CATIA V5
Parametric Surface Modeling
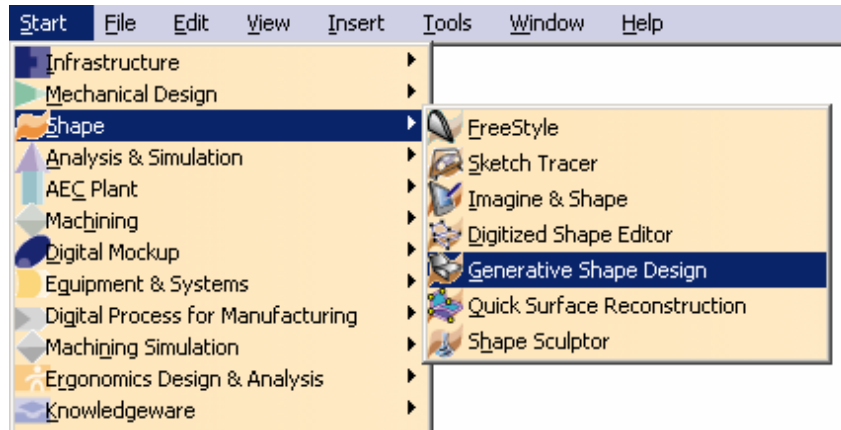
Version 5 Release 16

Generative Shape Design

A- 1

By Dickson Sham (ME dept, HKPU)

Toolbars in Generative Shape Design

A. **Wireframe**: Create 3D curves / lines/ points/ plane

B. **Surfaces**: Create surfaces

C. **Operations**: Join surfaces, Split & Trim surfaces, Change the 3D positions of surfaces, Fillets…

D. **Replication**: Pattern, Powercopy…

E. **Analysis:** Connection analysis, Draft analysis, curvature analysis…

F. **Surface-based Features:** (On Part Design Workbench), create a solid from surfaces, modify the solid by a surface…

A- 2

Generative Shape Design
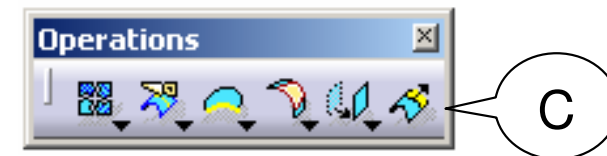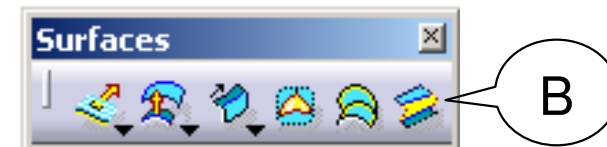
Point

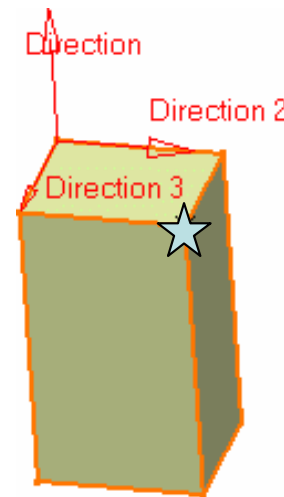**Point** (Create a point in the 3D space)
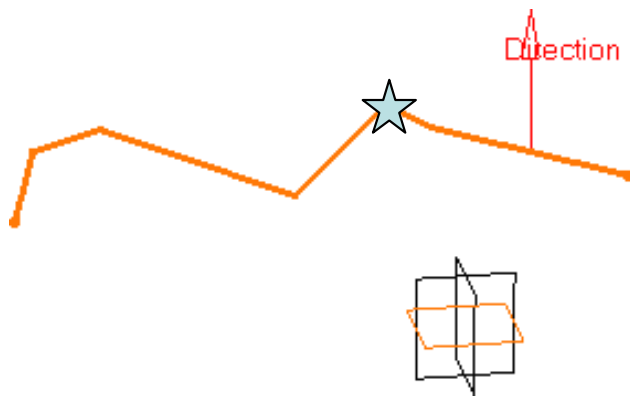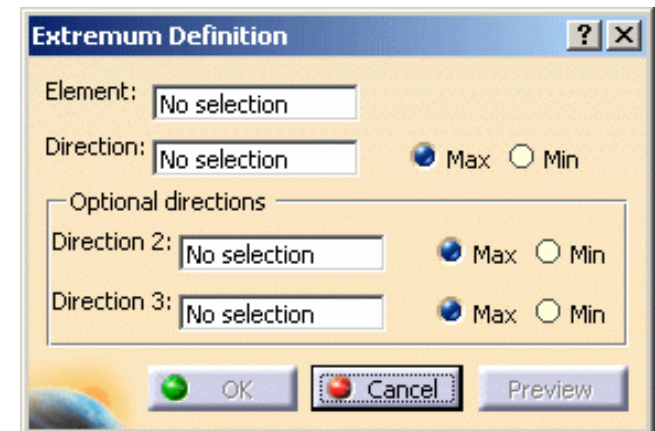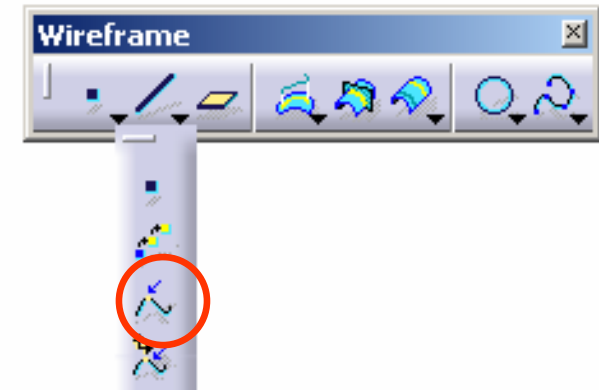
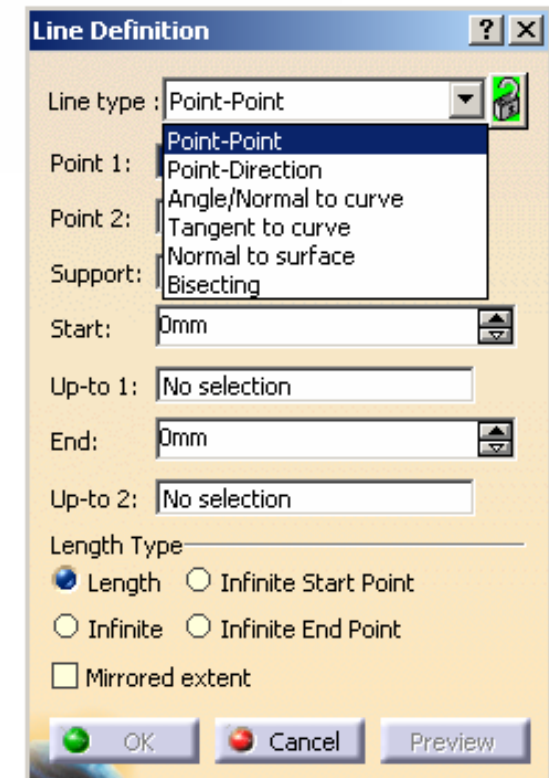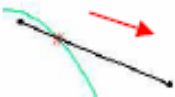| Type	Description
Point by Coordinates	Create a point by defining its coordinates in 3D.
Point on a Curve	Create a point on a curve at a distance from a reference point.
Point on a Plane	Create a point on a plane at a distance from a reference point.
Point on a Surface	Create a point on a surface at a specified distance and direction from a reference point.
Point at a Circle/Sphere Center	Create a point at the center of a circle/Sphere.
Point Tangent on a Curve	Create curve tangent points for a specified direction.
Point Between Two Points	Create a point between two existing points using a ratio value.
Points Spaced on a Curve	Create several points equally spaced on a curve

A- 3

By Dickson Sham (ME dept, HKPU)
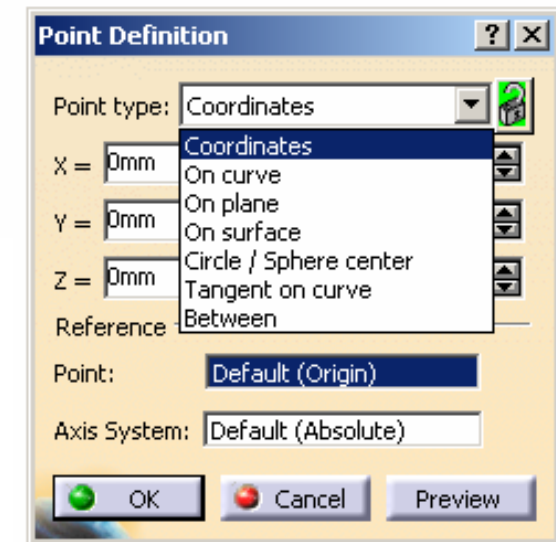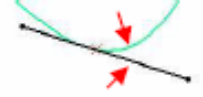
Extremum (max or min point)

Extremum (create an extremum element (point, edge, or face), which is at the minimum or maximum distance on a curve, a surface, or a pad, according to given directions.)
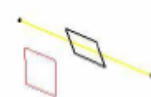

A- 4

**Generative
Shape Design**

Line

Line (Create a line in the 3D space)

Wireframe

Line Definition

Line type : Point-Point

- Point-Point
- Point-Direction
- Angle/Normal to curve
- Tangent to curve
- Normal to surface
- Bisecting

Point 1:

Point 2:

Support:

Start: 0mm

Up-to 1: No selection

End: 0mm

Up-to 2: No selection

Length Type
- ● Length ○ Infinite Start Point
- ○ Infinite ○ Infinite End Point

☐ Mirrored extent

OK   Cancel   Preview

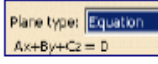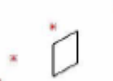| Type	Geometry	Description
Line Between Two Points		Create a line between two selected points.
Line from a Point and Direction		Create a line based on a reference point and a specified direction.
Line at an Angle or Normal to a Curve		Create a line at an angle to a curve that passes through a point.
Line Tangent to a Curve		Create a line tangent to a single curve, a point and a curve, or two curves.
Line Normal to a Surface		Create a line normal to a surface at a selected point.
Bisecting Line		Create a line that splits the angle between two lines into equal parts.

A- 5

**Generative
Shape Design**

Plane

Plane (Create a plane in the 3D space)

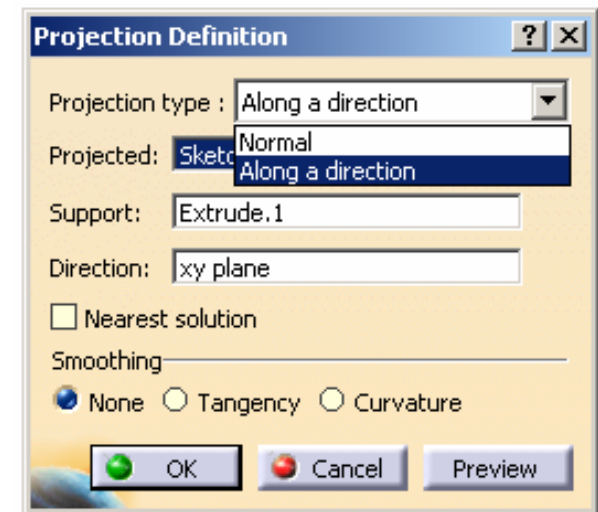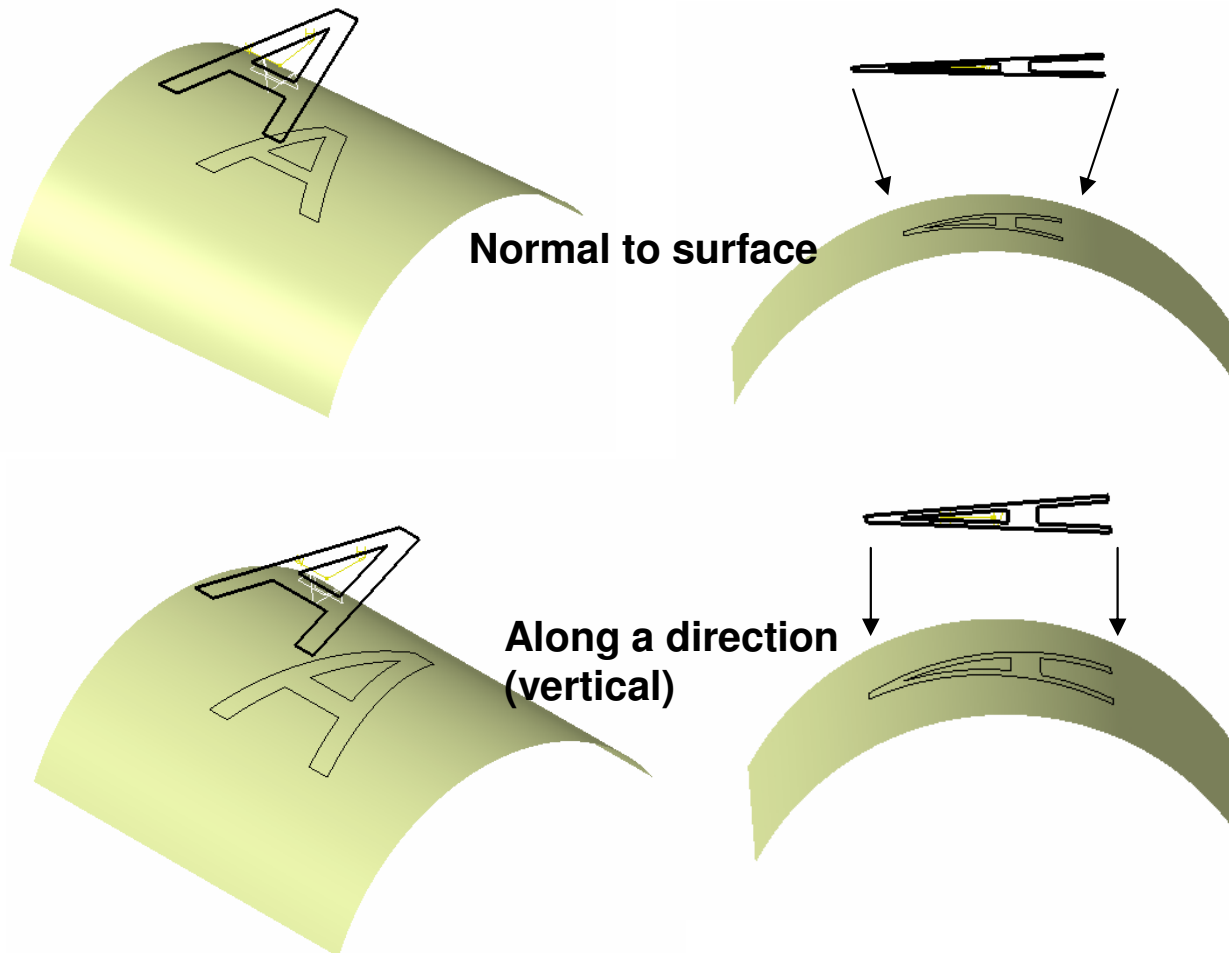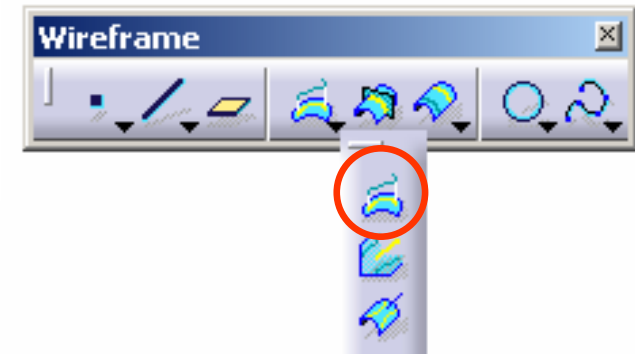| Type	Geometry	Description
Offset Plane		Create a plane parallel to a reference plane offset at a distance.
Parallel Plane through a Point		Create a plane parallel to a reference plane through a point.
Plane at an Angle or Normal to a Plane		Create a plane at an angle to a reference plane based on a rotation axis.
Plane through 3 Points		Create a plane passing through 3 points.
Plane through 2 Lines		Create a plane passing through 2 lines.
Plane through a Point and a Line		Create a plane passing through a point and a line.
Plane through a Planar Curve		Create a plane passing through a planar curve.
Plane Normal to a Curve		Create a plane normal to a curve at a specified point.
Plane Tangent to a Surface		Create a plane tangent to a surface passing through a specified point.
Plane by an Equation	Plane type: Equation Ax+By+Cz = D	Create a plane by defining the components of the equation of the plane.
Mean Plane through Points		Create a plane defined as the mean through 3 or more points.
Plane Spaced Between 2 Planes		Create several planes spaced equally between 2 selected reference planes.

Wireframe

Plane Definition

Plane type: Offset from plane

Offset from plane
Parallel through point
Angle/Normal to plane
Through three points
Through two lines
Through point and line
Through planar curve
Normal to curve
Tangent to surface
Equation
Mean through points

Reference:

Offset:

Reverse D

Repeat

OK

A-6

**Generative
Shape Design**
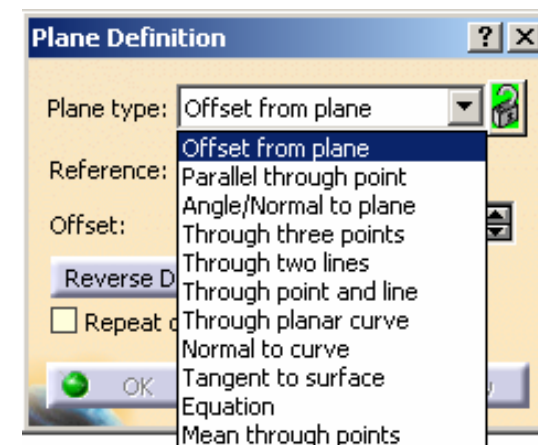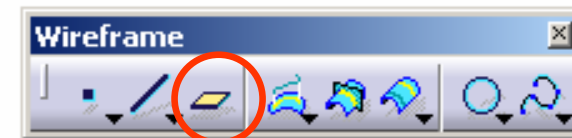
Projection onto a support

Projection (project one or more elements
onto a support. The projection can be normal
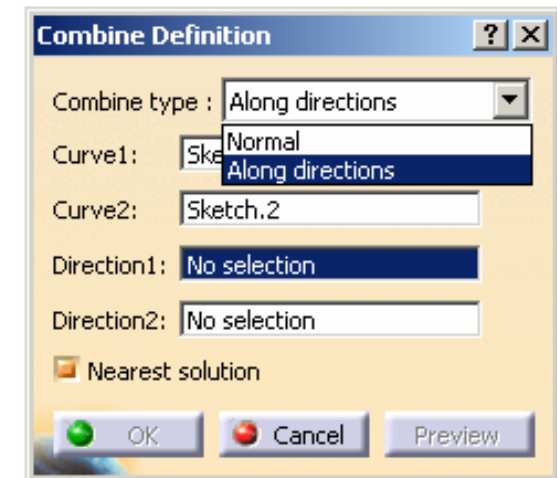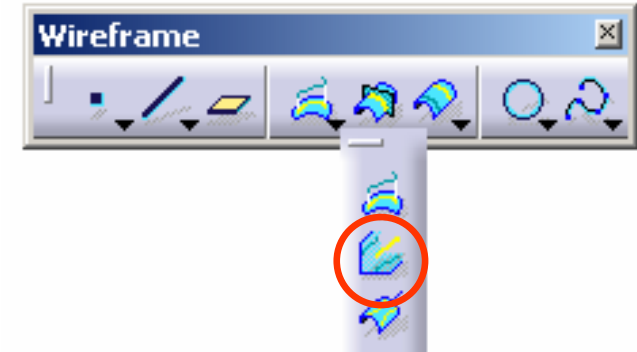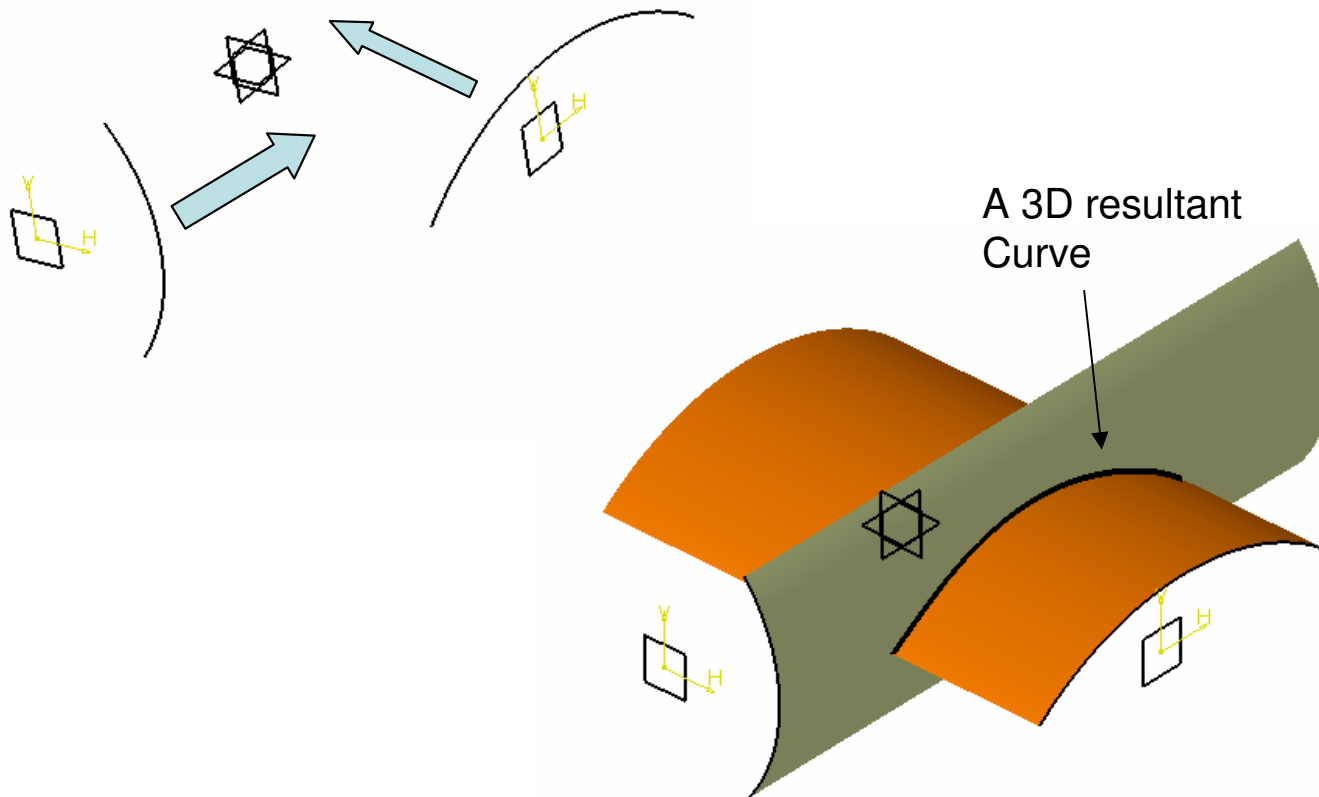to surface or along a specified direction.)

Wireframe

Normal to surface

**Along a direction
(vertical)**

Projection Definition

Projection type : Along a direction

Normal
Along a direction

Projected: Sketch

Support: Extrude.1

Direction: xy plane

☐ Nearest solution

Smoothing
● None ○ Tangency ○ Curvature
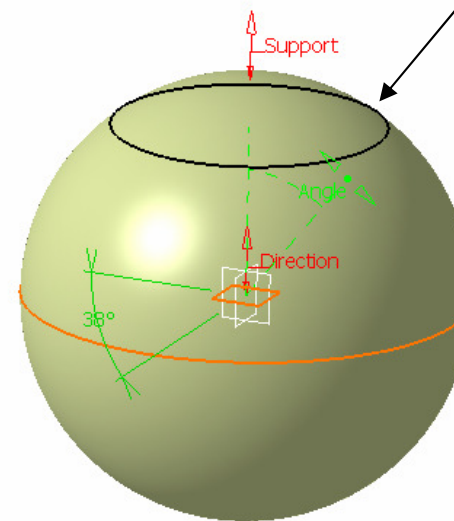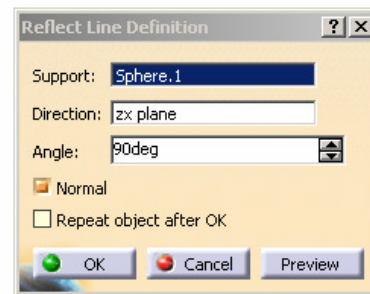
● OK   ● Cancel   Preview

A- 7

Combine Curves

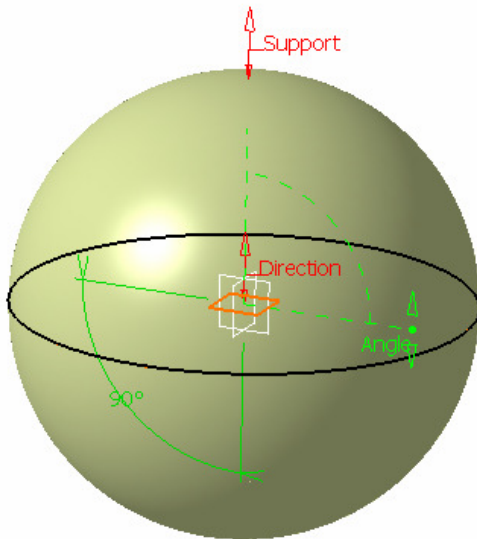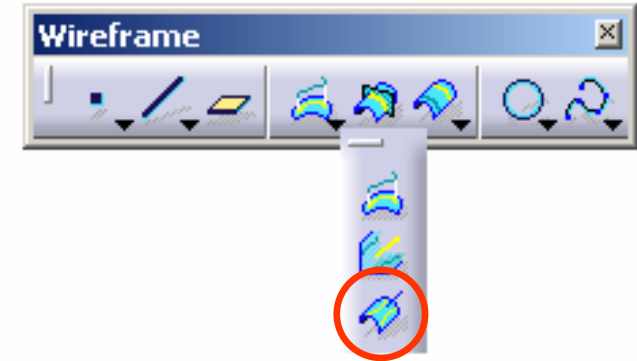**Combine Curves** (create a curve resulting
from the intersection of the extrusion of two
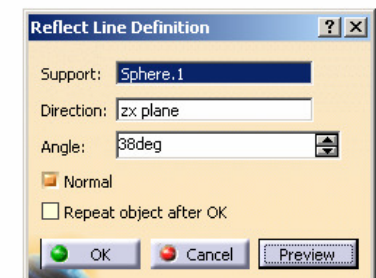curves.)

