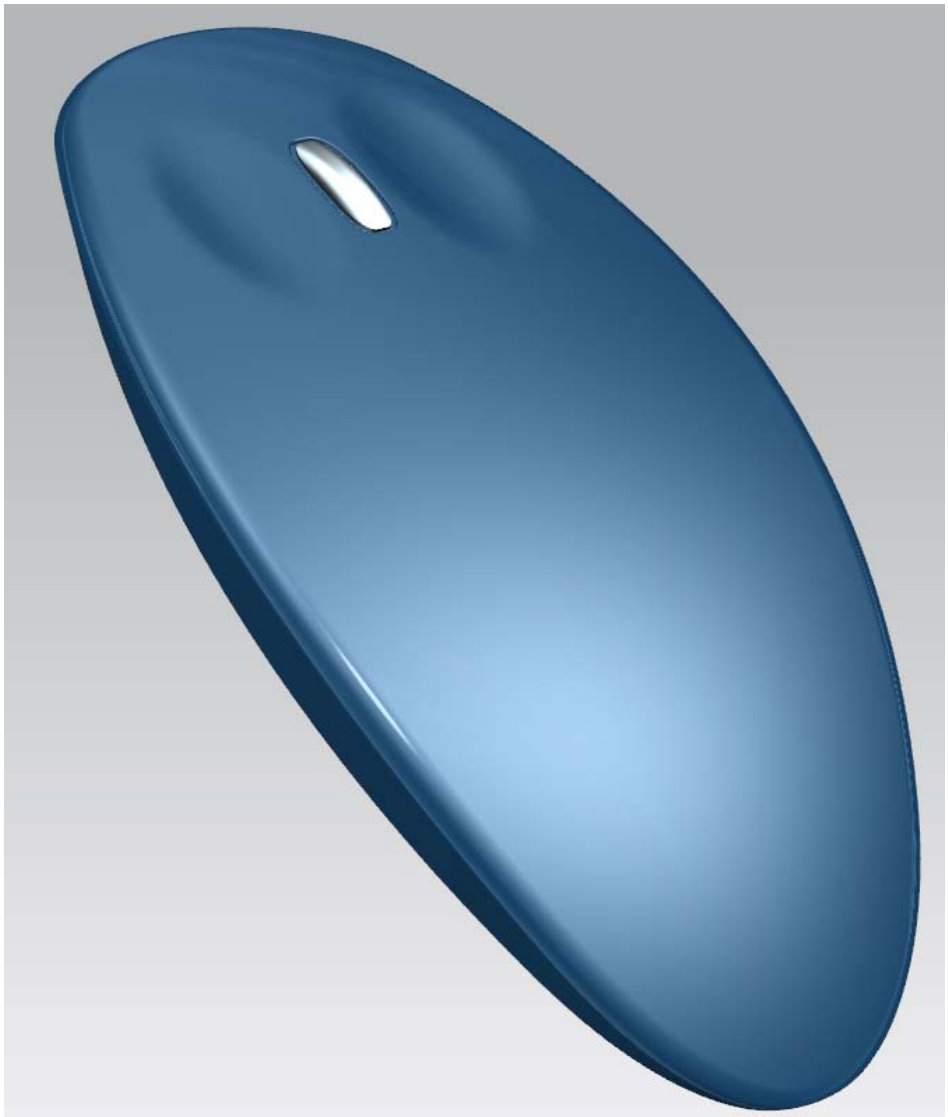
Using Siemens NX 11 Software

Surface Design - Mouse

Based on a YouTube NX tutorial[1].



[1] *https://www.youtube.com/watch?v=k92Id54oBw4*

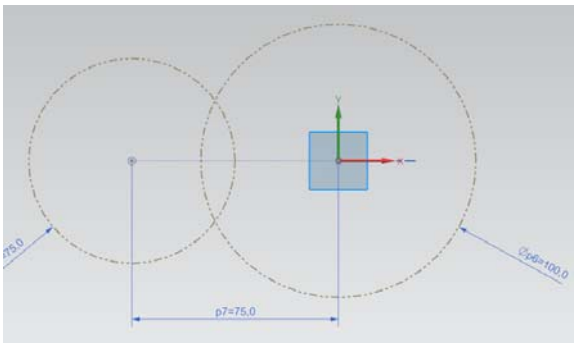
1 – Sketch A.

