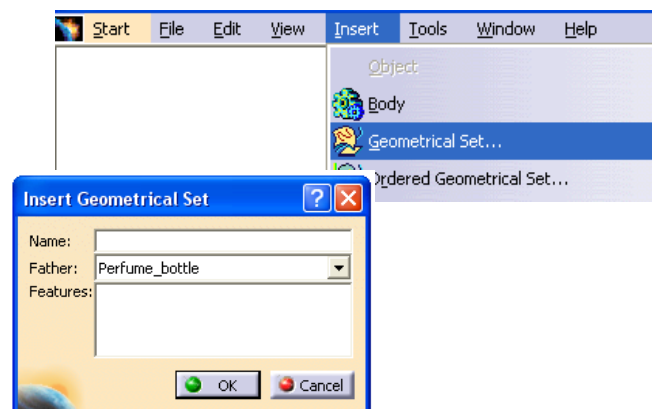
- (Optional) Multi-select all sketches, right-click to select “properties”, then change the line color to **yellow**.



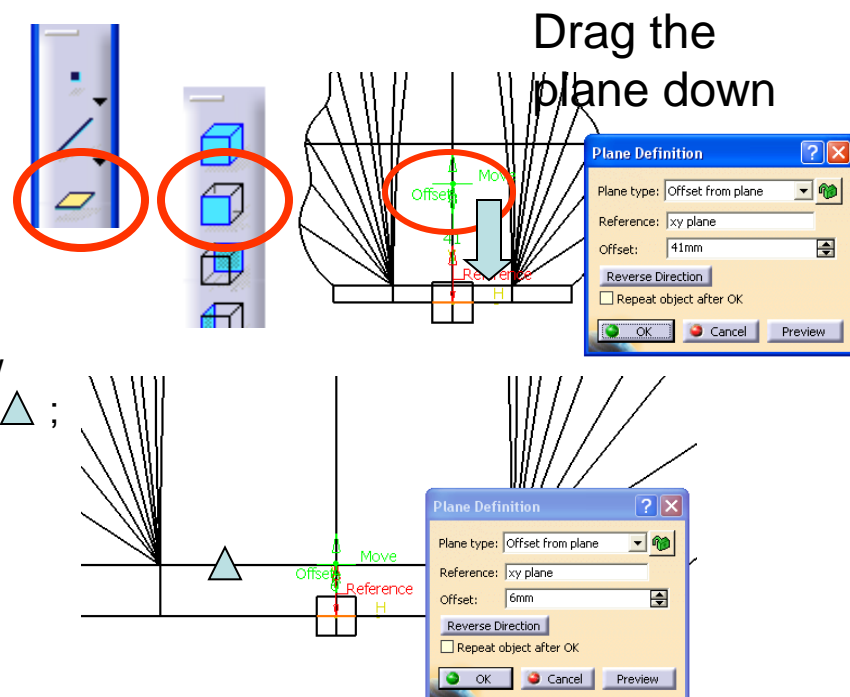
# Tutorial 5A

## To create 3D curves from the reference sketches:-

- Select “**Insert/Geometrical Set...**” on the menu bar (we are going to build a new folder to store new wireframe & surface elements);
- Click ok to confirm.





- Click “**Plane**” icon;
- Select **XY plane** ;
- Click “**Front View** “ icon;
- (Select “Offset from Plane” as plane type);
- Move the mouse cursor onto the green double arrow “Offset”, then drag the plane downward onto the line  $\triangle$  ;
- (Offset value should be ~ 6mm)
- Click ok to confirm.

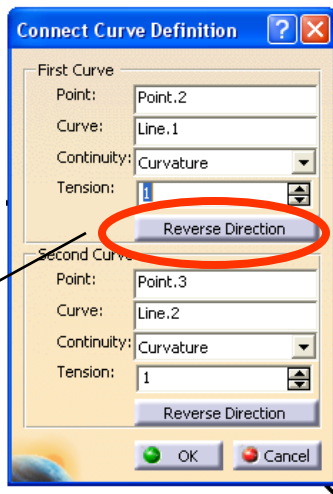
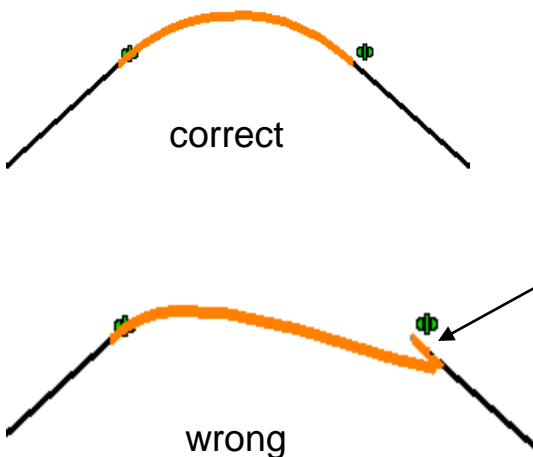
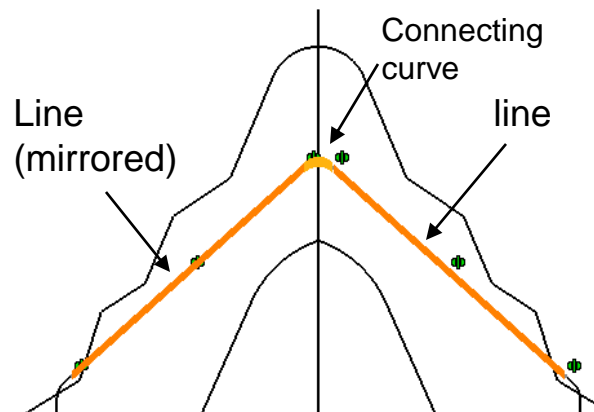
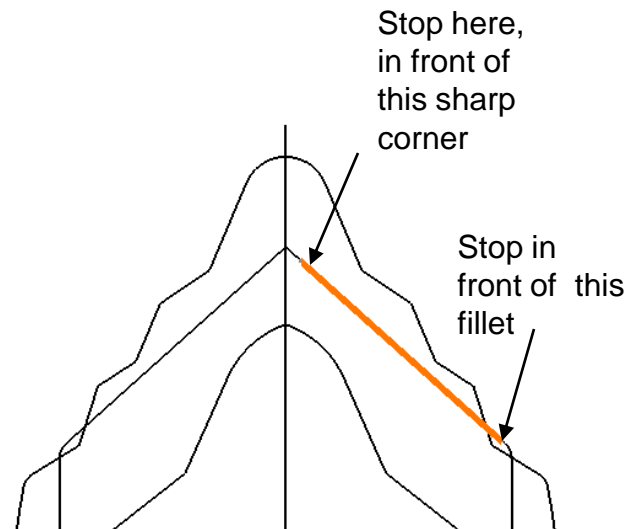


A- 16





# Tutorial 5A

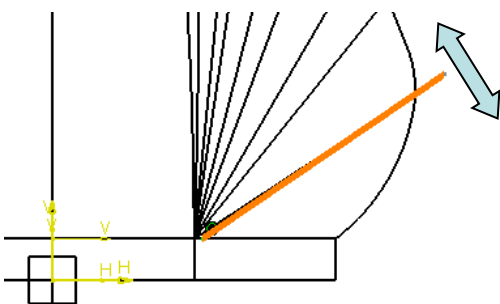
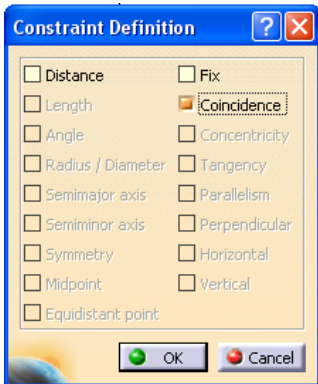
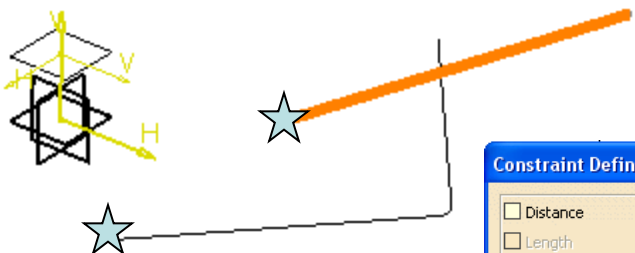
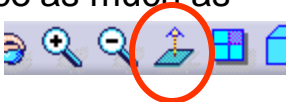
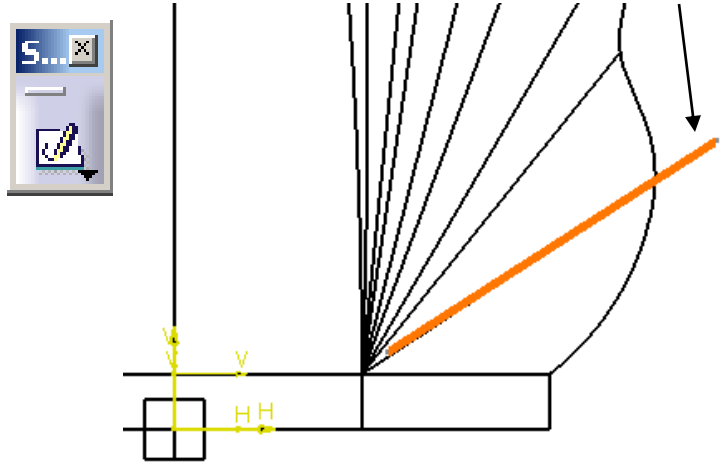
- Click **“Sketch”** icon and select **“Plane.6”**;
- **Draw a line** as shown, referring to the background reference;
- Select the line and click **“mirror”** icon , then click the y-axis
- Click **“connect”** icon , click the two endpoints to build a connecting curve (check if the tangency direction is correct or not)
- (if the tangency direction is wrong, double-click the curve and reverse the direction)
- Click **“Exit”** icon to complete.



# Tutorial 5A

Draw a little bit longer beyond the spline curve

- Click **“Sketch”** icon and select **“YZ plane”**;
- **Draw a line** as shown, referring to the background reference;
- Rotate the view a little bit (by the middle button & the right button of your mouse) to have an isometric view;
- Multi-select these two endpoints  , then click the icon  (constraints defined in a dialog box)
- Select **“Coincidence”** and ok;
- Click **“Normal View”** icon and adjust the line to match the background reference as much as possible.
- Click **“Exit”** icon to complete.

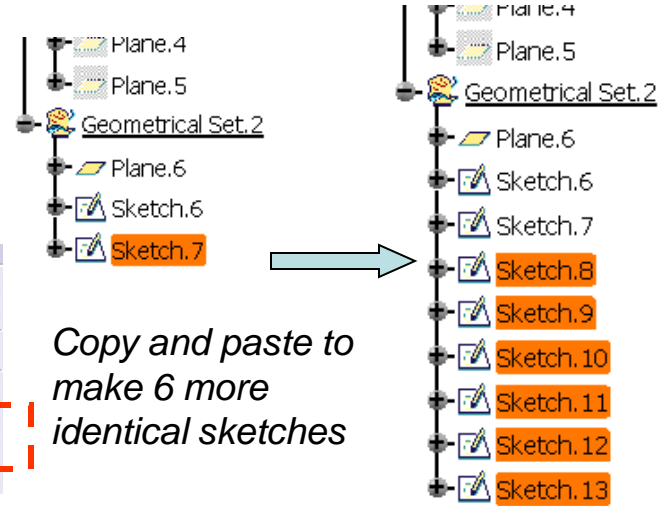



Adjust the line to match the background reference

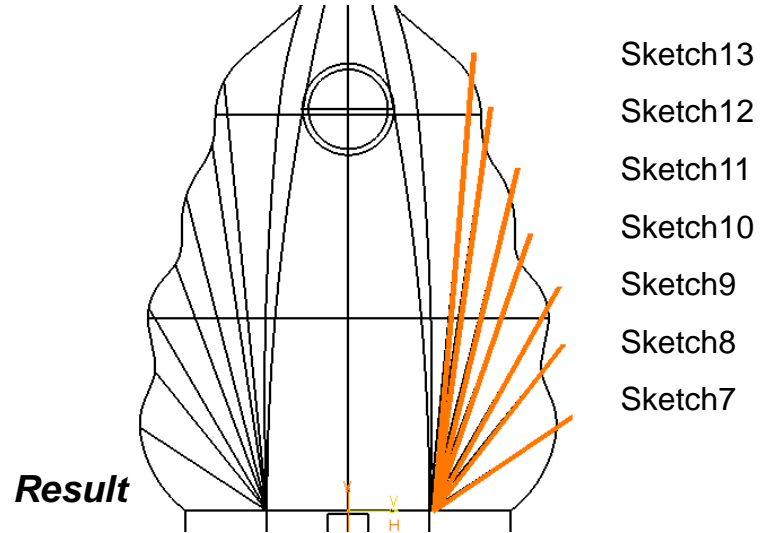
A- 18

# Tutorial 5A



- Select “Sketch.7” on tree, then press “**Ctrl C**” on the keyboard to copy;
- Press “**Ctrl V**” to paste by 6 TIMES (6 more identical sketches are created on tree, i.e. “sketch.8” to “13”).

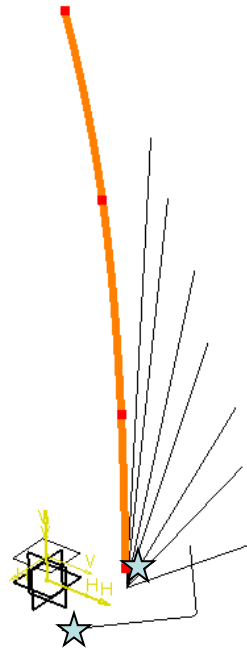
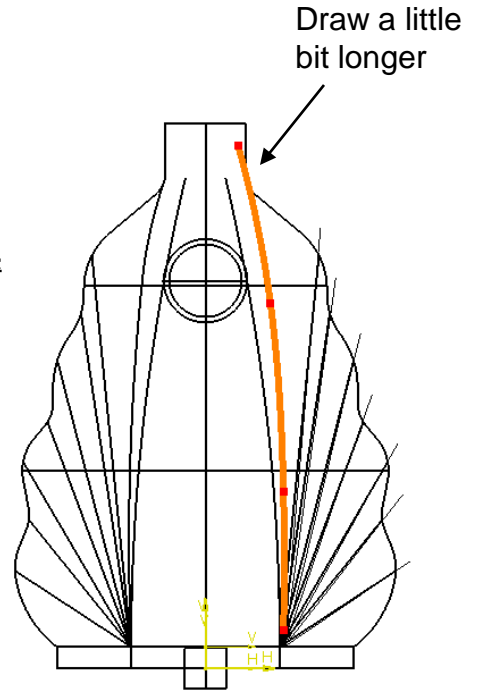
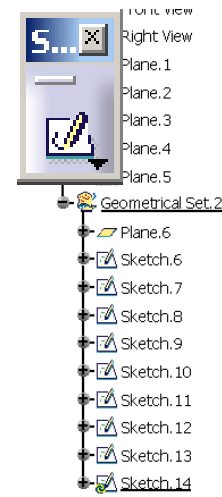


- Double-click “**Sketch.8**”;
- Adjust the line to match the background reference
- Click exit  to complete
- Similarly, edit “**Sketch9**”, “**Sketch10**”, “**Sketch11**”, “**Sketch12**” & “**Sketch13**” to match the reference.







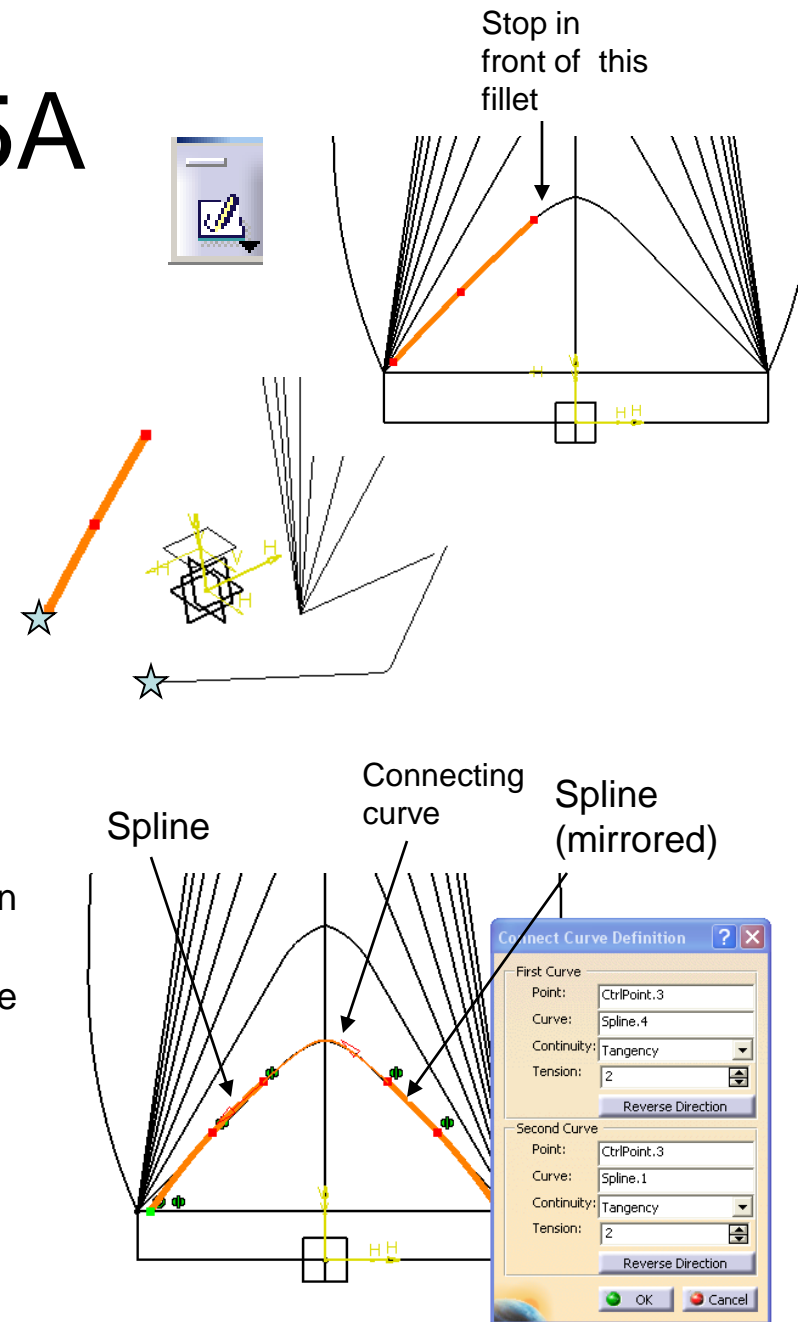
# Tutorial 5A

- Click **“Sketch”** icon and select **“YZ Plane”**;
- **Draw a spline** (4 points) as shown, referring to the background reference
- Rotate the view a little bit (by the middle button & the right button of your mouse) to have an isometric view;
- Multi-select these two endpoints  , then click the icon  (constraints defined in a dialog box)
- Select **“Coincidence”** and ok;
- Click **“Normal View”** icon and adjust the spline to match the background reference as much as possible.
- Click **“Exit”** icon to complete.



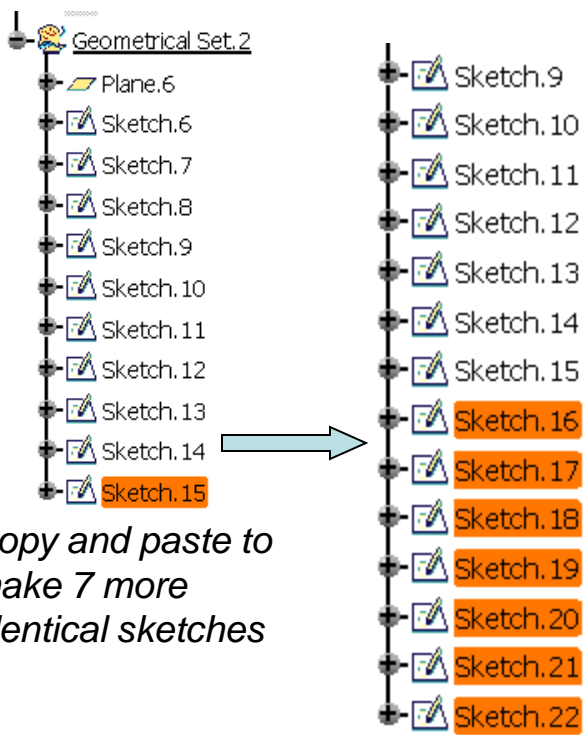
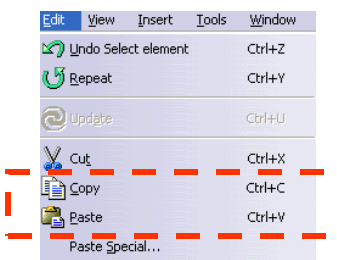
# Tutorial 5A

- Click **“Sketch”** icon and select **“ZX Plane”**;
- **Draw a spline** (3 points) as shown, referring to the background reference;
- Rotate the view a little bit;
- Multi-select these two endpoints , then click the icon  (constraints defined in a dialog box)
- Select **“Coincidence”** and ok;
- Select the spline and click **“mirror”** icon , then click the y-axis;
- Click **“connect”** icon , click the two endpoints to build a connecting curve; (check if the tangency direction is correct or not)
- (if the tangency direction is wrong, double-click the curve and reverse the direction)
- Double-click **“connect”** curve, adjust the tensions to match the reference (e.g. tension =2);
- Click **“Exit”** icon to complete.