A 3D resultant
Curve

A- 8

Reflect Line

Reflect Line (create curves for which the normal to the surface in each point present the same angle with a specified direction. They can be closed or open.)
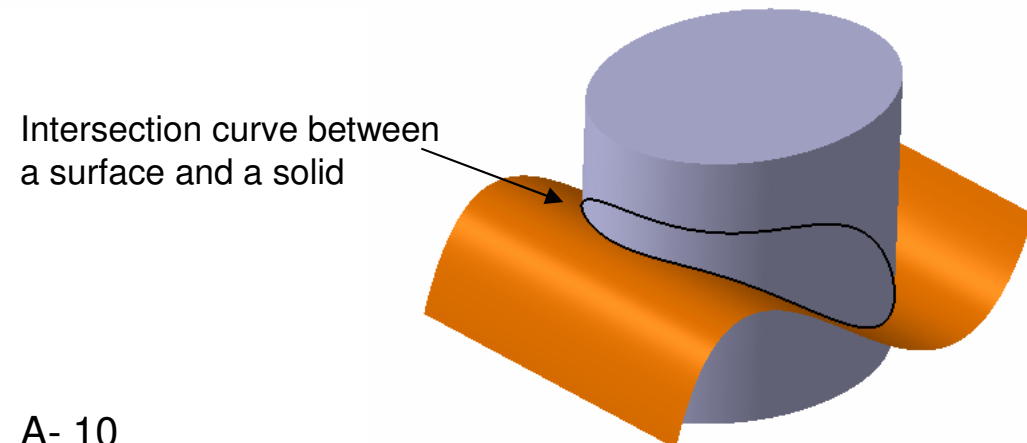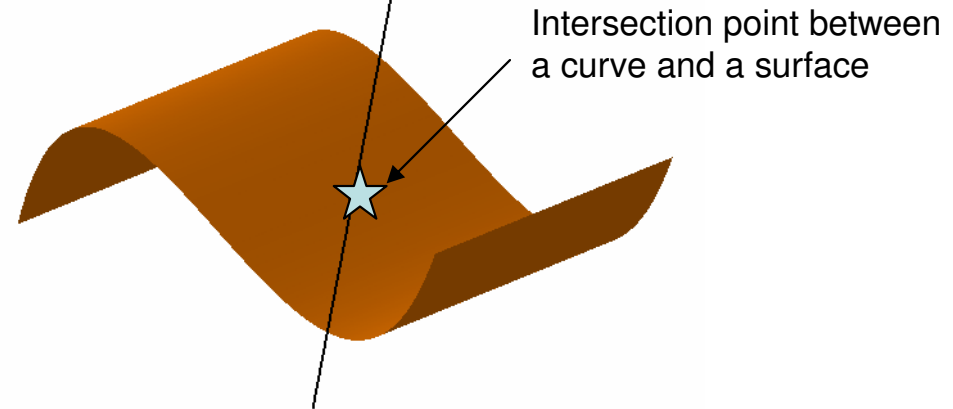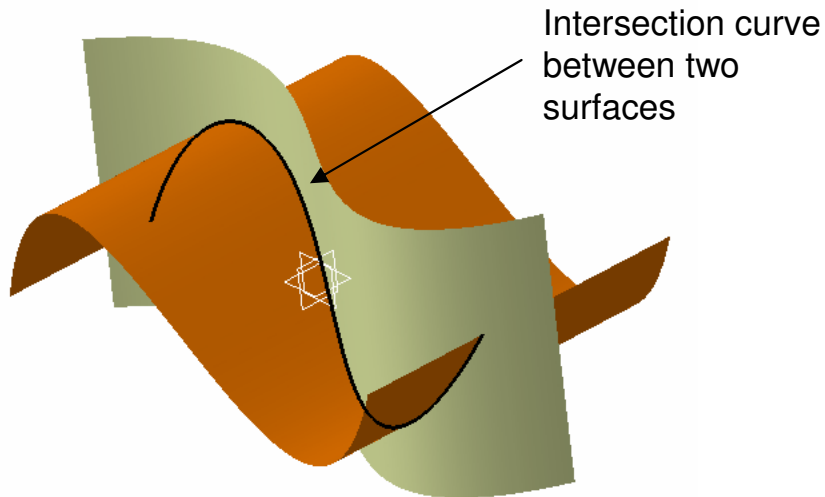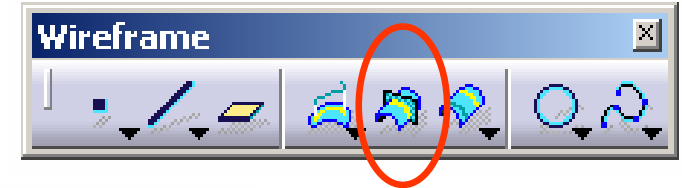

The normal of surface at all points along the curve is 38deg from the vertical axis
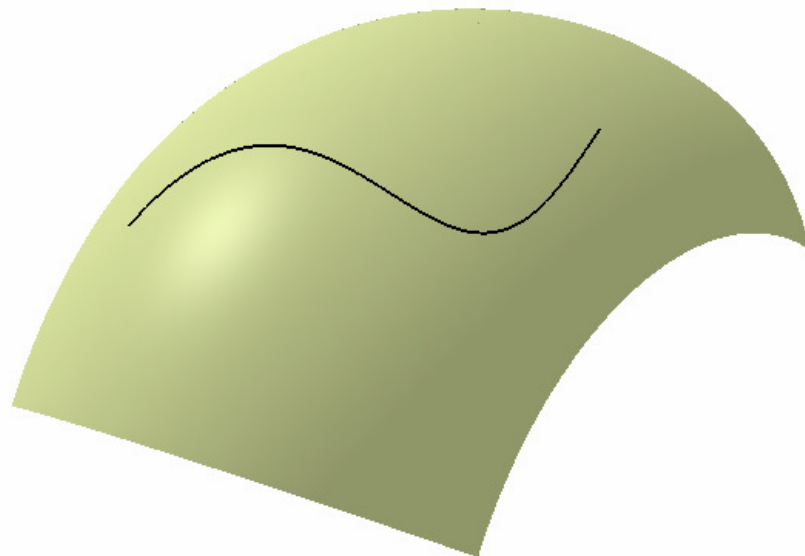
A- 9

**Generative
Shape Design**

Intersection

Intersection (create wireframe geometry by intersecting elements.)

Intersection curve between two surfaces

Intersection point between a curve and a surface

Intersection curve between a surface and a solid
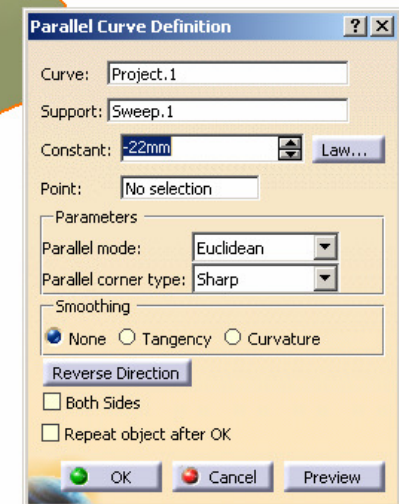
A- 10
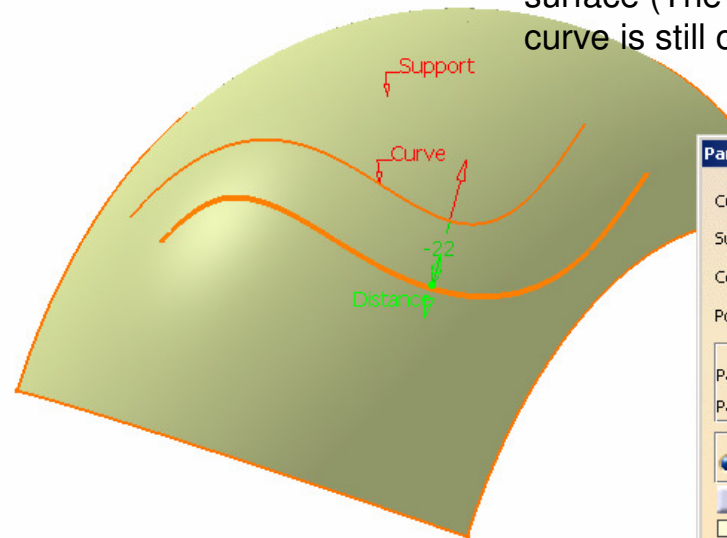
**Generative
Shape Design**

Parallel Curve

Parallel Curve (create a curve that is parallel
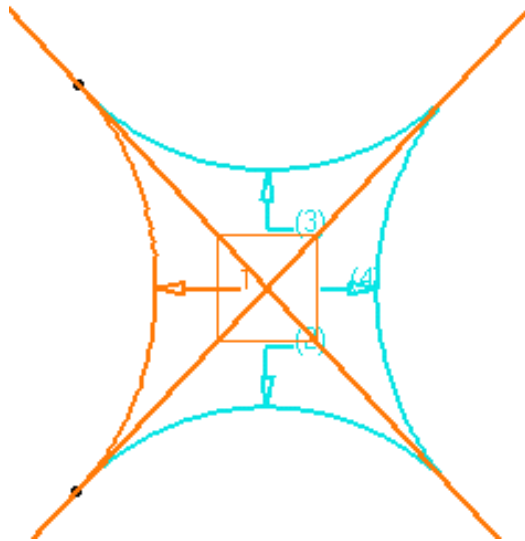to a reference curve.)
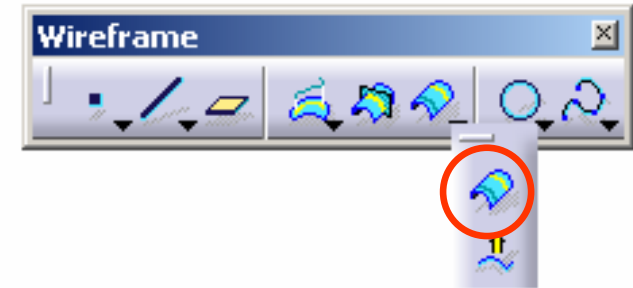
We have a curve lying on
the surface

Offset the curve on the
surface (The resultant
curve is still on the surface)
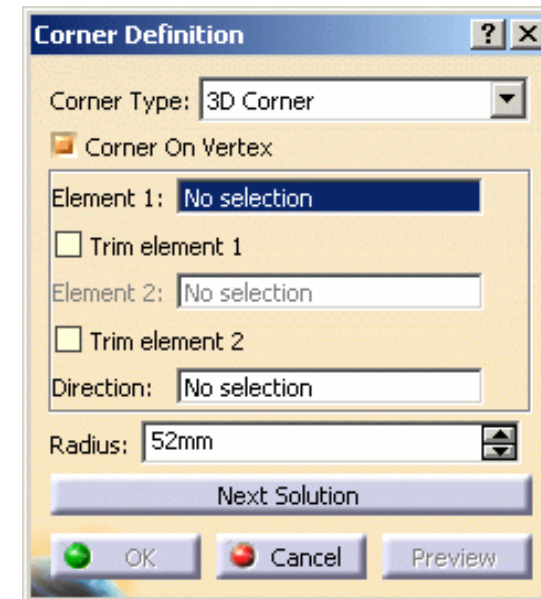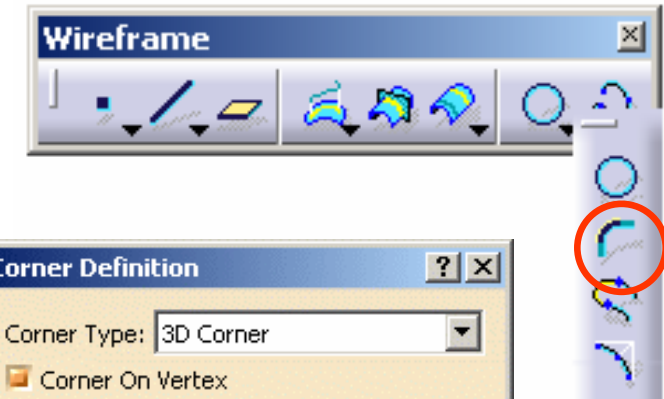
A- 11

Corner

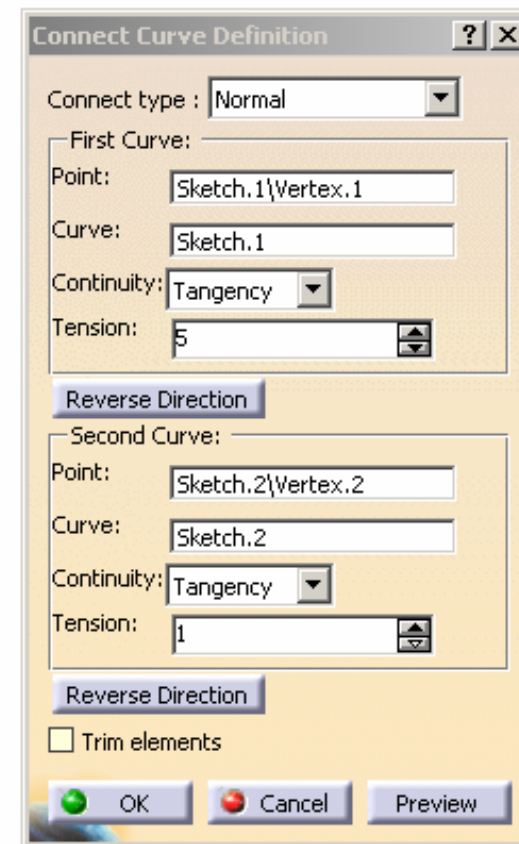**Corner** (create a corner between two curves)

If several solutions may be possible, click the **Next Solution** button to move to another corner solution, or directly select the corner you want in the geometry

A- 12

Connect Curve

Connect Curve (create a connecting curve between two curves.)

Point-continuous, tangent-continuous or curvature-continuous

Point-continuous, tangent-continuous or curvature-continuous
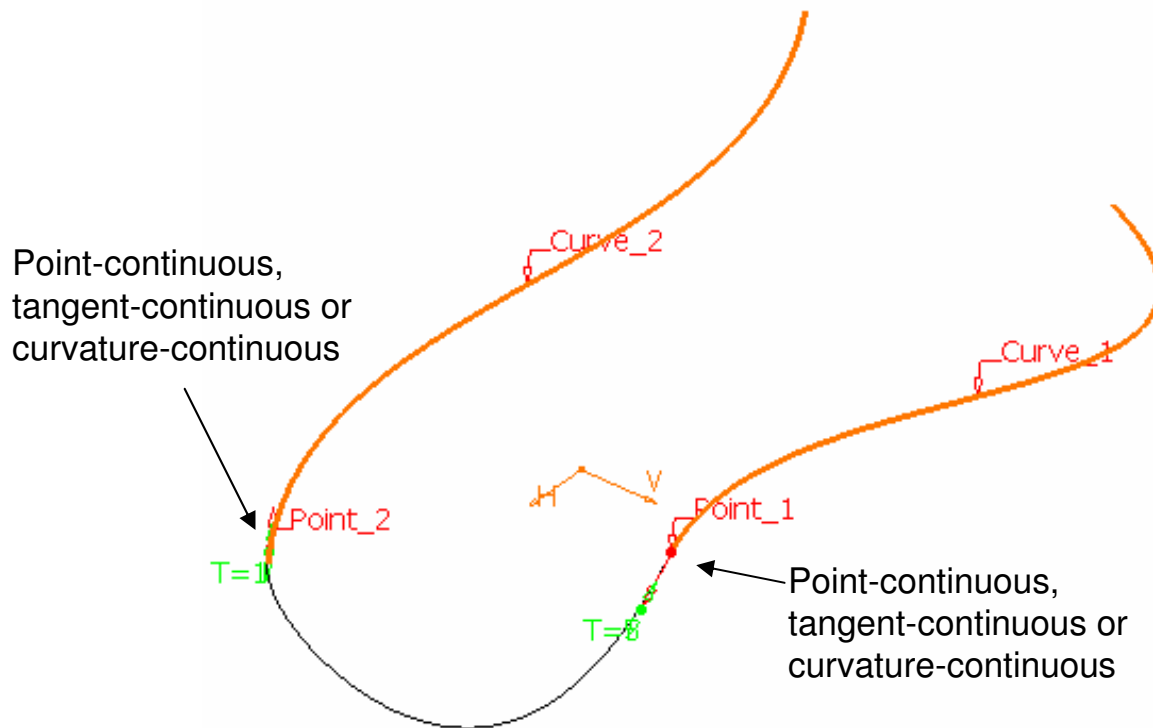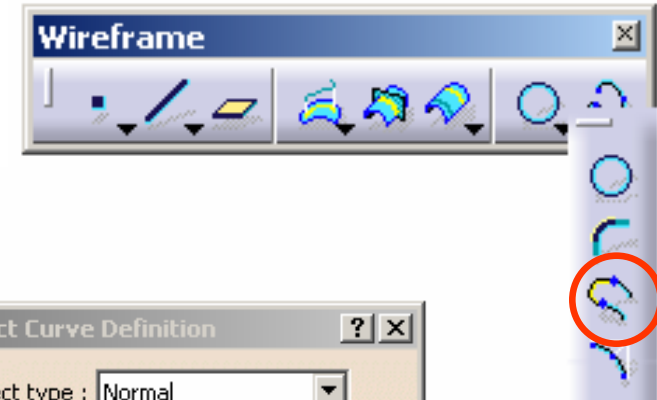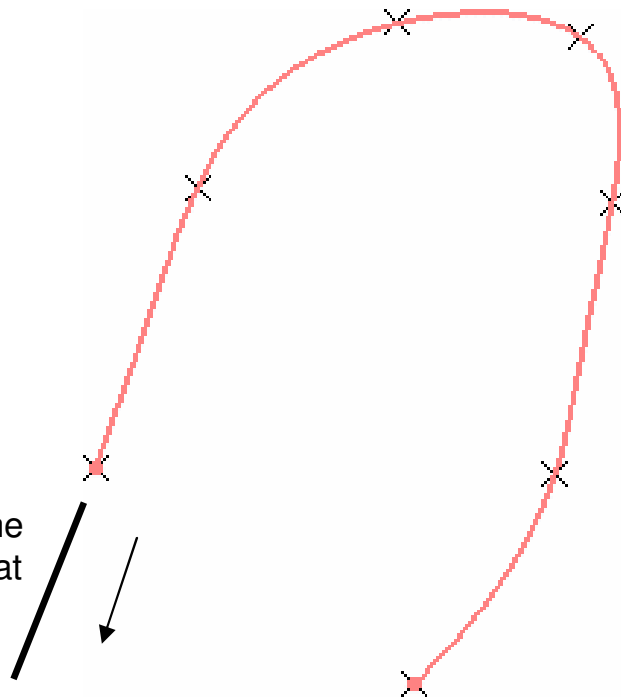
The curvature in the middle can be controlled by tension

A- 13

Spline Curve

Spline Curve (create a 2D/ 3D spline curve)
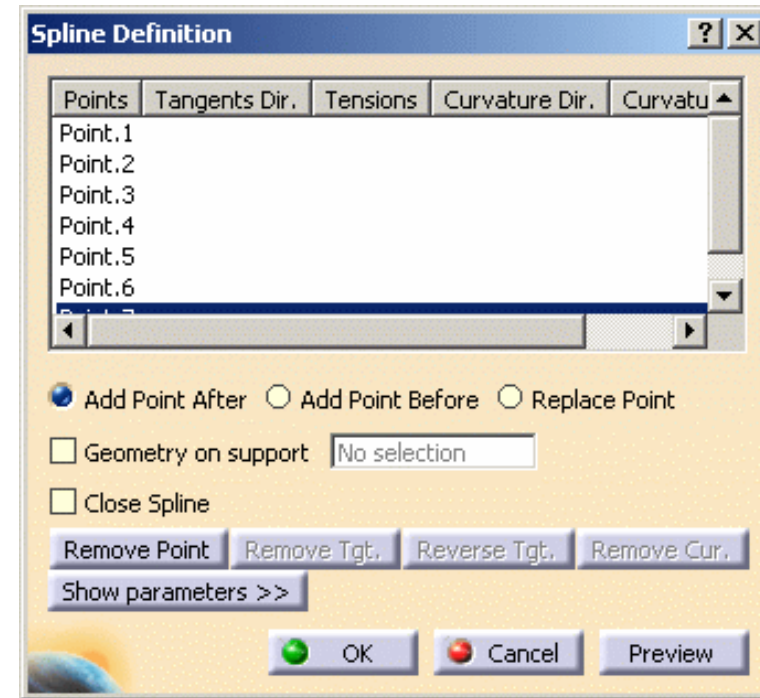
We can create an
additional line to define
the tangent direction at
a point.

Helix

Helix (create a helix curve like a spring)

First Create a point
and a straight line

(Optional)

With Taper Angle

(Optional)

Follows a profile

A- 15

**Generative
Shape Design**
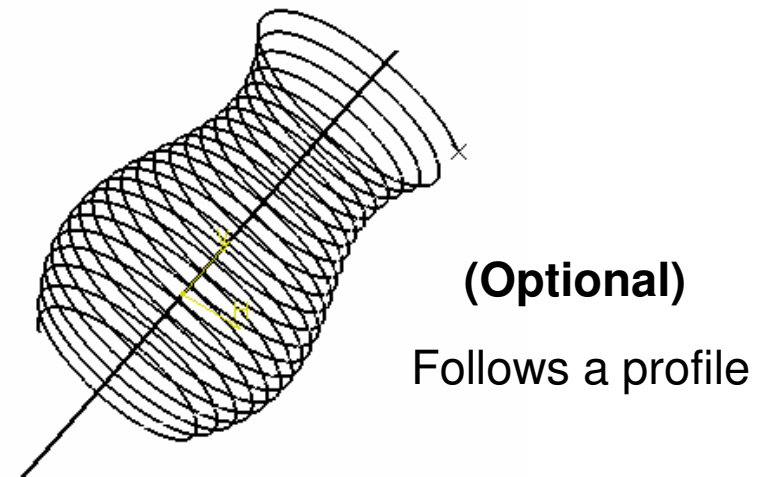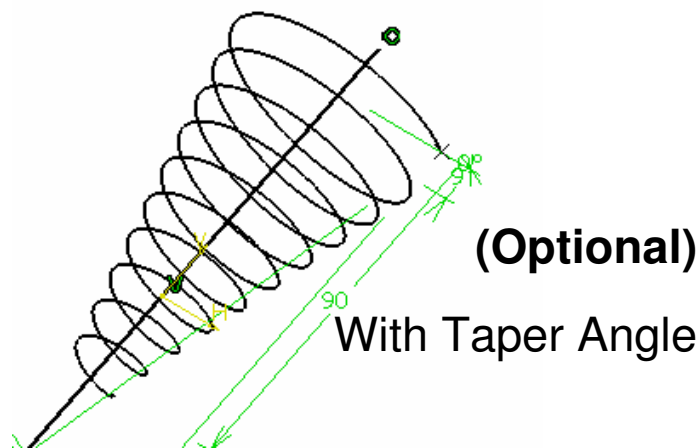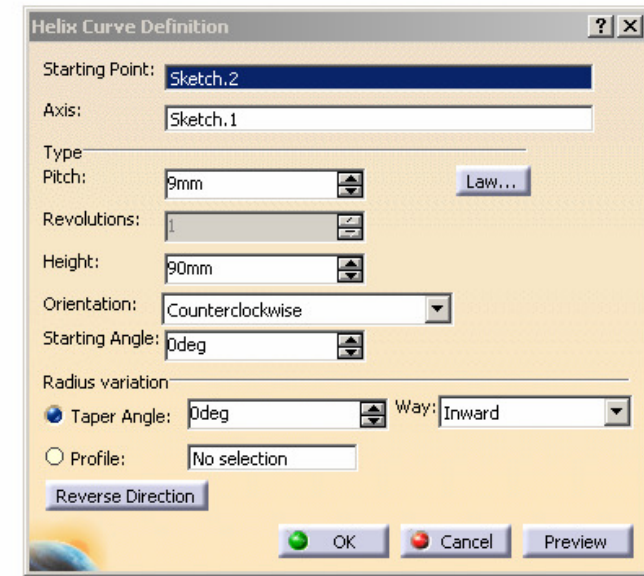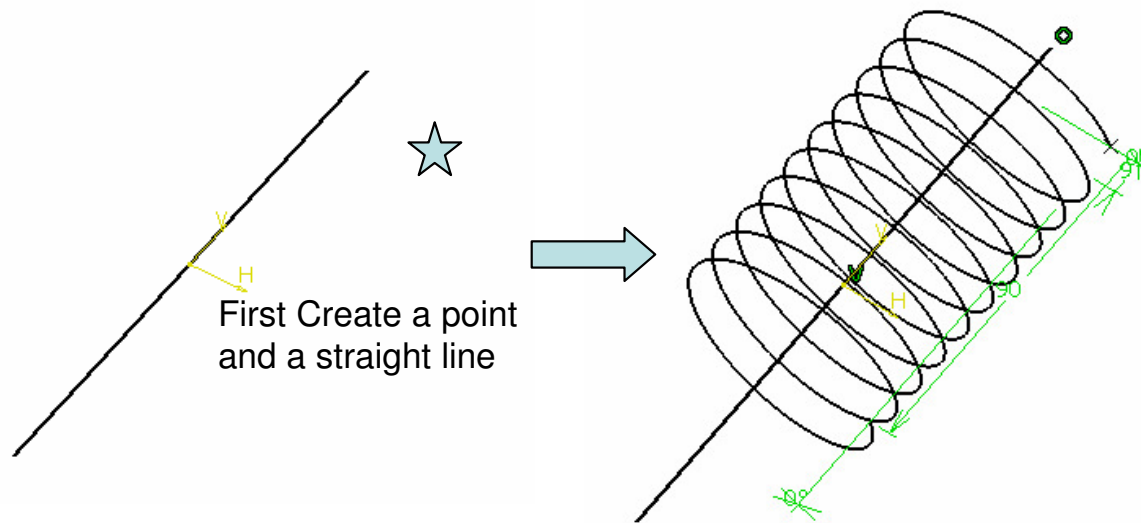
Extrude

Extrude (create a surface by extruding a
profile along a given direction)
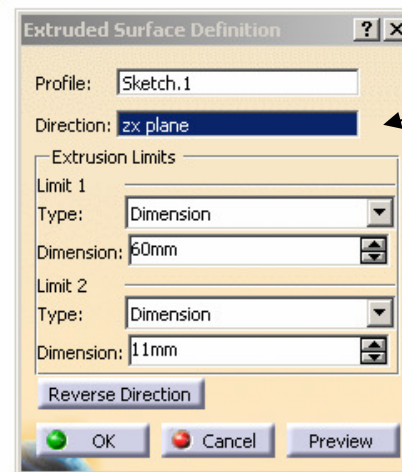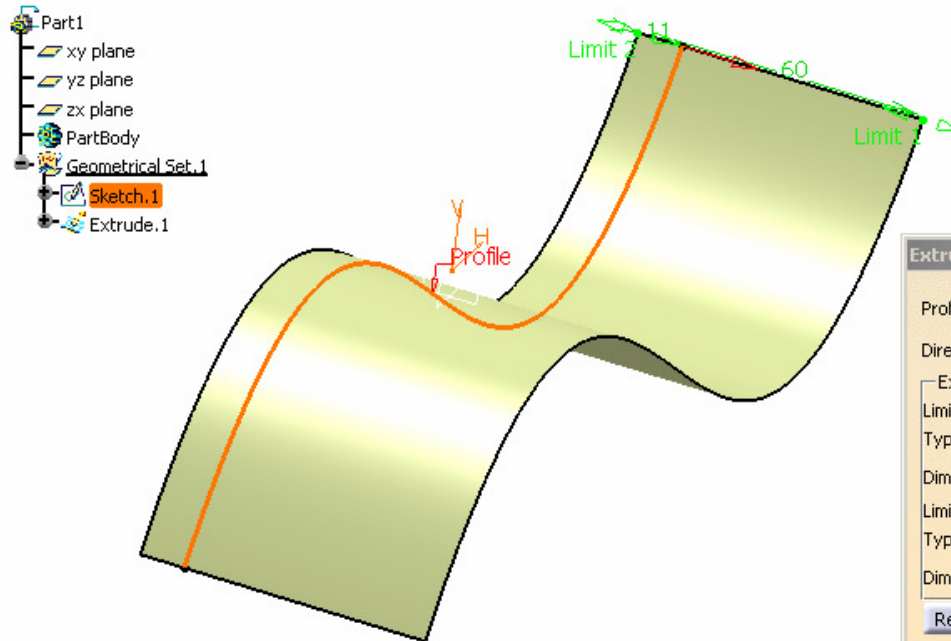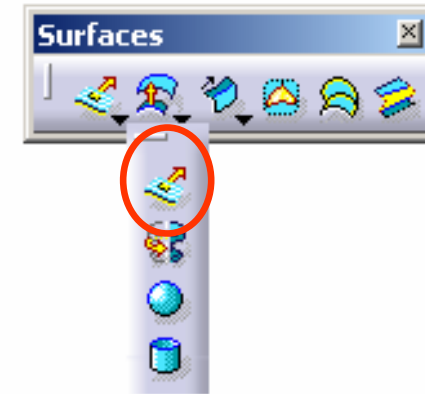
If the profile is
planar, the
direction will be
its normal by
default. But you
can change it to
other direction.