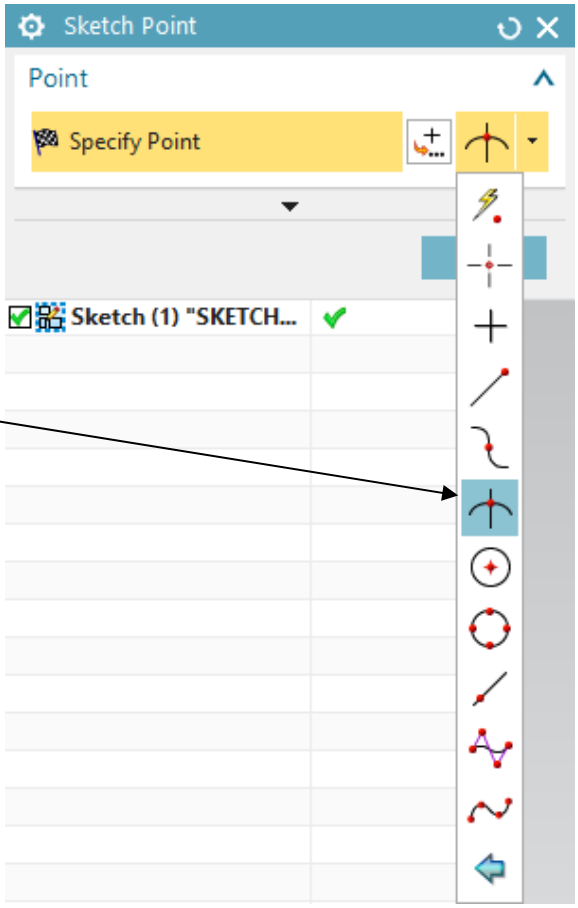
- Create a model file named *mouse.prt* and save it into your local folder.
- In the XY-plane draw a sketch consisting in a first circle of **100 mm** in diameter centred at the origin, and a second circle of **75 mm** in diameter which centre is located in the x-axis, **75 mm** left wise from the origin.
- Convert these circles as *References* by right-clicking on each one and select *Convert to Reference* in the menu.

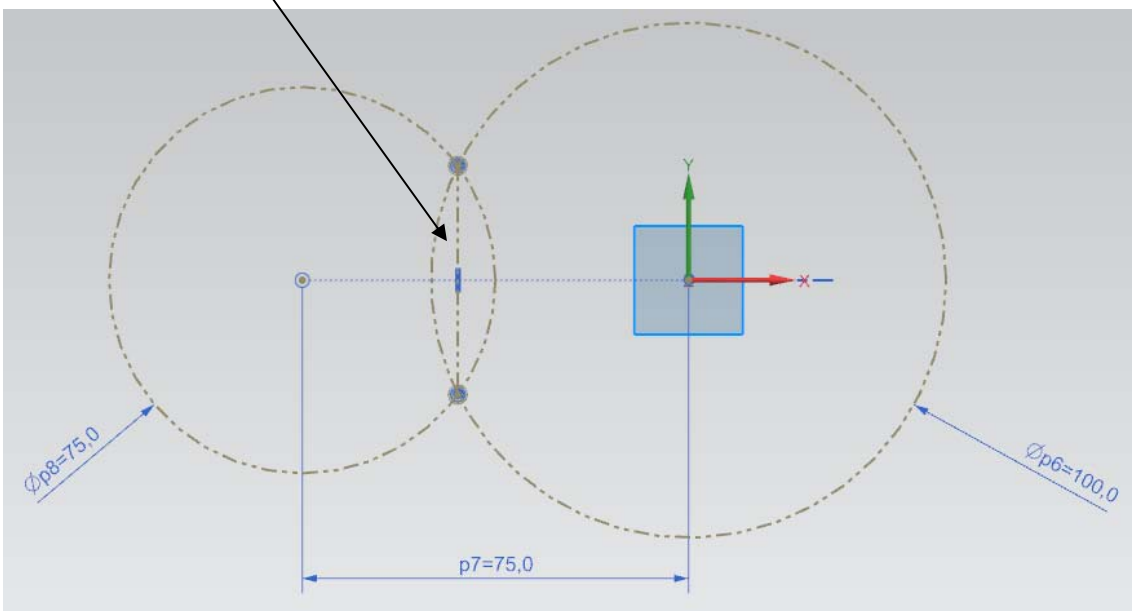
- Add two points (as *references*) at the intersections of the two circles.

- Click the *Point* button and select the *Intersection Point* option in the *Sketch Point* dialog box.
- Select the first circle and then the second one.
- Redo the above operations for the second intersection point.
- Convert these to point to *Reference Points* as done here above for the circles.

- Draw a *reference* line starting from one intersection point and finishing at the other.