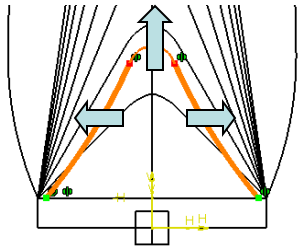
# Tutorial 5A

- Select “Sketch.15” (the previous sketch) on tree, then press “**Ctrl C**” on the keyboard to copy
- Press “**Ctrl V**” to paste 7 TIMES (7 more identical sketches will be created on tree, i.e. “sketch.16” to “22”)

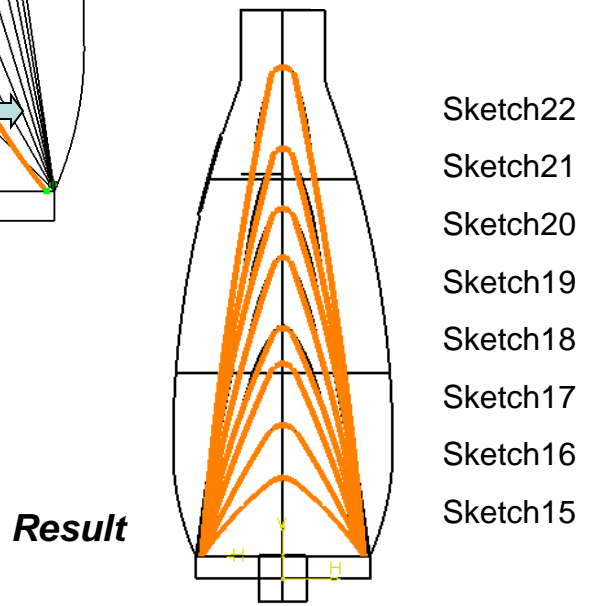


*Copy and paste to make 7 more identical sketches*

- Double-click “**Sketch.16**”;
- Adjust the curves to match the background reference:
- Click exit  to complete.



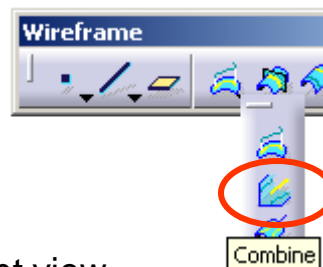
**Similarly, edit “Sketch17”, “Sketch18”, “Sketch19”, “Sketch20”, “Sketch21” & “Sketch22” to match the reference**



# Tutorial 5A

## To Create a “Combine” Curve:-

- Click “**Combine**” icon;
- Select “**Sketch.7**” & “**Sketch.15**”;
- Click ok to confirm.
- (The new curve can fit the shape on both front view and right view)



- Repeat the steps for the below combinations:

Sketch8 – Sketch16

Sketch9 – Sketch17

Sketch10 – Sketch18

Sketch11 – Sketch19

Sketch12 – Sketch20

Sketch13 – Sketch21

Sketch14 – Sketch22

- **Hide Sketch 7 to Sketch22**

Sketch22

Sketch21

Sketch20

Sketch19

Sketch18

Sketch17

Sketch16

Sketch15

Sketch14

Sketch13

Sketch12

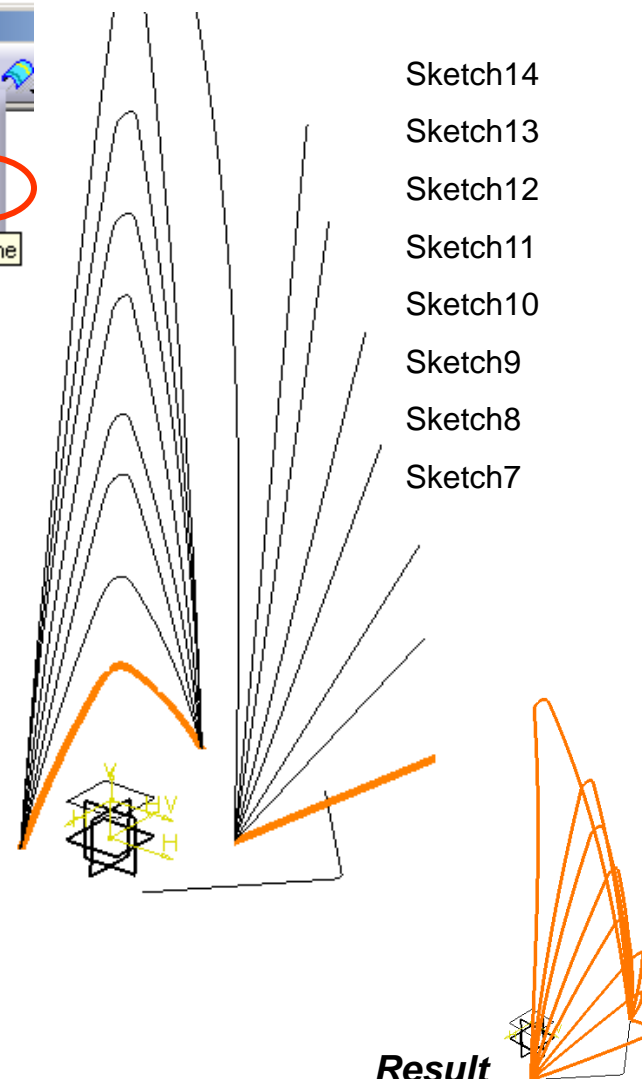
Sketch11

Sketch10

Sketch9

Sketch8


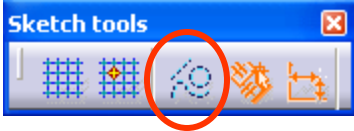
Sketch7

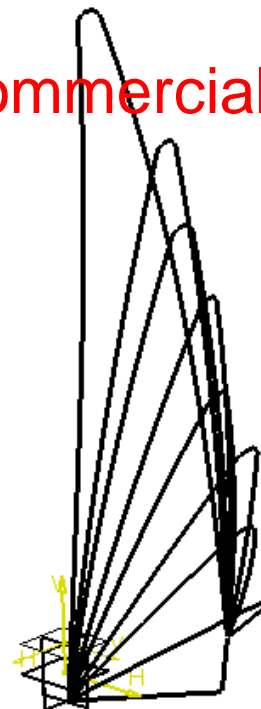
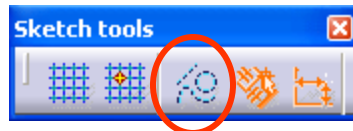
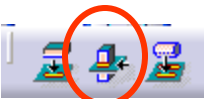


**Result**

# Tutorial 5A

Not For Commercial Use


- Click **“Sketch”** icon and select **“YZ Plane”**;
- Rotate the view a little bit (by the middle button & the right button of your mouse) to have an isometric view;
- Multi-select all combined curves & **“Sketch.6”** on the tree;
- Click **“Intersect 3D elements”** icon ;
- Click **“Construction/Standard element”** icon ;
- Click on an empty space to deselect the points;
- Click **“Construction/Standard element”** icon again to deactivate the command;
- **Draw a Spline** to connect all the intersection points;
- (When the mouse cursor is placed at an intersection point, a **BLUE** solid circle can be seen near the cursor that helps you click on the point exactly)

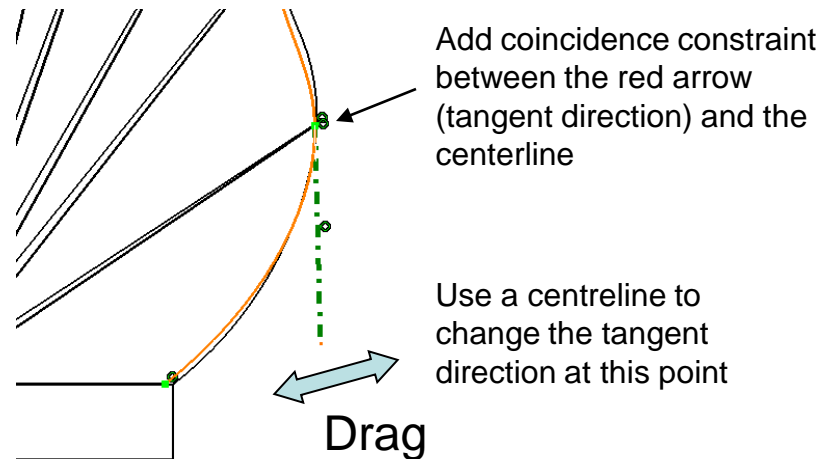
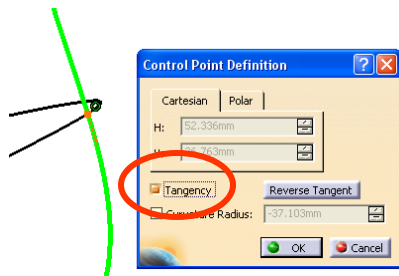
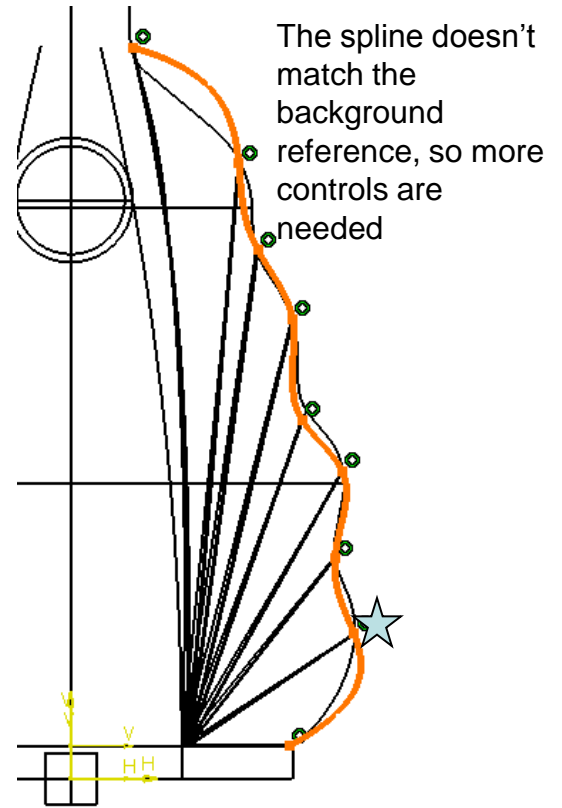


Combine8  
Combine7  
Combine6  
Combine5  
Combine4  
Combine3  
Combine2  
Combine1  
Sketch.6





# Tutorial 5A

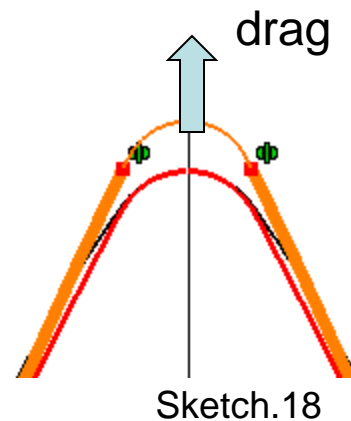
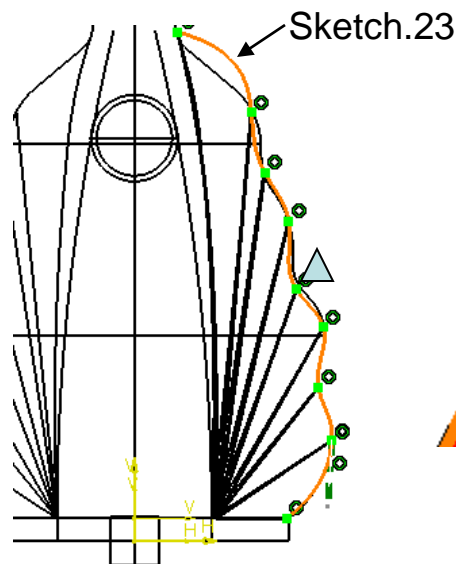
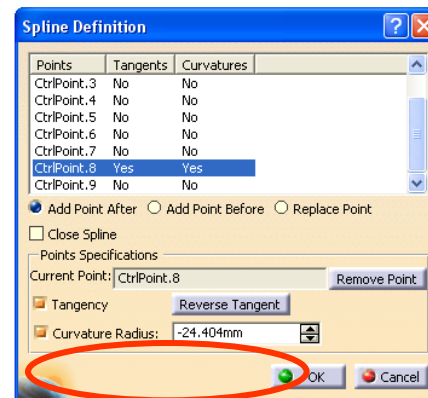
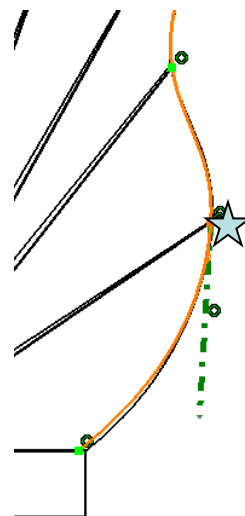
- Click “**Normal View**” icon; 
- (you should see that the spline doesn't match the background reference)
- Double click the point; ★
- Select “Tangency” (a red arrow appears at the point, showing the tangency direction)
- Click ok ;
- **Draw a centerline** starting from the point;
- Add “Coincidence” constraint between the centerline and the red arrow;
- (Now Drag the centerline as to change the tangent direction, until the portion near the point can match the reference as much as possible)



A- 25

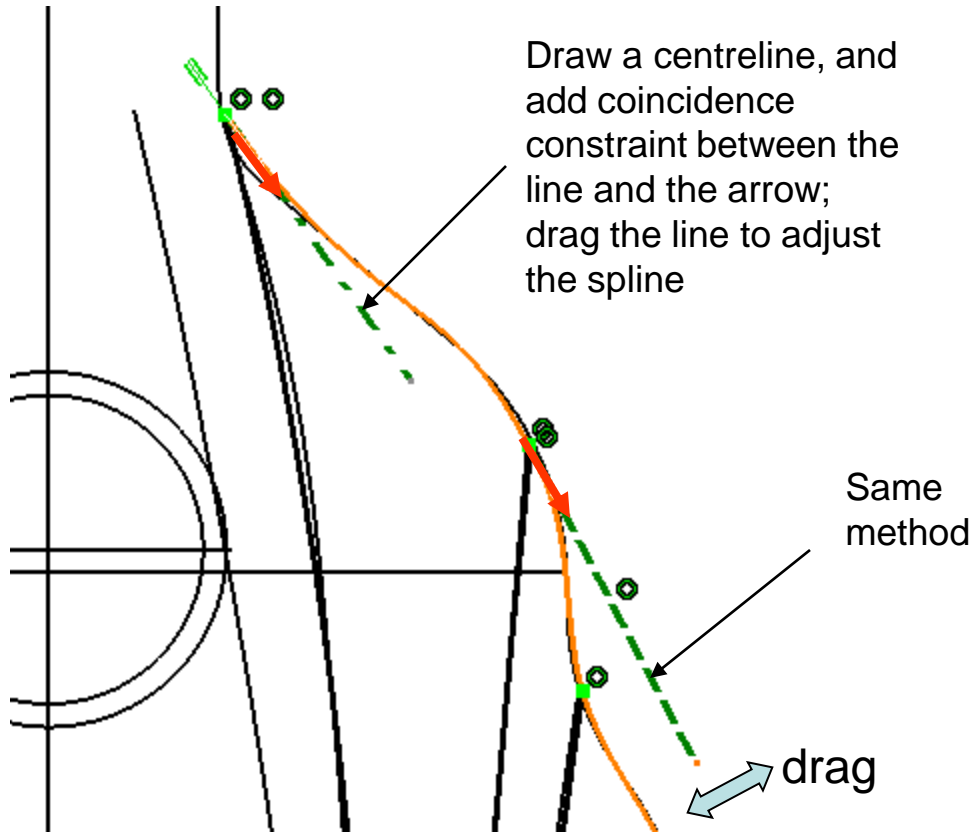
# Tutorial 5A

- To further adjust, double-click the spline and then select the point  on the list;
- Highlight “Curvature Radius”;
- Enter a value so that the spline can match the reference;
- (Next, we can see the 5<sup>th</sup> point  is a little bit lower than the reference.)
- Click Exit icon.
- Double Click “Sketch.18” to modify;
- Push the “connect” curve a little bit upward;
- Double Click “Sketch.23” again to see if the problem is improved.
- (For this case, we know that Front View is more important than Right View for this product; if we cannot match both views at the same time, we should sacrifice the less important one)

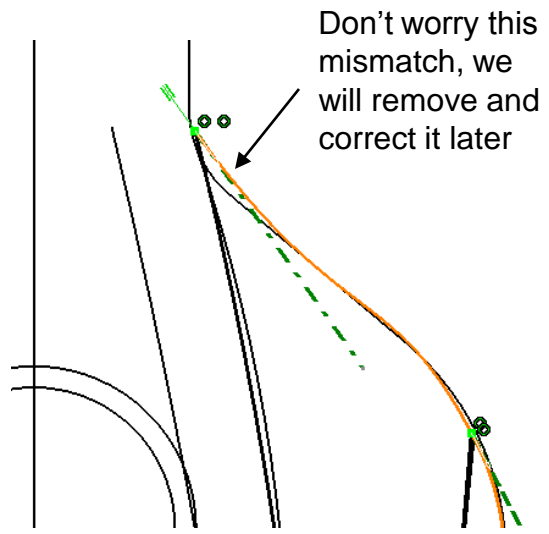
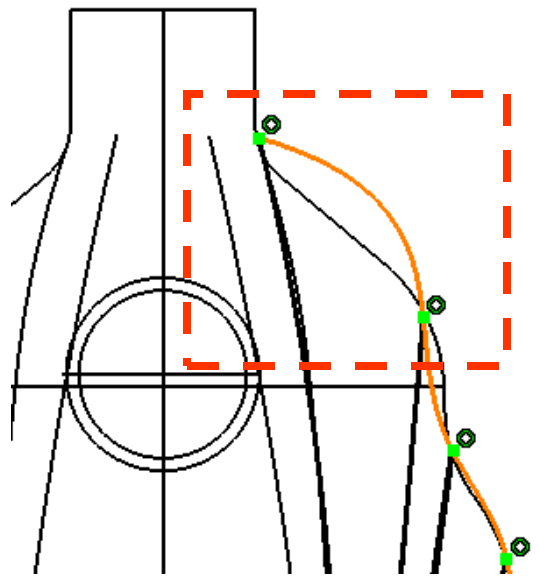


# Tutorial 5A

- Repeat the steps to improve the upper portion of the spline (the dashed portion)
- Finally, Click Exit to complete.





A- 27

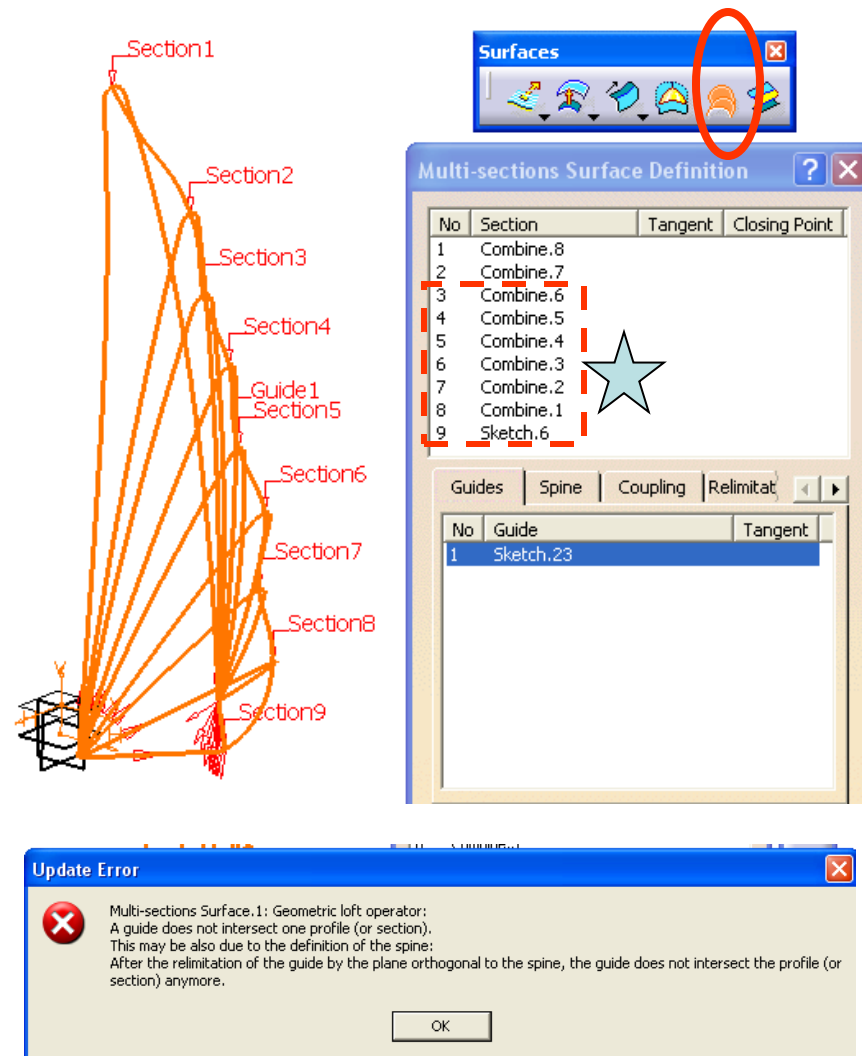


result

# Tutorial 5A

## To create Multi-sections Surfaces:-

- Click “Multi-sections surface” icon; 
- Select “Combine.8”, “Combine.7”, “Combine.6”, “Combine.5”, “Combine.4”, “Combine.3”, “Combine.2”, “Combine.1”, & “Sketch.6” as **SECTION** (The red arrows should be pointing to the same direction; if not, click on the arrow to change)
- Select “Sketch23” as **GUIDE**
- Click Preview (a warning window will then pop up, saying that the system cannot create the surface)
- (Now, we need to make them separately)
- **Remove** “Combine.6”, “Combine.5”, “Combine.4”, “Combine.3”, “Combine.2”, “Combine.1”, & “Sketch.6” on the list 