Revolve

Revolve (create a surface by revolving a planar profile about an axis)

Remark: The axis must be a straight line.

A- 17

Generative
Shape Design
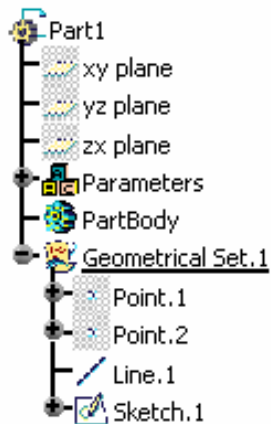
Offset

Offset (create a surface, or a set of surfaces, by offsetting an existing surface, or a set of surfaces)

A- 18
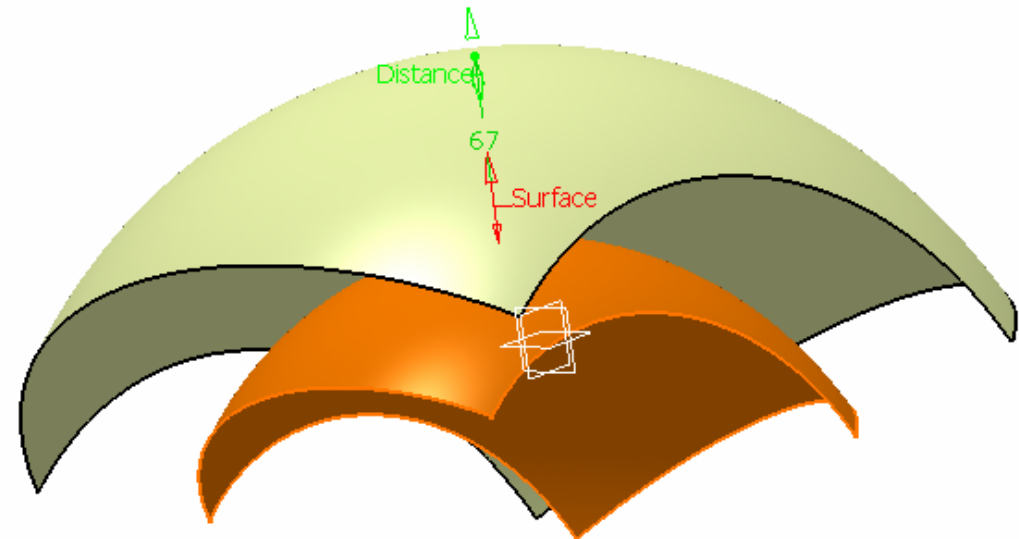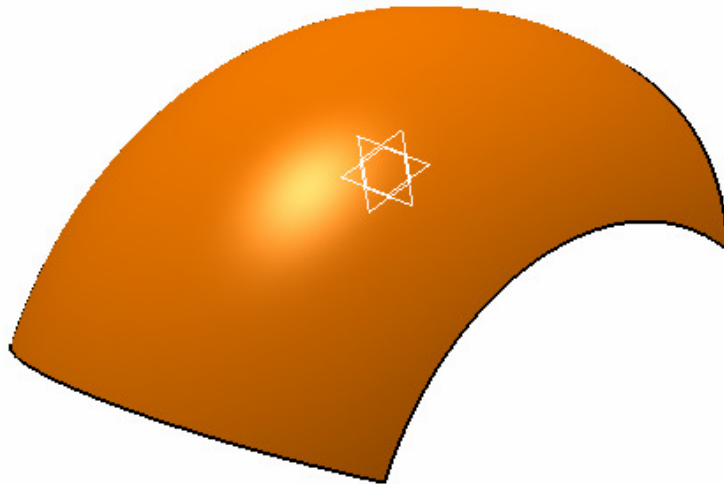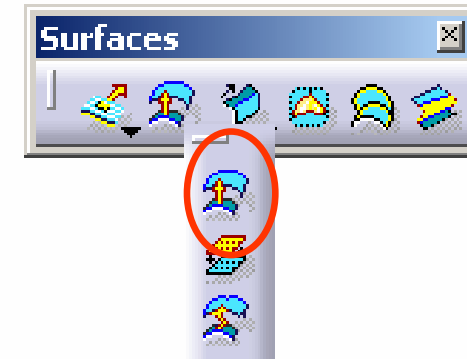
Sweep

Sweep (create a surface by sweeping out a profile along one or two guide curves)

Sweeping an **Explicit** profile

- With reference surface (optional)
- With two guide curves (optional)
- With pulling direction (optional)

(We can use the above three options to control the profile orientation)
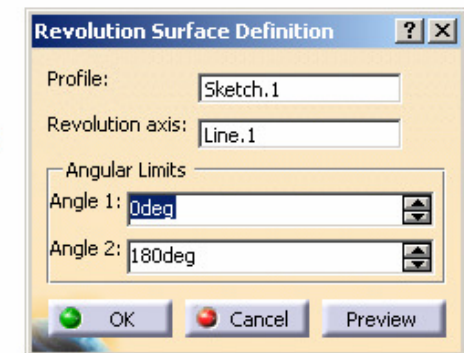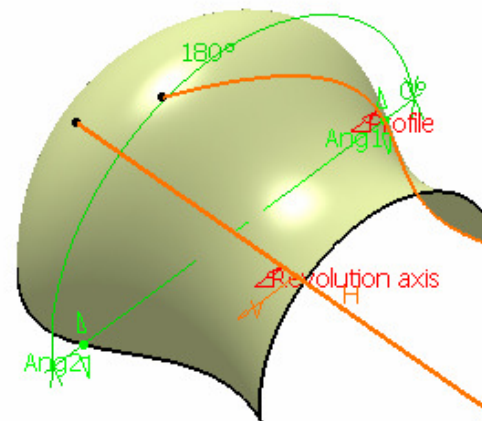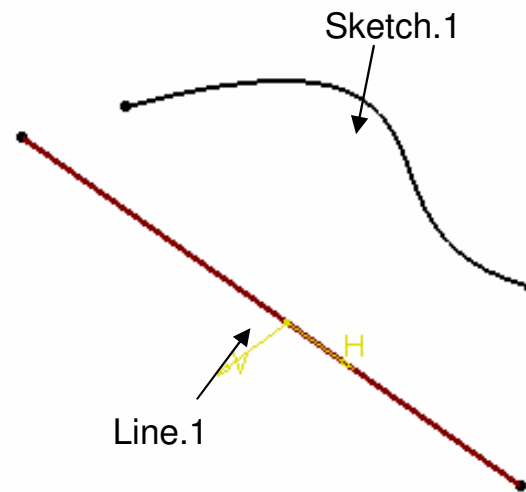
Profile

Guide Curve

Explicit
Line
Circular
Conical
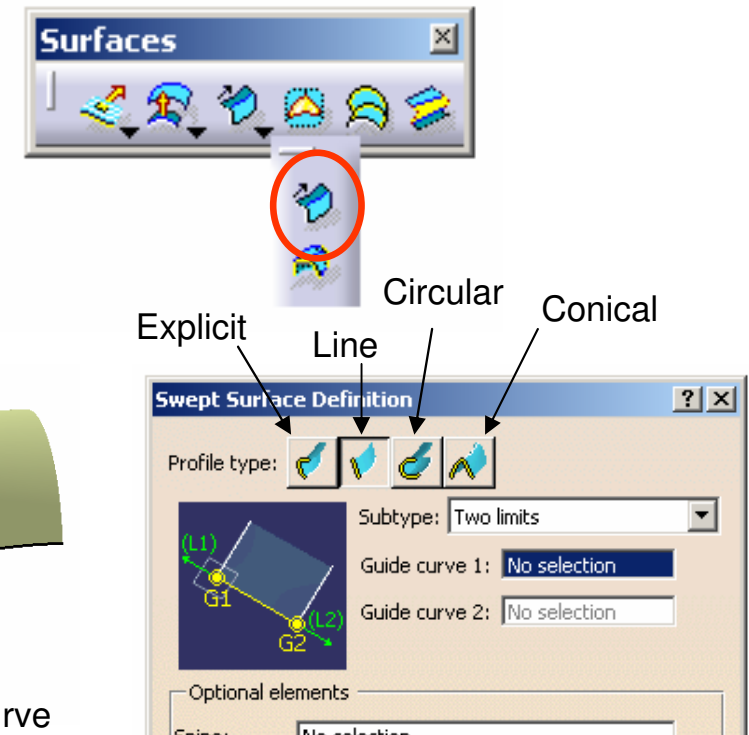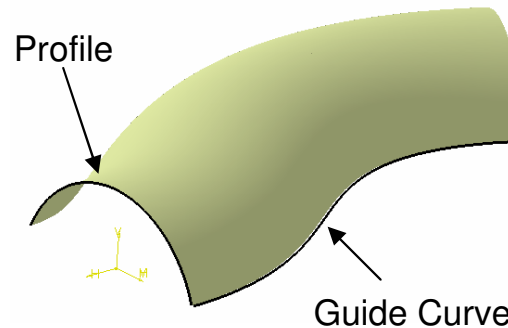
Sweeping a **Linear** profile

- Two limits
- Limit and middle
- With reference surface
- With tangency surface
- With reference curve
- With two tangency surfaces
- **With draft direction**

We first create a guide curve (4 lines)
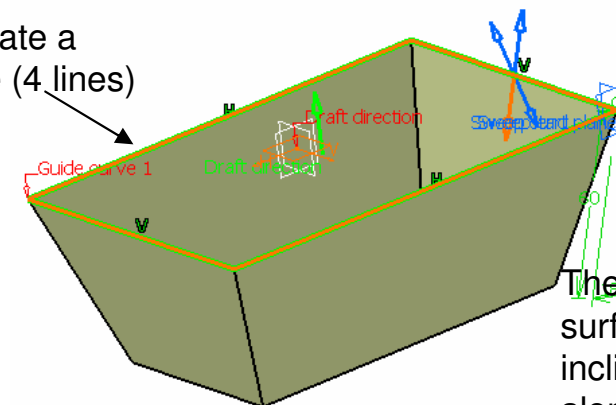
Then create a draft surface by sweeping an inclined linear profile along a guide curve

A- 19

Sweep – Con't

Sweeping a **Circular** profile

- Three guides
- **Two guides and radius**
- Center and two angles
- Center and radius
- Two guides and tangency surface

- One guide and tangency surface

Sweeping a **Conical** profile

- Two guides
- **Three guides**
- Four guides
- Five guides

A- 20

**Generative
Shape Design**
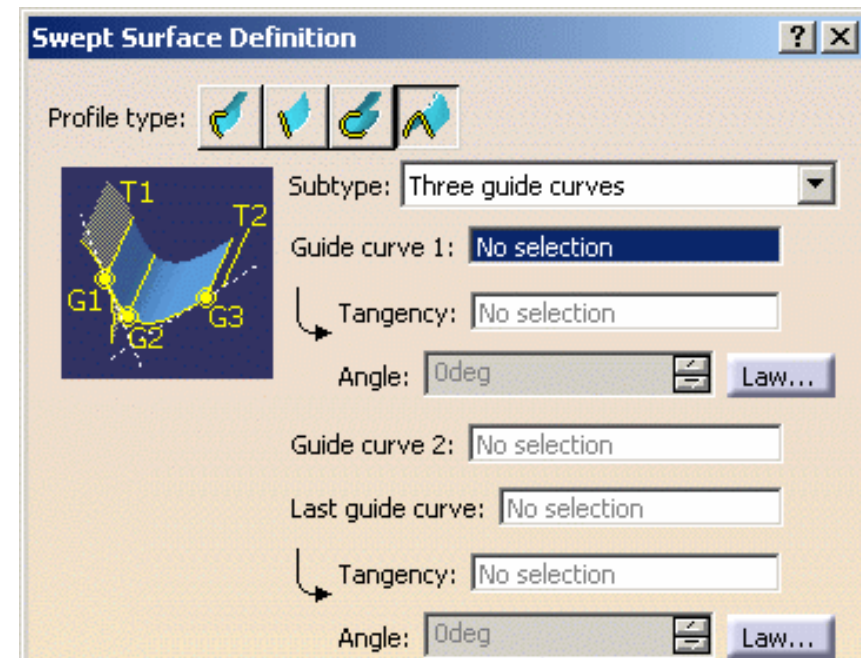
Fill

Fill (create a surface to fill the opening
among a number of boundary segments)
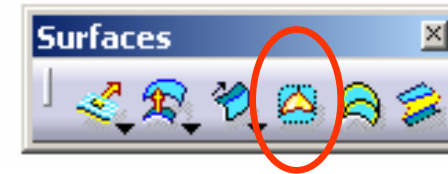
We can specify the desired continuity type
between any selected support surfaces and
the fill surface (Point, Tangent or Curvature
continuous)

The four ☆ points must
be tangent-continuous or
curvature-continuous

Passing through a
point (optional)

Curve4
Passing point

Curve Curve2

Curve1

Support3

Support Surface

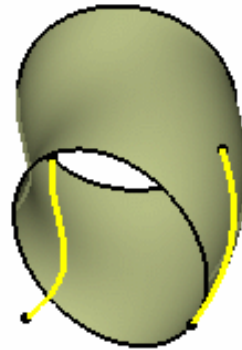Support1

Support Surface

Fill Surface Definition

Boundary:

No	Curves	Supports
1	Join.1	Extrude.1
2	Connect.2	
3	Join.2	Extrude.2
4	Connect.1	

AddAfter Replace Remove
AddBefore ReplaceSupport RemoveSupport
Continuity: Tangent

Passing point: Point.6

☐ Planar Boundary Only

OK   Cancel   Preview

A- 21
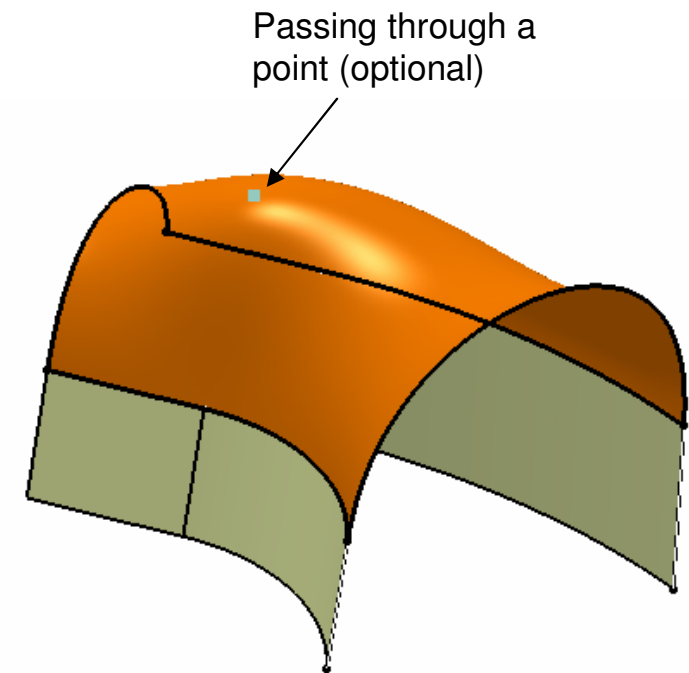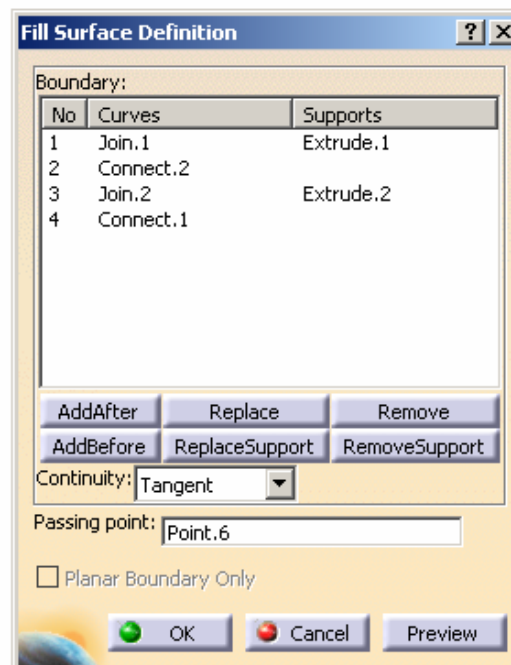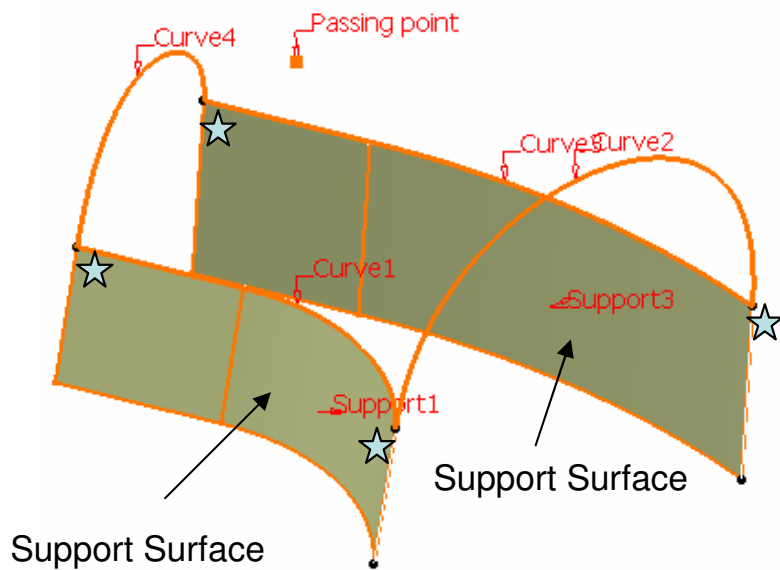
Multi-sections Surface

Multi-sections surface (create a surface by sweeping two or more section curves along an automatically computed or user-defined spine. The surface can be made to respect one or more guide curves.)
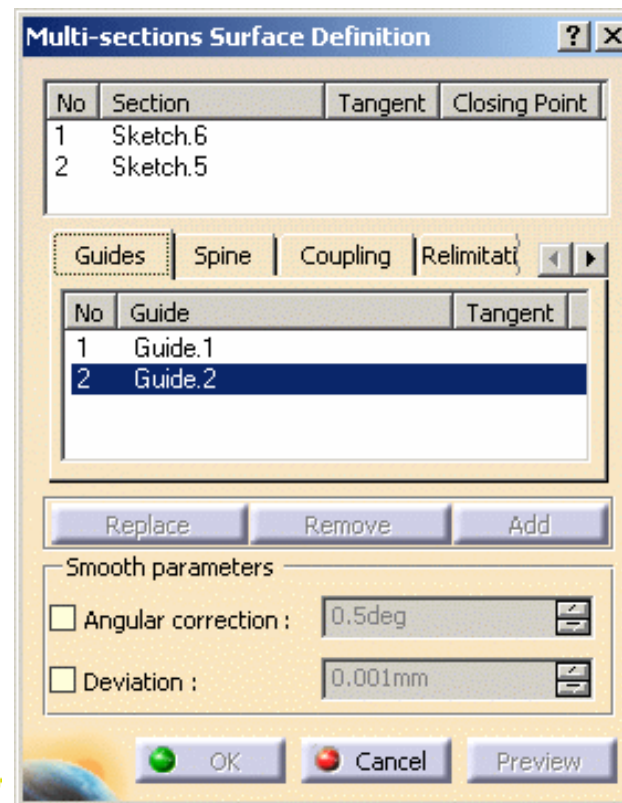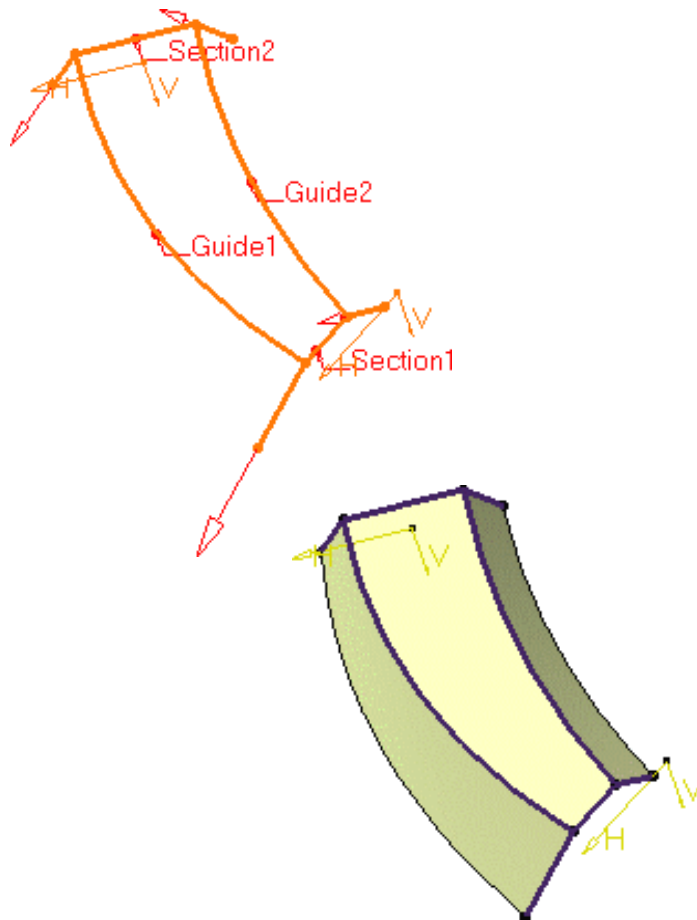
Further control point-point matching by **"manual coupling"**

A- 22

Generative Shape Design
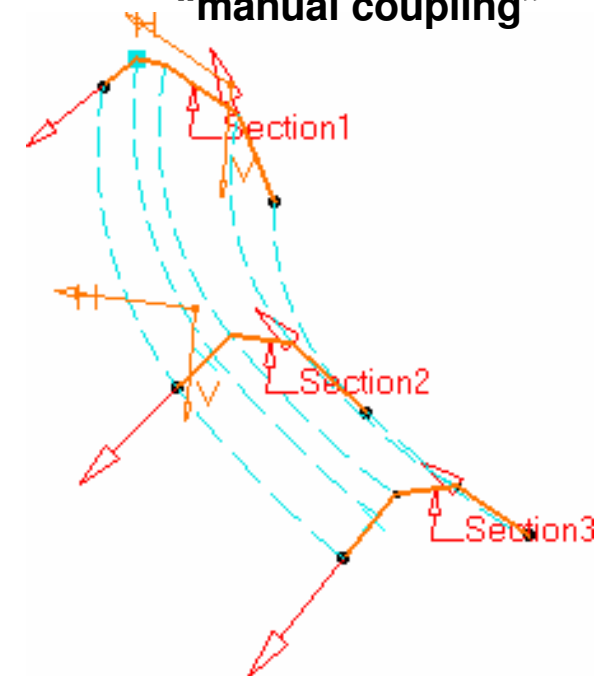
Blend

Blend (Create a surface between two wireframe elements or surface edges)

A- 23
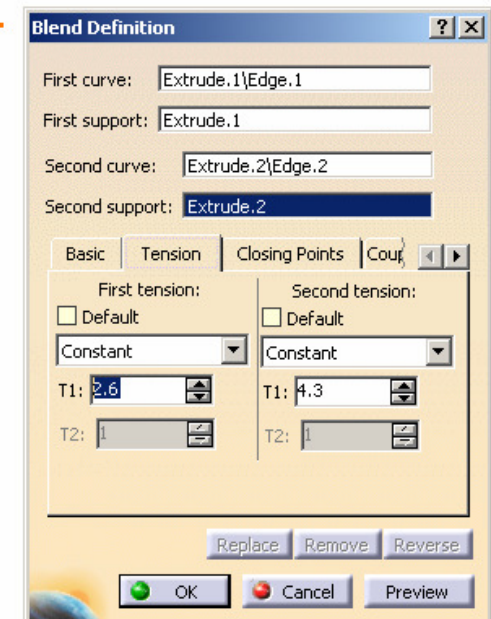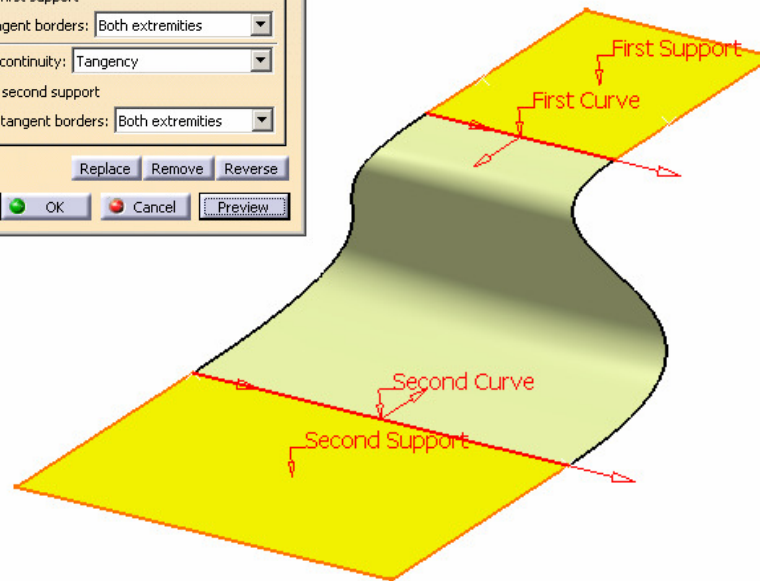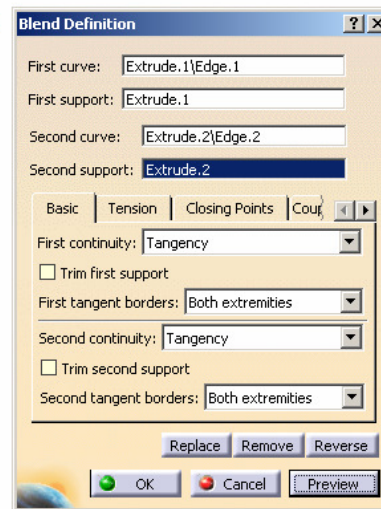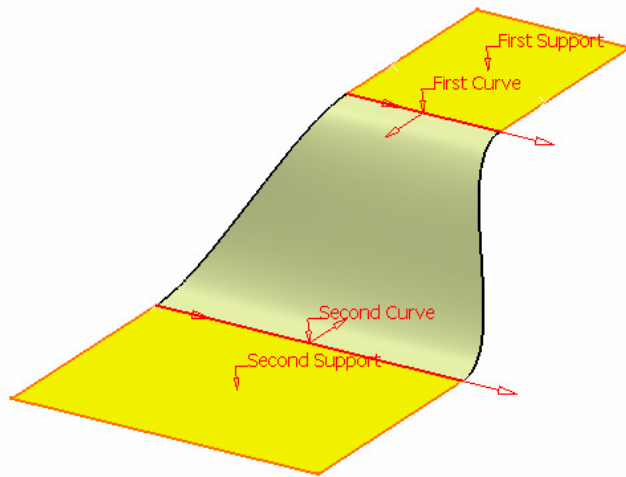
Join

Join (join surfaces or curves as one element)
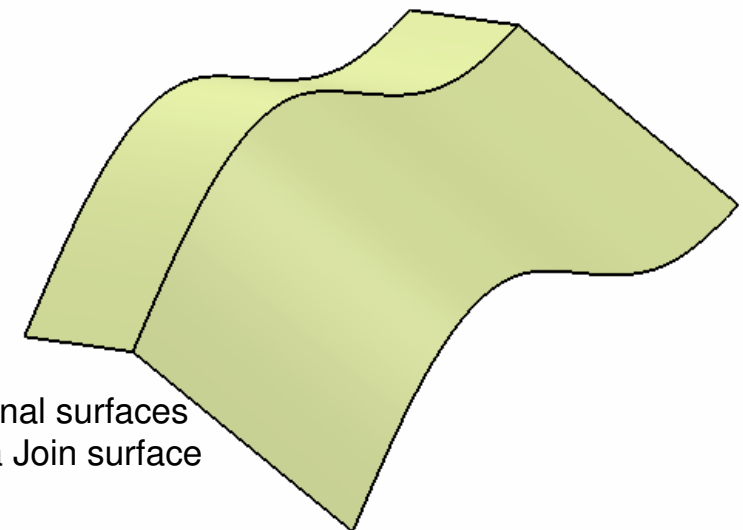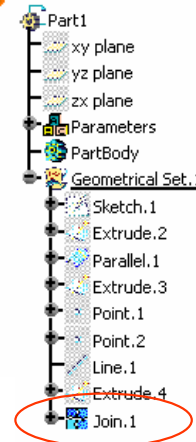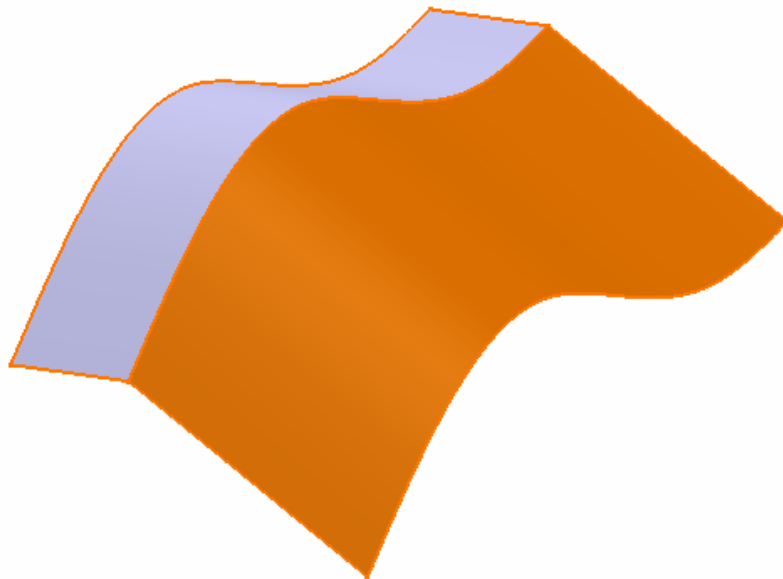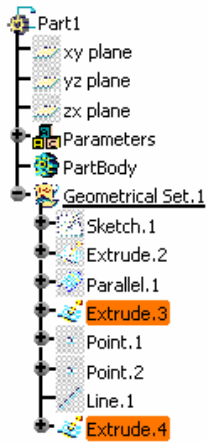
The two original surfaces are hidden; a Join surface is created

A- 24

**Generative
Shape Design**

Split & Trim

Split (split a surface or wireframe element by means of a cutting element. You can split a wireframe element by a point, another wireframe element or a surface; or a surface by a wireframe element or another surface.)