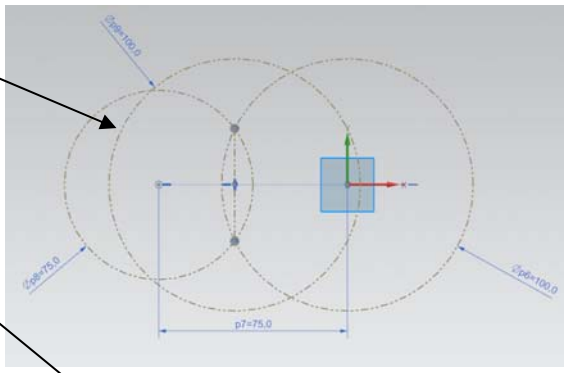


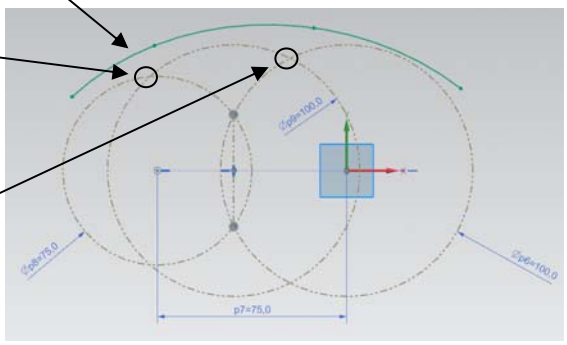


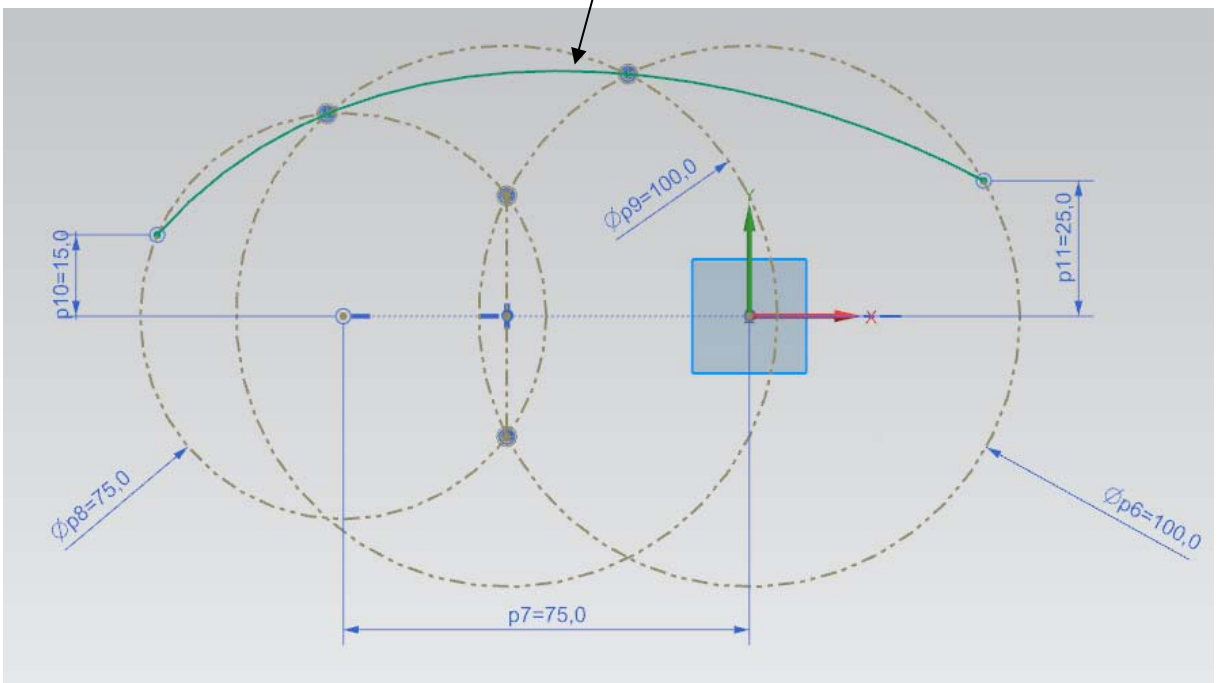
- Draw a *reference* circle of **100 mm** in diameter and centred on the middle point of the line.

- Using the *Studio Spline* button , draw approximately a 3-degree spline curve interpolating four point as shown.
- Add a *reference* point on the intersection between the left and centre circles with positive y-coordinate.
- Constraint the second interpolated point from the left of the spline to lie on the above point.
- Add a *reference* point on the intersection between the centre and right circles with positive y-coordinate.
- Constraint the third interpolated point from the left of the spline to lie on the above point.