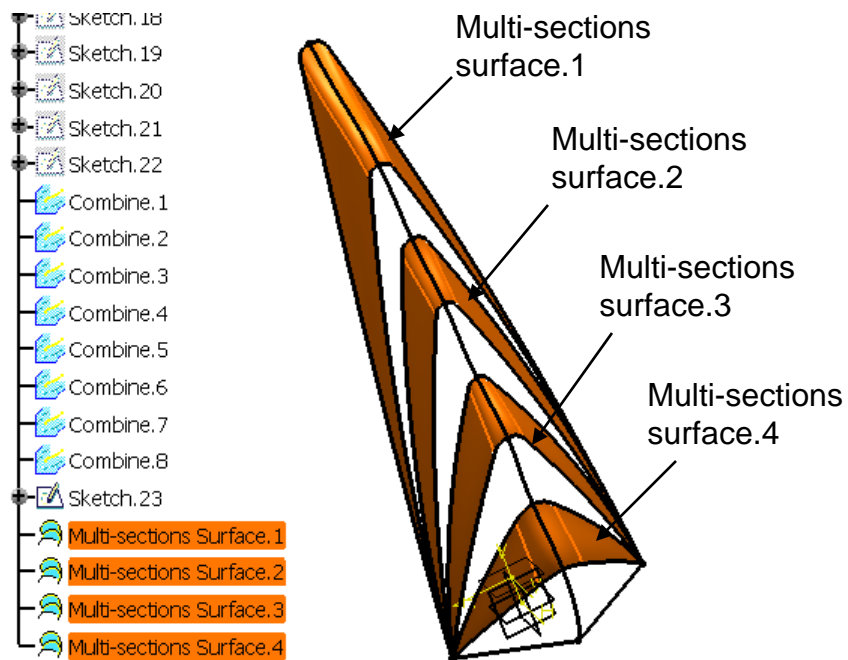
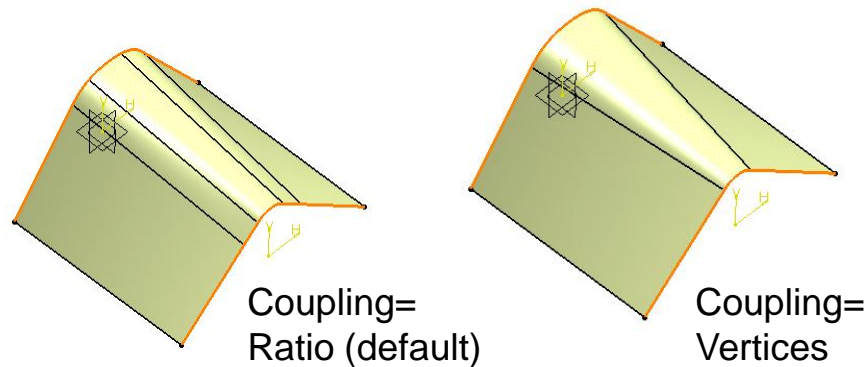


# Tutorial 5A

## What is coupling?

### Cont':-


- Click “Preview” (we can see some small sub-surfaces);
- Click tab page “Coupling”;
- Select “Vertices” as Sections Coupling;
- Click ok to complete.
- Repeat the previous steps to make 3 more multi-sections surfaces as shown:  
 (Multi-sections Surface.2)  
 Combine5 & Combine6 as Sections  
 Sketch23 as Guide  
 Coupling = Vertices  
  
 (Multi-sections Surface.3)  
 Combine4 & Combine3 as Sections  
 Sketch23 as Guide  
 Coupling = Vertices  
  
 (Multi-sections Surface.4)  
 Combine2 & Combine1 as Sections  
 Sketch23 as Guide  
 Coupling = Vertices

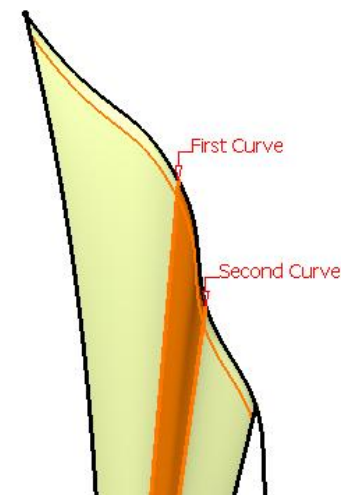
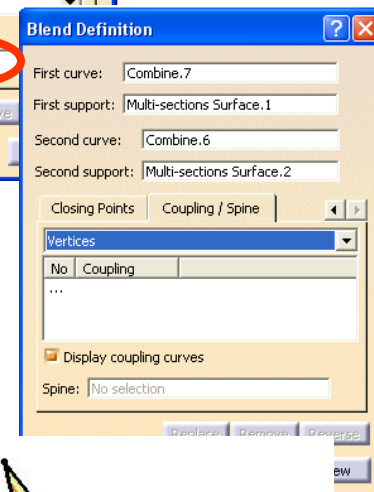
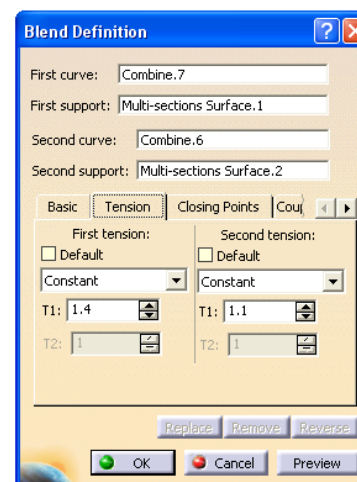
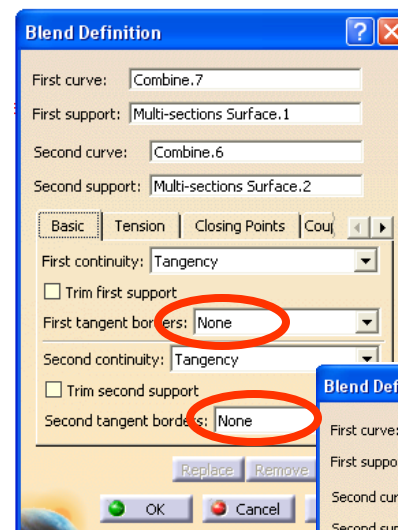


# Tutorial 5A

## To create Blend Surfaces:-



- Click “Blend” icon;
- Select “Combine.7” as First Curve;
- Select “Multi-sections surface.1” as First Support;
- Select “Combine.6” as Second Curve;
- Select “Multi-sections surface.2” as Second Support;
- On tab page “Basic”, select “None” for both First and Second tangent borders; (because the first curve and second curve are touching each other)
- On tab page “Coupling/Spline”, select “Vertices”;
- Click “Front View” icon; 
- On tab page, adjust tensions to match the reference; (e.g First tension~1.4; Second tension~1.1)
- Click ok to complete.



# Tutorial 5A

## Con't:-

- Repeat the previous steps to make 2 more blend surfaces as shown:



### (Blend.2)

Combine5 as First Curve

Multi-sections Surface.2 as First Support

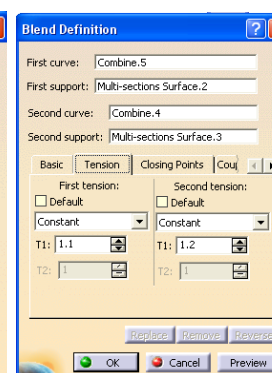
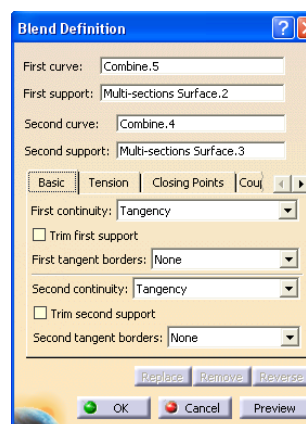
Combine4 as Second Curve

Multi-sections Surface.3 as Second Support

Coupling = Vertices

First Tension ~ 1.1

Second Tension ~ 1.2



### (Blend.3)

Combine3 as First Curve

Multi-sections Surface.3 as First Support

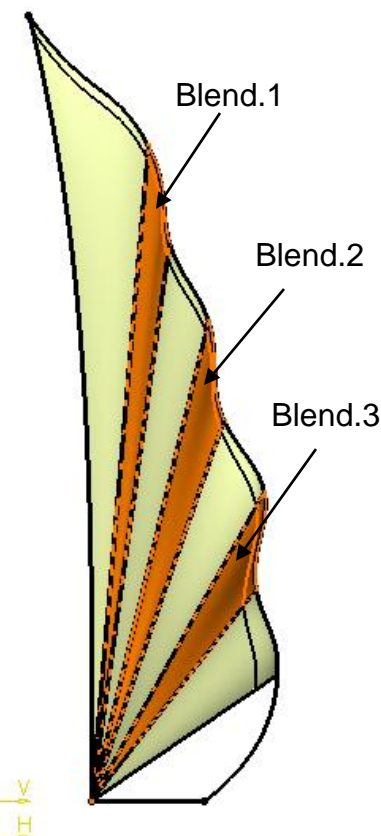
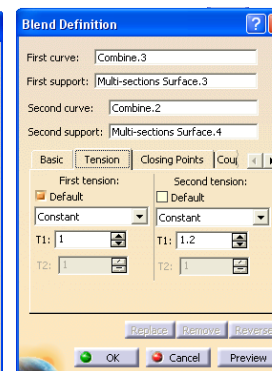
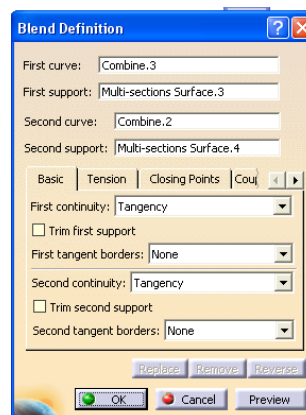
Combine2 as Second Curve

Multi-sections Surface.4 as Second Support

Coupling = Vertices

First Tension ~ 1.0

Second Tension ~ 1.2





# Tutorial 5A

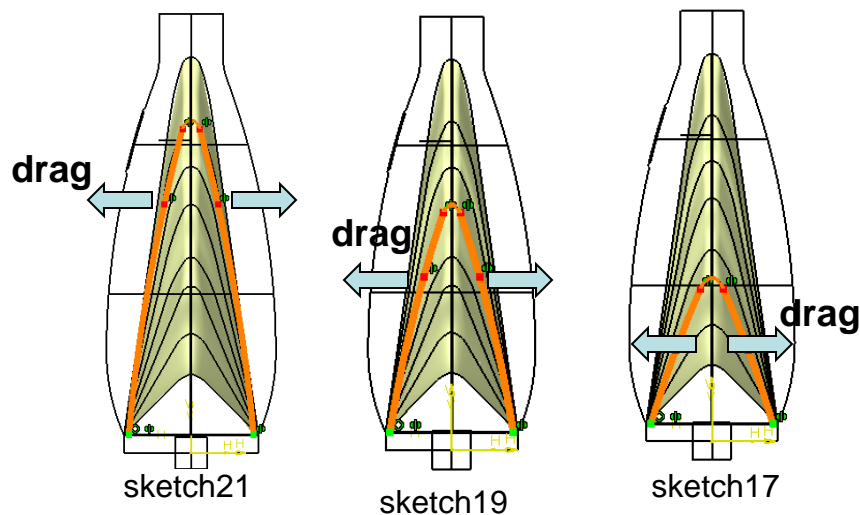
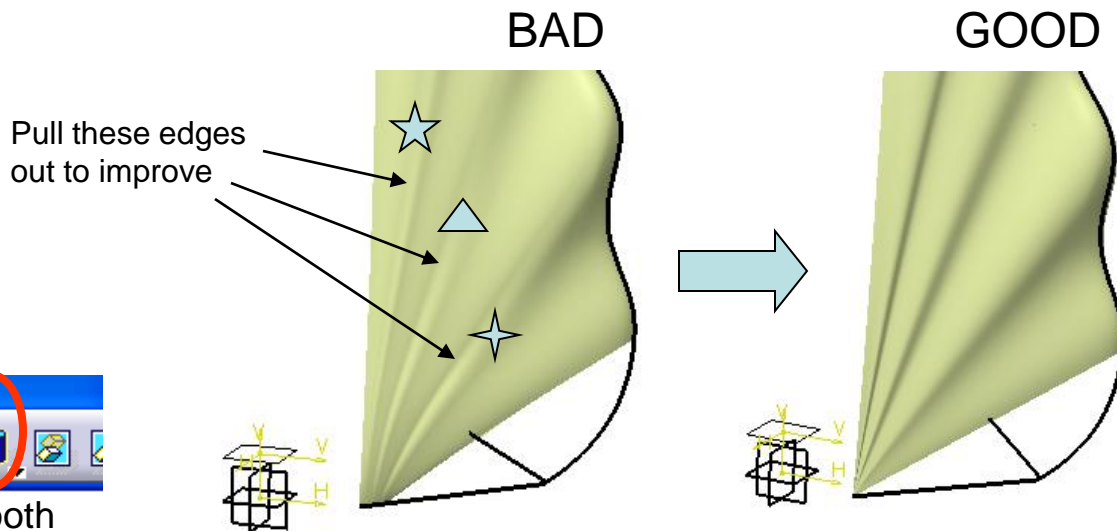
## To join Surfaces as One:-

- Click “Join” icon;
- Select all Surfaces;
- Click ok to complete.

## Hide All “Combine” Curves

## To Fine Tune the Surface:-

- Click “Shading” icon;
- If the Joined Surface is not smooth enough as shown,
- (at position ☆), modify sketch21
- (at position ▲), modify sketch19
- (at position ✦), modify sketch17



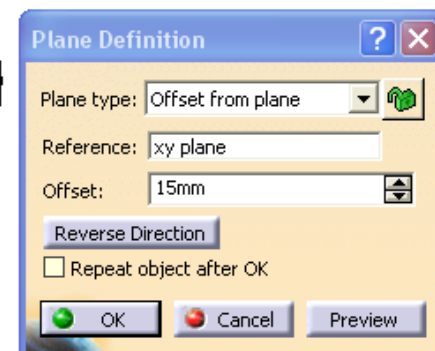
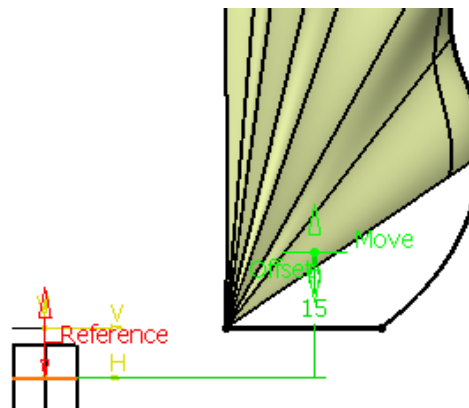
A- 32



# Tutorial 5A

## To Create a Plane:-

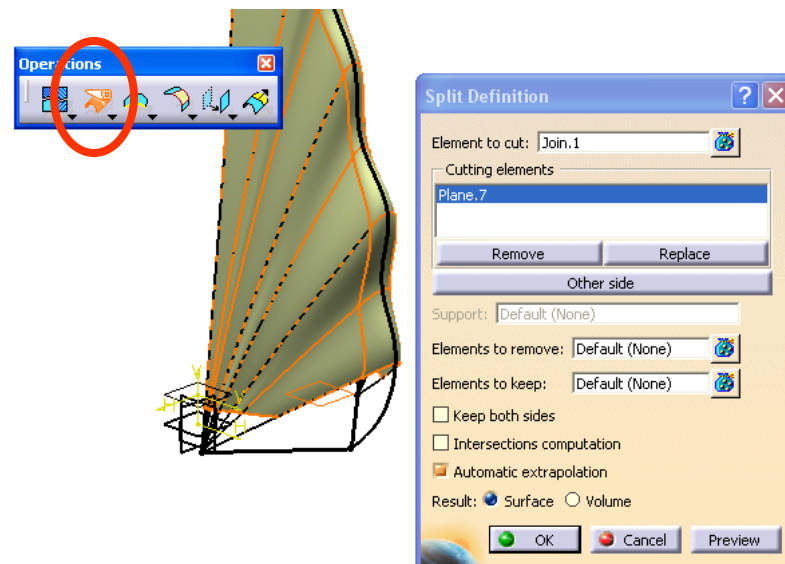
- Click **“Plane”** icon;
- Select **XY Plane**;
- Click **“Front View”** icon;
- Drag the offset plane upward (drag the text **“Offset”** next to the plane to increase the distance; drag the text **“Move”** near the surface)
- (Remark: dragging **“Move”** will not change the offset value; a plane is indefinitely big and the text **“Move”** is just a symbol)
- Click ok to complete.



# Tutorial 5A

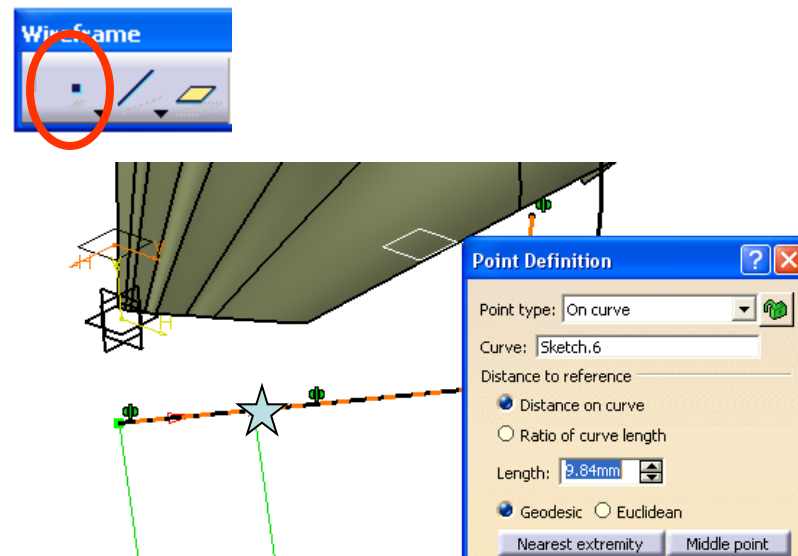
## To Split the Surface by the plane:-

- Click **“Split”** icon;
- Select the Joined Surface as “Element to cut”;
- Select the previous offset plane as “Cutting element”;
- (click “other side” if the result is not the bigger portion)
- Click ok.



## To Create a point on curve:-

- Click **“Point”** icon;
- Click on the curve “Sketch6” at the position;★
- Click ok to complete.

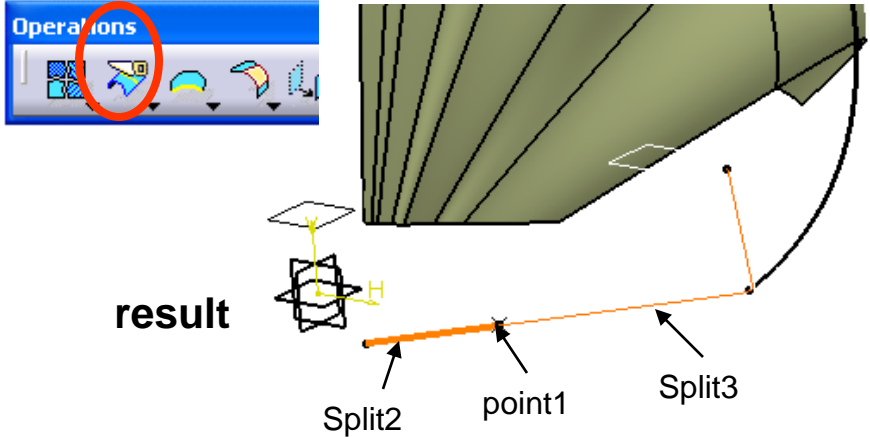


# Tutorial 5A

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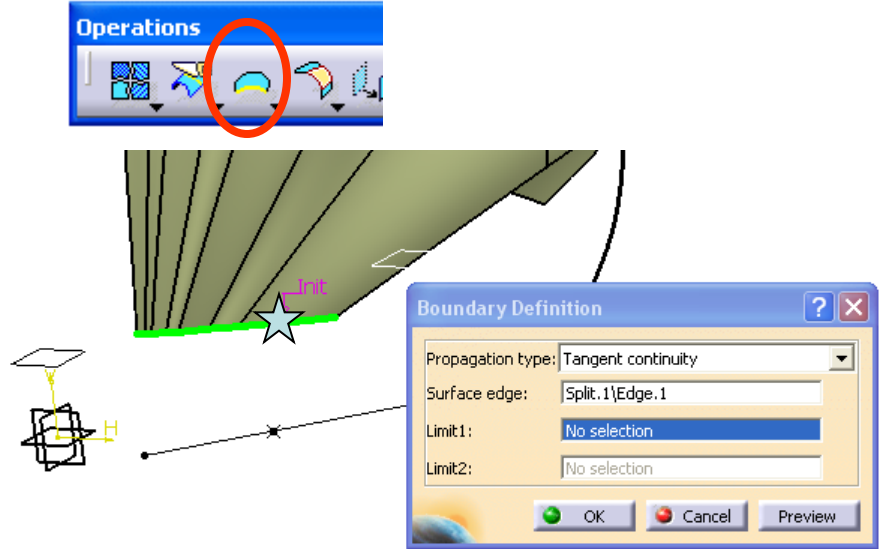
## To Split the Curve by the point:-

- Click **“Split”** icon;
- Select Sketch6 as “Element to cut”;
- Select the previous point “point1” as “Cutting element”;
- Highlight **“Keep both sides”**;
- Click ok.