Operations

Split

Trim

Original

Cutting Element

Result by "Split"

Element to Cut

Result by "Trim"
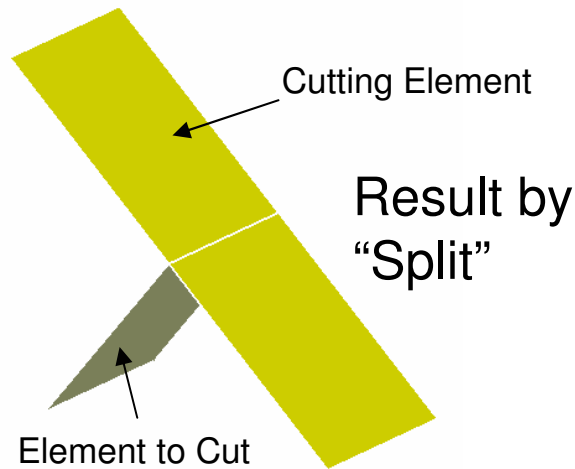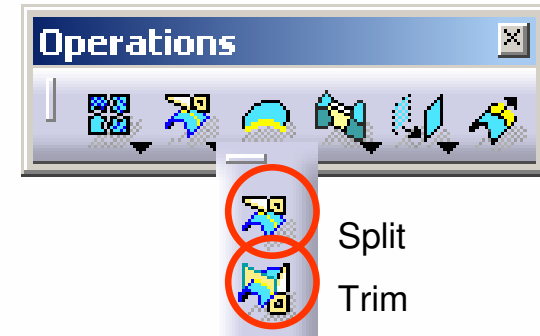
Trim (trim two or more surface or wireframe elements)

A- 25
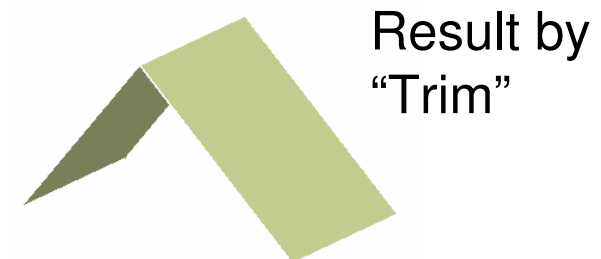
Boundary

Boundary (create the boundary curve of a surface)

No propagation

Tangent continuity

Point continuity

Complete boundary
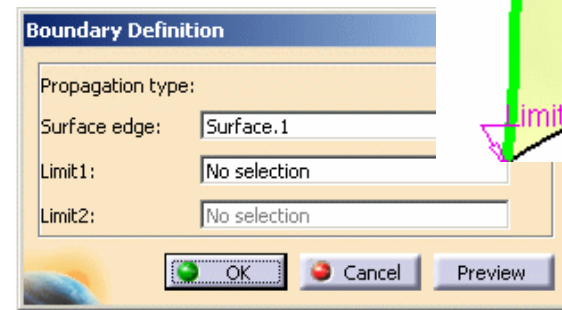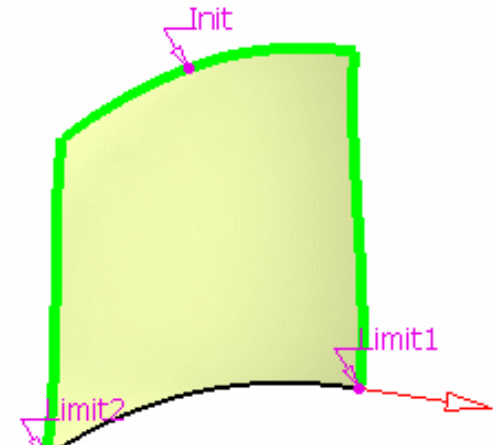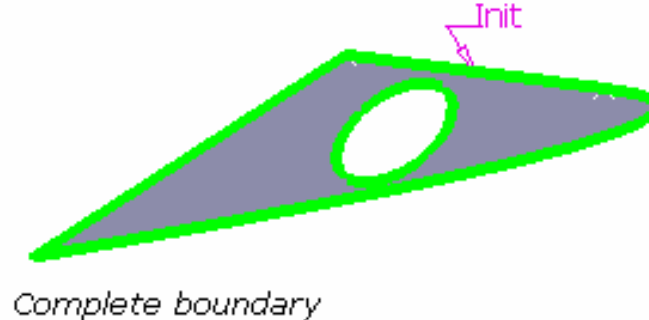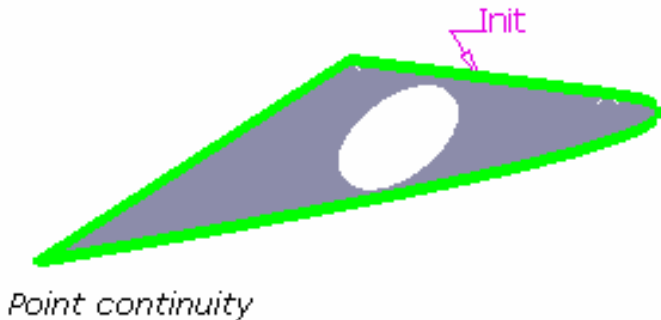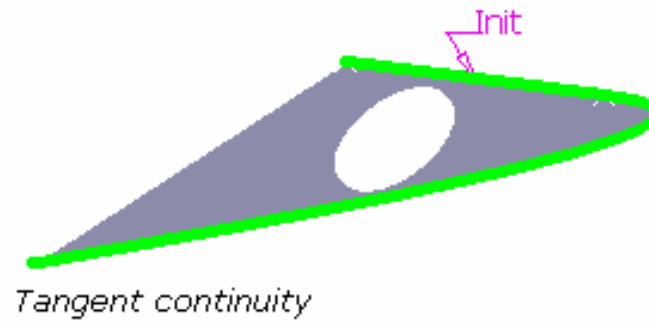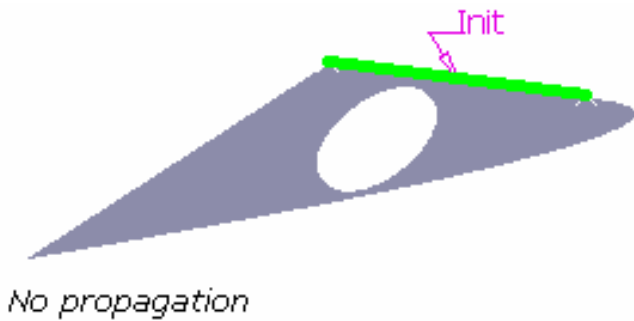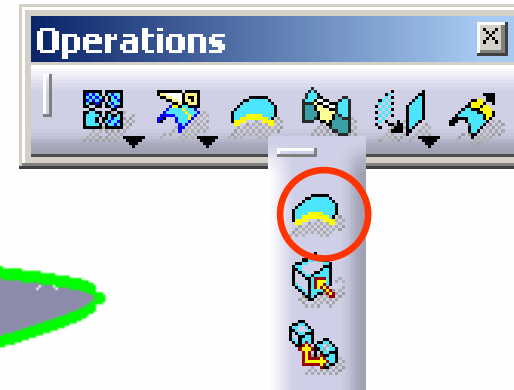
We can select limit points to limit the boundary

A- 26

**Generative
Shape Design**

Extract

Extract (extract from elements (curves, points, surfaces or solids)

Operations

Only Selected surface

Extract Definition
Propagation type: No propagation
Element(s) to extract: EdgeFillet.1\Face.1
Support: No selection
☐ Complementary mode
☐ Federation
Show parameters >>
OK   Cancel   Preview

Only tangent surfaces are selected

Extract Definition
Propagation type: Tangent continuity
Element(s) to extract: EdgeFillet.1\Face.1
Support: No selection
☐ Complementary mode
☐ Federation
Show parameters >>
OK   Cancel   Preview

All surfaces are selected

Extract Definition
Propagation type: Point continuity
Element(s) to extract: EdgeFillet.1\Face.1
Support: No selection
☐ Complementary mode
☐ Federation
Show parameters >>
OK   Cancel   Preview

⚠ Curvature Discontinuity (0.468

⚠ Curvature Discontinuity (0.45115)

For this case, the extracted element must be a curve.

Extract Definition
Propagation type: Curvature continuity
Element(s) to extract: EdgeFillet.1\Edge.5
Support: No selection
☐ Complementary mode
☐ Federation
Show parameters >>
OK   Cancel   Preview

A- 27

Shape Fillet

Bi-tangent Shape Fillet (create a shape fillet between two surfaces)
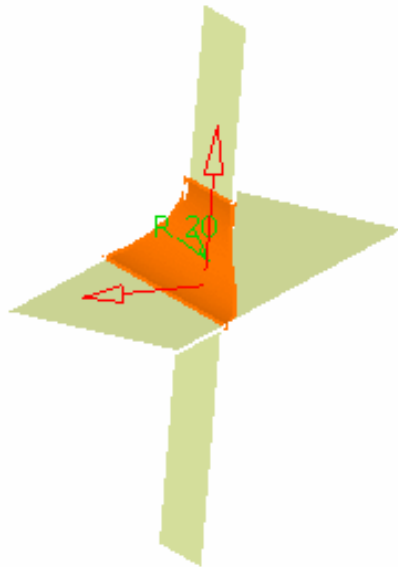
Smooth: a tangency constraint is imposed at the connection between the fillet surface and the support surfaces, thus smoothing the connection.
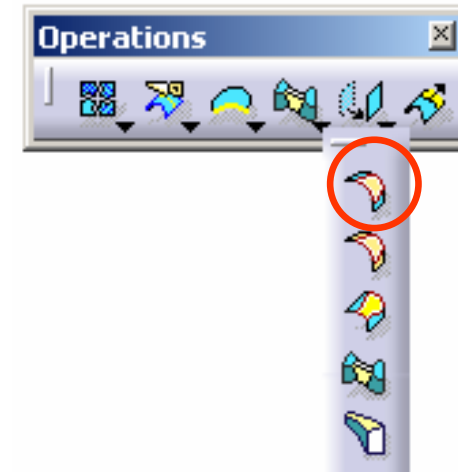
Tri-tangent Shape Fillet (create a shape fillet between three surfaces)

A- 28
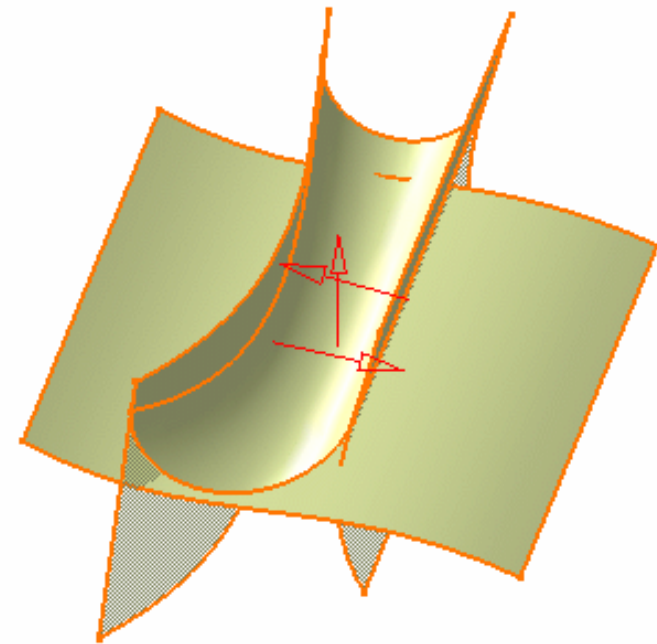
Edge Fillet

Edge Fillet (create a constant radius fillet along the internal edge of a joined surface)

Select the edge of the Join Surface

Operations

Edge Fillet Definition

Support:	Join.1
Extremities:	Smooth
Radius:	20mm
Object(s) to fillet:	Join.1\Edge.1
Propagation:	Tangency

☐ Trim ribbons
☑ Trim support

More>>

OK   Cancel   Preview

A- 29
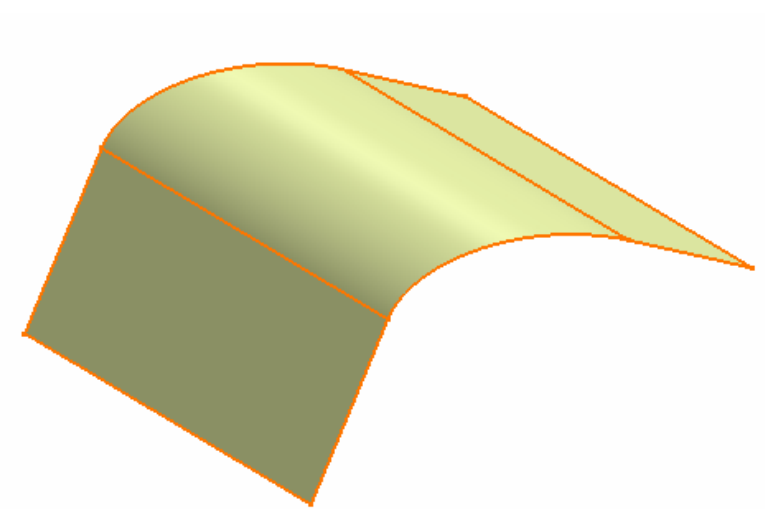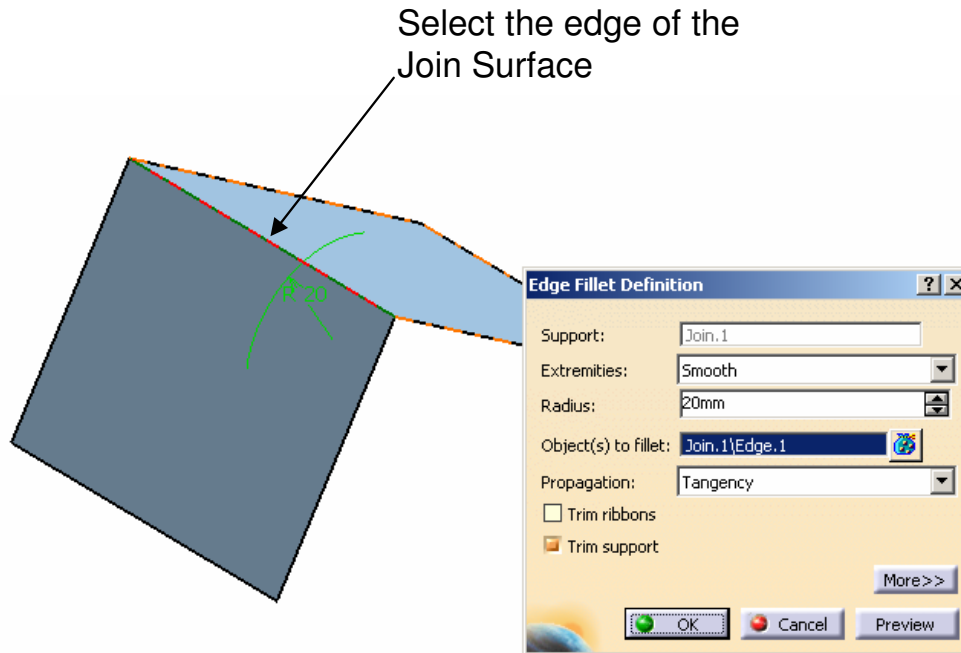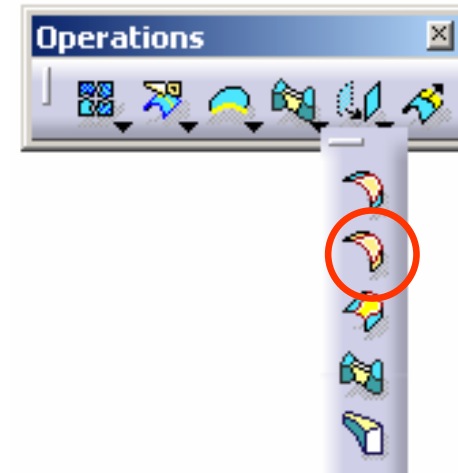
Variable Fillet

Variable Fillet (create a variable radius fillet.
In this type of fillet, the radius varies at
selected points along a selected edge. The
fillet surface is obtained by rolling a sphere,
which radius would vary, over the selected
edge.)

Click the box
and select the
point
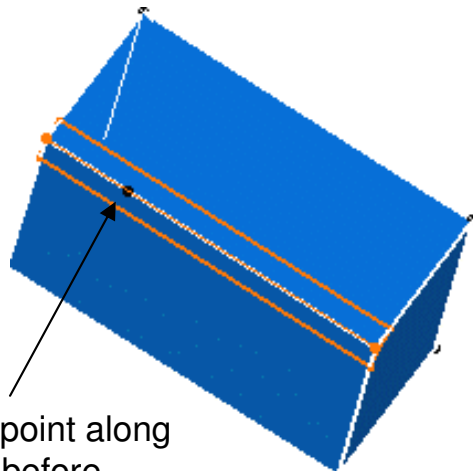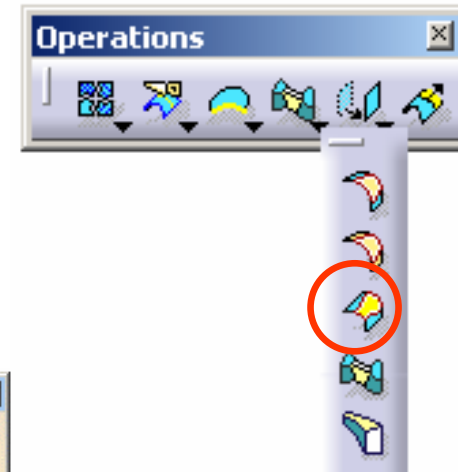
Create a point along
the edge before
filleting
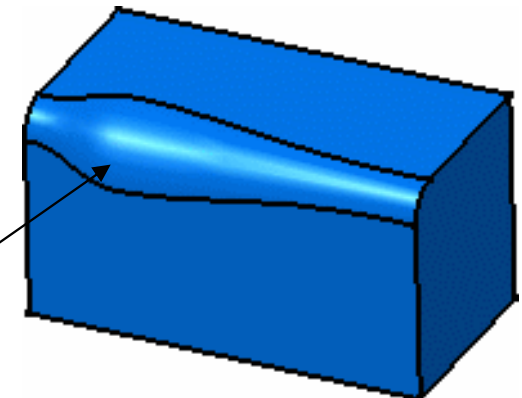
After entering a
new value for
this point, we
have a different
radius here

A- 30

Generative
Shape Design

Face-Face Fillet

Face-Face fillet (create a face-face fillet. The fillet surface is obtained by rolling a sphere, which radius is larger than the distance between the selected elements, between the selected surfaces.)

Operations
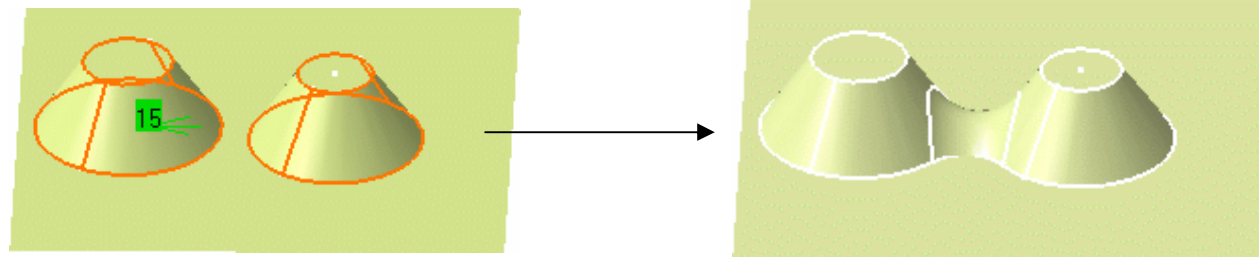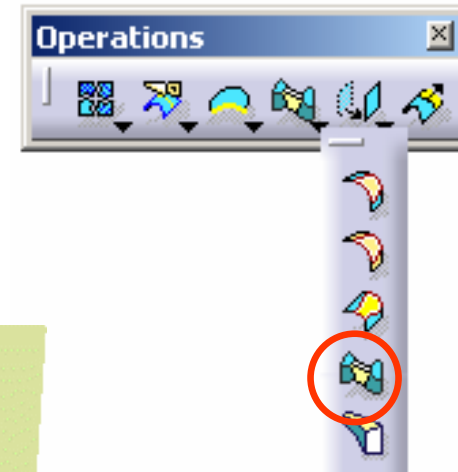
Remark: This is a "Joined" Surface
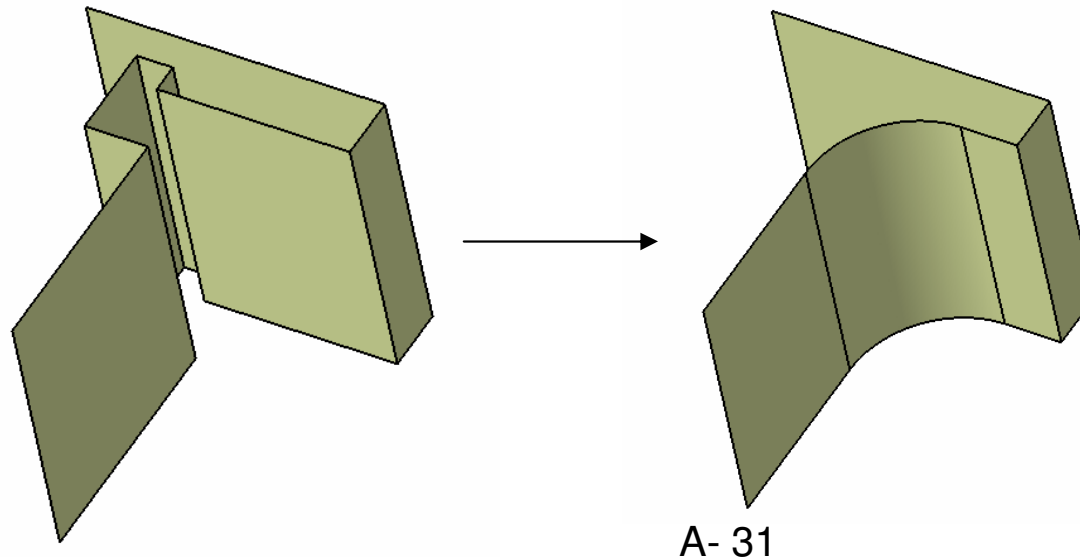
We can add this fillet between two faces that are not touching each other

A- 31

Tri-tangent Fillet

Tri-tangent Fillet (The creation of tritangent fillets involves the removal of one of the three faces selected, as the fillet surface is obtained by rolling a sphere, which radius is automatically computed to be larger than the removed surface, between the selected surfaces.)