- Constraint the left starting spline point (resp. right ending) to lie on the left (resp. right) circle.
- Constraint the y-coordinate of the left starting spline point (resp. right ending) to be **15 mm** (resp. **25 mm**).
- Hide all the reference elements (ctrl+b) and exit the sketch mode.



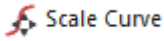




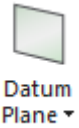
2 – Sketch B: offset, scale and projection.

- Select the spline curve in the visualization window (or in the *Part Navigator*).
- In the *Curve* tab of the toolbar click on the *Offset Curve* button 

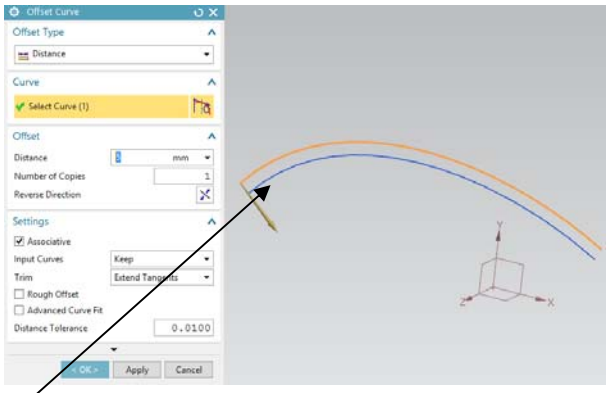
.
- In the *Offset Curve* dialog box, select *Distance* as *Offset Type* and use a distance of **5 mm**. Make sure the offset is oriented as shown.
- Click *OK* to validate.

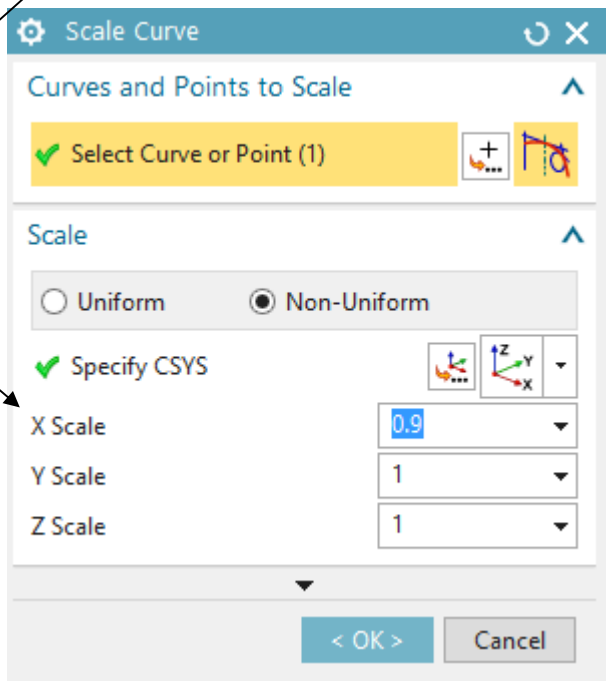
- Click on the *Scale Curve* button 

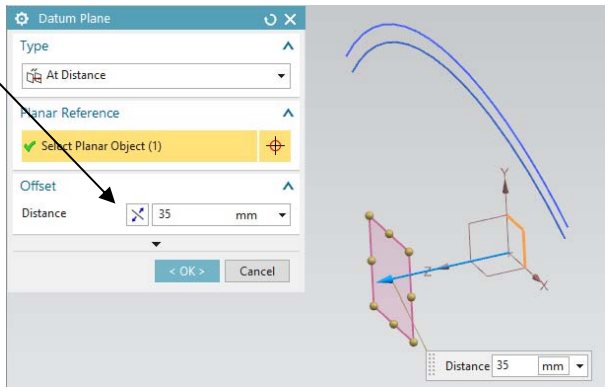
.
- Select the above offset curve and choose a non-uniform scale **x=0.9**, **y=1**, **z=1**.
- Hide the initial offset curve.

- Create a new datum plane by clicking the *Datum Plane* button 

. We will project the scaled curve on this plane.
- In the *Datum Plane* dialog box, select *At Distance* as *Type* and select the XY plane as *Planar Object*.
- Set the offset distance **35 mm** to the left.