## To Create a Boundary curve:-

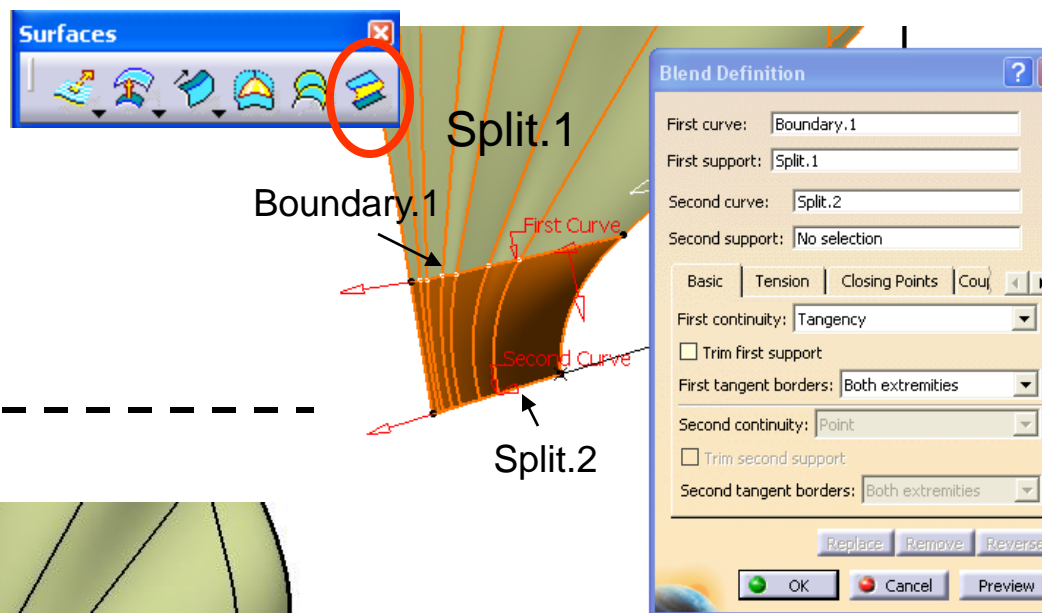
- Click **“Boundary”** icon;
- Select “Tangent Continuity” as propagation type;
- Click the surface edge;★
- Click ok to complete.



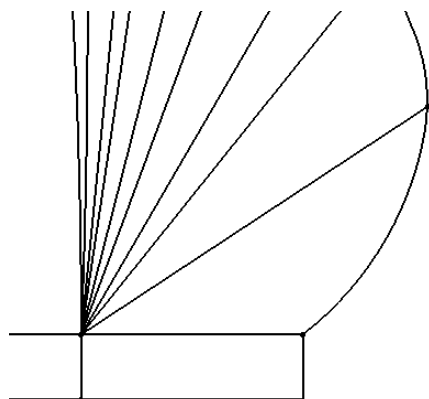
# Tutorial 5A

## To Create a Blend Surface:-

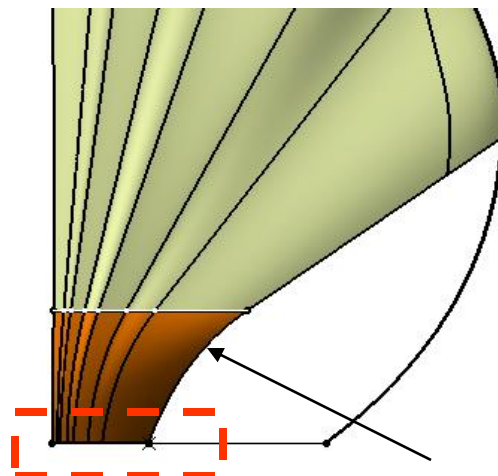
- Click “Blend” icon;
- Select “Boundary.1” as First Curve;
- Select “Split.1” as First Support;
- Select “Split.2” as Second Curve;
- Select “Tangent” as First continuity;
- Click ok to complete.



## Problem on the blend surface



reference



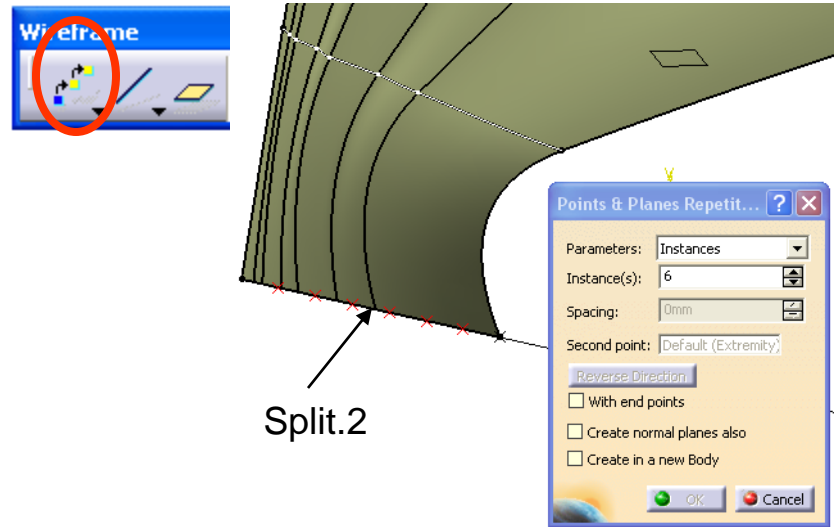
Bended Too Much

We don't want to see that all points are overlapping each other in the 3d model; but if the point-point spacing is even, the result will be closer to the reference

# Tutorial 5A

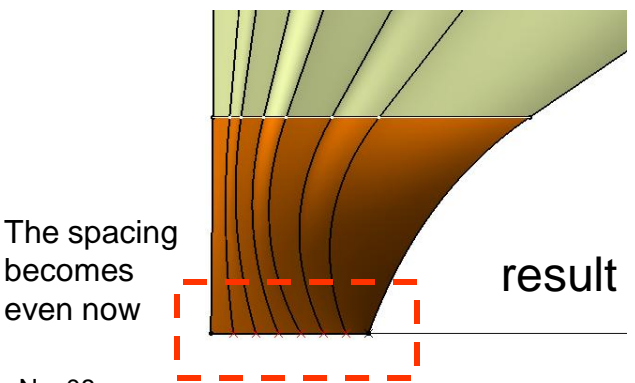
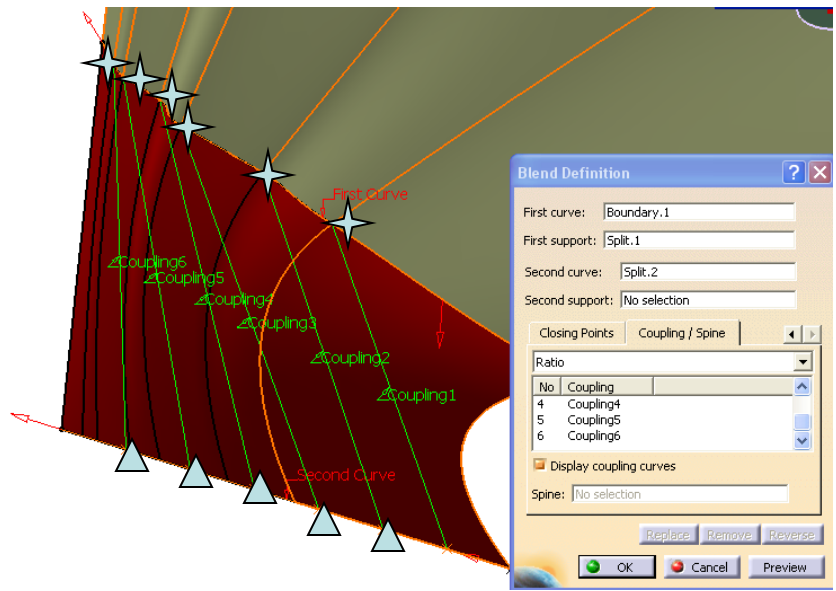
## To Split the Curve by the point:-

- Click “Points and Planes Repetition” icon;
- Enter 6 as Instance(s);
- Deselect “Create in a new body”;
- Click on the curve “Split.2”, then click ok.



## To Modify the Blend Surface:-

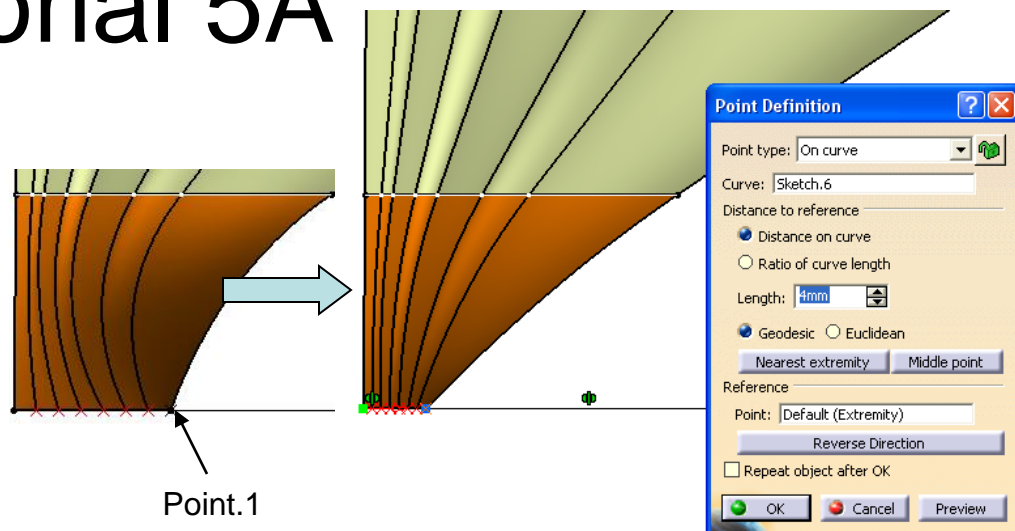
- Double-click the Blend surface;
- Select the tab page “Coupling/Spine”;
- Click the points (6 Couplings are made)
- Click ok to complete.
- (Remark: the surface can be modified by the late-coming feature (the 6 points), without reordering the part tree; this is an advantage of using the non-hybrid mode)



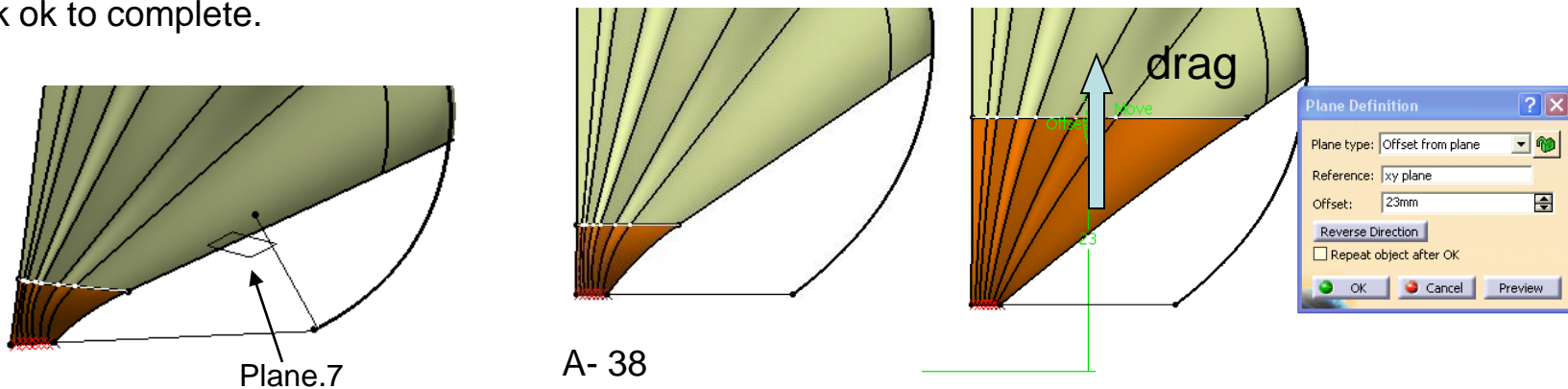
# Tutorial 5A

## Cont’:-

- Double-click the point “**point.1**”;
- Reduce the Length to ~4mm;
- Click ok to complete.



- Double-click the plane “**plane.7**”;
- Drag the plane upward so that the blend is as close as the reference;
- (Offset~23mm)
- Click ok to complete.



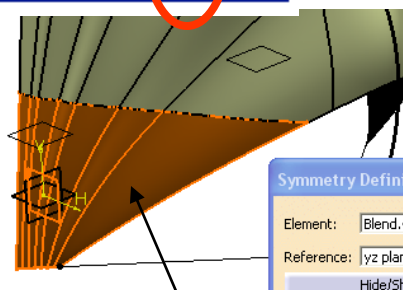
A- 38

# Tutorial 5A

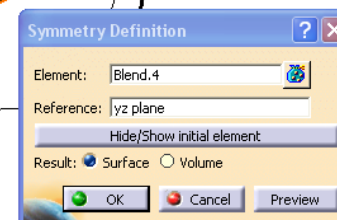
## Hide all Points (1 to 7) , Split.2 & Boundary.1

### To Create a Symmetric Surface:-

- Click “Symmetry” icon;
- Select “Blend.4” as Element;
- Select “YZ plane” as Reference;
- Click ok.

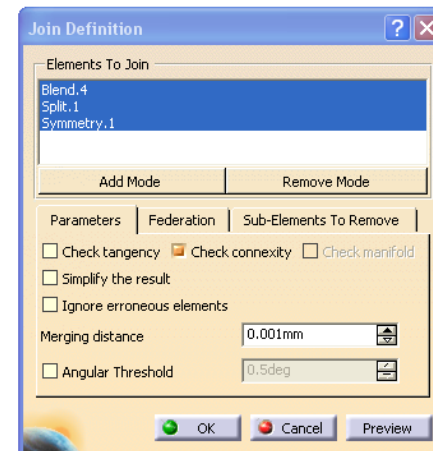
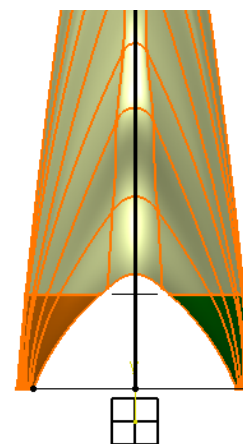
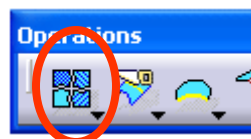


Blend.4



### To Join surfaces as One:-

- Click “Join” icon;
- Select all Surfaces;
- Click ok to complete.

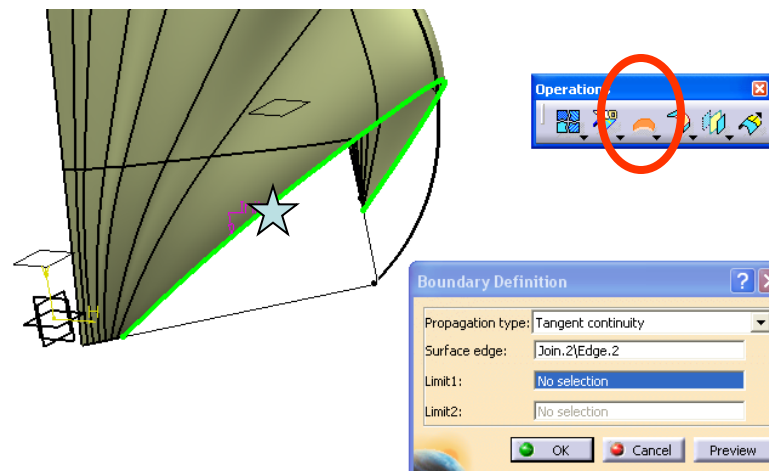




# Tutorial 5A

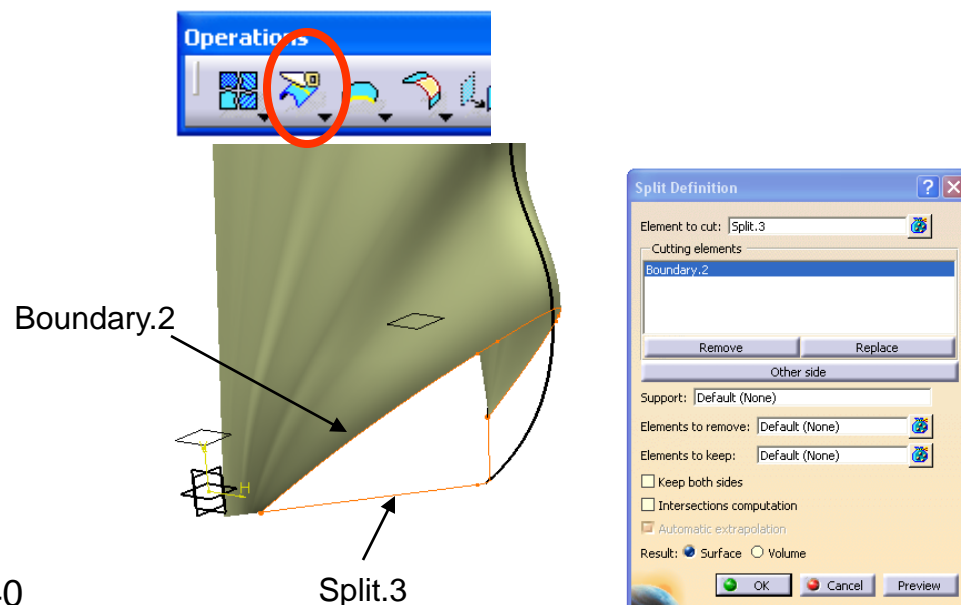
## To Create a Boundary curve:-

- Click “**Boundary**” icon;
- Select “Tangent Continuity” as Propagation type;
- Click the surface edge;★
- Click ok to complete.



## To Split a line by another line:-

- Click “**Split**” icon;
- Select “Split.3” as “element to cut”;
- Select “Boundary.2” as “Cutting element”;
- Click ok.



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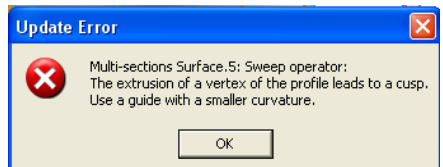
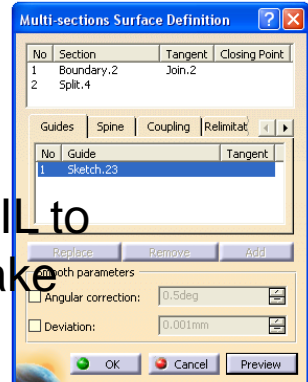
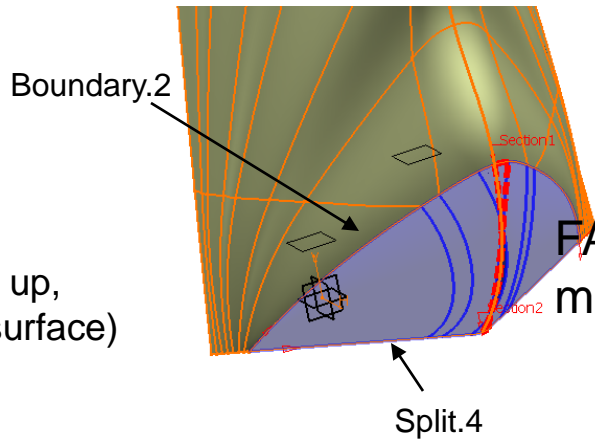
Split.3



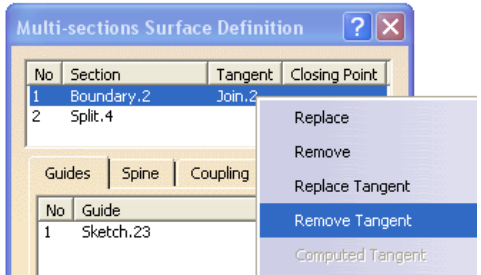
# Tutorial 5A

## To create a Multi-sections Surface:-

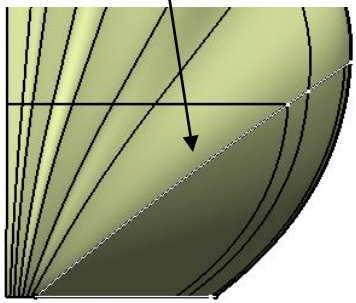
- Click “Multi-sections surface” icon;
- Select “Boundary.2” as Section, then select “Join.2” as support;
- Select “Split.4” as another Section;
- Select “Sketch23” as **Guide**;
- Click Preview (a warning window will pop up, saying that the system fails to make the surface)



- Select Section1 on the list, right-click then select “Remove Tangent”;
- Coupling = Ratio (default);
- Click ok to complete.



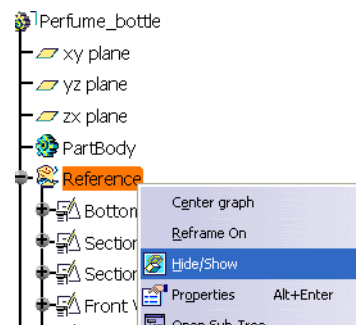
A sharp edge can be found here



## Hide Boundary.2 & Split.4

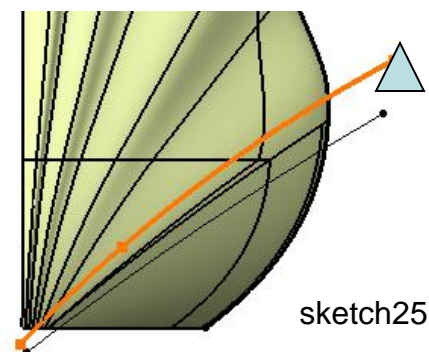
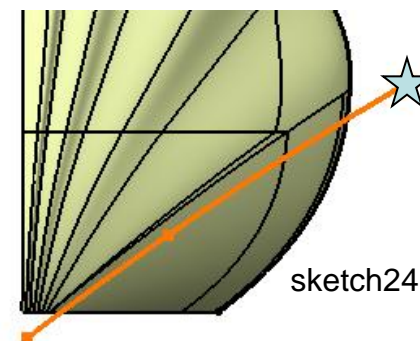
# Tutorial 5A

## Hide “Reference”



## To create Sketches:-

- Click “**Sketch**” icon and select “**YZ Plane**”;
- Draw a Spline as shown ★
- Click “**Exit**” icon to complete.
  
- Click on the empty space to deselect the active sketch
  
- Click “**Sketch**” icon again and select “**YZ Plane**”;
- Draw a Spline as shown ▲
- Click “**Exit**” icon to complete.