A- 32

Generative Shape Design

Translate, Rotate, Symmetry, Scale

Operations

Translate

Rotate

Symmetry

Scale

Affinity

Translate

Rotate

Symmetry

Scale

Affinity

A- 33

**Generative
Shape Design**
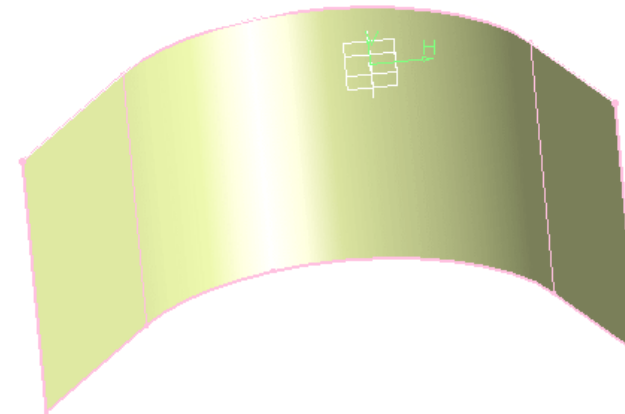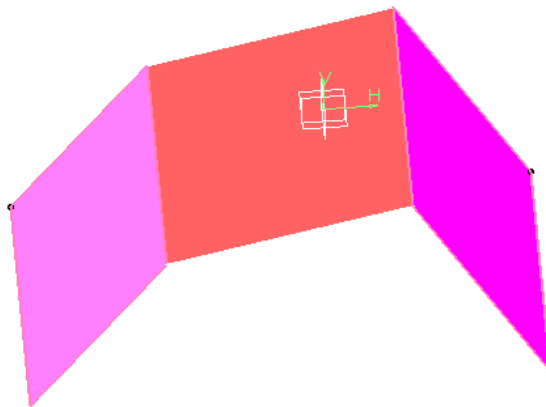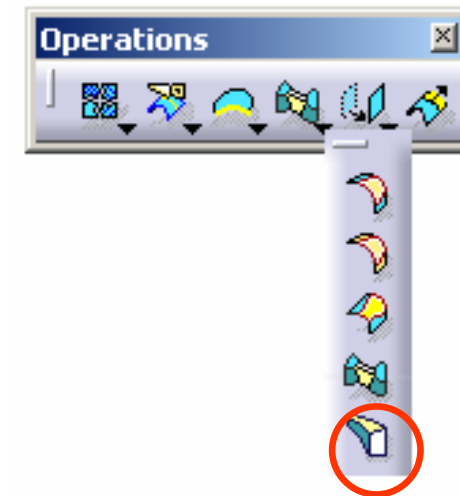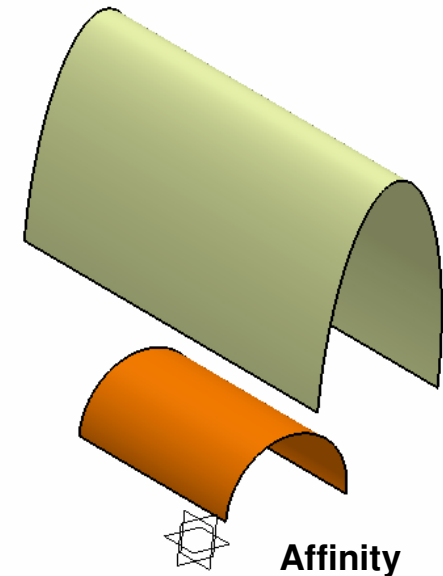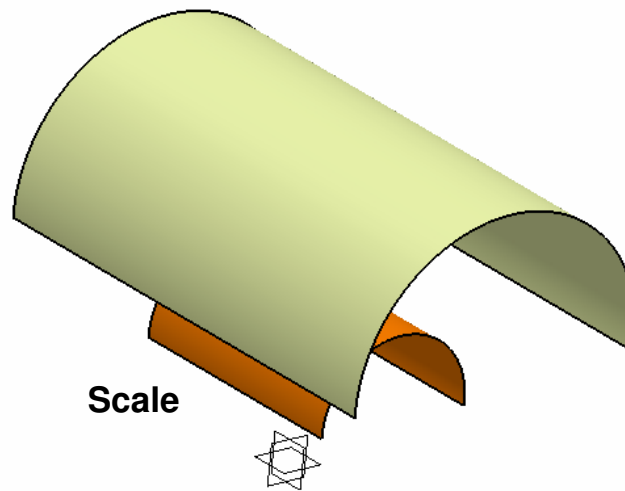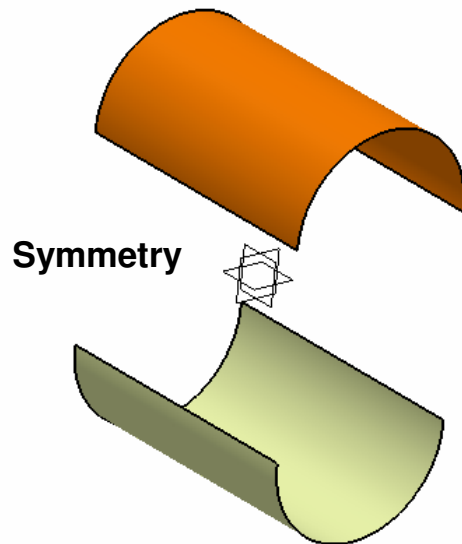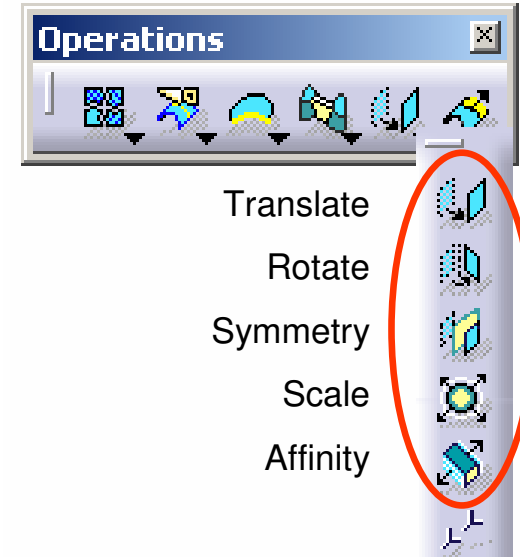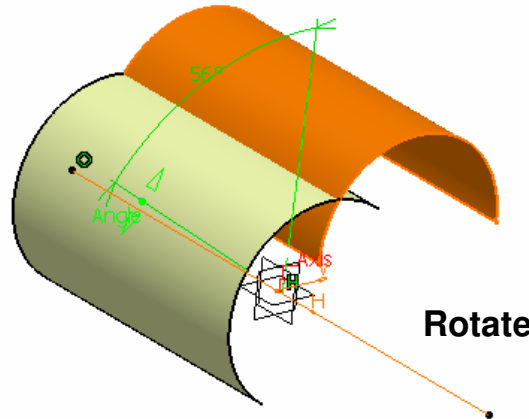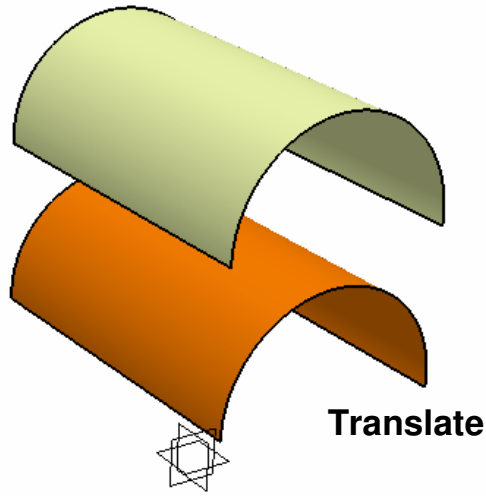
Extrapolate

Extrapolate a surface boundary:

Tangent Continuity
– this will be a
straight edge

Extrapolated

Boundary

Length

Operations

Extrapolate Definition

Boundary: Sweep.1\Edge.1

Extrapolated: Sweep.1

Limit

Type: Length

Length: 40mm

☐ Constant distance optimization

Up to: No selection

Continuity: Tangent

Extremities: Tangent

Propagation mode: None

Internal Edges: Default (None)

☐ Assemble result

☐ Extend extrapolated edges

● OK   ● Cancel   Preview

Tangent/Curvature

We can join the
extrapolated
surface with the
original surface

Extrapolate a Curve:

Extrapolation without support

Extrapolation with a support

A- 34

Patterns

Replication
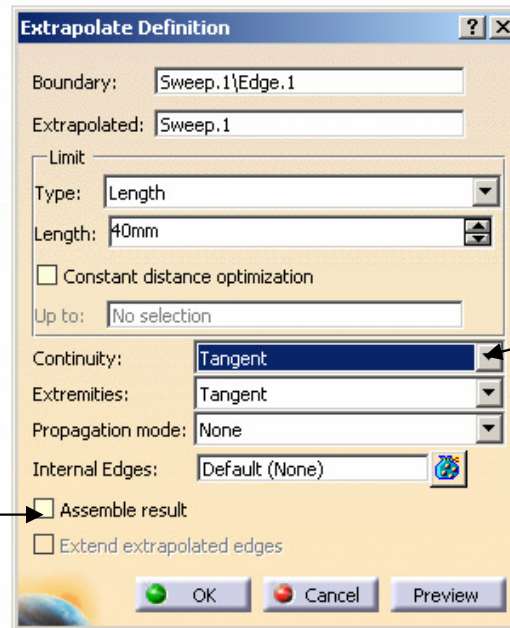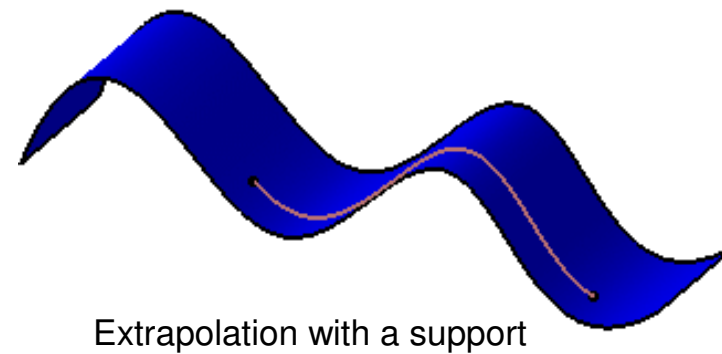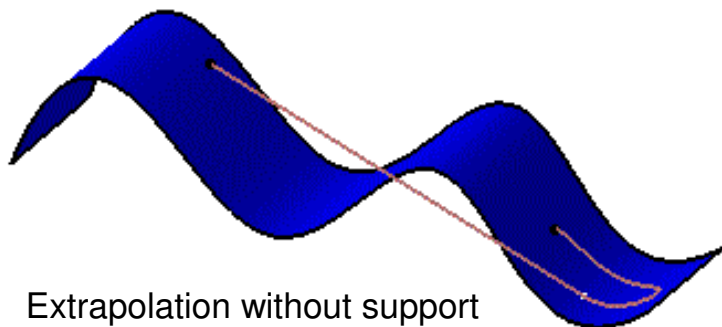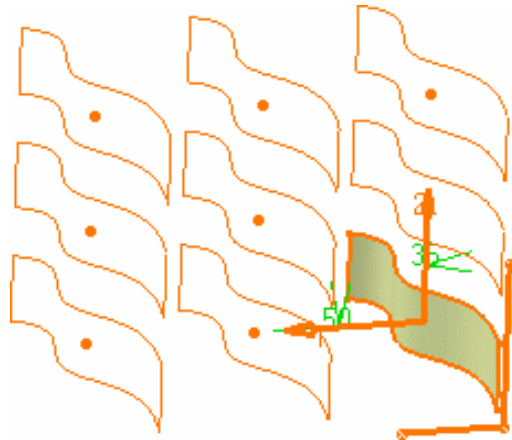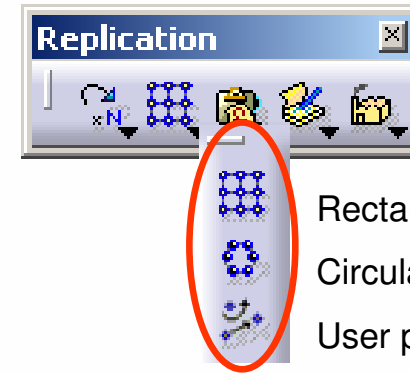
Rectangular pattern
Circular pattern
User pattern

Rectangular pattern

First create a sketch
with points

Circular pattern

User pattern

A- 35
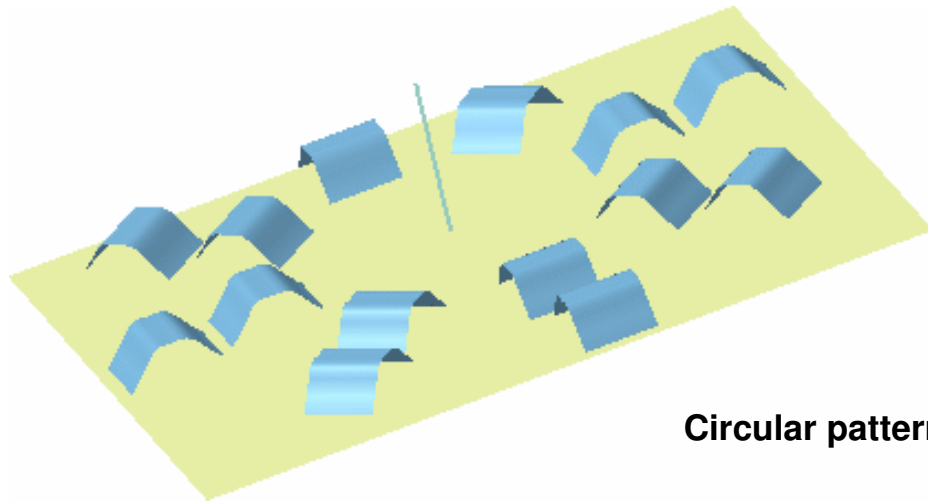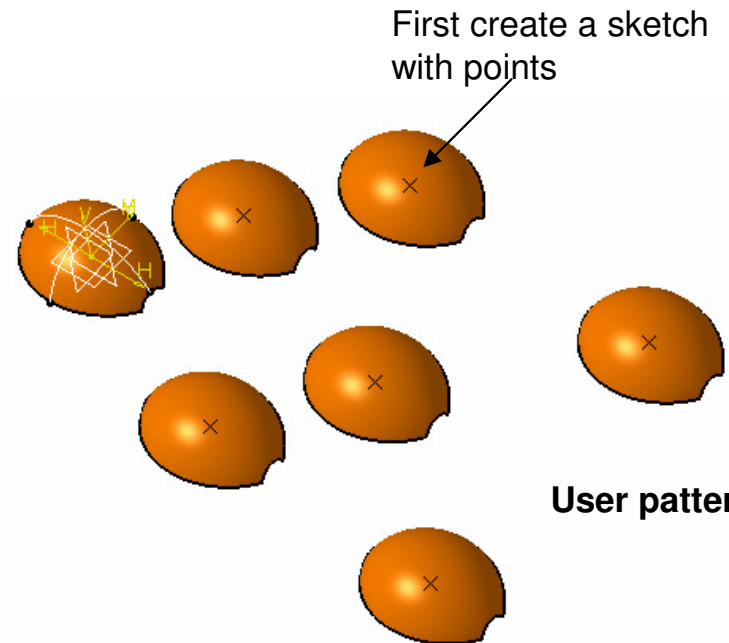
Connect Checker

Connect Checker (analyze how two surfaces are connected)

Distance - minimal distance between two vertices
Tangency - angle between two surfaces
Curvature Difference $(|C2 - C1|) / ((|C1 + C2|) / 2)$
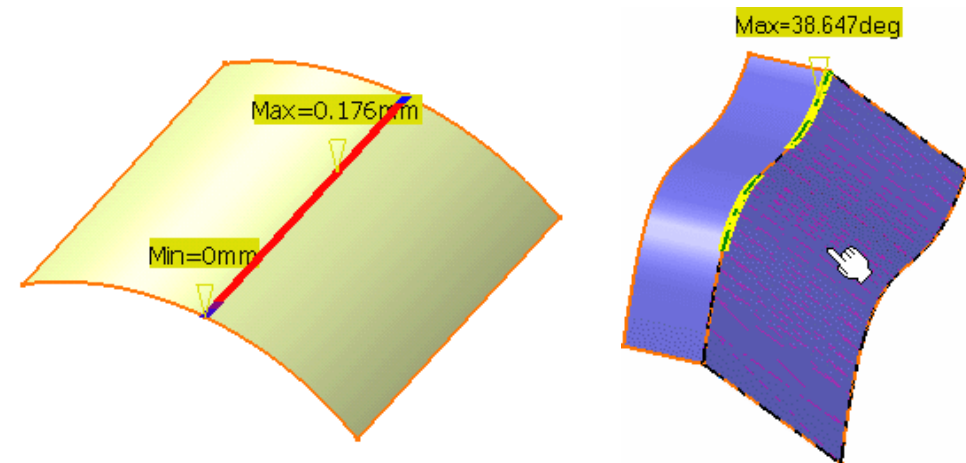
Curve Connect Checker

(analyze how two curves are connected)

Distance - minimal distance between two vertices
Tangency - angle between two curves
Curvature Difference $(|C2 - C1|) / ((|C1 + C2|) / 2)$

A- 36
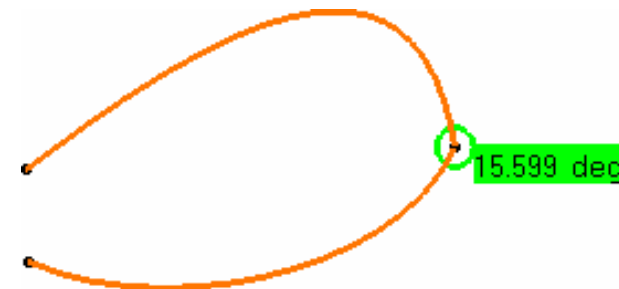
Draft Analysis

Draft Analysis

(analyze the draft angle on a surface)

(Remark: To view the draft result, we need to use the Shading

with Material mode.)
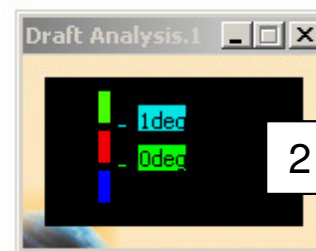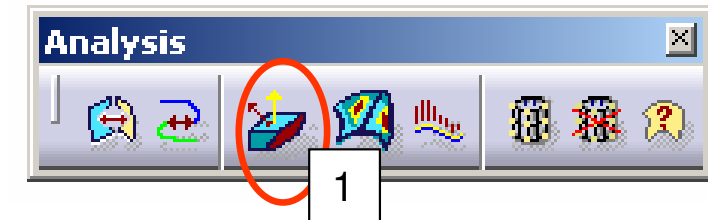
STEPS:

1. Click "Feature Draft Analysis
2. Define the color scale (e.g. -1, 0, +1 deg)
3. Click the option "Compass" on the pop-up menu
4. Select all surfaces

A- 37

**Generative
Shape Design**
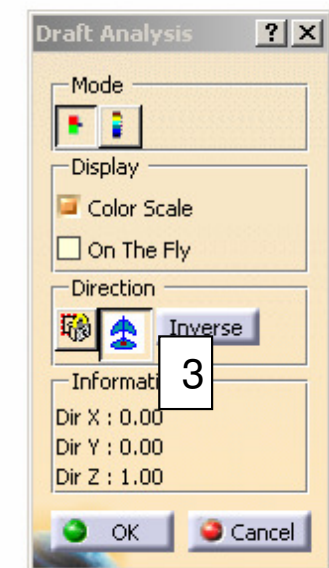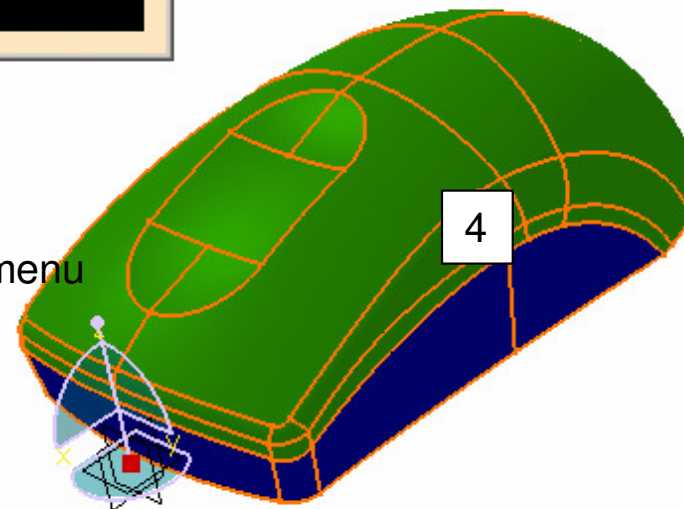
Create a New Geometrical Set

To CREATE a new geometrical set:-

- Select "Insert/Geometrical Set…" on the top menu

- Click ok

(Remark: Provided that Hybrid Design is disabled, a geometrical set will be created automatically when the first wireframe/ surface/ plane is created)
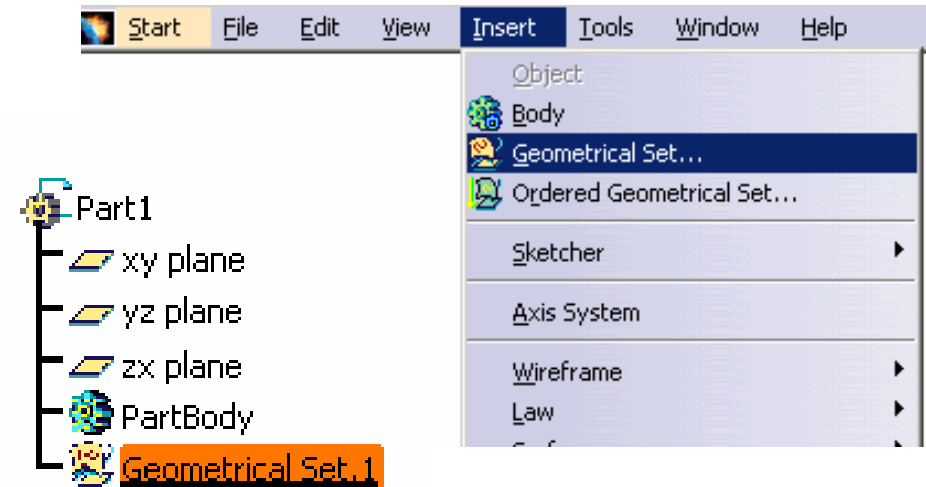
To MOVE a surface from One Geometrical Set to the other:-

-Right-click on the surface to access the contextual menu

-Select "**Change Geometrical Set…**"

-Select the other geometrical set from the list of Destination

A- 38
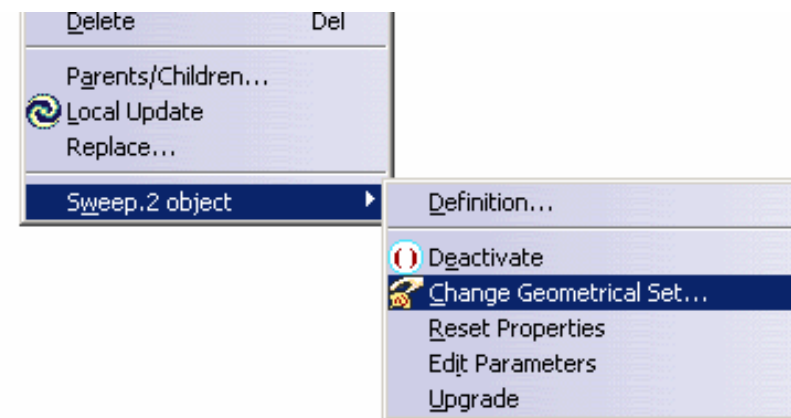
Split (by Surface)

Remark:

The surface-based features (Split, Thick Surface, Close surface & Sew) are available only on **Part Design** Workbench
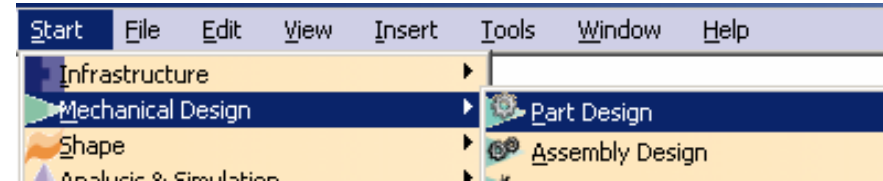
Split (split a solid with a plane, face or surface)

Part Design

**Generative
Shape Design**
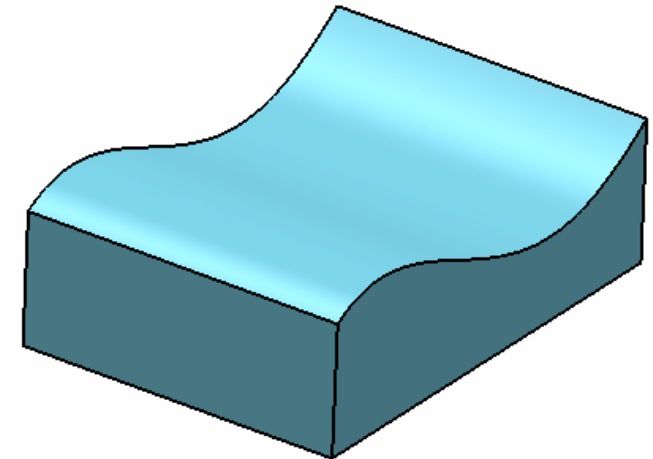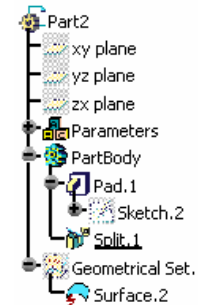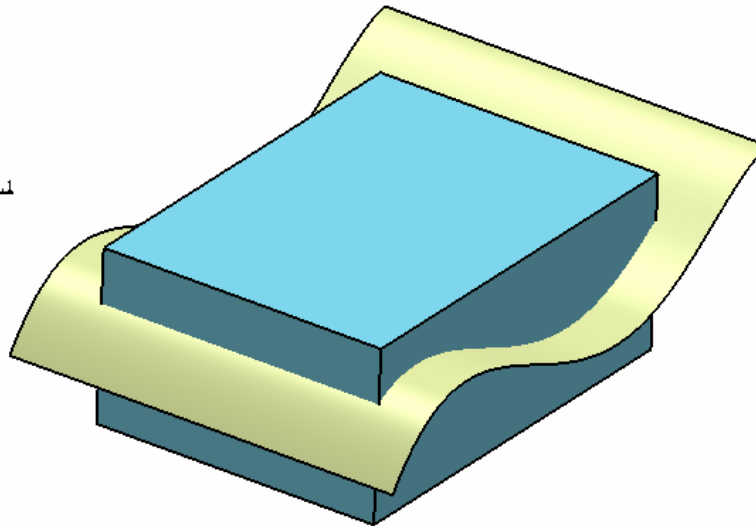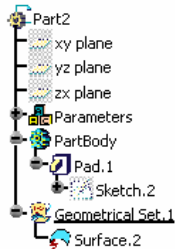
Thick Surface

Thick Surface (add material to a surface in
two opposite directions or in one direction)
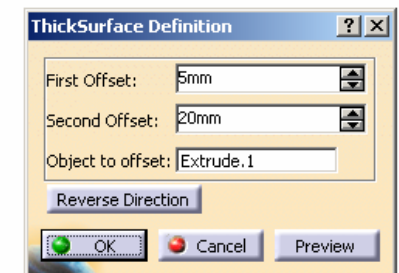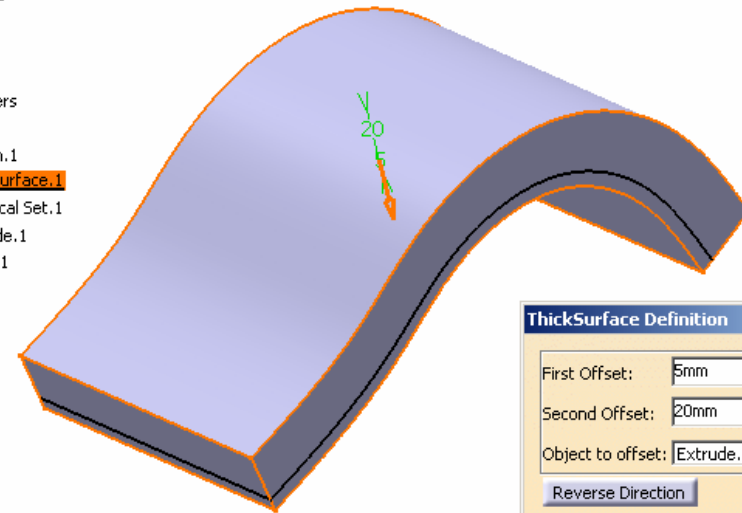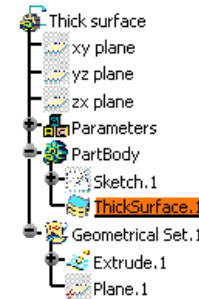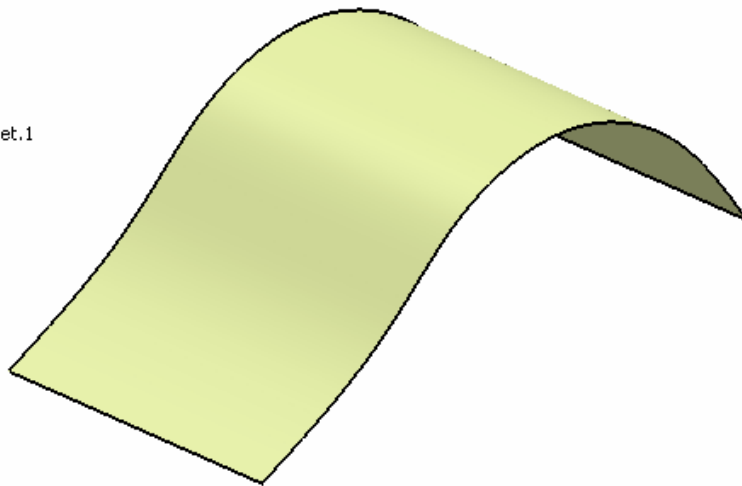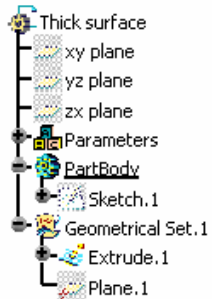
Close Surface