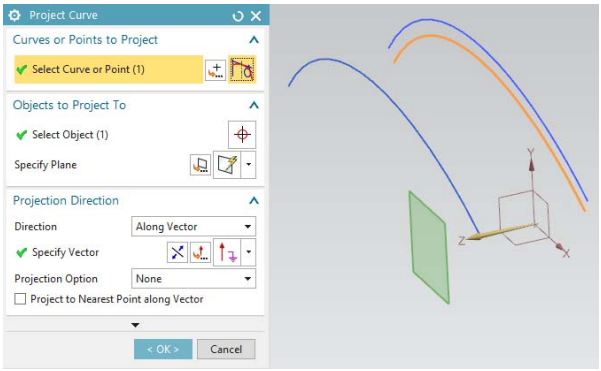






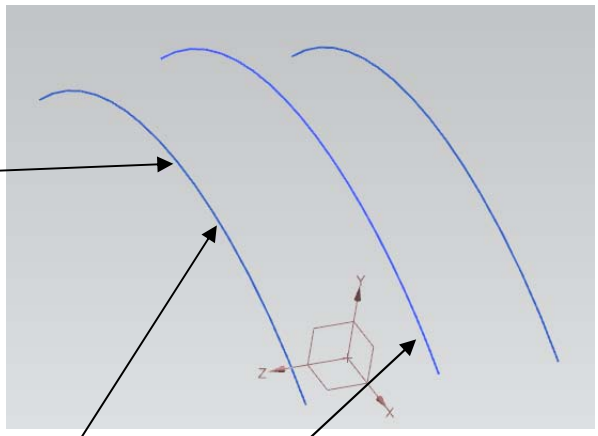
- Click on the *Project Curve* button 

, and project the scaled curve on the datum plane you just created.
- Hide the scaled curve.



3 – Mirroring a curve.

- Click on *Menu →Insert →Associative Copy →Mirror Geometry* and select the projected curve.
- In the *Mirror Geometry* dialog box, select as *Mirror Plane* the XY-plane.



4 – Upper surface of the mouse.

- Click on the *Through Curves* button

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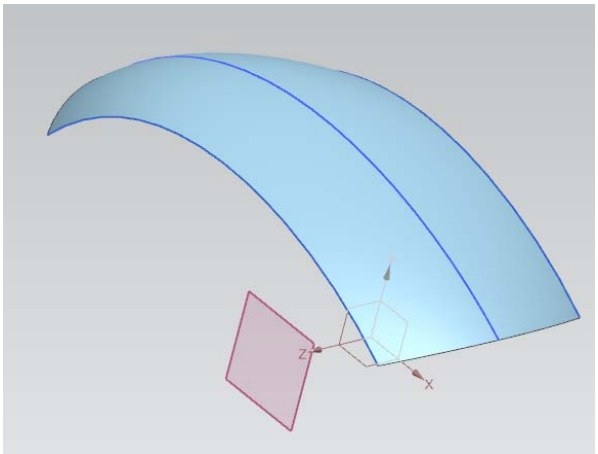
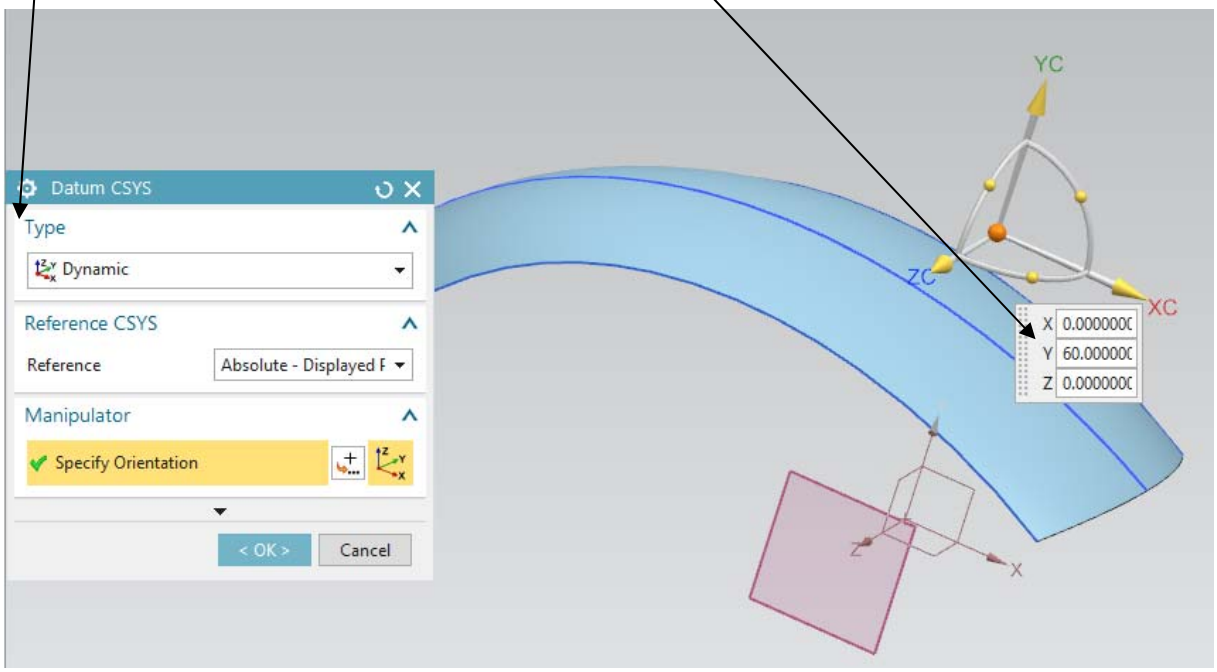
- Select the projected (left) curve an click on the *Add New Set* button 
.
- Select the middle curve and click the *Add New Set* button again 
.
- Finally, select the last (mirrored) curve and click *OK*.