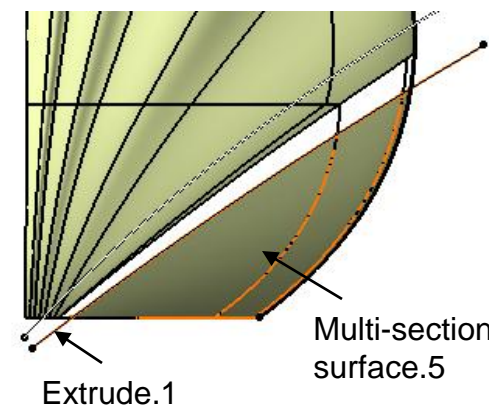
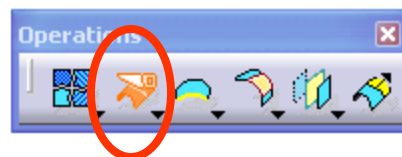
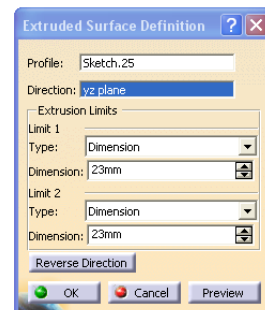
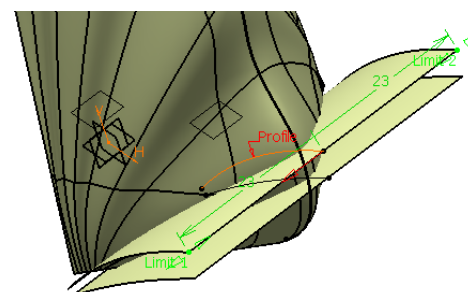
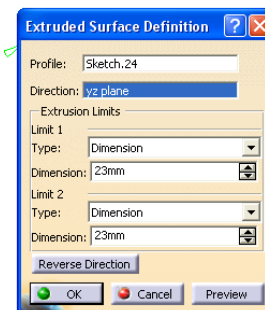
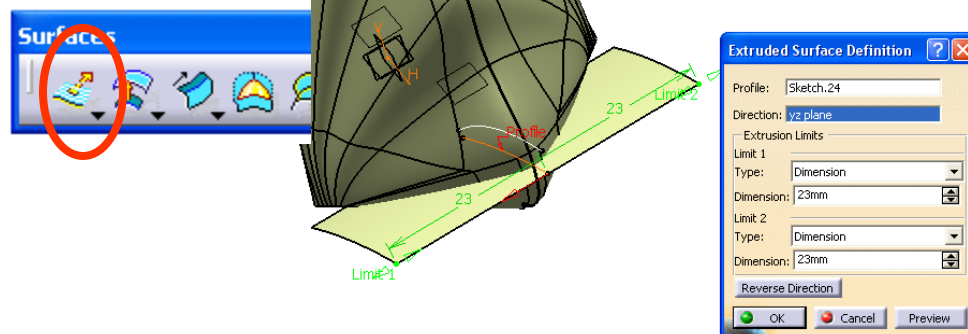


# Tutorial 5A

Not For Commercial Use

## To Split a surface by a curve:-

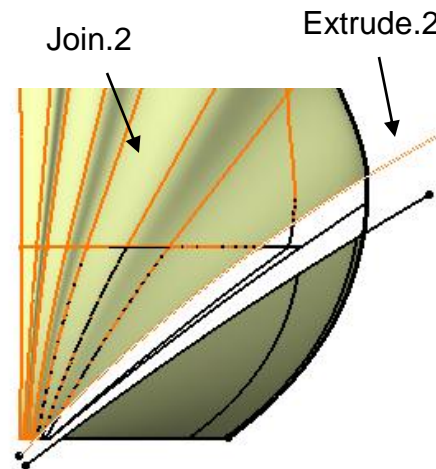
- Click **“Extrude”** icon ;
- Select “Sketch24”;
- Drag “Limit1” & Limit2” to increase the length until it is long enough to cut the nearby surface (e.g. >23mm)
- Click ok.
- Click **“Extrude”** icon;
- Select “Sketch25”;
- Drag “Limit1” & Limit2” to increase the length until it is long enough to cut the nearby surface (e.g. >23mm)
- Click ok.
- Click **“Split”** icon;
- Select “Multi-sections Surface.5” as “element to cut”;
- Select “Extrude.1” as cutting element;
- Click ok.



# Tutorial 5A

## Cont’:-

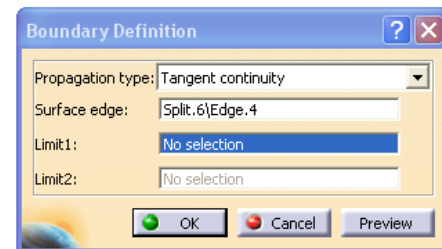
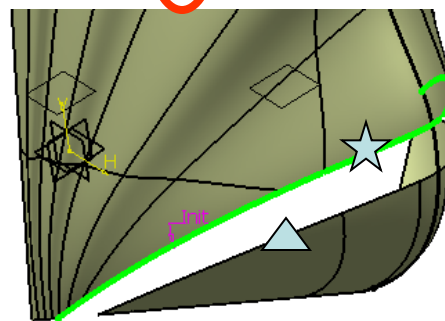
- Click **“Split”** icon again;
- Select **“Join.2”** as **“element to cut”**;
- Select **“Extrude.2”** as cutting element;
- Click ok.



**Hide “Sketch24”, “Sketch25”,  
“Extrude1” & “Extrude2”**

## To Create Boundary Curves:-

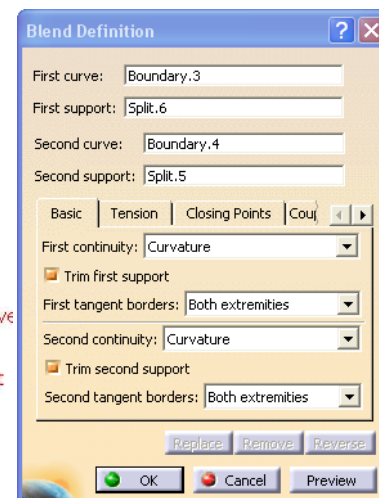
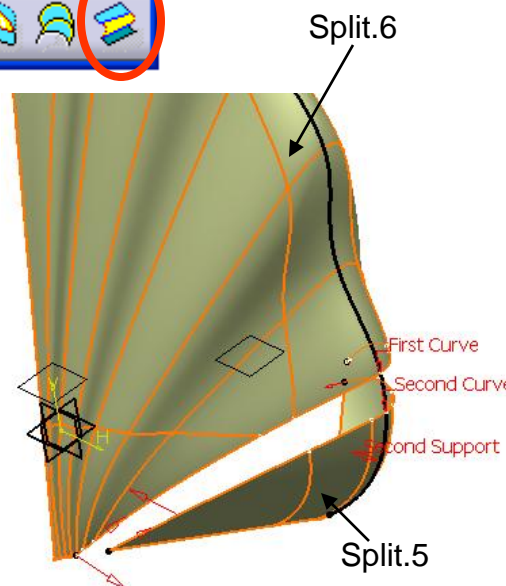
- Click **“Boundary”** icon;
- Select **“Tangent Continuity”**;
- Select the edge;★
- Click ok.
  
- Again, Click **“Boundary”** icon;
- Select the edge;▲
- Click ok.



# Tutorial 5A

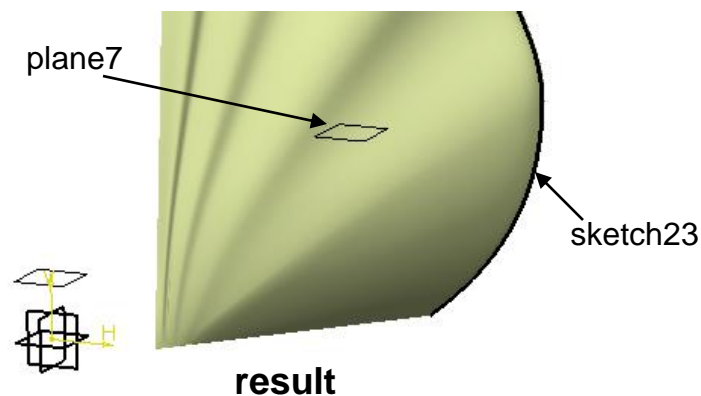
## To create a Blend Surface:-

- Click “Blend” icon;
- Select “Boundary3” as First Curve;
- Select “Split6” as First Support;
- Select “Boundary4” as Second Curve;
- Select “Split5” as Second Support;
- On tab page “Basic”, select “Curvature” for first and second continuity;
- Select “Trim First Support” & “Trim Second Support” (the result will group all surfaces together)
- On tab page “Coupling/Spline”, select “Ratio”;
- Click ok to complete.



**Hide Plane.7 & Sketch23**

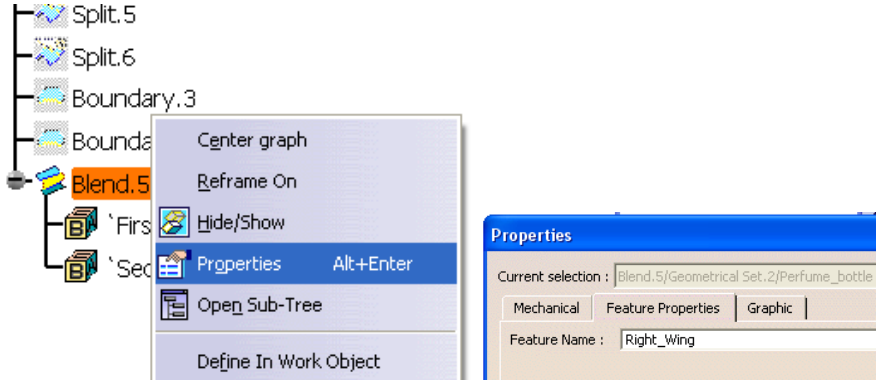
**Hide Boundary3 & Boundary4**



# Tutorial 5A

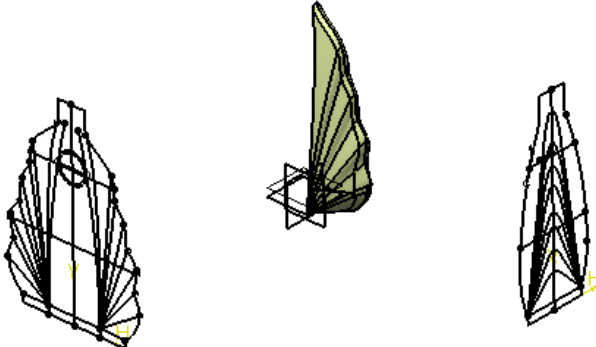
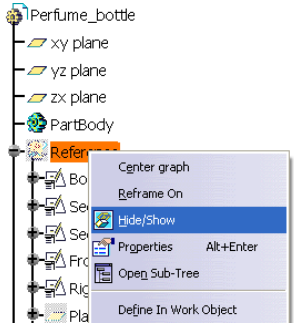
### To Rename a Surface:-

- Right-click the Surface “Blend.5”;
- Select “Properties”;
- Enter “Right\_Wing” as Feature Name;
- Click ok.

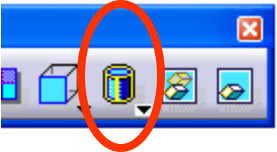


### To Show a Geometrical Set:-

- Right-click “Reference” on the tree;
- Select “Hide/Show”;
- Click ok.



### Switch back to “Shading with Edge”



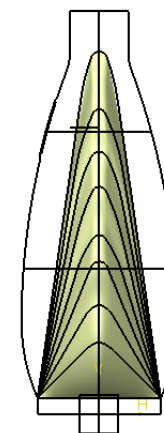
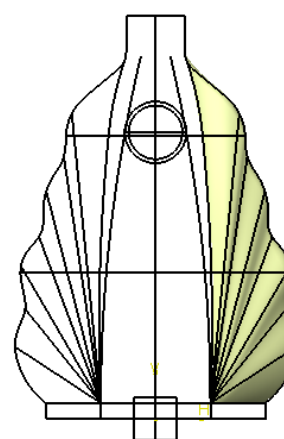
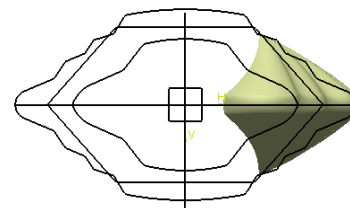
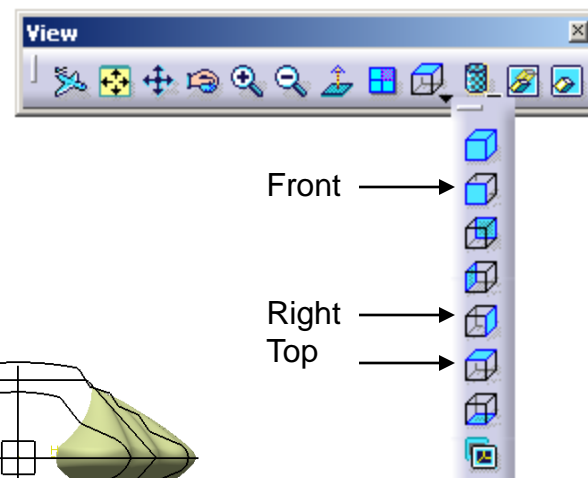
File/Save.... Bottle\_a.CATPART



# Tutorial 5B

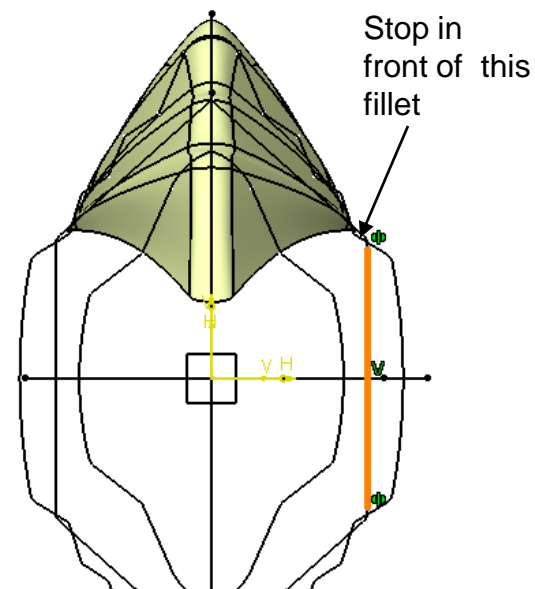
***We continue to build the remaining portion of the outer skin of the perfume bottle....***

- *Reopen the file “Bottle.CATPART” (if it is closed) ;*
  - *Ensure that the current workbench is “Generative Shape Design”;*
  - Click **“Front View”** icon to check the front view;
  - Click **“Right View”** icon to check the right view;
  - Click **“Top View”** icon to check the top view;
- (Remark: the surface should match Front View and Right View)

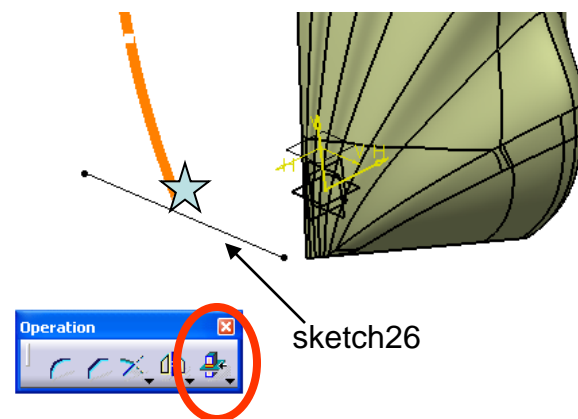
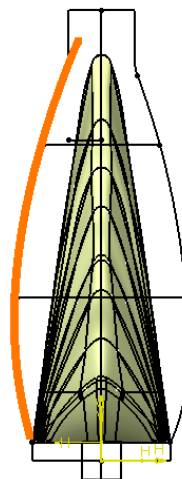


# Tutorial 5B

- Click **“Sketch”** icon and select “Plane.6”;
- **Draw a line** as shown, referring to the background reference;
- Create “Symmetry” constraint between two end points (first select endpoints then x-axis, click icon “constraint in dialog box”)
- Click **“Exit”** icon to complete.



- Click **“Sketch”** icon again and select “XZ plane”;
- **Draw a spline** (4 points) as shown, referring to the background reference;
- Select “sketch26”, then click icon “Intersect 3D elements”;
- Change the intersection point into “construction element”;
- Add “coincidence” constraint between the intersection point and the endpoint,★
- Click **“Exit”** icon to complete.



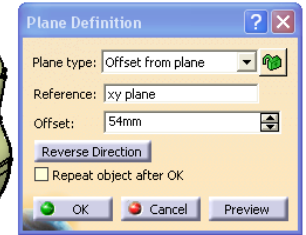
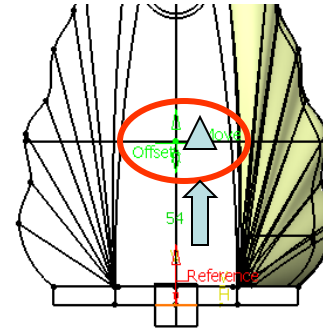
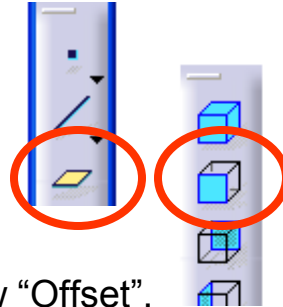


# Tutorial 5B

Drag the plane up

## To create a Plane (Plane8):-

- Click **“Plane”** icon;
- Select **xy plane** ;
- Click **“Front View”** icon;
- (Select **“Offset from Plane”** as plane type);
- Move the mouse cursor onto the double arrow **“Offset”**, then drag the plane downward onto the line  $\triangle$  ;
- (Offset value should be  $\sim 54\text{mm}$ )
- Click ok to confirm.

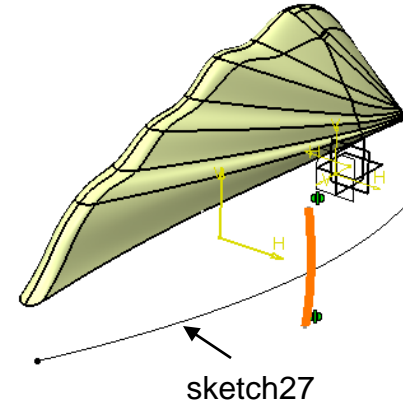
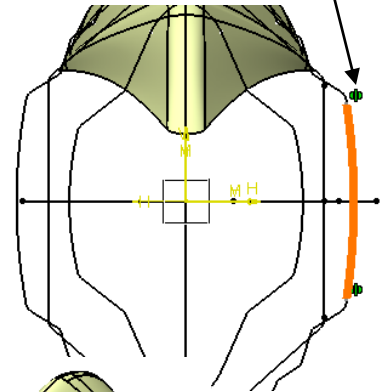


## To create a Sketch:-

- Click **“Sketch”** icon again and select **“Plane8”**;
- **Draw an arc** as shown, referring to the background reference;
- Create **“Symmetry”** constraint between two end points ;
- Select **“sketch27”**, then click icon **“Intersect 3D elements”**;
- Change the intersection point into **“construction element”**
- Add **“coincidence”** constraint between the intersection point and the arc;
- Click **“Exit”** icon to complete.




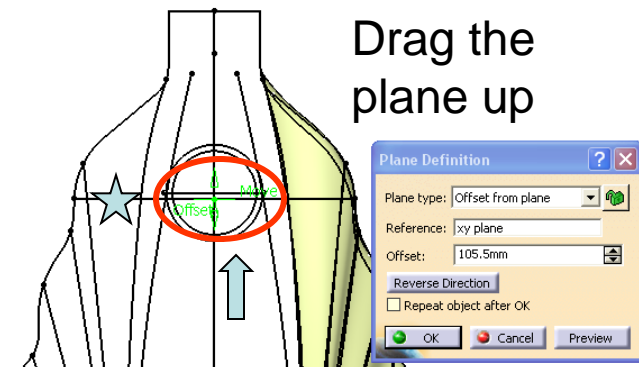
Stop in front of this fillet



# Tutorial 5B

## To create a Plane (Plane9):-

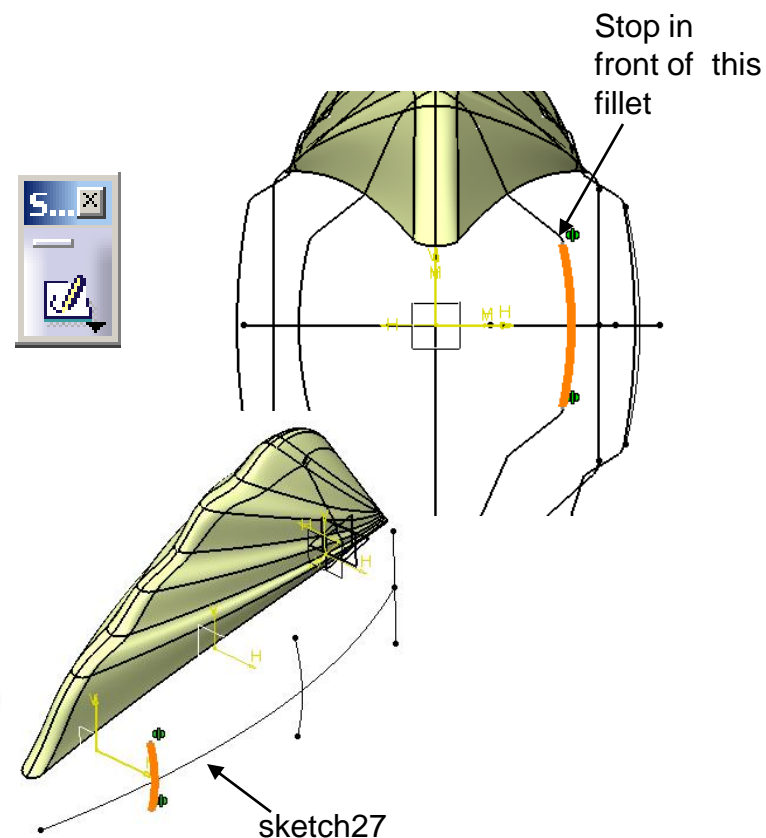
- Click **“Plane”** icon;
- Select **xy plane** ;
- Click **“Front View”** icon;
- Move the mouse cursor onto the double arrow **“Offset”**, then drag the plane downward onto the line  ;
- (Offset value should be ~ 105.5mm)
- Click ok to confirm.