Close Surface (Add material inside the enclosed surface so that a solid is created)
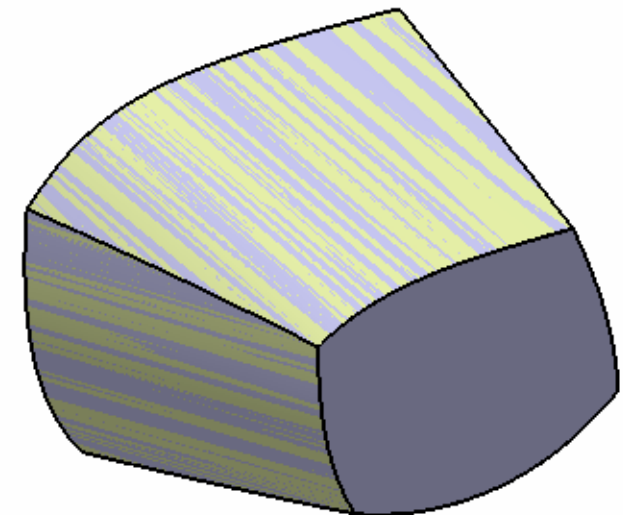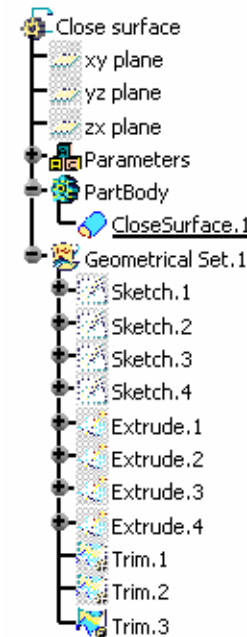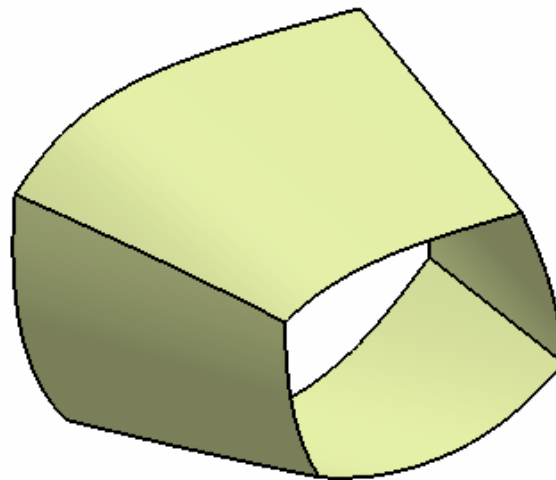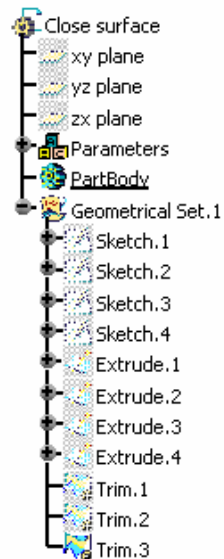
Sew Surface

Sew Surface (a Boolean operation combining a surface with a body. This capability adds or removes material by modifying the surface of the solid.)
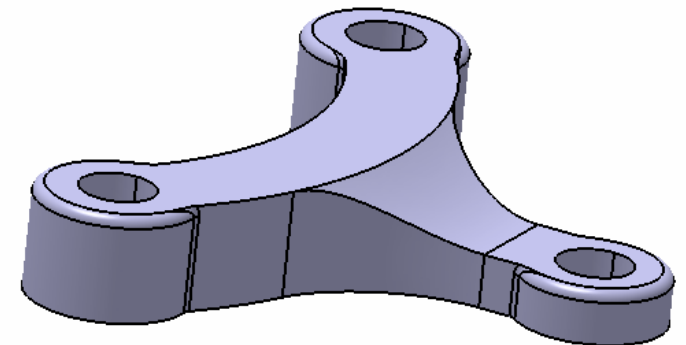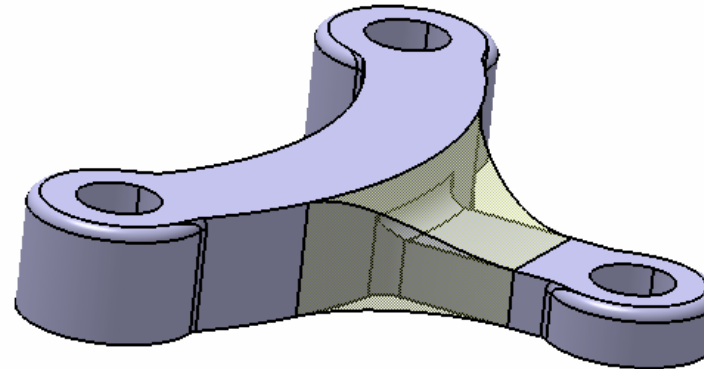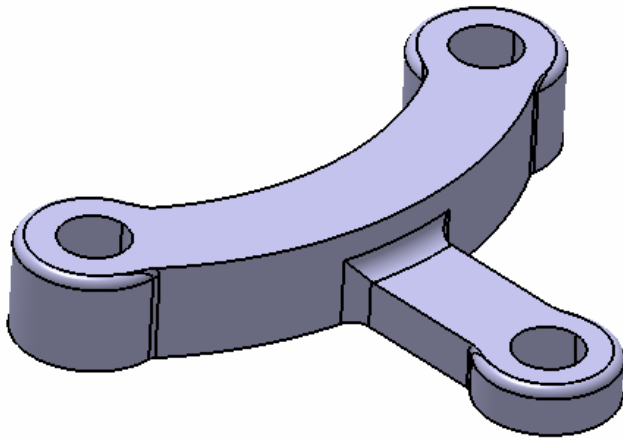
Exercise
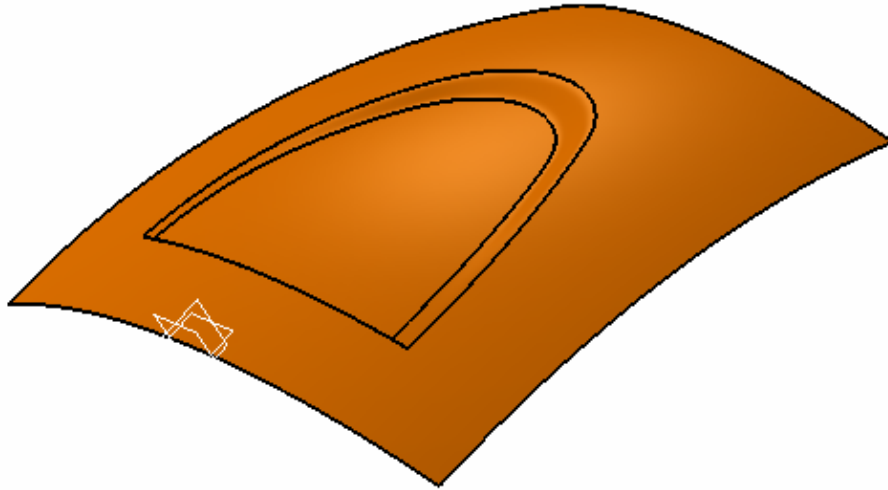
Exercise 1

- Sweep/ Extrude/ Offset

- Blend/ Split/ Boundary

- Fill/ Join
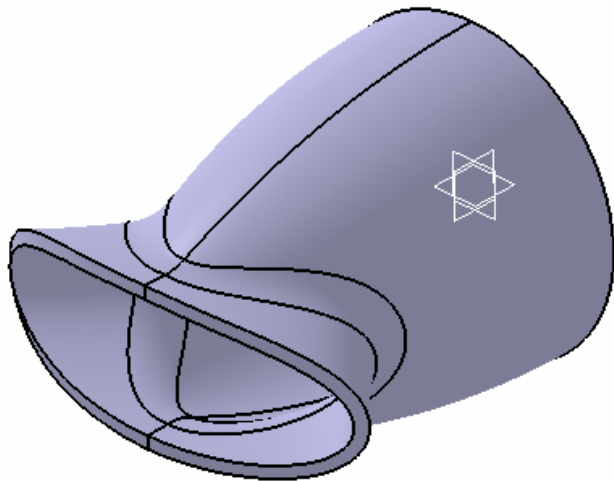
Exercise 2

- Revolve/ Sweep/ Split

- Shape Fillet/ Extrude

- Symmetry/ Join

- Thick Surface

A- 43

Exercise 1

No sharp edges along
the boundary

A

A

Section A-A
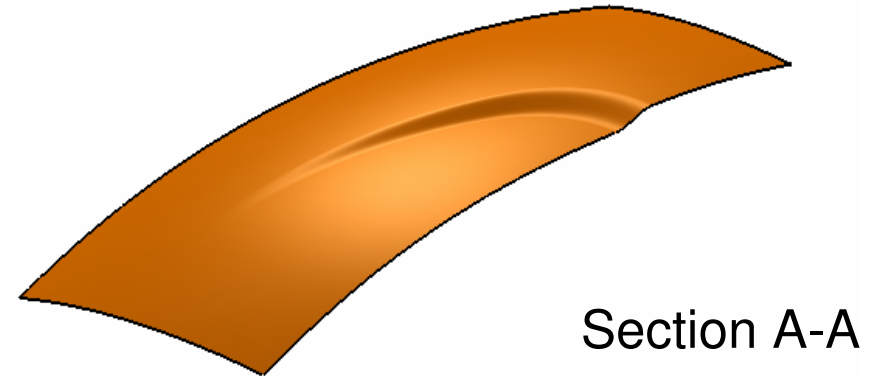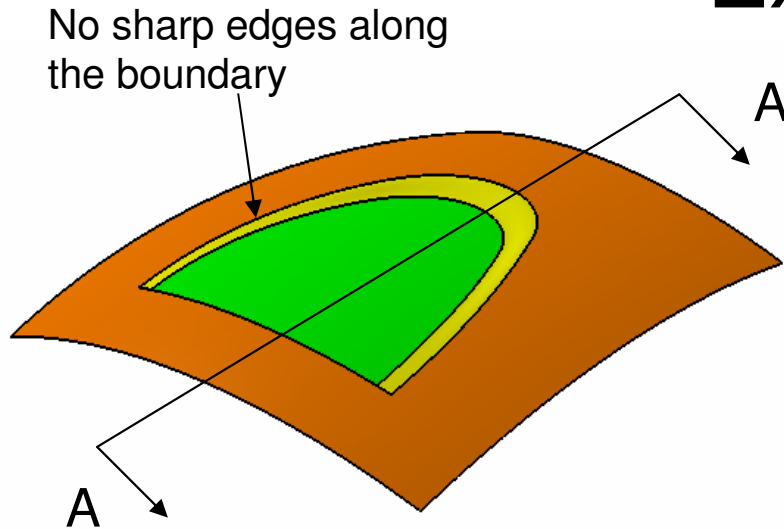
(1) Start/Shape/Generative Shape Design

(2) To make a Sweep surface:-

- Click "**Sketch**" icon and select **yz plane**

- Draw an **arc** (R500) with one end (0,0) as shown
  in Fig.1

- Click "Exit" to complete

- Deselect Sketch.1

- Click "**Sketch**" icon again and select **zx plane**

- Draw an **arc** (R400) with symmetric endpoints as
  shown in Fig.2

- Click "Exit" to complete   A- 44

300

R 500

Fig.1

350

R 400

Fig.2

Generative Shape Design
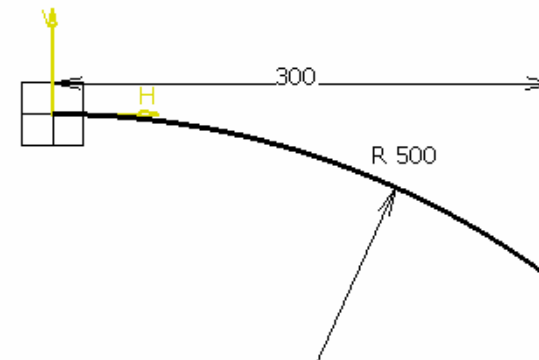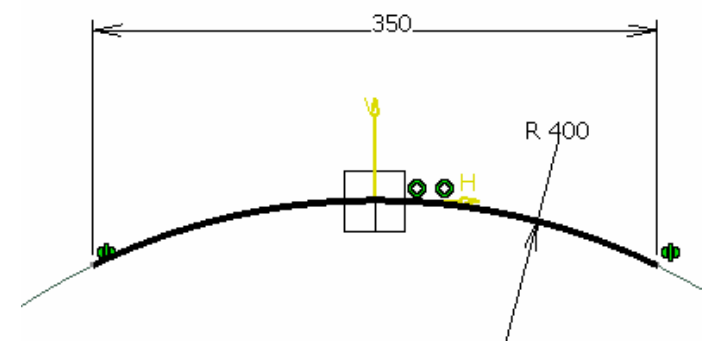
Exercise 1

(Con't)

- Click "**Sweep**" icon
- Select "**Explicit**" as **Profile Type**
- Select **Sketch.1** as **Profile**
- Select **Sketch.2** as **Guide Curve**
- Click ok to complete
- **Hide Sketch.1** & **Sketch.2**
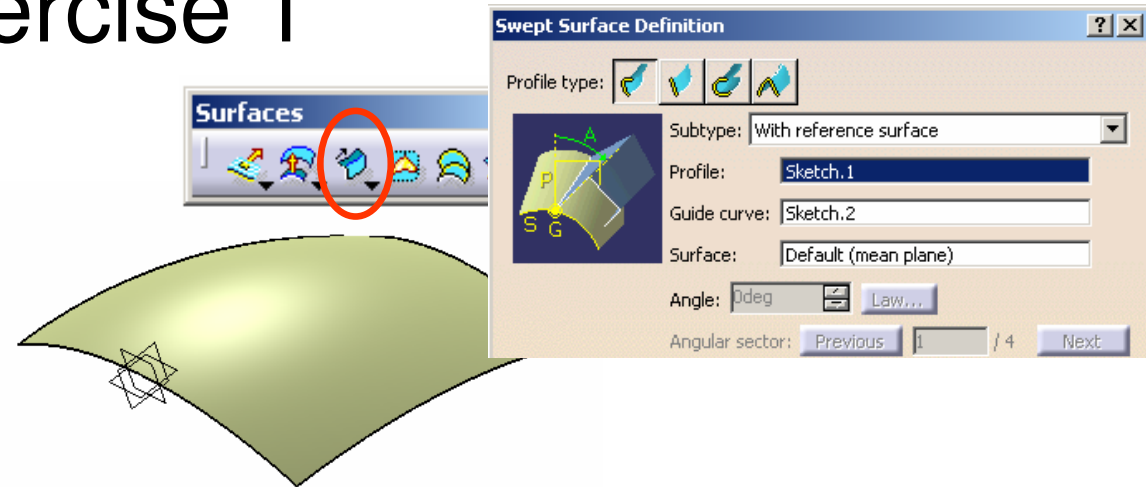
(3) To make an Offset Plane:-

- Click "**Plane**" icon
- Select **xy plane** as **Reference**
- Enter <u>160mm</u> as **Offset** (*upward*)
- Click ok to complete

(4) To make a sketch on the offset plane:-

- Click "**Sketch**" icon and select **Plane.1**
- Draw the Profile as shown in Fig.3
- Click "**Exit**" to complete

Surfaces

Swept Surface Definition

Profile type:

Subtype: With reference surface

Profile: Sketch.1

Guide curve: Sketch.2

Surface: Default (mean plane)

Angle: 0deg   Law...

Angular sector: Previous 1 / 4 Next

R 65

R 300

180

50

200

Fig.3

**Generative
Shape Design**

Exercise 1

(5) To Project the sketch onto the surface:-

- Click "**Projection**" icon
- Select "**Along a direction**" as **Projection type**
- Select **Sketch.3** as **Projected**
- Select **Sweep.1** as **Support**
- Select **xy plane** as **Direction**
- Click ok to complete
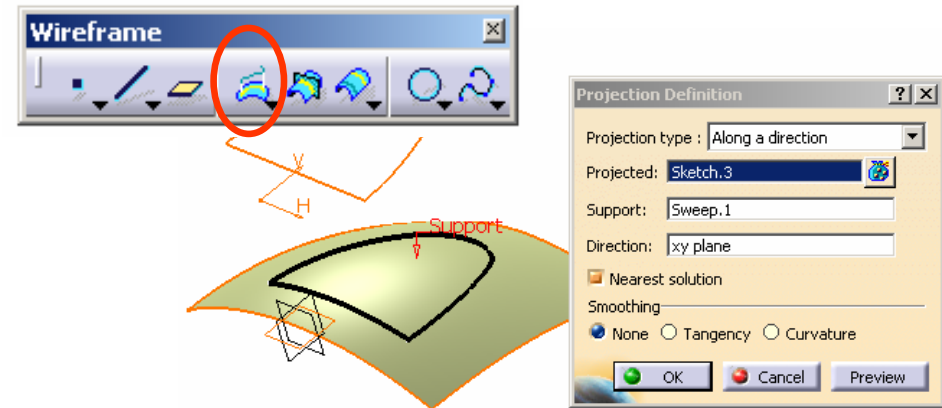
(6) To Split the surface:-

- Click "**Split**" icon
- Select **Sweep.1** as **Element to cut**
- Select **Project.1** as **Cutting element**
- (Click "**Other Side**" option to choose the outer portion)
- Click ok to complete
- **Hide Sketch.3 & Project.1**
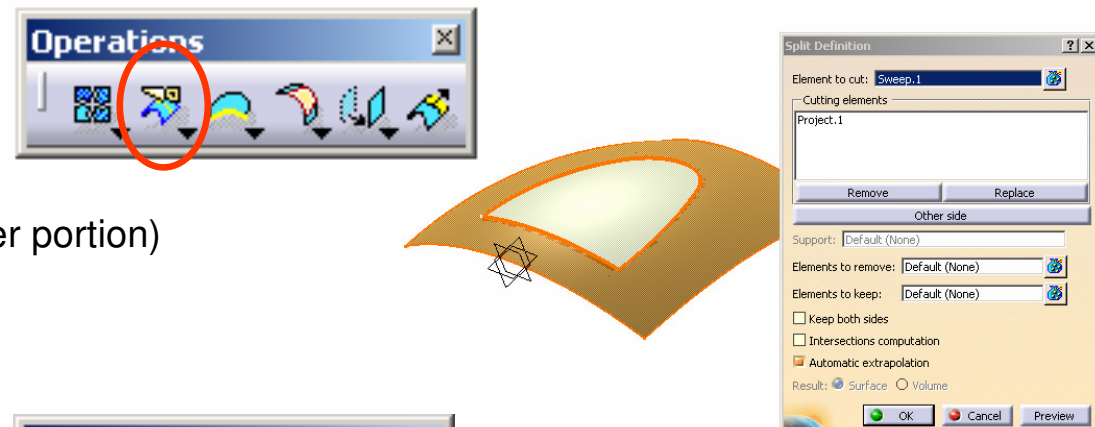
(6b) To Offset the surface:-

- Click "**Offset**" icon
- Select **Sweep.1** as **Surface**
- Enter <u>6mm</u> as Offset (Downward)
- Click ok to complete

A- 46

Exercise 1

(7) To Create Two offset planes:-

- Click "**Plane**" icon
- Select **zx plane** as **Reference**
- Enter 50mm as **Offset** (positive side)
- Click ok to complete
- Click "**Plane**" icon again
- Select **zx plane** as **Reference**
- Enter 230mm as **Offset** (positive side)
- Click ok to complete
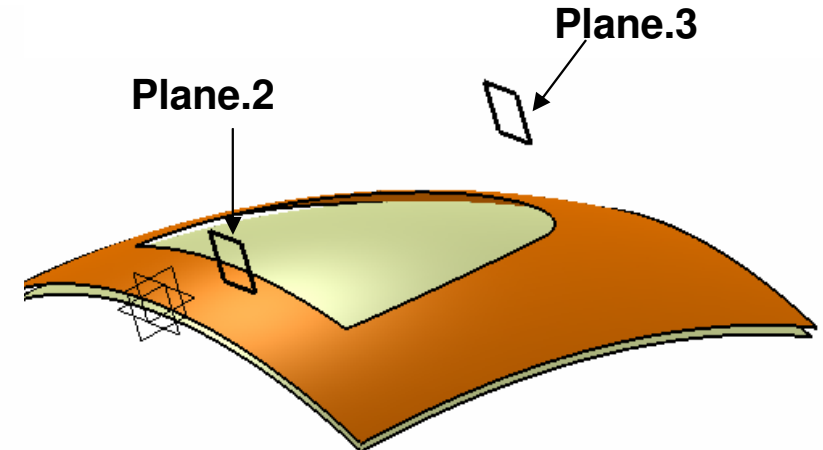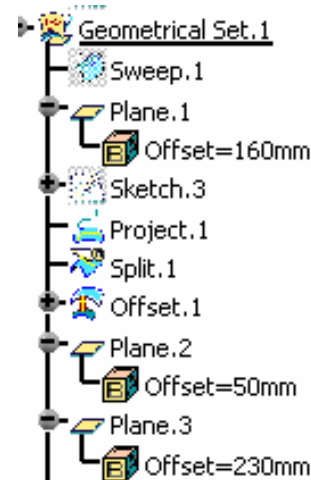
Plane.2

Plane.3

(8) To Split Surfaces:-

- **Hide** Surface **Split.1; Show** Surface **Sweep.1**
- Click "**Split**" icon
- Select **Sweep.1** as **Element to cut**
- Select **Plane.2** as **Cutting element**
- Click "**Other Side**" option to choose the smaller portion
- Click ok to complete
- Click "**Split**" icon again
- Select **Offset.1** as **Element to cut**
- Select **Plane.3** as **Cutting element**
- Click "**Other Side**" option to choose the smaller portion
- Click ok to complete

Result of Split.3

Result of Split.2

A- 47
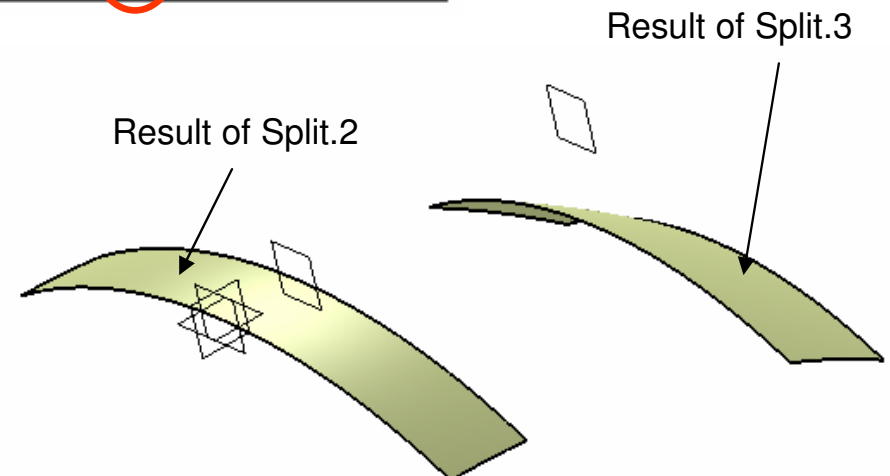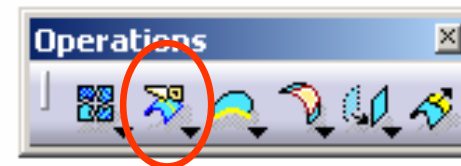
Exercise 1

(9) To Create a Blend:-

- Click "**Blend**" icon
- Select **the edge of Split.2** ☆ as **First Curve**
- Select **Split.2** as **First Support**
- Select **the edge of Split.3** ✦ as **Second Curve**
- Select **Split.3** as **Second Support**
- Select **Tangency** for First continuity and Second continuity
- Click ok to complete

Surfaces

Blend Definition

First curve: Split.2\Edge.1

First support: Split.2

Second curve: Split.3\Edge.2

Second support: Split.3

Basic | Tension | Closing Points | Coup

First continuity: Tangency

☐ Trim first support

First tangent borders: Both extremities

Second continuity: Tangency

☐ Trim second support

Second tangent borders: Both extremities

Replace | Remove | Reverse

OK | Cancel | Preview

Second Support
Second Curve

First Curve
First Support

(10) To make a sketch on the offset plane:-

- Click "**Sketch**" icon and select **Plane.1**
- Draw the Profile as shown in Fig.4
- Click "**Exit**" to complete

R 58.5

R 270

157

50

180

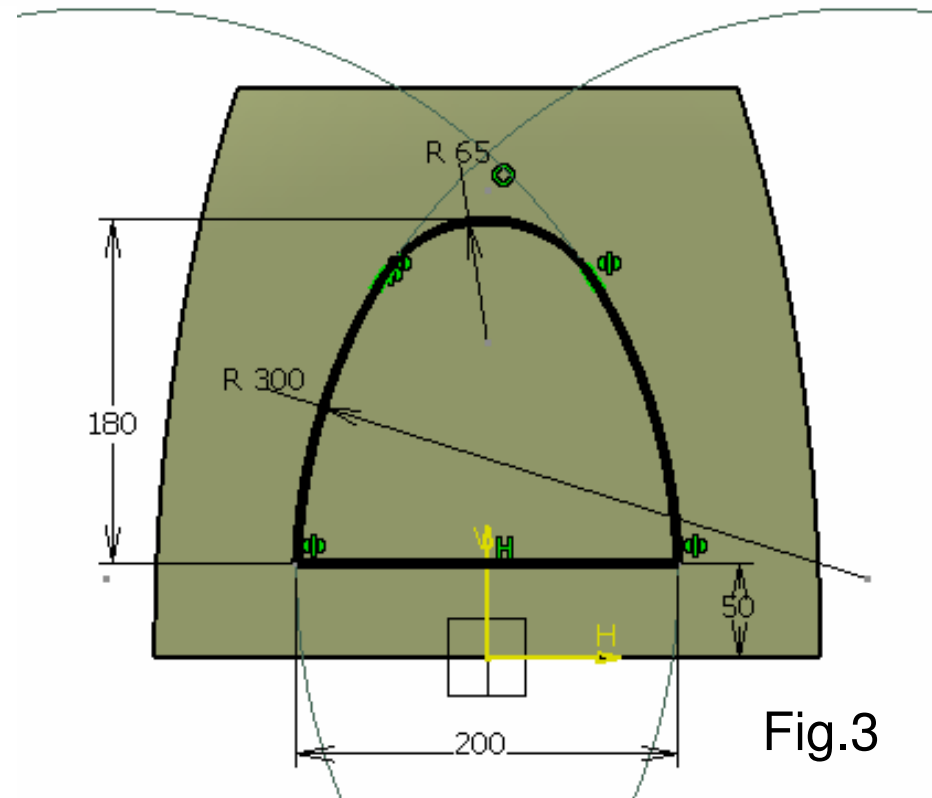Fig.4

A- 48

Exercise 1

(11) To Project the sketch onto the Blend:-

- Click "**Projection**" icon
- Select "**Along a direction**" as **Projection type**
- Select **Sketch.4** as **Projected**
- Select **Blend.1** as **Support**
- Select **xy plane** as **Direction**
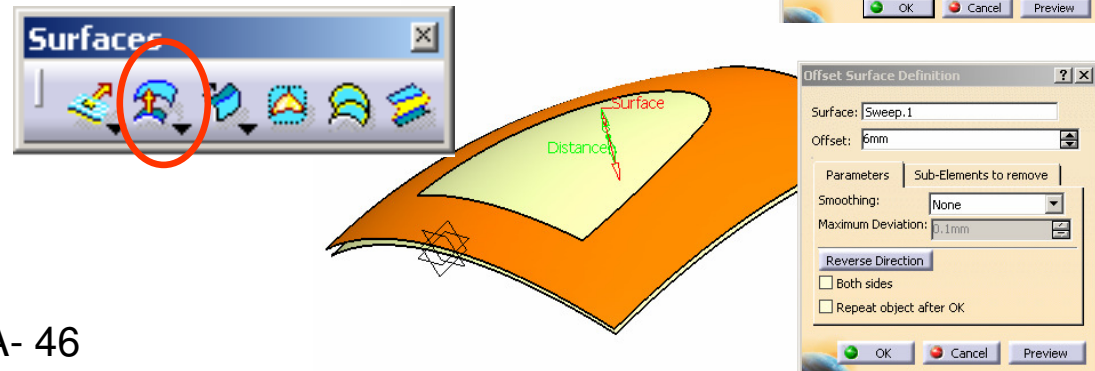
- Click ok to complete
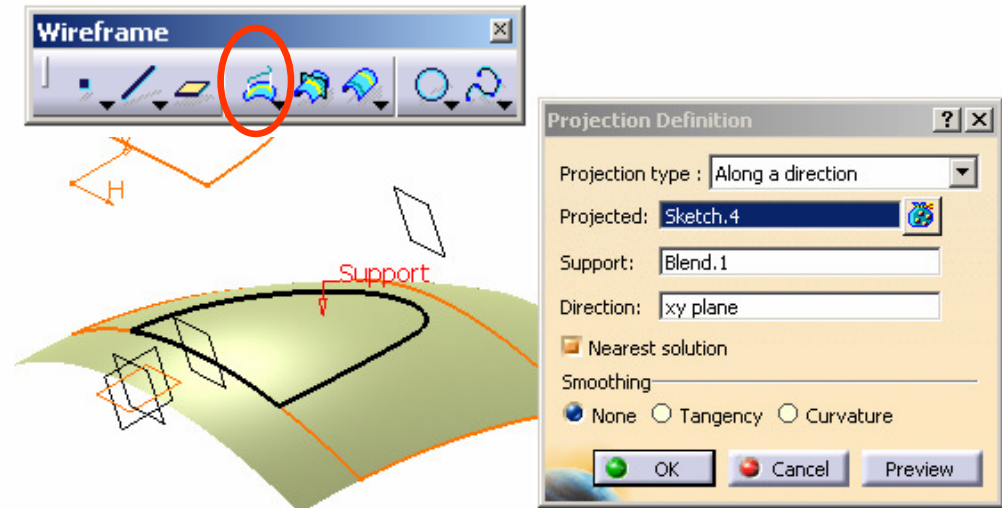
(12) To Split the Blend:-