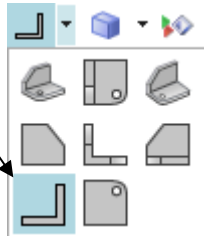


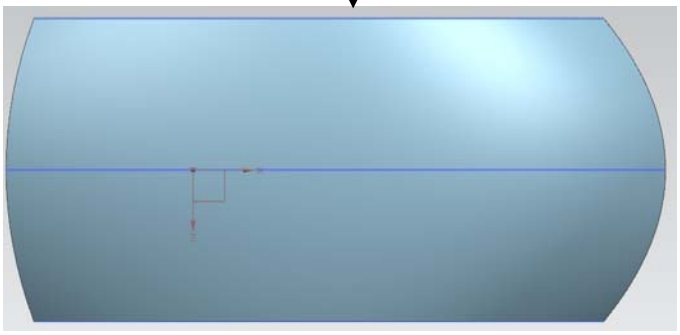
5 – Moving the *Datum Coordinate System*.

- Select the *Datum Coordinate System* (either in the visualization window or in the *Part Navigator*) and click on the *Edit Parameters* button  .
- In the *Datum CSYS* dialog box, check if the *Type* field is set to *Dynamic*.
- In the *Y* field, enter **60** (mm) and press *Enter*.
- Then, rotate the reference frame by **180 degrees** around the *YC* axis and click *OK*.



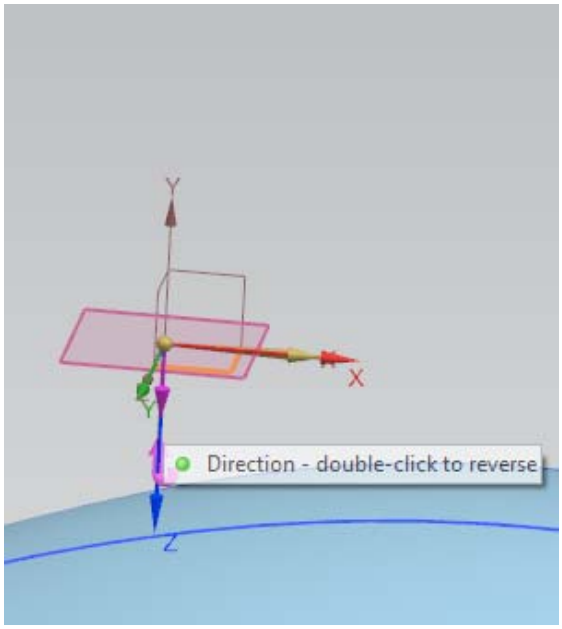
- Click on the *Back* view button.
- You should get the shown view.