Drag the plane up

## To Create a Sketch:-



- Click **“Sketch”** icon again and select **“Plane9”**;
- Draw an arc as shown, referring to the background reference;
- Create **“Symmetry”** constraint between two end points;
- Select **“sketch27”**, then click icon **“Intersect 3D elements”**;
- Change the intersection point into **“construction element”**;
- Add **“coincidence”** constraint between the intersection point and the arc;
- Click **“Exit”** icon to complete.

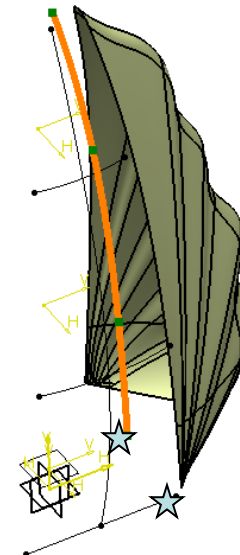
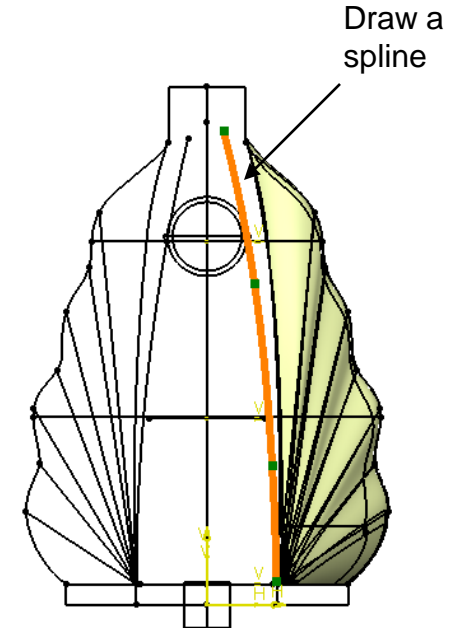


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# Tutorial 5B


## To Create a Sketch:-

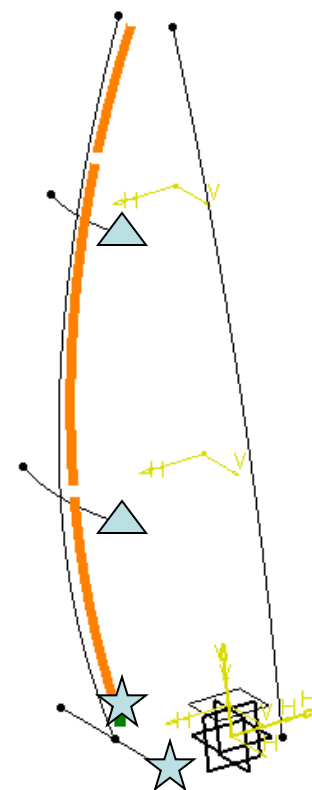
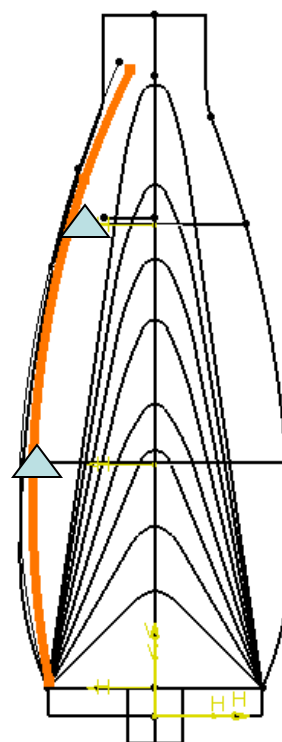
- Click **“Sketch”** icon and select **“YZ Plane”**;
- **Draw a spline** (4 points) as shown, referring to the background reference
- Rotate the view a little bit (by the middle button & the right button of your mouse) to have an isometric view;
- Multi-select these two endpoints  , then click the icon  (constraints defined in a dialog box)
- Select **“Coincidence”** and ok;
- Click **“Normal View”** icon and adjust the spline to match the background reference as much as possible;
- Click **“Exit”** icon to complete.



# Tutorial 5B

## To Create a Sketch:-

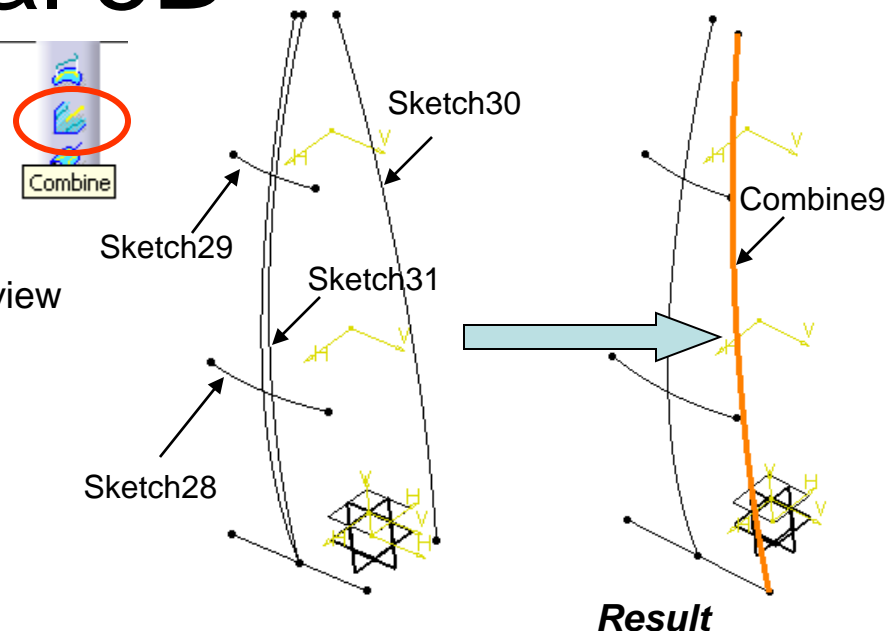
- Click **“Sketch”** icon and select **“XZ Plane”**;
- **Draw a spline** (4 points) as shown, referring to the positions of the endpoints of the previous arcs ▲
- Rotate the view a little bit (by the middle button & the right button of your mouse) to have an isometric view;
- Multi-select these two endpoints ☆ , then click the icon  (constraints defined in a dialog box)
- Select **“Coincidence”** and ok;
- Click **“Normal View”** icon and adjust the spline to match the background reference as much as possible;
- Click **“Exit”** icon to complete.



# Tutorial 5B

## To Create a “Combine” Curve:-

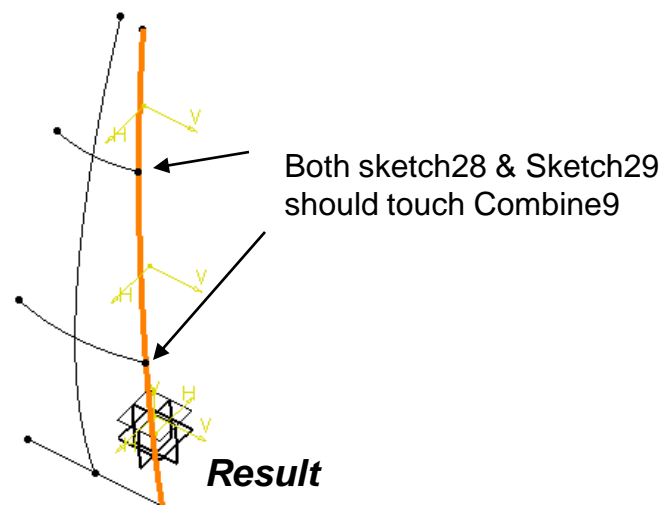
- Click “**Combine**” icon;
- Select “**Sketch.30**” & “**Sketch.31**”;
- Click ok to confirm.
- (The new curve can fit the shape on both front view and right view)



## Hide Sketch.30 to Sketch.31

## To Modify Sketch28 & Sketch29:-

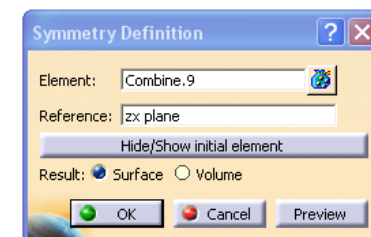
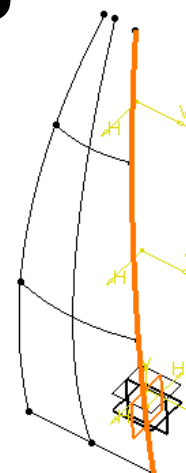
- Double Click “**Sketch.28**”;
- Select “Combine9”, then click icon “Intersect 3D elements”;
- Change the intersection point into “construction element”;
- Add “coincidence” constraint between the intersection point and the arc endpoint;
- Click Exit to complete.
- **Repeat the steps for “Sketch.29” too.**




# Tutorial 5B

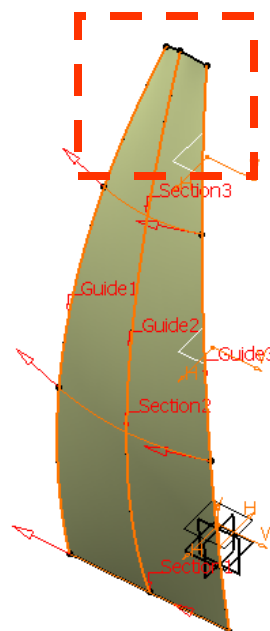
## To Create a Symmetric Curve:-

- Click “**Symmetry**” icon;
- Select “Combine9” as Element;
- Select “zx plane” as Reference;
- Click ok.

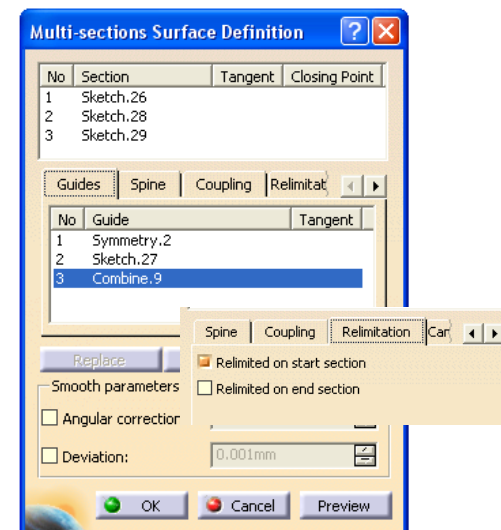


## To create a Multi-sections Surface:-

- Click “**Multi-sections surface**” icon; 
- Select “Sketch26” “Sketch28” “Sketch29” as **Section** (The red arrows should be pointing to the same direction; if not, click on the arrow to change)
- Select “Symmetry2” ”Sketch27” ”Combine9” as **Guide**;
- (On tab page “Relimitation”), **deselect** “**Relimited on end section**”;
- Click ok.

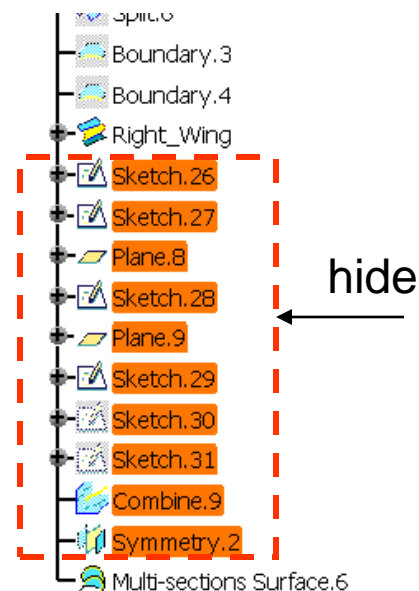


The result of “no limitation on end section”



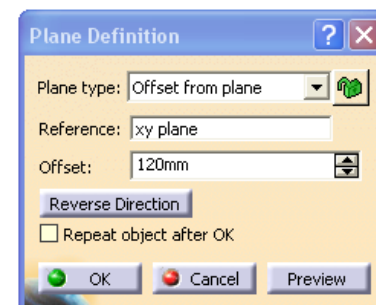
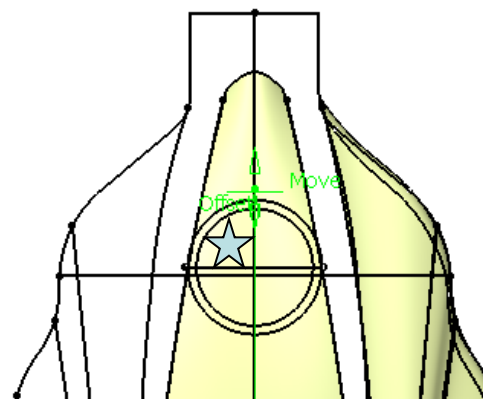
# Tutorial 5B

Hide the elements which were used to create the previous multi-sections surface.6



To create a Plane (Plane10):-

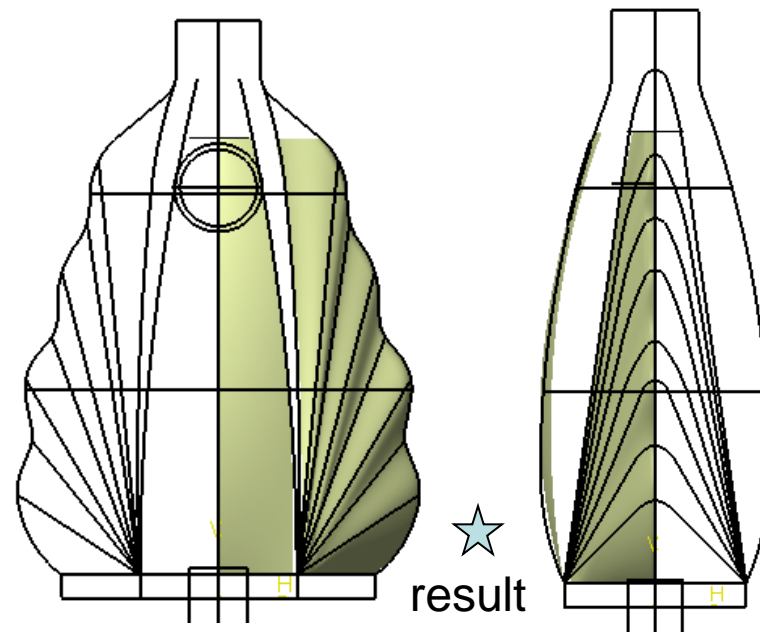
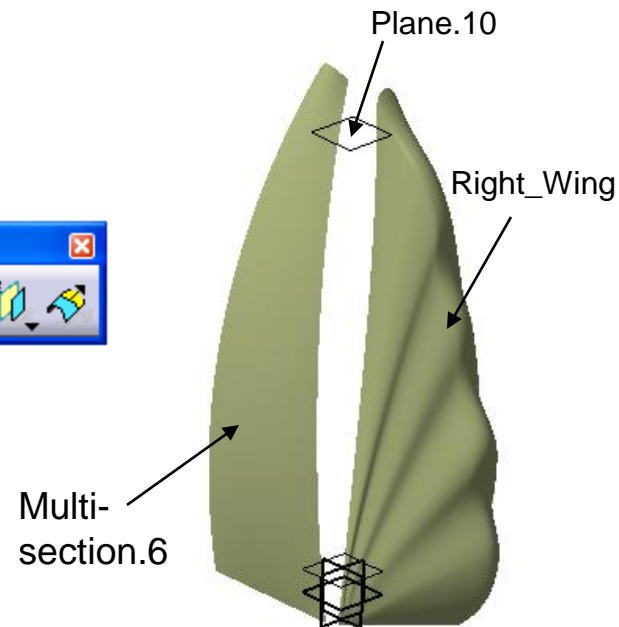
- Click “Plane” icon;
- Select **xy plane** ;
- Click “Front View “ icon;
- Move the mouse cursor onto the double arrow “Offset”, then drag the plane just above the circle ★ ;
- (Offset value should be ~ 120mm)
- Click ok to confirm.



# Tutorial 5B

## To Split Surfaces:-

- Click **“Split”** icon;
- Select Multi-sections.6 as “element to cut”;
- Select “zx plane” & “Plane10” as “cutting elements”;
- (if the solution is not as shown ☆, click “other side” to choose another solution)
- Click ok to confirm.
  
- Click **“Split”** icon again;
- Select “Right\_Wing” as “element to cut”;
- Select “Yz plane” & “Plane10” as “cutting elements”;
- (if the solution is not as shown, click “other side” to choose other solution)
- Click ok to confirm.



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result

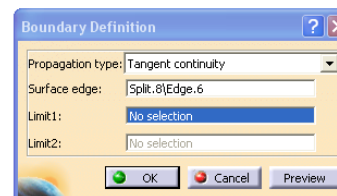


# Tutorial 5B

Not For Commercial Use

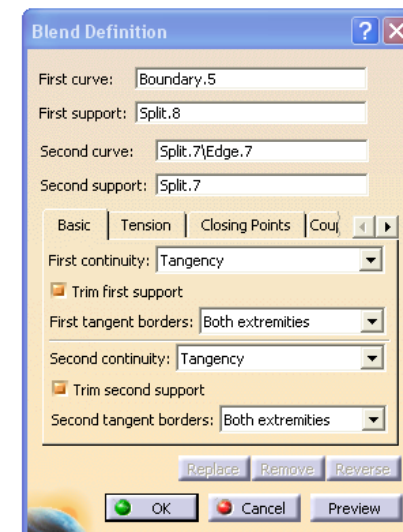
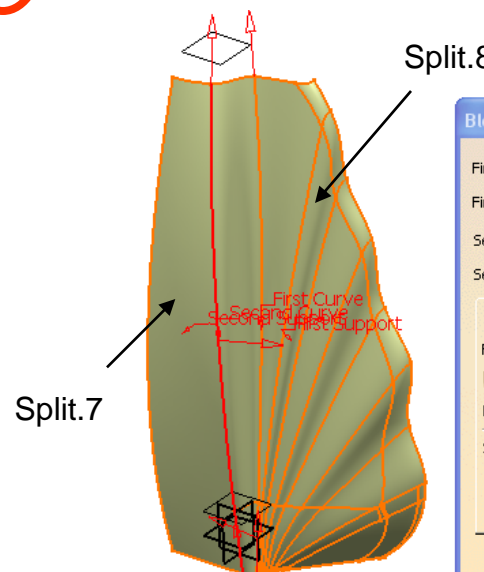
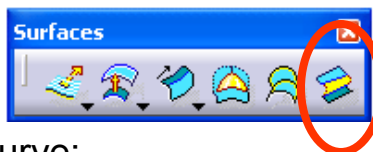
## To Create a Boundary Curve:-

- Click “**Boundary**” icon;
- Select “Tangent continuity”;
- Select the edge ;
- Click ok to confirm.



## To Create a Blend Surface:-

- Click “**Blend**” icon;
- Select “Boundary.5” as first curve;
- Select “Split.8” as first support;
- Select “Split.7/Edge7” as second curve;
- Select “Split7” as second support;
- Select “Tangency” for first & second continuity;
- Select “**Trim first support**” & “**Trim second support**” (so that the surfaces are grouped together)
- Click ok.

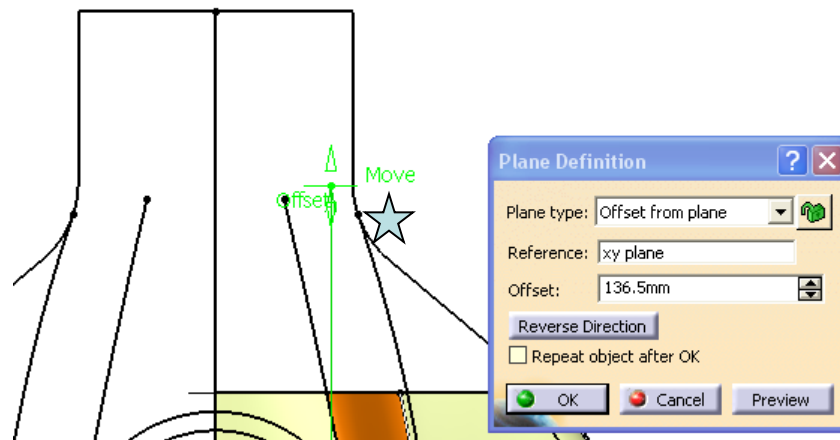


## Hide “Boundary.5”

# Tutorial 5B

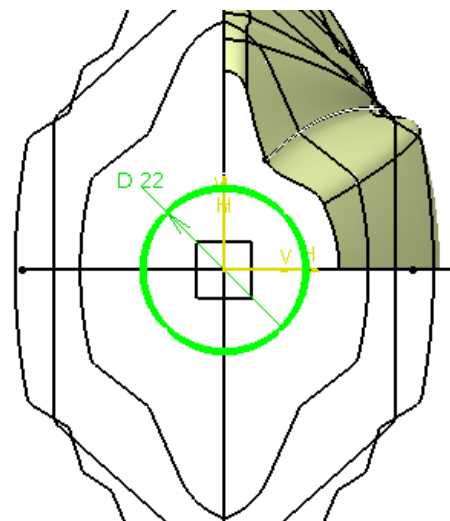
## To Create a Plane (Plane11):-

- Click “**Plane**” icon;
- Select **XY plane** ;
- Click “**Front View** “ icon;
- Move the mouse cursor onto the double arrow “Offset”, then drag the plane just above the fillet ☆;
- (Offset value should be ~ 136.5mm)
- Click ok to confirm.