- Click "**Split**" icon
- Select **Blend.1** as **Element to cut**
- Select **Project.2** as **Cutting element**
- (Click "**Other Side**" option to choose the inner portion)
- Click ok to complete
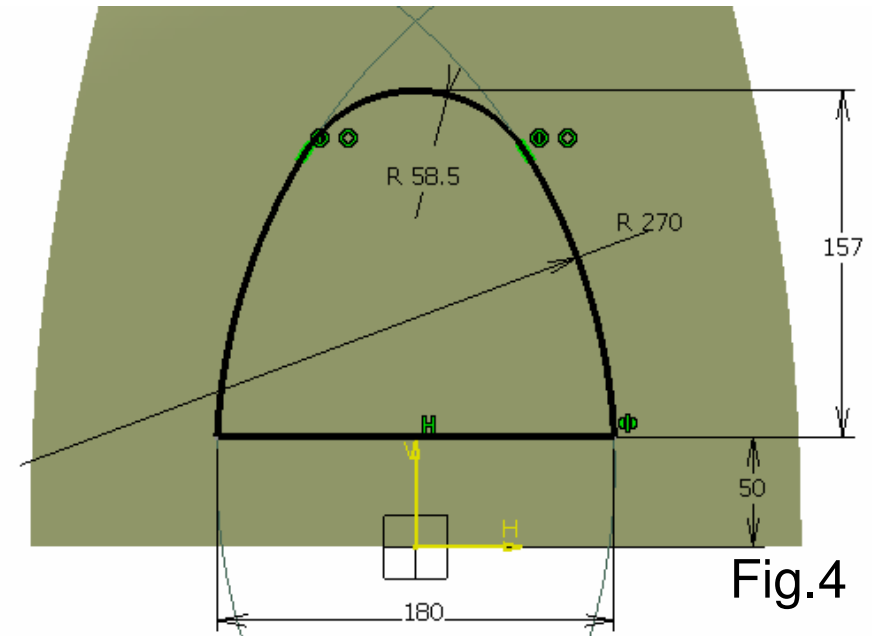- **Hide Sketch.4 & Project.2**

A- 49

**Generative
Shape Design**
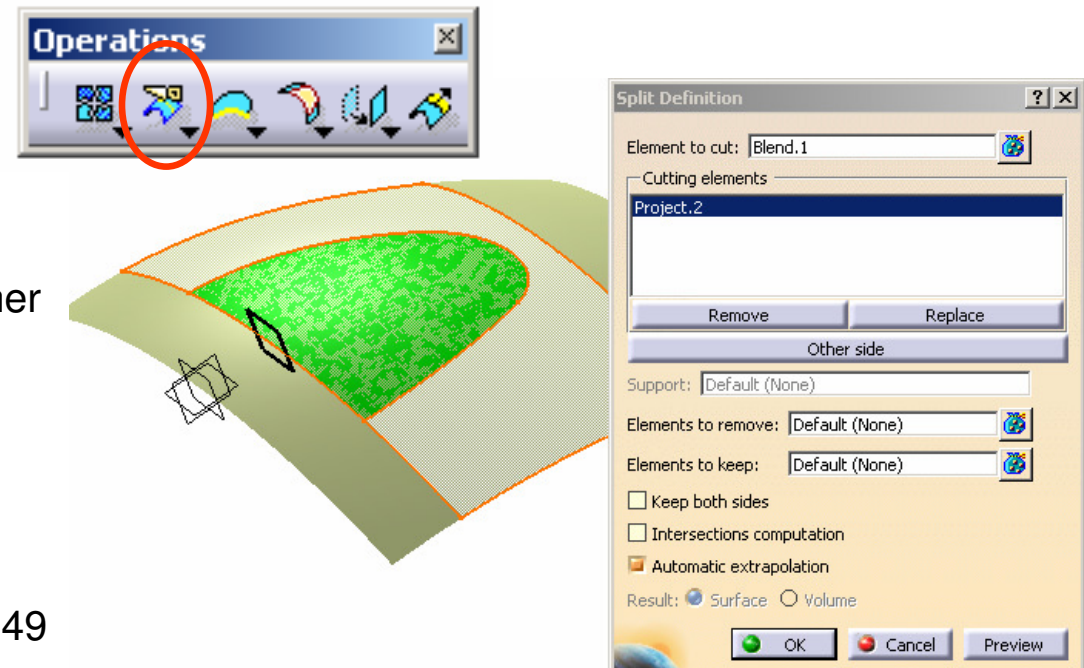
Exercise 1

(13) To Hide all constructive elements:-

• Hide all elements except **Split.1** & **Split.4**

Split.4

Split.1
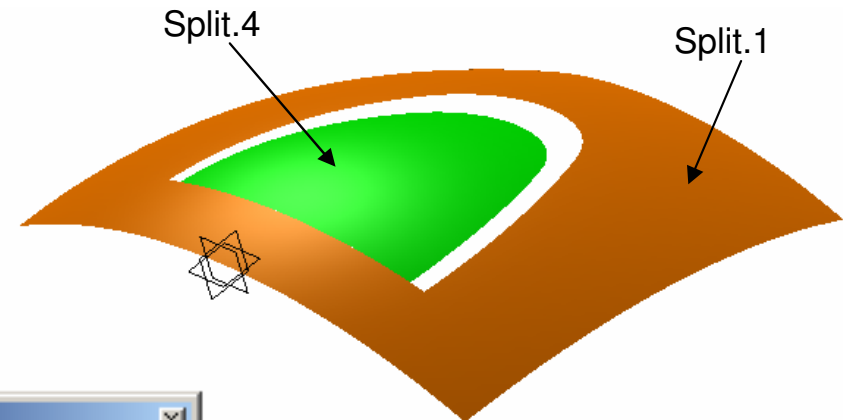
(14) To make 4 boundaries:-

(1st Boundary)

• Click "**Boundary**" icon

• Select "**Tangency continuity**" as Propagation type

• Select the edge as shown in Fig.5

• Click ok to complete

1st Boundary
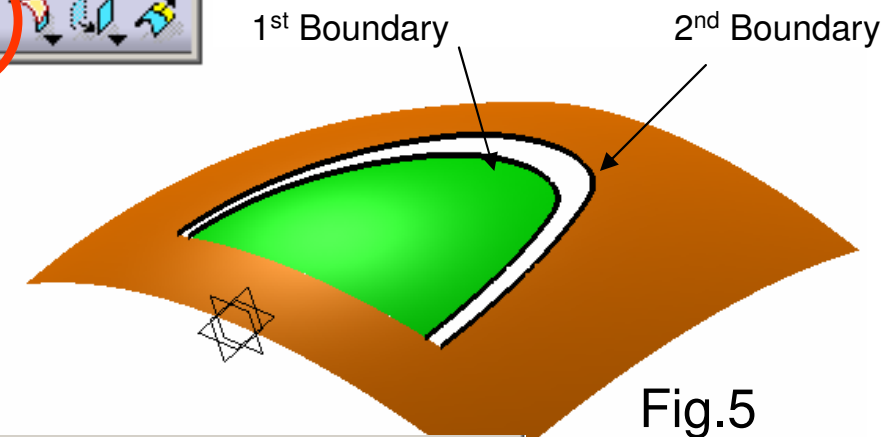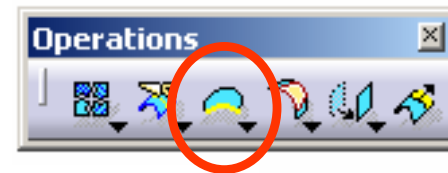
2nd Boundary

(2nd Boundary)

• Click "**Boundary**" icon again

• Select "**Tangency continuity**" as Propagation type

• Select the edge as shown in Fig.5

• Click ok to complete

Fig.5

Boundary Definition

Propagation type:	Tangent continuity
Surface edge:	Split.1\Edge.4
Limit1:	No selection
Limit2:	No selection

OK Cancel Preview

A- 50

Exercise 1

(3rd Boundary)

• Click "**Boundary**" icon again

• Select the edge as shown in Fig.6

• Select the point ⭐ as **Limit 1**

• Click ok to complete

(4th Boundary)

• Click "**Boundary**" icon again

• Select the edge as shown in Fig.6

• Select the point ✦ as **Limit 1**

• Click ok to complete

4th Boundary
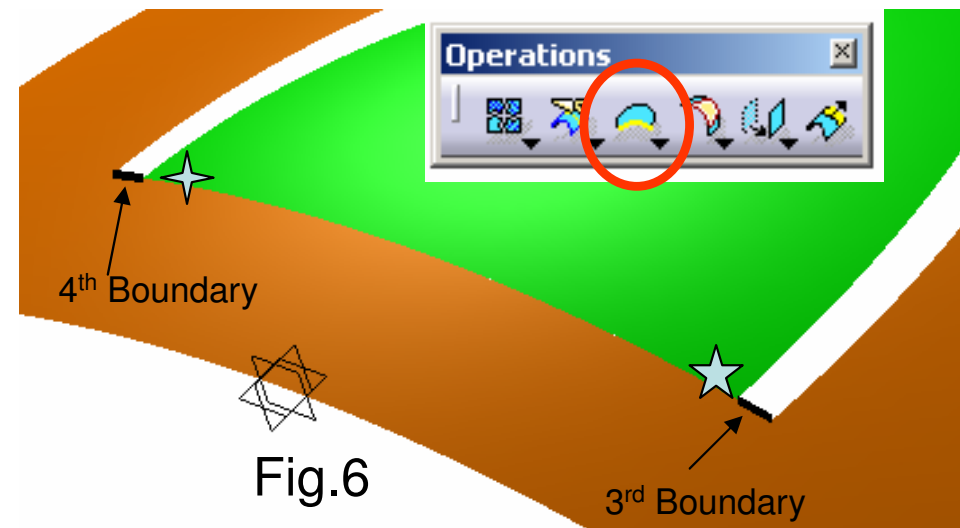
3rd Boundary

Fig.6

(15) To Create a Fill:-

• Click "**Fill**" icon

• Select **Boundary.1** then **Split.4** then **Tangent**

• Select **Boundary.2** then **Split.1** then **Tangent**

• Select **Boundary.3** then **Split.1** then **Tangent**

• Select **Boundary.4** then **Split.1** then **Tangent**

• Click ok to complete

A- 51

Fill Surface Definition

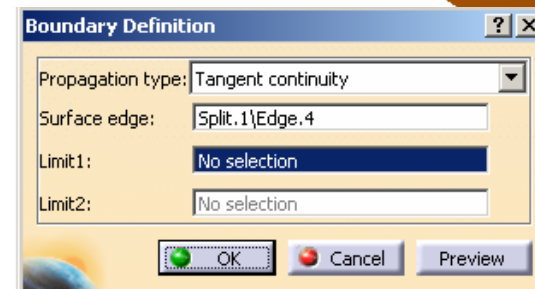| No	Curves	Supports
1	Boundary.1	Split.4
2	Boundary.3	Split.1
3	Boundary.2	Split.1
4	Boundary.4	Split.1

AddAfter   Replace   Remove
AddBefore   ReplaceSupport   RemoveSupport
Continuity: Tangent
Passing point: No selection
☐ Planar Boundary Only
OK   Cancel   Preview
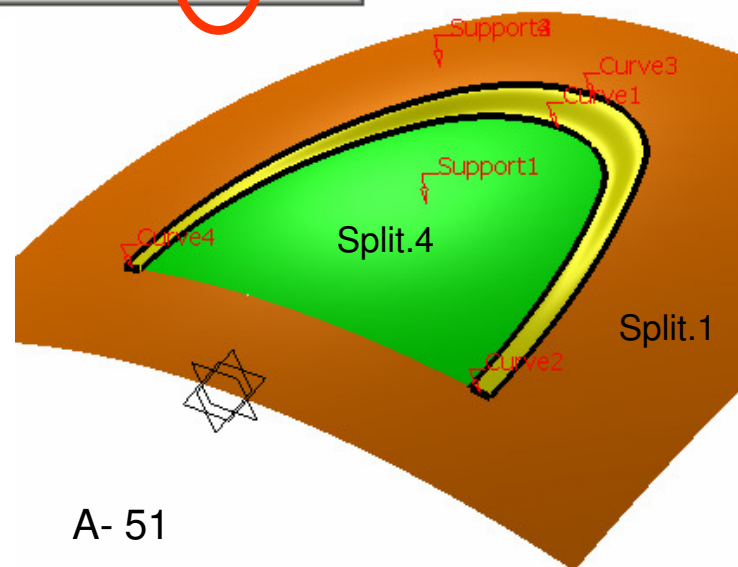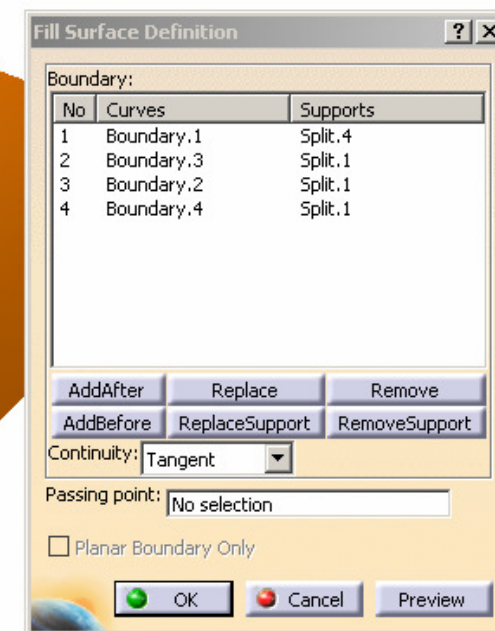
Exercise 1

(16) To Join surfaces:-

- Click "**Join**" icon
- Select **Split.1, Fill.1 & Split.4**
- Click ok to complete
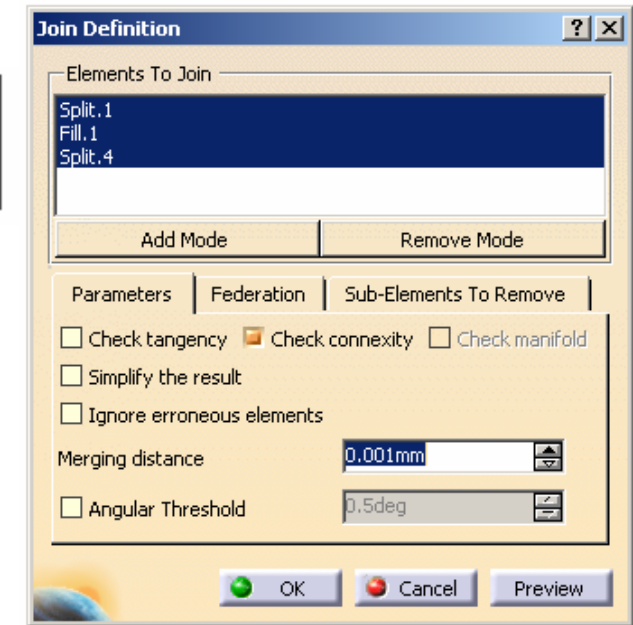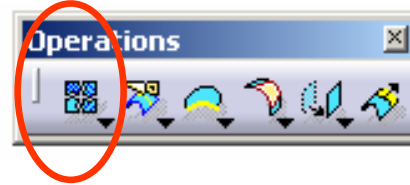
(17) Hide all Boundaries
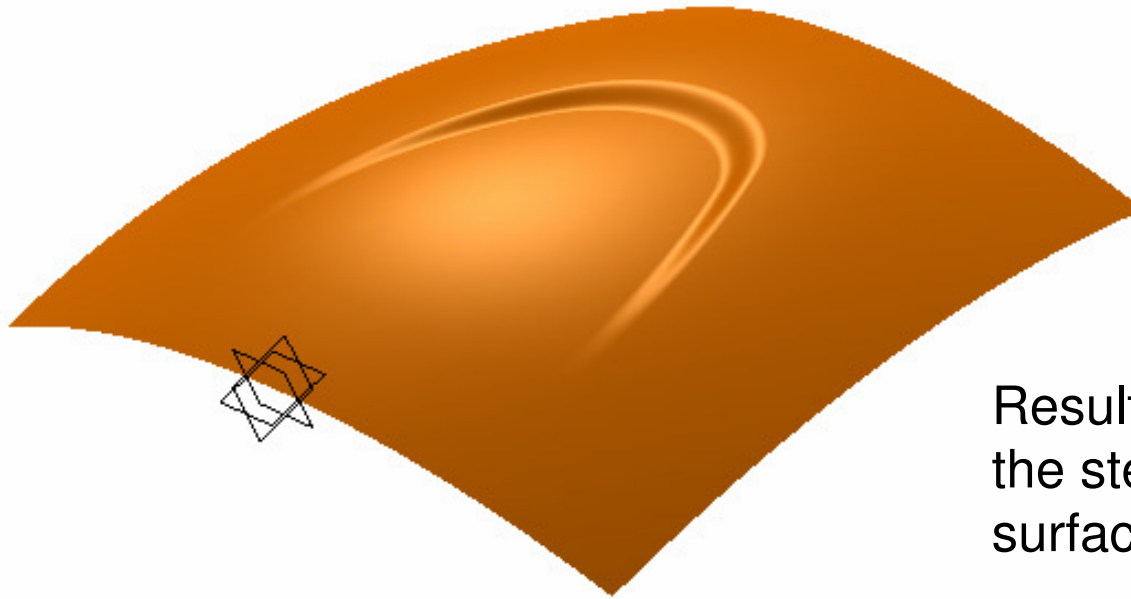
Result: No sharp edge between the step-down and the original surface

END of Exercise.1

A- 52

Exercise 2
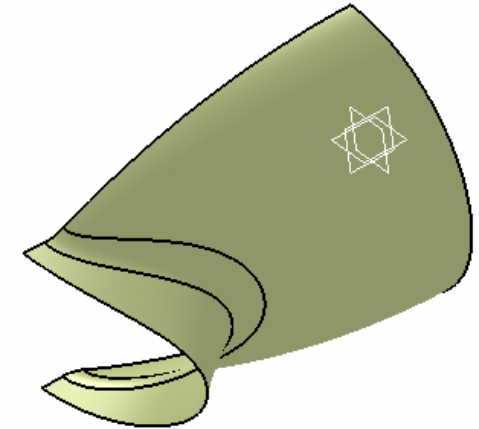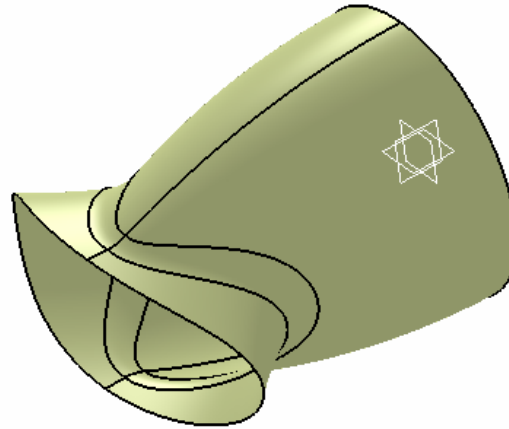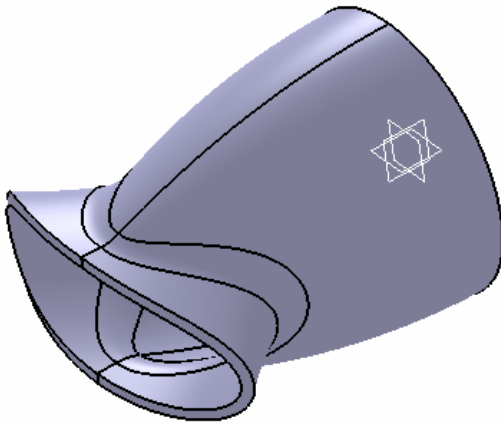
(1) Start/Shape/Generative Shape Design

(2) To make a Revolve surface:-

- Click "**Sketch**" icon and select **zx plane**
- Draw an **arc** (R160) with one end (0,30) as shown in Fig.1, which should be tangent to a horizontal axis
- Draw another horizontal axis on x-axis (which will be selected to be the axis of rotation later)
- Click "Exit" to complete

70

R 160

30

Fig.1
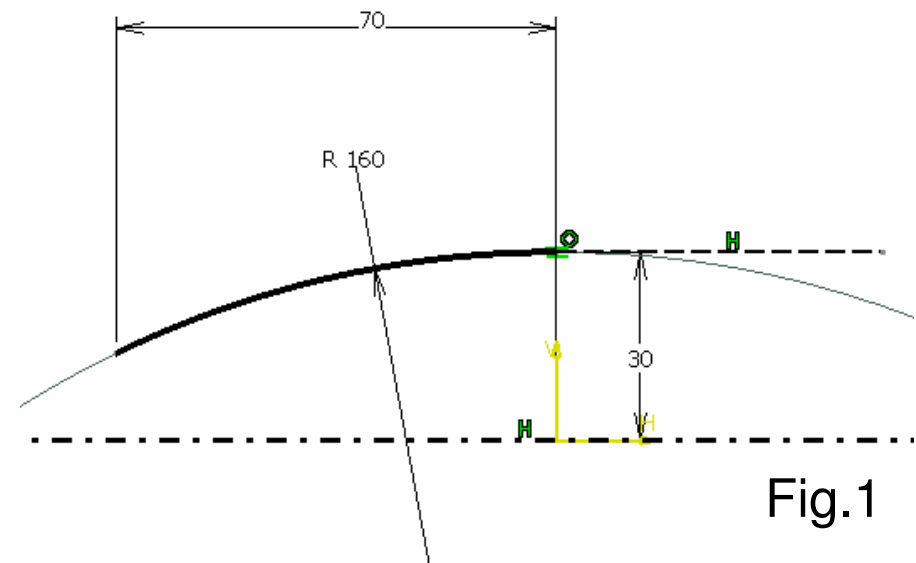
Exercise 2

(con't)

- Click "**Revolve**" icon
- Select **Sketch.1** as **Profile**
- (Sketch axis will be selected as **Revolution axis**)
- Enter 0deg as **Angle.1**
- Enter 180deg as **Angle.2**
- Click ok to complete
- **Hide Sketch.1**

Surfaces

Revolution Surface Definition

Profile: Sketch.1

Revolution axis: Default (Sketch axis)

Angular Limits

Angle 1: 0deg

Angle 2: 180deg

OK   Cancel   Preview
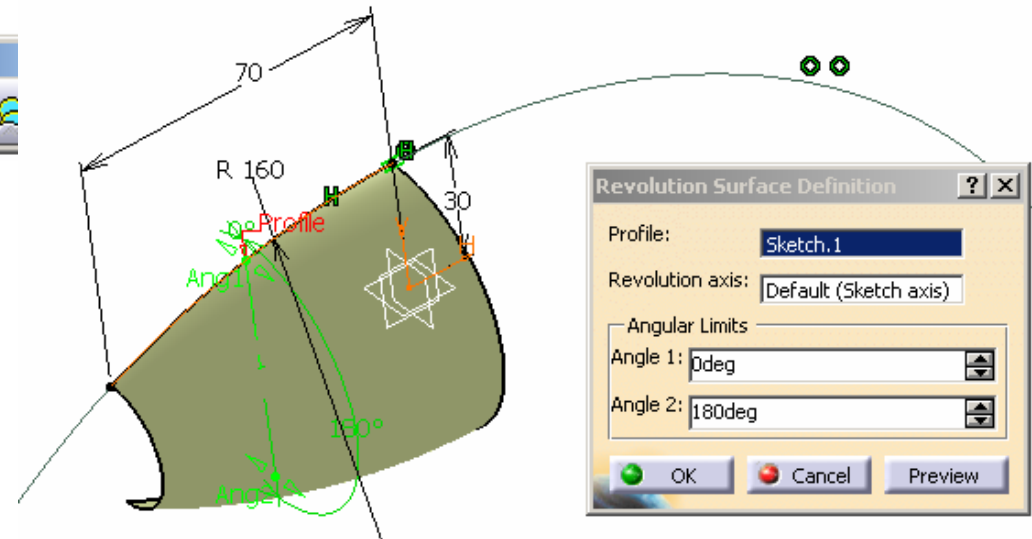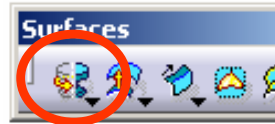
(3) To make the 2nd Sketch:-

- Click "**Sketch**" icon and select **xy Plane**
- Draw an Arc (R90) as shown in Fig.2
- Click "**Exit**" icon to complete

80

25

R 90

60

15

Fig.2

A- 54

**Generative
Shape Design**
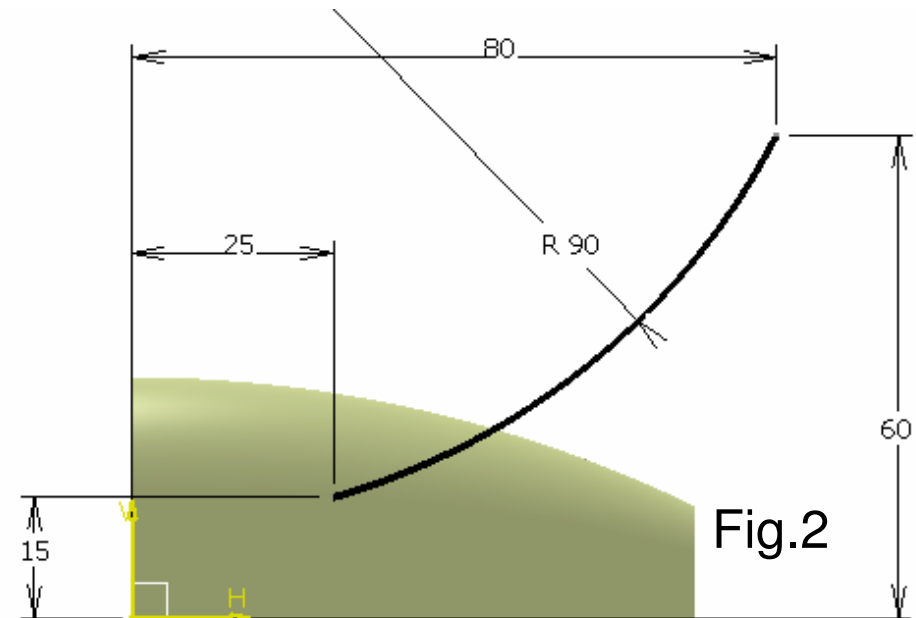
Exercise 2

(4) To make reference planes:-

- Click "**Plane**" icon
- select **yz Plane**
- **then select the end point** ☆ **of the arc**
- ("Parallel through point" will be automatically selected as "Plane Type")
- Click ok to complete