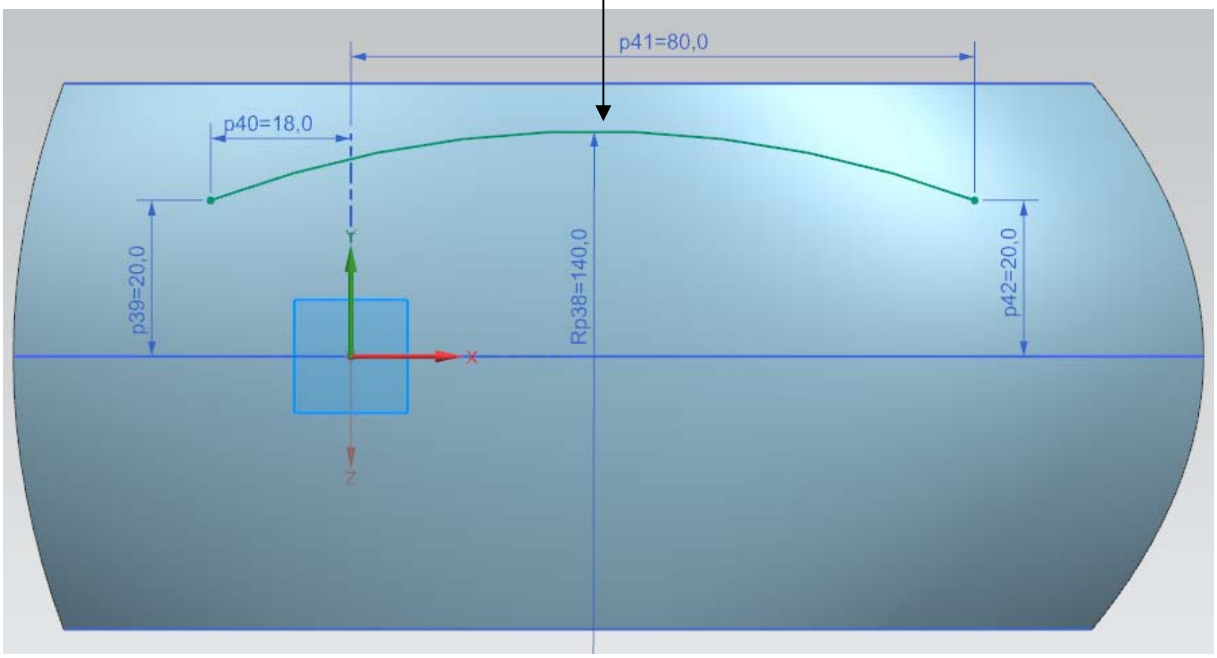


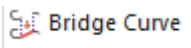


7.a – Surface trimming (sketch).

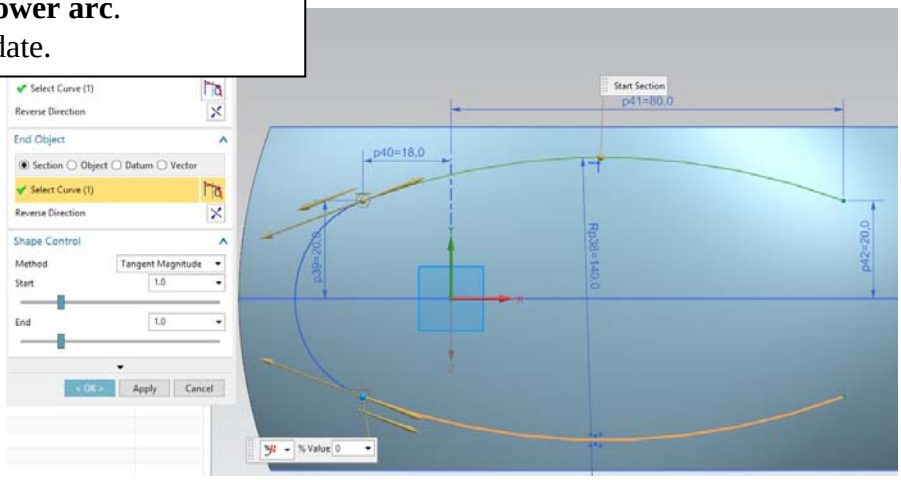
- Create a new sketch in the XZ-plane of the moved *Datum Coordinate System*. You can notice that the sketch will now be located above the mouse's surface.
- Double-click on the orange arrow along the local z-axis of the sketch reference frame in order to orient it upwards.
- Draw a 3-point arc of **140 mm** in radius with starting (i.e. left) point coordinate **(18, 20)** and ending (i.e. right) point coordinate **(80, 20)**.
- Create a symmetric arc w.r.t the x-axis.