## To Create a Sketch:-

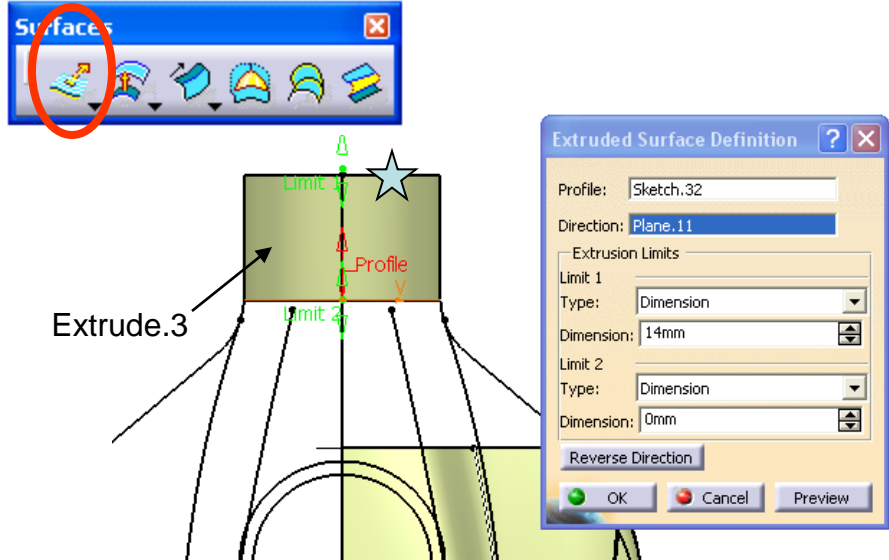
- Click “**Sketch**” icon;
- Select “Plane11”;
- **Draw a Circle** (dia= 22mm) at the origin;
- Click Exit to complete.



# Tutorial 5B

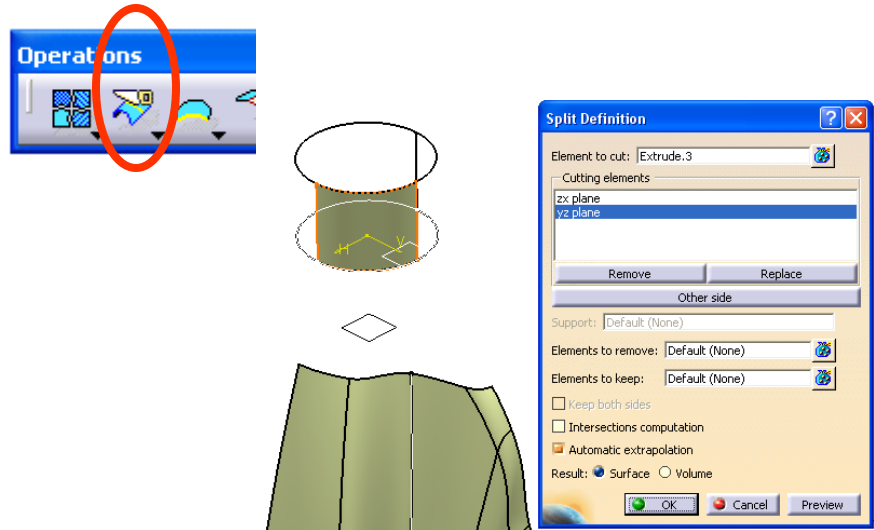
## To Create an Extrude Surface:-

- Click “**Extrude**” icon;
- Select the previous sketch (sketch.32) ;
- Click “**Front View** “ icon;
- Move the mouse cursor onto the double arrow “Limit1”, then drag the plane just on the line★;
- ( Limit.1 should be ~ 14mm)
- Click ok to confirm.



## To Split the Extrude Surface:-

- Click “**Split**” icon;
- Select “Extrude3” as “element to cut”;
- Select “zx plane” & “yz plane” as “cutting elements”;
- (if the solution is not as shown, click “other side” to choose other solution)
- Click ok to confirm.

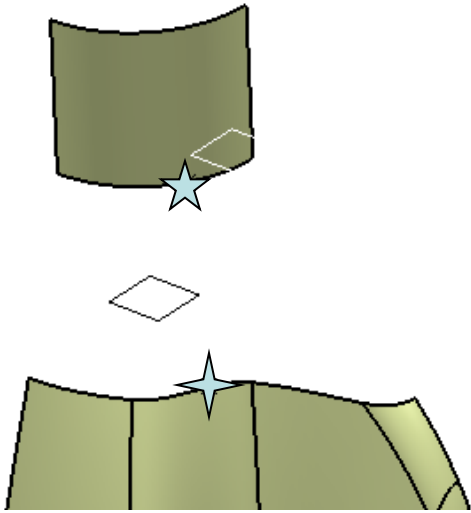


## Hide “Sketch.32”

# Tutorial 5B

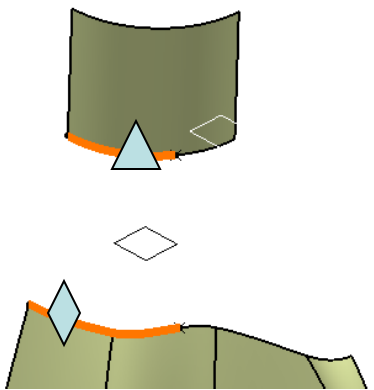
## To Create a point on the surface edge:-

- Click “point” icon;
- Click to define a point on the surface edge;★
- Click ok to complete.
- Click “point” icon again;
- Click to define a point on the surface edge;★
- Click ok to complete.



## To Create a boundary curve:-

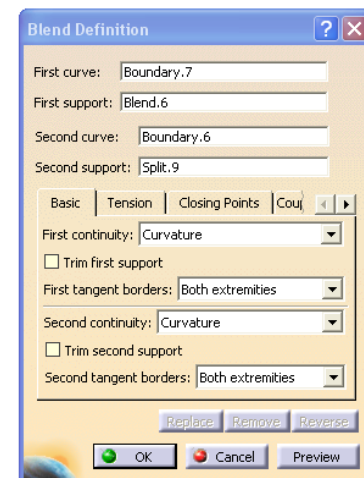
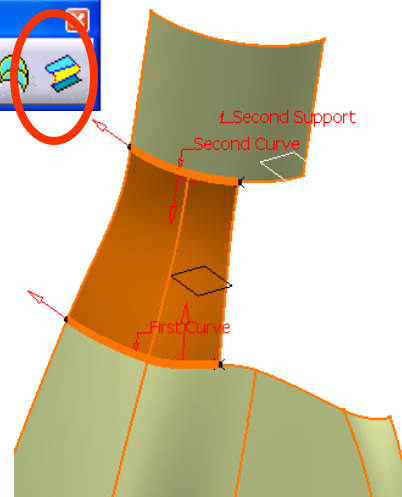
- Click “boundary” icon;
- Select the surface edge;▲
- Select “Point.8” as limit 1;
- (Reverse the red arrow if needed)
- Click ok to complete.
- Repeat the above steps to create another boundary curve as shown ◆



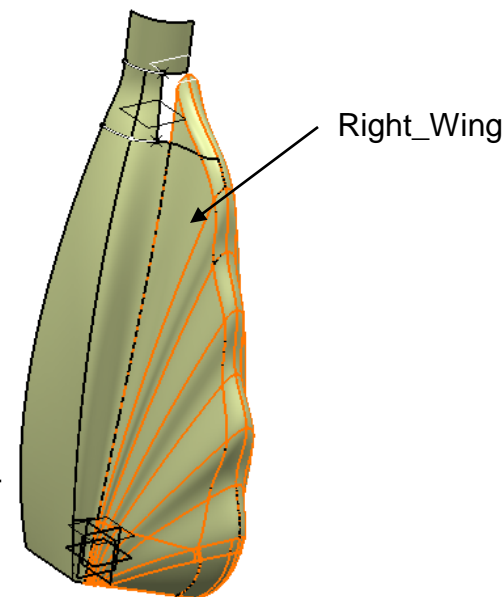
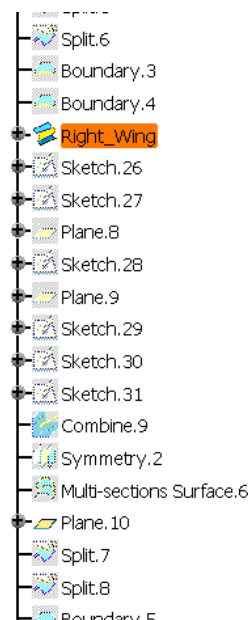
# Tutorial 5B

## To Create a Blend Surface:-

- Click **“Blend”** icon;
- Select **“Boundary.7”** as first curve;
- Select **“Blend.6”** as first support;
- Select **“Boundary.6”** as second curve;
- Select **“Split.9”** as second support;
- Select **“Curvature”** for first & second continuity;
- Click ok.



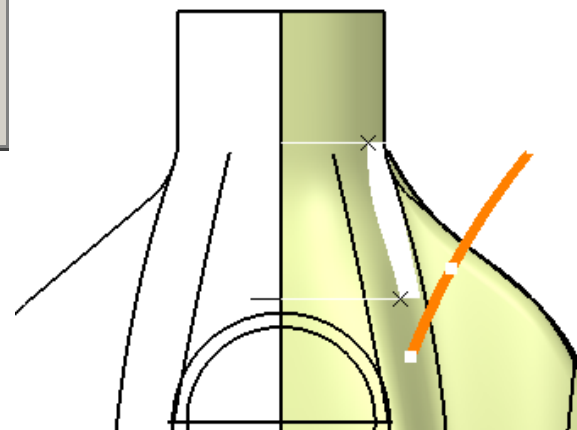
**“Show” the surface “Right\_Wing”**



# Tutorial 5B

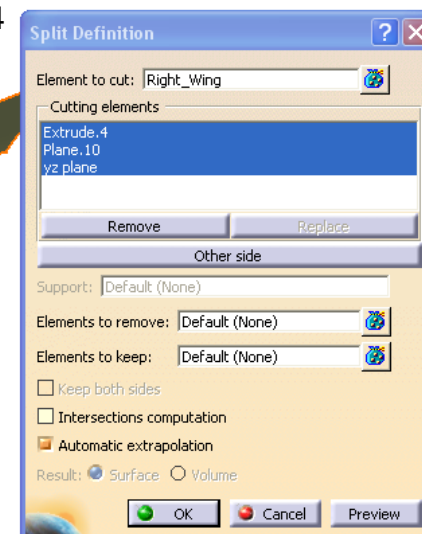
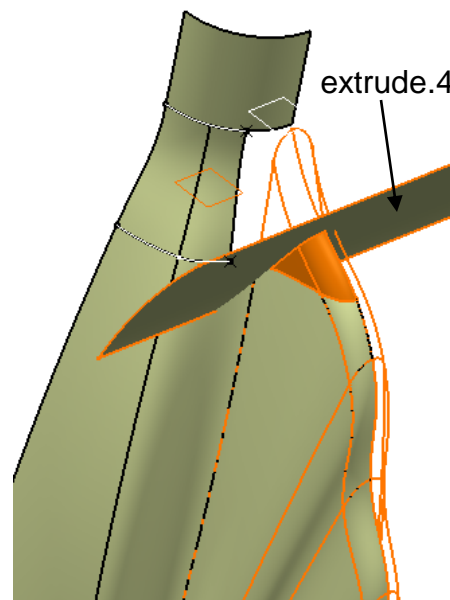
## To Create a Sketch:-

- Click “**Sketch**” icon;
- Select YZ plane;
- Draw a spline as shown;
- Click Exit to complete.



## To Split a surface by a sketch:-

- Click “**Extrude**” icon;
- Select “Sketch33”;
- Enter 30mm for both Limit1 & Limit2;
- Click ok.
  
- Click “**Split**” icon;
- Select “Right\_wing” as “element to cut”;
- Select “Extrude.4”, “Plane10”, “yz Plane” as “cutting element” (Click “other side” to choose other solution if needed)
- Click ok.







## Hide Extrude.4

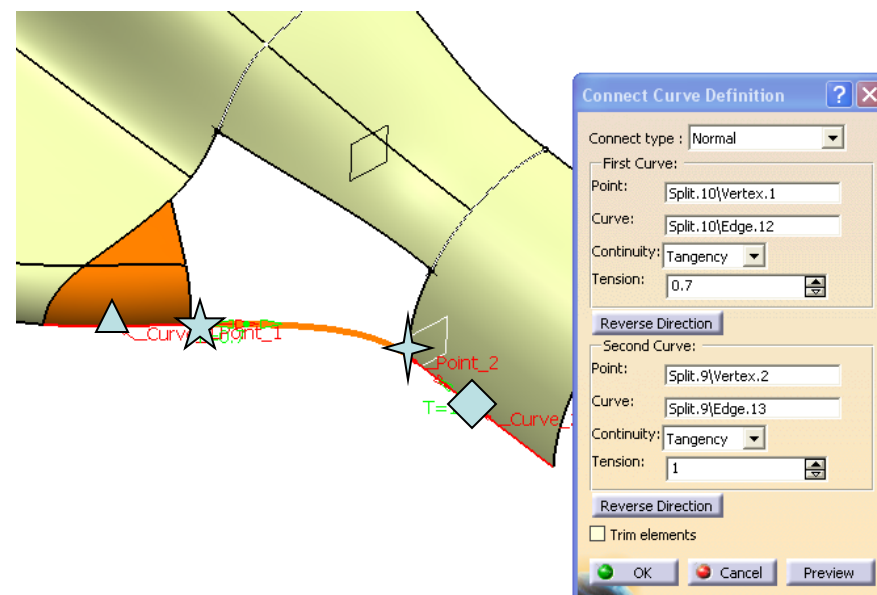
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# Tutorial 5B



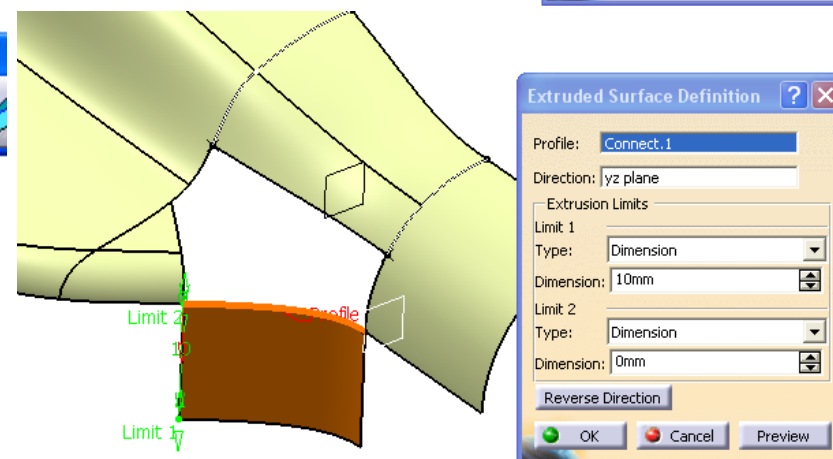
## To Create a Connect Curve:-

- Click **“Connect”** icon;
- First Curve
  - Select the point 
  - Select the edge 
  - Select “Tangency”
- Second Curve
  - Select the point 
  - Select the edge 
  - Select “Tangency”
- Click ok to complete.



## To Create an Extrude Surface:-

- Click **“Extrude”** icon;
- Select the Connect curve as Profile;
- Select “YZ plane” as Direction;
- Enter 10mm as Limit1 (Reverse direction if needed)
- Click ok.

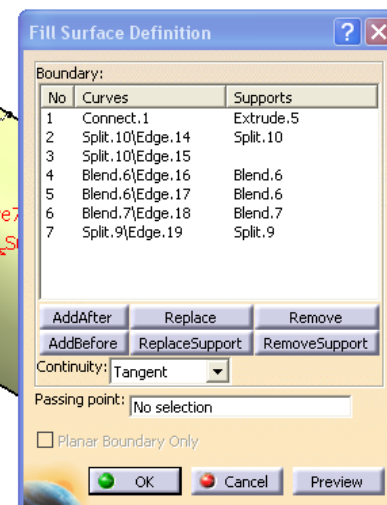
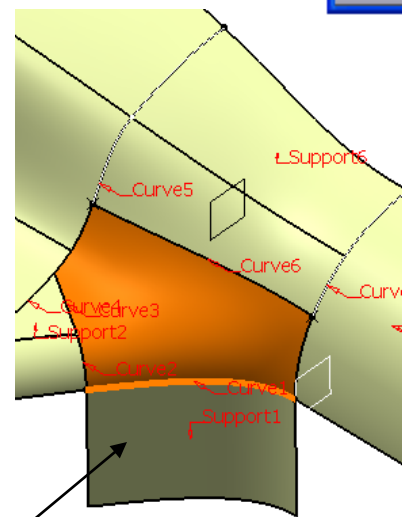
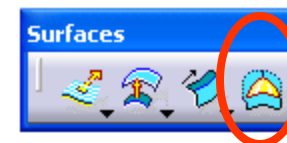




# Tutorial 5B

## To Create a Fill Surface:-

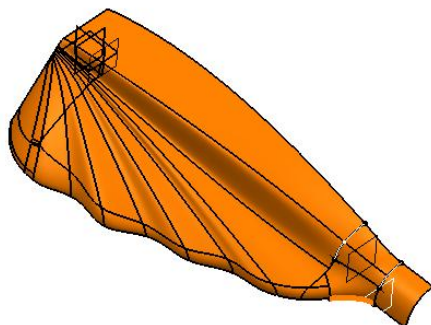
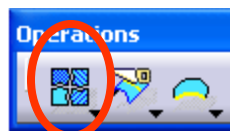
- Click “Fill” icon;
- Select the edges and the corresponding support surfaces;
- Select “Tangent” as continuity;
- Click ok to complete.



## Hide Extrude.5

## To Join Surfaces:-

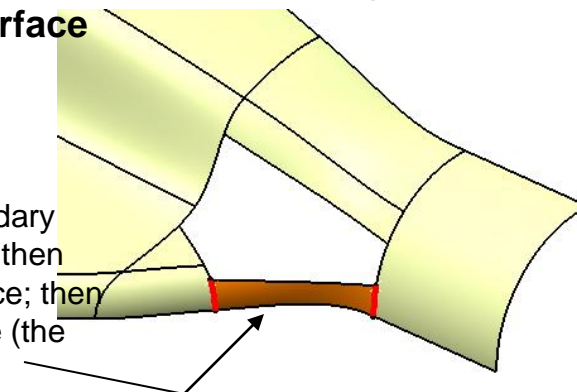
- Click “Join” icon;
- Select all surfaces;
- Click ok to complete.



Extrude.5

**(Optional) – Try the below method to get a smoother Fill Surface**

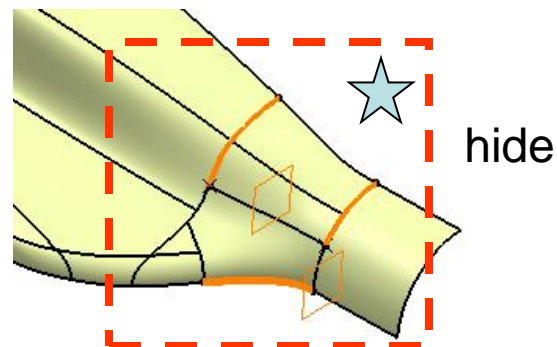
Create a small boundary curve on both sides, then create a blend surface; then create the fill surface (the result is better)





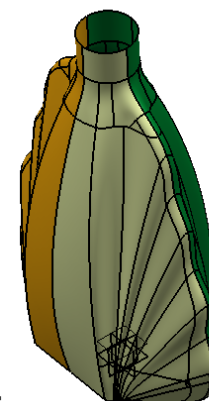
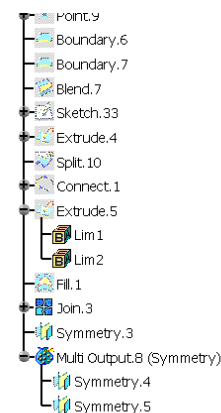
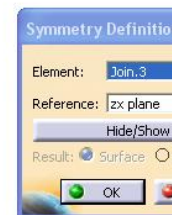
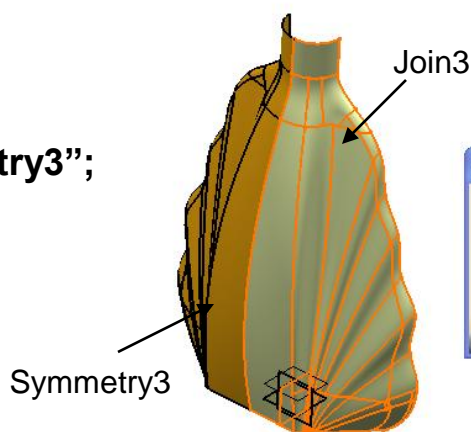
# Tutorial 5B

Hide all these elements  
(curves/sketches/planes) ★



## To Create a Symmetry:-

- Click “Symmetry” icon;
- Select Join3 as Element;
- Select “ZX plane” as Reference;
- Click ok.
- **Multi-select “Join3” & “Symmetry3”;**
- Click “Symmetry” icon;
- Select “YZ plane” as Reference;
- Click ok.



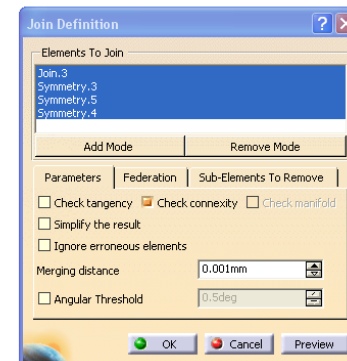
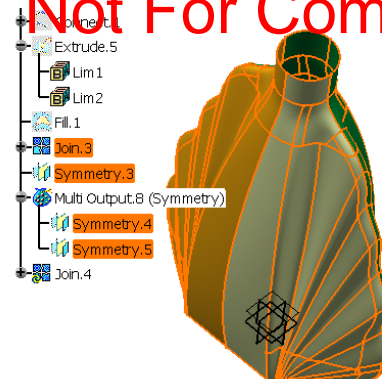
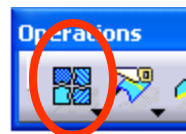
**result**

# Tutorial 5B

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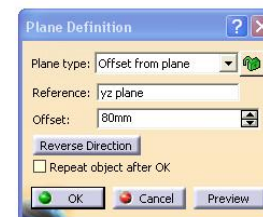
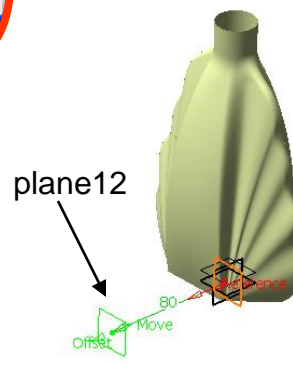
## To Join Surfaces:-

- Click “Join” icon;
- Select all surfaces;
- Click ok to complete.