- Click "**Plane**" icon again
- select **yz Plane**
- **then select the end point** ✦ **of the arc**
- Click ok to complete

yz plane

Wireframe

Plane Definition ? X

Plane type: Parallel through point

Reference: yz plane

Point: Sketch.2\Vertex.1

OK   Cancel   Preview
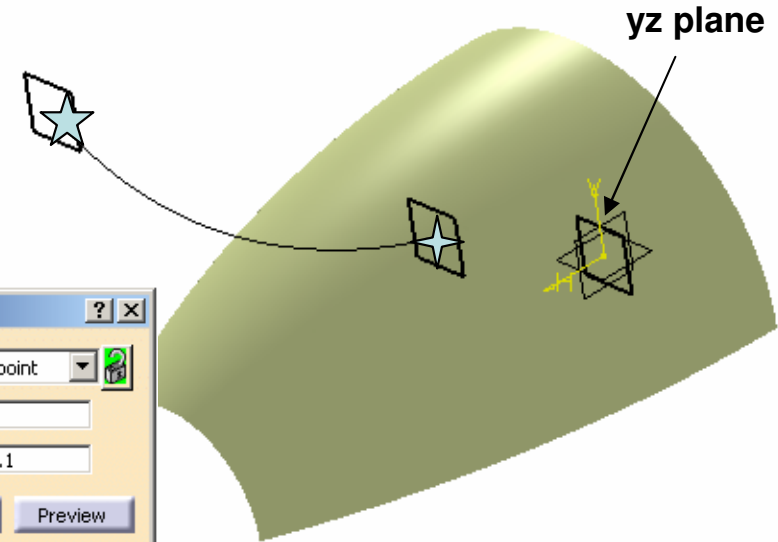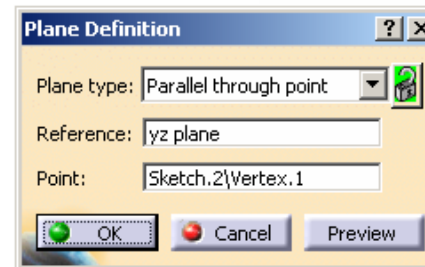
(5) To make the 3ʳᵈ Sketch:-

- Click "**Sketch**" icon and select **Plane.1**
- Draw an ellipse with one end touching **Sketch.2 as shown in Fig.3**
- (While adding the constraint (D30), right-click and select "semiminor axis")
- Click Exit to complete

touching
Sketch.2

D 30

Fig.3

A- 55
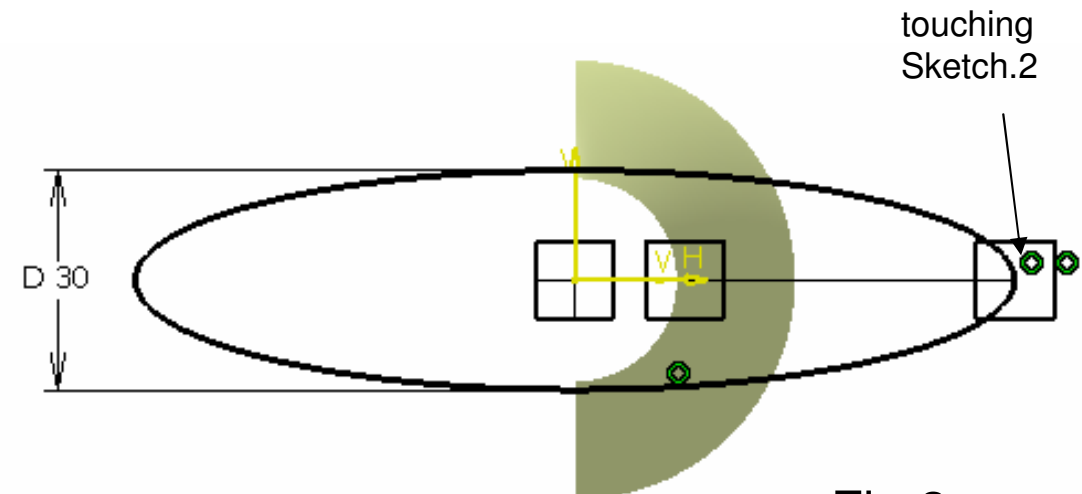
Exercise 2

(6) To make the 4ᵗʰ Sketch:-

- Click "**Sketch**" icon and select **Plane.2**
- Draw an ellipse with one end touching **Sketch.2 as shown in Fig.4**
- (While adding the constraint (D10), right-click and select "semiminor axis")
- Click Exit to complete

touching Sketch.2

D 10

Fig.4

Result
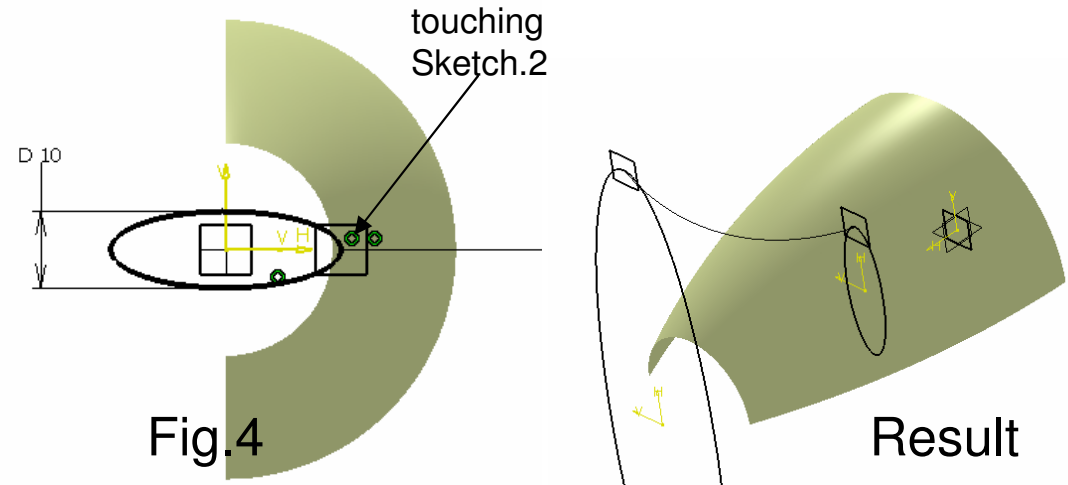
(7) To make a symmetric curve:-

- Click "**Symmetry**" icon
- Select **Sketch.2** as **Element**
- select **zx Plane** as **Reference**
- Click ok to complete

Symmetry Definition

Element: Sketch.2

Reference: zx plane

Hide/Show initial element

Result: ● Surface ○ Volume

OK   Cancel   Preview

Operations

Zx plane

A- 56

Generative Shape Design
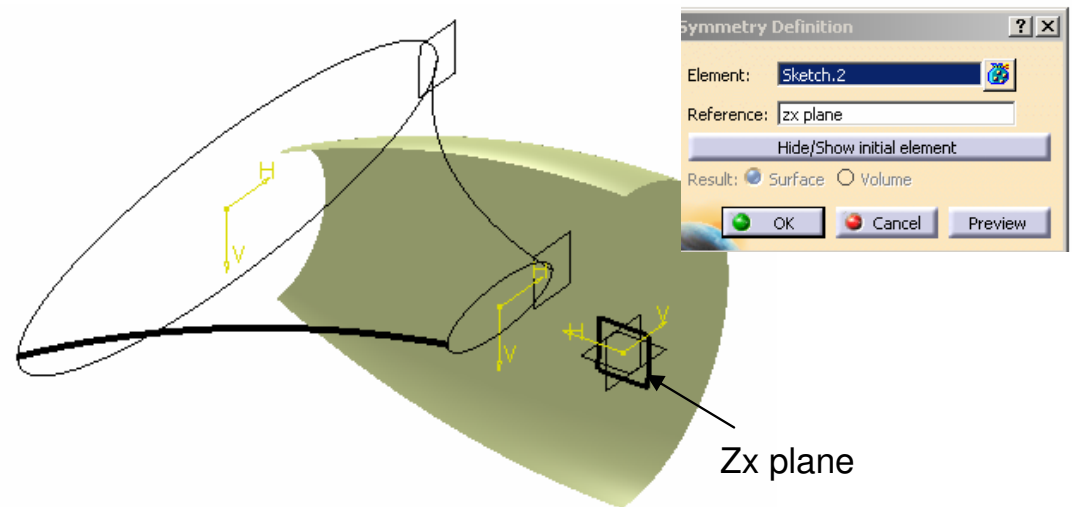
Exercise 2

(7) To make a Multi-sections Surface:-

- Click "**Multi-sections Surface**" icon
- Select **Sketch.3** as **Section#1**
- Select **Sketch.4** as **Section#2**
- Select **Sketch.2** as **Guide#1**
- Select **Symmetry.1** as **Guide#2**
- Click ok to complete
- **Hide Sketch.2, Sketch.3, Sketch.4, Symmetry.1, Plane.1 & Plane.2**

(8) To Split the surface:-

- Click "**Split**" icon
- Select **Multi-sections Surface.1** as **Element to cut**
- Select **zx Plane** as **Cutting element**
- (Click "**Other Side**" option to choose the correct portion)
- Click ok to complete

Zx Plane

A- 57
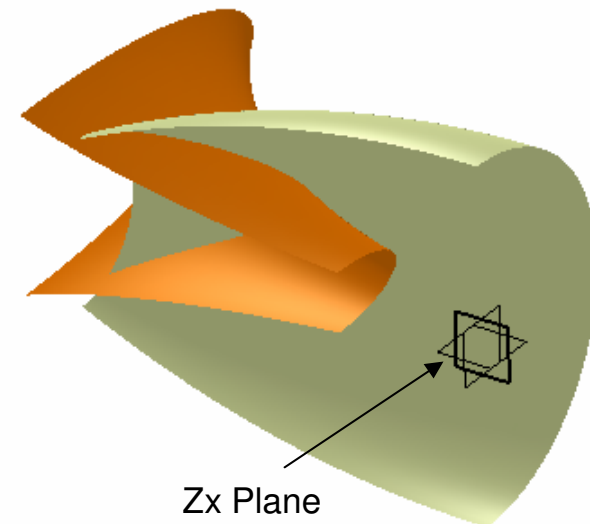
Exercise 2

(9) To make a Fillet between 2 surfaces:-

- Click "**Shape Fillet**" icon
- Select **Split.1** as **Support.1**
- Select **"Trim Support.1"**
- Select **Revolute.1** as **Support.2**
- Select **"Trim Support.2"**
- Enter <u>10mm</u> as **Radius**
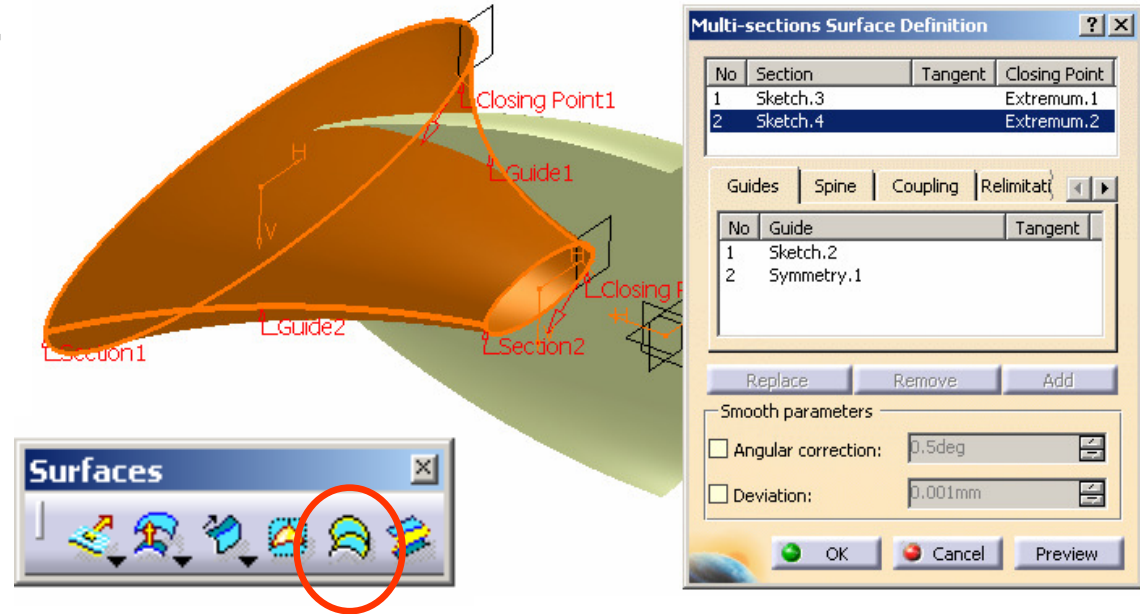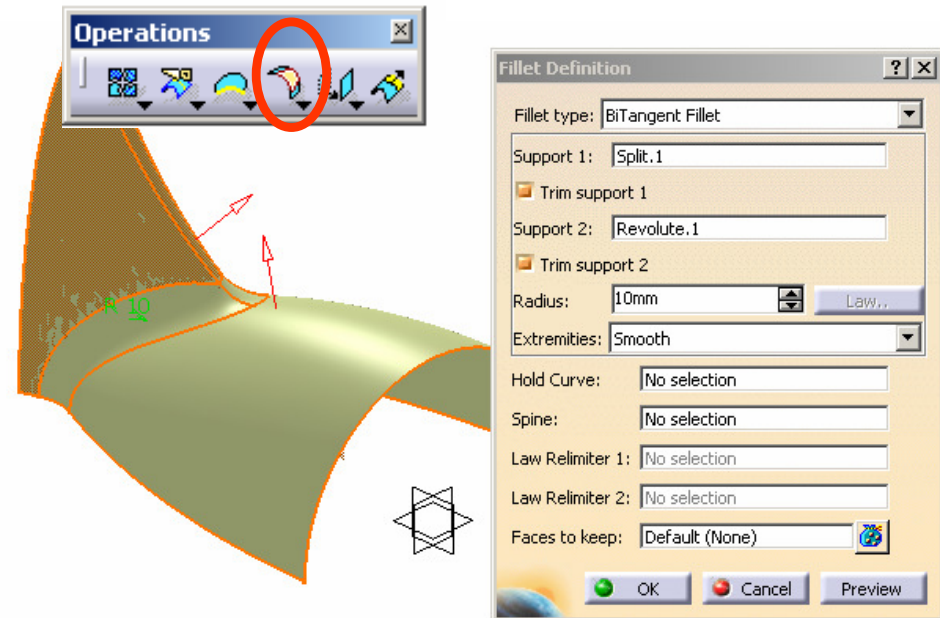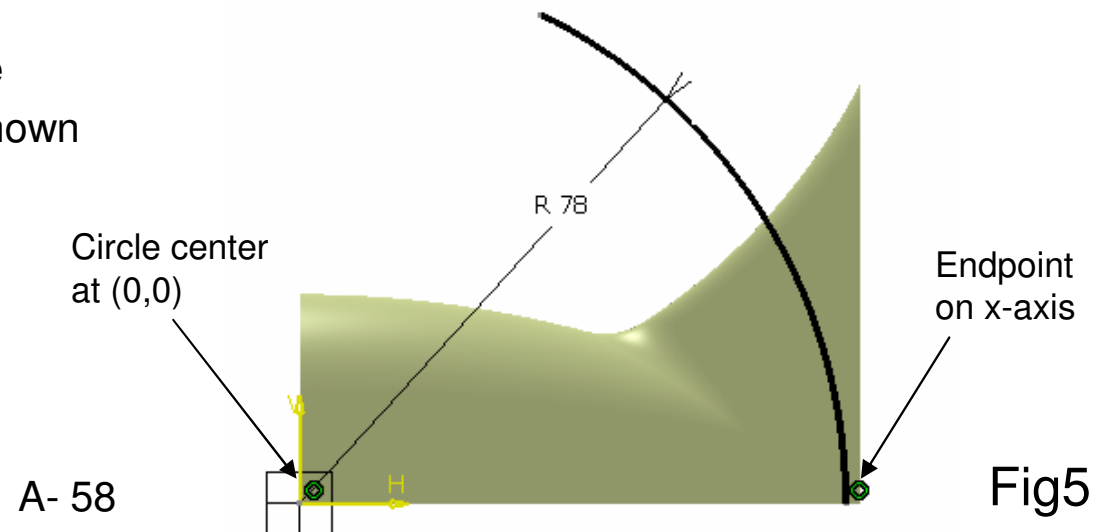- (Click on the red arrow if it is not pointing outward)
- Click ok to complete

## (10) To make 5th Sketch:-

- Click "**Sketch**" icon and select **xy Plane**
- Draw an Arc (R78, center at (0,0)) as shown in Fig.5
- (One endpoint must be on x-axis)
- Click ok to complete

Circle center at (0,0)

R 78

Endpoint on x-axis

A- 58

Fig5

Generative Shape Design

Exercise 2

(11) To make an Extrude:-

- Click "**Extrude**" icon

- Select **Sketch.5** as **Profile**

- (The Sketch Plane, **xy Plane** will be automatically selected as **Direction**)

- Enter <u>20mm</u> as **Limit.1**

- Enter <u>20mm</u> as **Limit.2**

- Click ok to complete
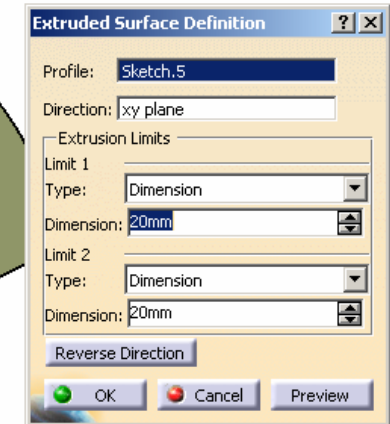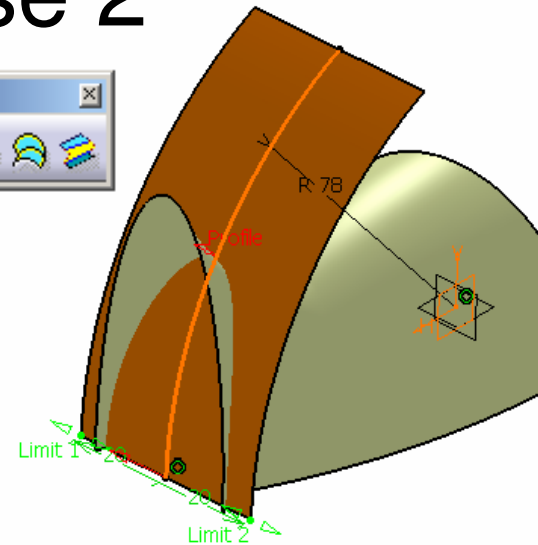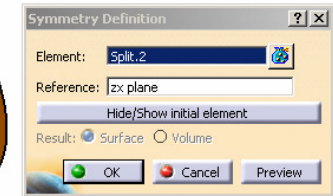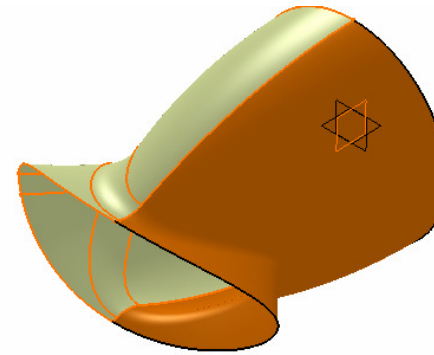

(12) To Split Surface:-

- Click "**Split**" icon

- Select **Fillet.1** as **Element to cut**

- Select **Extrude.1** as **Cutting element**

- (Click "**Other Side**" option to choose the bigger portion)

- Click ok to complete

- **Hide Extrude.1 & Sketch.5**



A- 59

Generative Shape Design
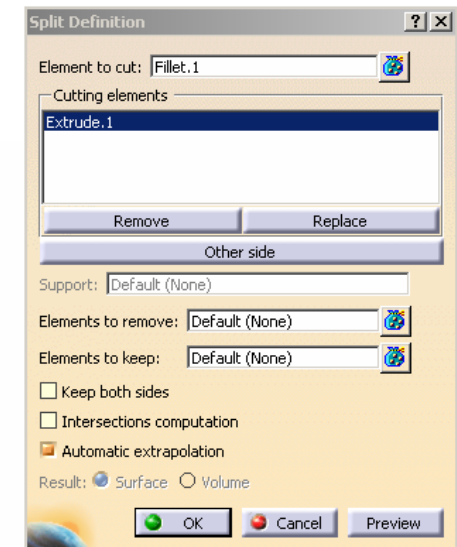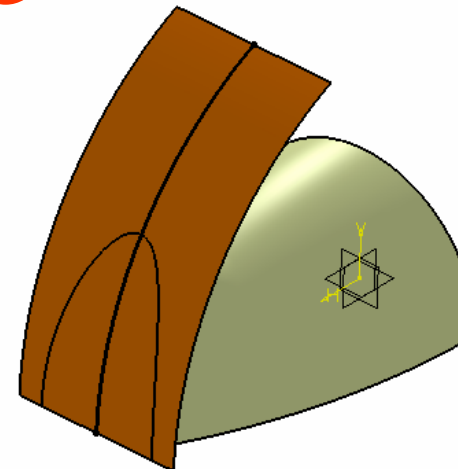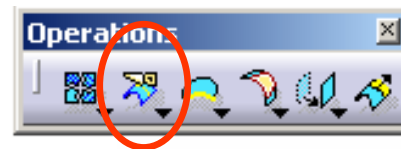
Exercise 2

(13) To make a Symmetry:-

- Click "**Symmetry**" icon
- Select **Split.2** as **Element**
- Select **zx Plane** as **Reference**
- Click ok to complete

(14) To visual-check the tangency continuity along the interface:-

- Click "**Shading**" icon
- (All black surface edges now disappear)
- Check if any sharp edge appears along the centre interface. If yes, go back to previous step(s) to correct the error.
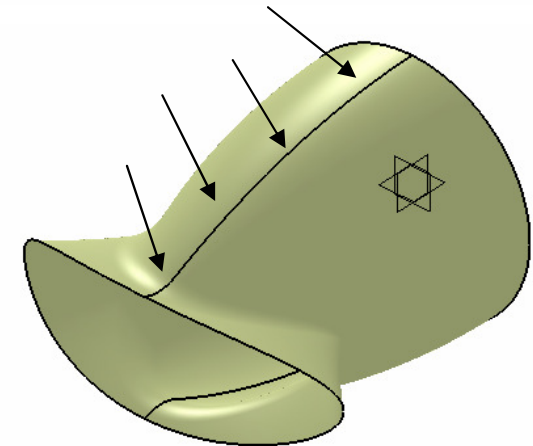

(15) To Join Surfaces:-

- Click "**Join**" icon
- Select **Split.2 and Symmetry.2** as **Elements to Join**
- Click ok to complete
- (Split.2 & Symmetry.2 will be hidden automatically)

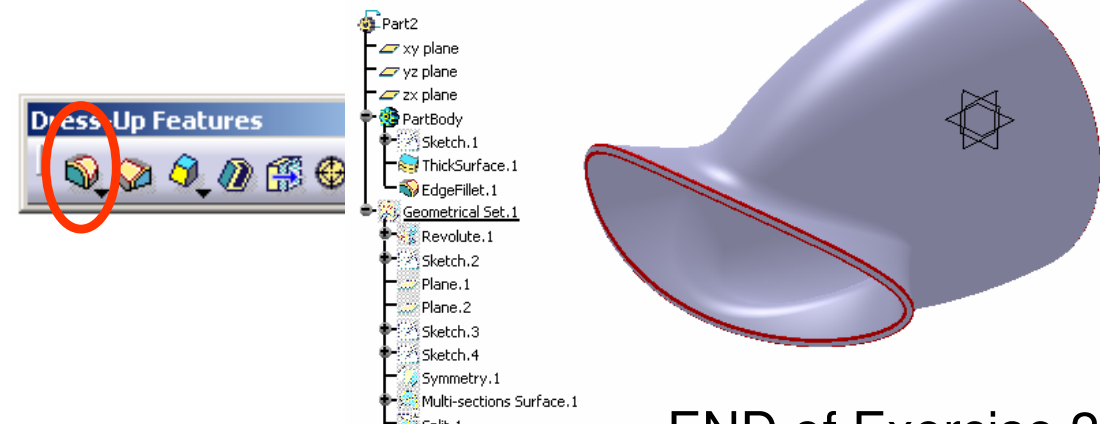A- 60

By Dickson Sham (ME dept, HKPU)

Exercise 2

(16) To make a Solid:-

- **Start/Mechanical Design/Part Design**
- Click "**Thick Surface**" icon
- Click ok on the pop-up warning window
- Select **Join.1** as **Object to Offset**
- Enter 2mm as **First Offset**
- (If the red-arrows are not pointing inward, click "Reverse Direction" or directly click on an arrow to change the direction)
- Click ok to complete
- **Hide Geometrical Set.1**
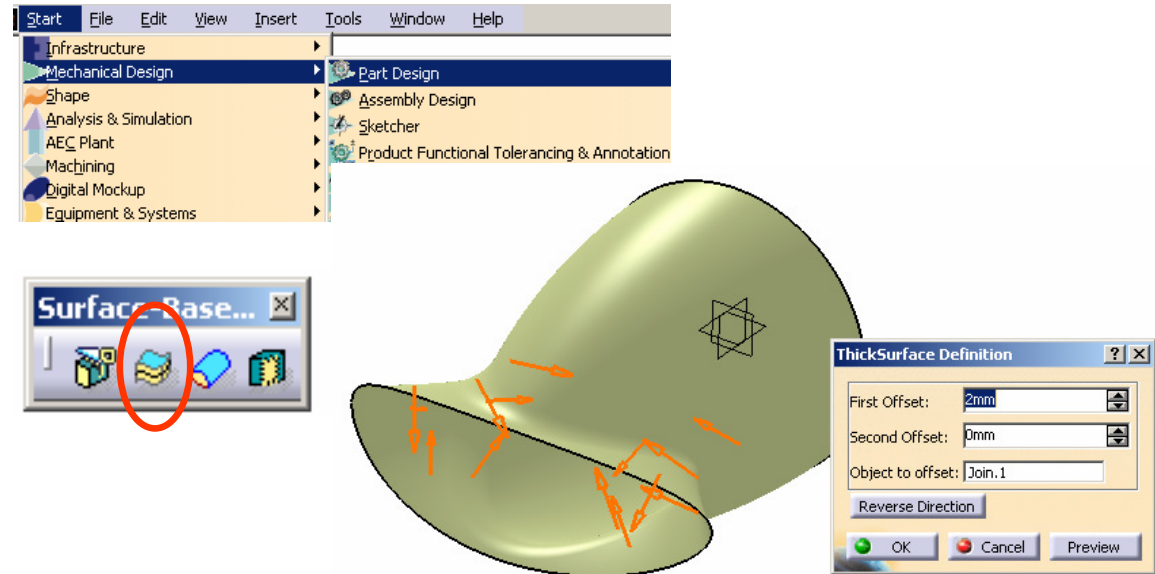
(17) To add Fillets onto the solid:-

- Click "**Edge Fillet**" icon
- Select **all sharp edges**
- Enter 0.5mm as **Radius**
- Click ok to complete

A- 61

END of Exercise.2