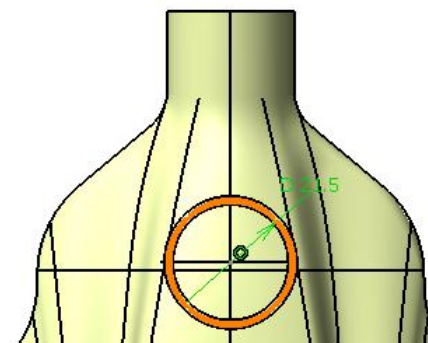
## To Create a Plane:-

- Click “Plane” icon;
- Select YZ plane;
- Enter 80mm as Offset (in front of the model);
- Click ok to complete.



## To Create a Sketch:-

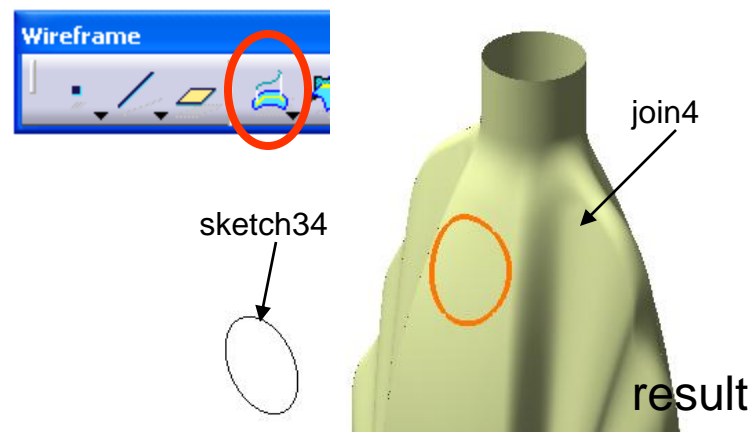
- Click “Sketch” icon;
- Select the previous plane “Plane12”;
- **Draw a Circle** (dia 21.5mm) as shown;
- Drag the circle center to adjust its position, which should be aligned on y-axis;
- Click Exit to complete.



# Tutorial 5B

## To Project the sketch onto model:-

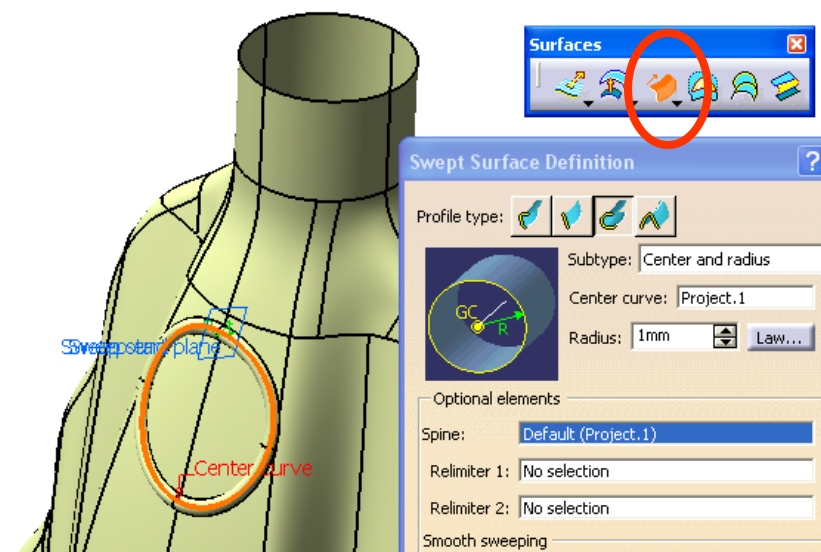
- Click **“Project”** icon;
- Select the previous sketch “Sketch34” as Projected;
- Select Join.4 as Support;
- Select “Along a direction” as Projection type;
- Select “yz plane” as direction;
- Click ok to complete.



## To Create a Swept surface (circular):-

- Click **“Sweep”** icon;
- Select “Circular” as profile type;
- Select “center and radius” as subtype;
- Select the projected curve “Project.1” as center curve
- Enter 1mm as radius;
- Click ok to complete.

**Hide the sketch, the sketch plane and the projected curve**

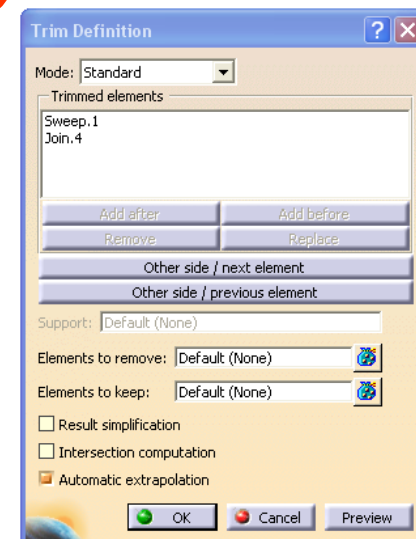
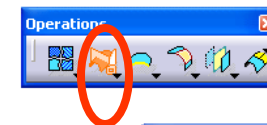
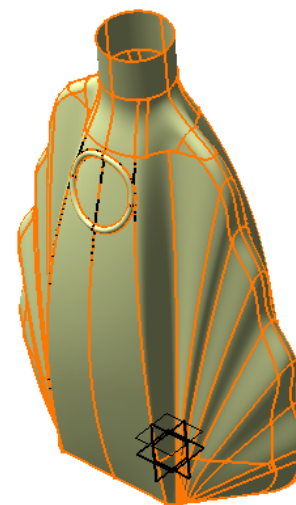


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# Tutorial 5B

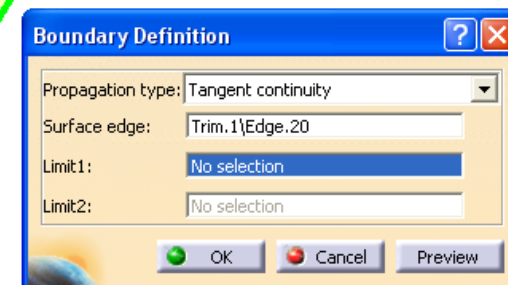
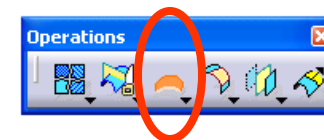
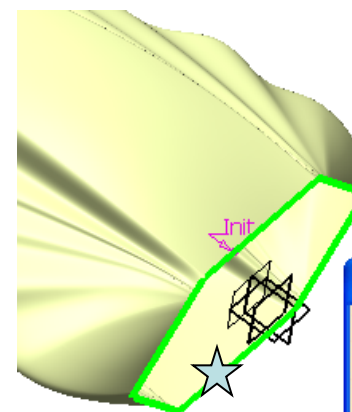
## To Mutual Trim between 2 surfaces:-

- Click “Trim” icon;
- Select “Sweep.1” and “Join.4”;
- (the solution should be the combination of all outermost faces)
- Click ok to complete.



## To Create a Boundary curve:-

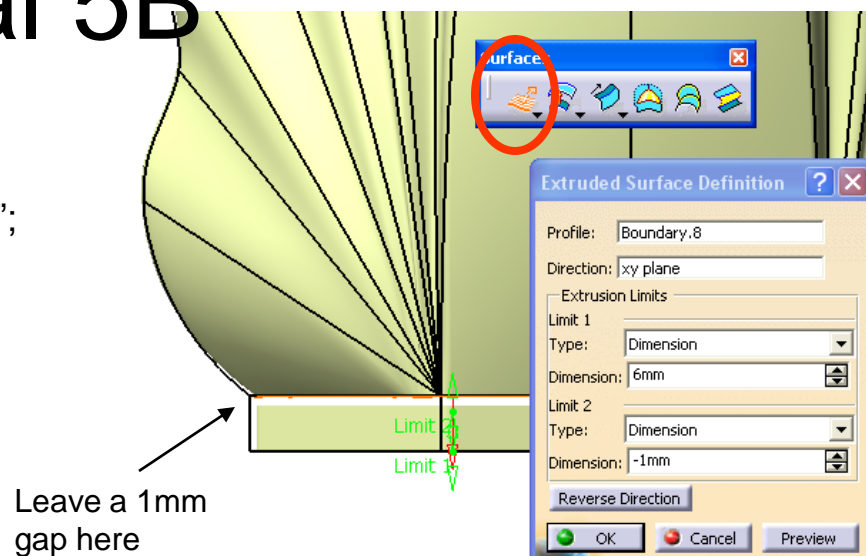
- Click “Boundary” icon;
- Select the edge;★
- Select “tangent continuity” as propagation type;
- Click ok to complete.



# Tutorial 5B

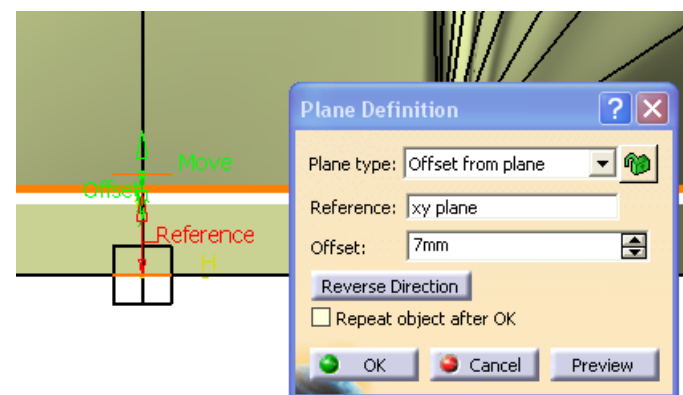
## To Create an Extrude Surface:-

- Click “**Extrude**” icon;
- Select the previous boundary curve “Boundary.8”;
- Select xy plane as direction;
- Click “Reverse Direction”;
- Switch to “Front View”;
- Limit1 = 6mm; Limit2 = -1mm
- Click ok to complete.



## To Create a Plane:-

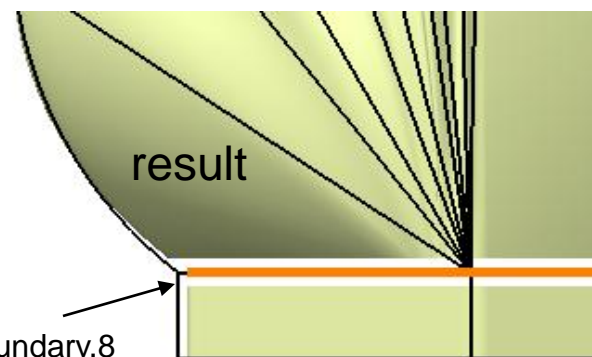
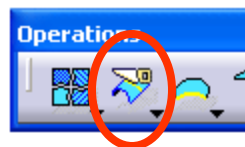
- Click “**Plane**” icon;
- Select xy plane as reference;
- Enter 7mm as Offset value;
- Click ok to complete.



# Tutorial 5B

## To Split a Surface:-

- Click “**Split**” icon;
- Select “Trim.1” as “element to cut”;
- Select the previous offset plane “Plane13”;
- Click ok to complete.

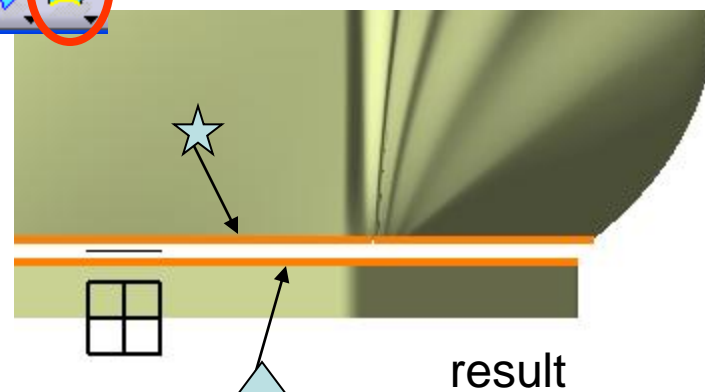
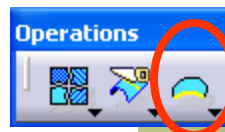


Upper (lower) surface is 1mm away from the boundary curve

## Hide Boundary.8

## To Create boundary curves:-

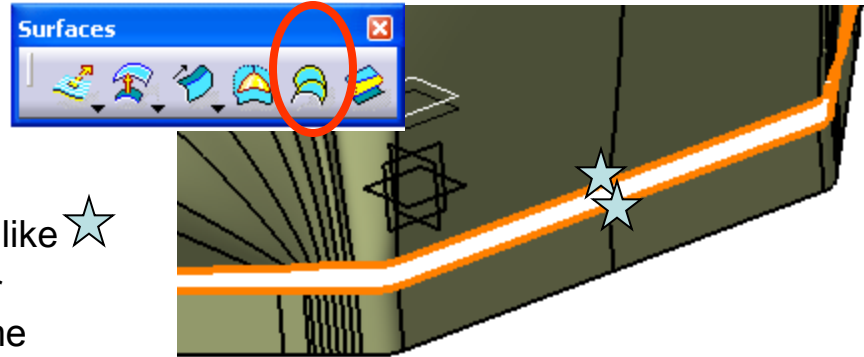
- Click “Boundary” icon;
- Select the edge;★
- Select “tangent continuity” as propagation type;
- Click ok to complete.
- Click “Boundary” icon again;
- Select the edge;▲
- Click ok to complete.



# Tutorial 5B

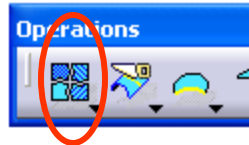
## To Create a Multi-sections Surface:-

- Click “Multi-sections surface” icon;
- Select the boundary curves and the corresponding support surfaces;
- Check if the closing points are a correct pair like ☆
- (on tab page ”Coupling”), select “Vertices” or “Ratio” (if number of vertices are not the same on both sides)
- Click ok to complete.

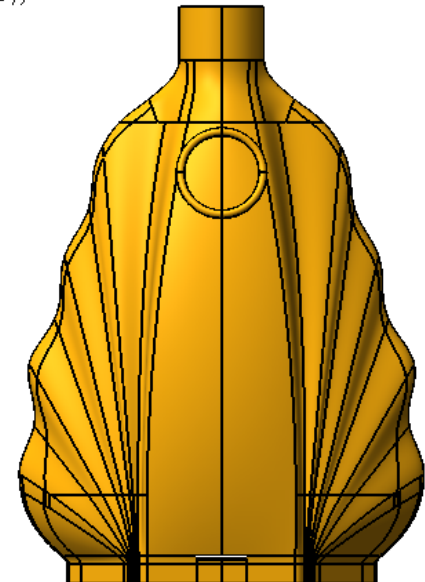
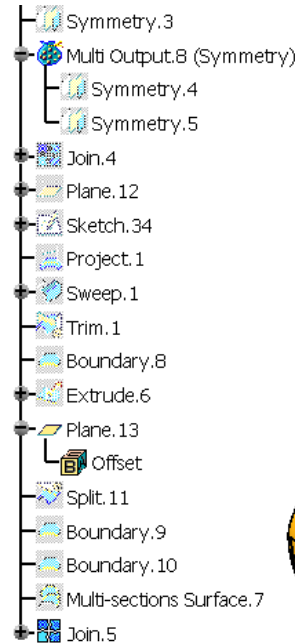


## To Join all surfaces:-

- Click “Join” icon;
- Select all surfaces;
- Click ok to complete.



## Hide the two boundary curves



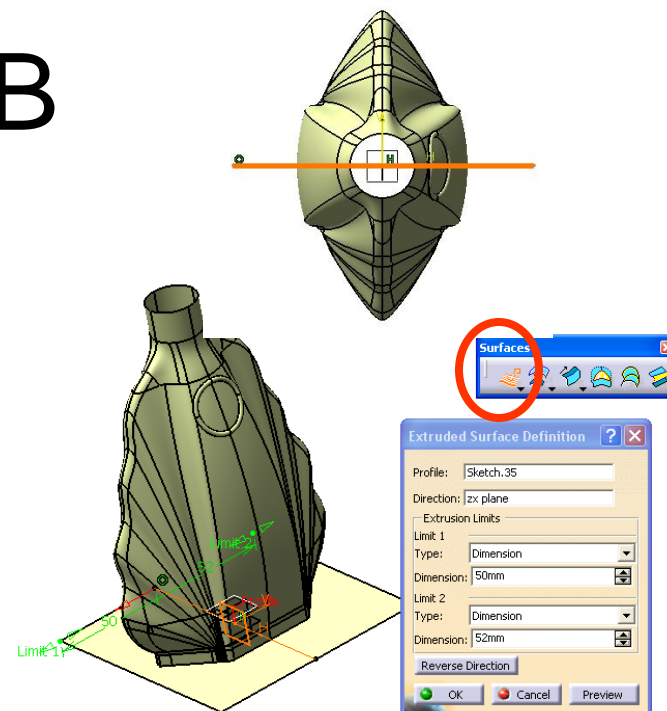
result



# Tutorial 5B

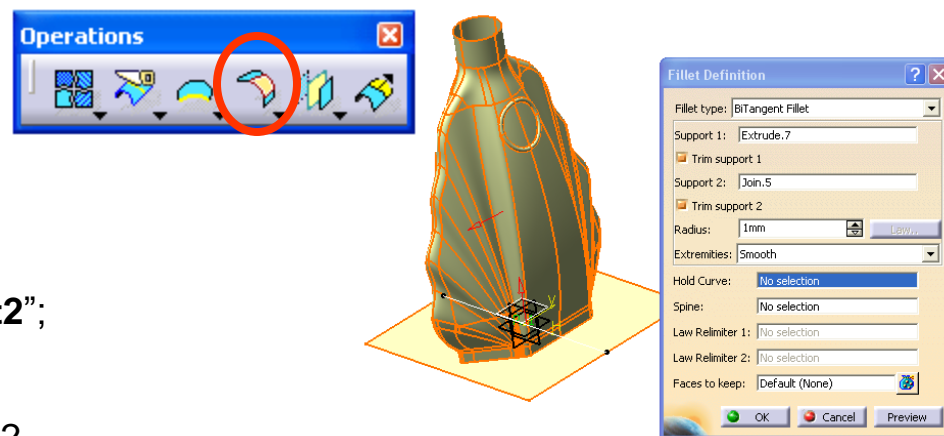
## To Create an Extrude Surface:-

- Click **“Sketch”** icon, select XY plane;
- **Draw a line** (long enough to cut through the whole model); no need to make it symmetric
- Click Exit to complete;
- Click **“Extrude”** icon;
- Select the sketch as Profile;
- Select ZX plane as direction;
- Drag “Limt1” & “Limit2” to increase the lengths until the surface is big enough to cut through the model;
- Click ok to complete.



## To Create a Surface-to-Surface fillet:-

- Click **“Shape Fillet”** icon;
- Select the two surfaces;
- (reverse red arrows if they are not pointing inward)
- Highlight **“Trim Support1”** & **“Trim Support2”**;
- Enter 1mm as radius;
- Click ok.



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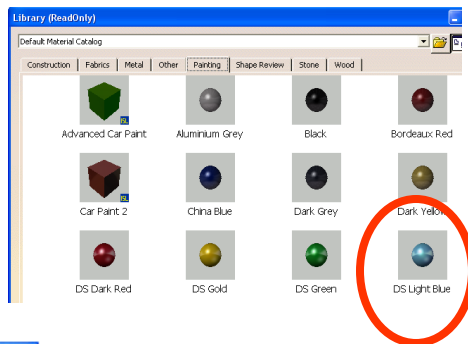
# Tutorial 5B

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### Hide all Elements except the final surface

### To Apply a Material Texture:-

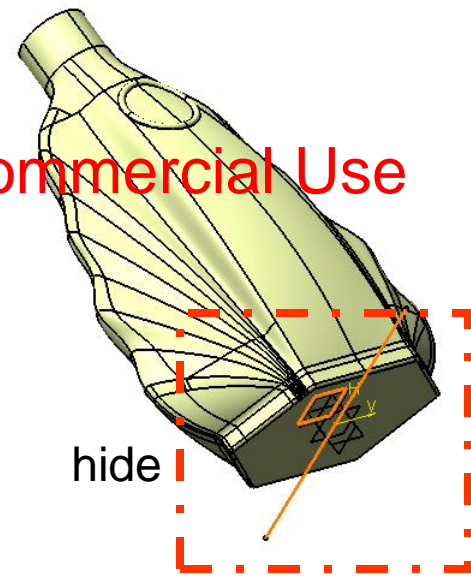
- Click **“Material”** icon;
- Select the tab page **“Painting”**;
- Select **“DS Light Blue”**;
- Click on the surface;
- Click ok.



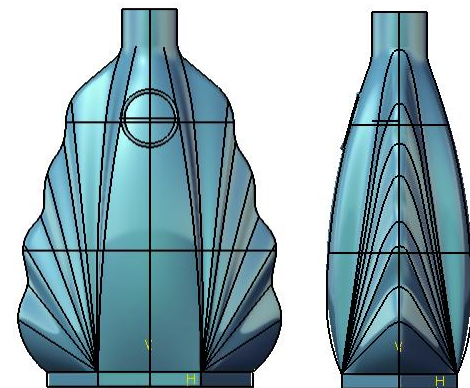
- Click **“Shading with material”** icon



- Click **“Front View”** icon to check
- Click **“Right View”** icon to check



result



**File /SAVE**

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## END of Tutorial 5B

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**CATIA Certified Professional**



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