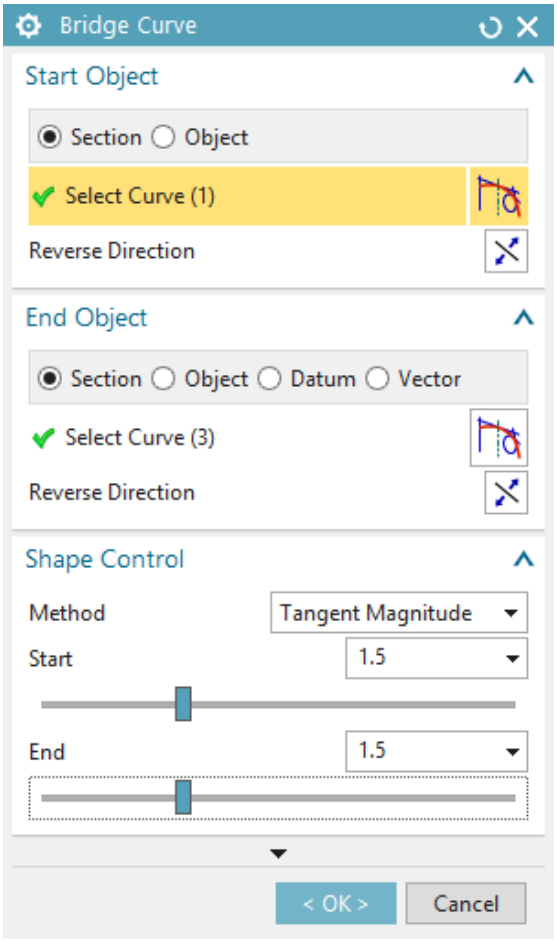


- Click on the *Bridge Curve* button 

.
- Select as *Start Object* the **upper arc** and as *End Object* the **lower arc**.
- Click *Apply* to validate.



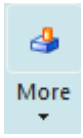
- Bridge the other side by selecting as *Start Object* the **lower arc** and, as *End Object* the **upper arc**.
- Set the *Start* and *End* options of the *Shape Control* field to **1.5**
- **Note**: if you do not manage to select the arcs individually, check if the *Curve Rule* filter is set to *Single Curve*.



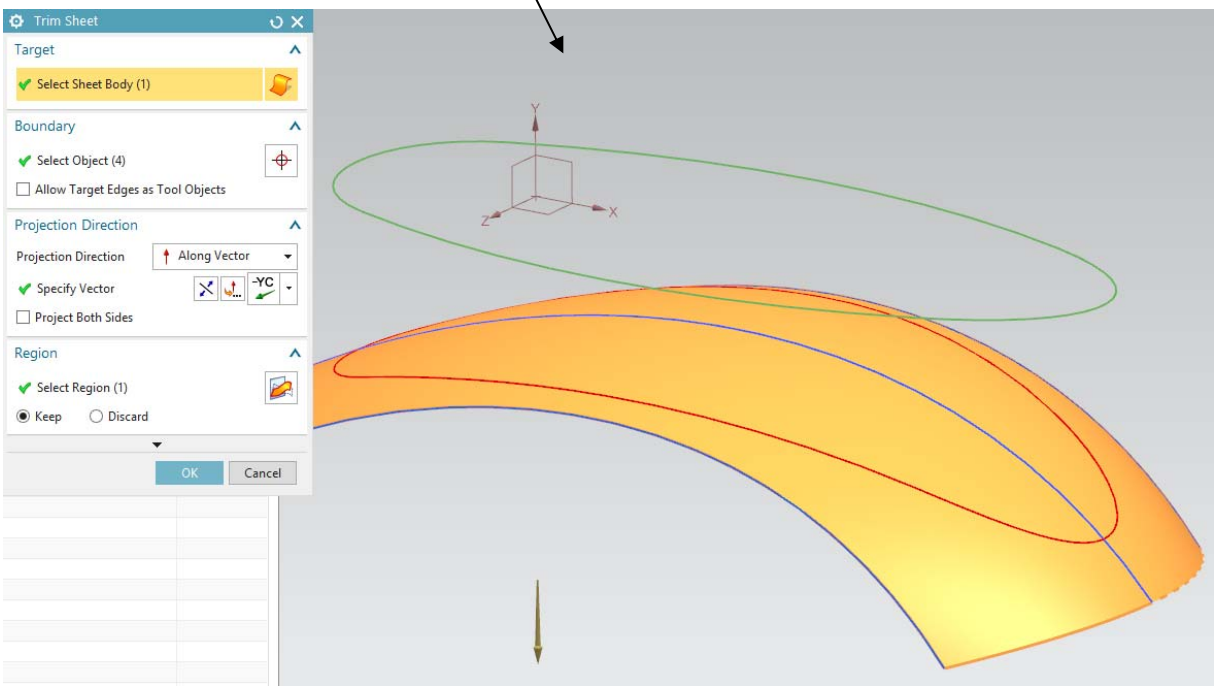
7.b – Surface trimming.

We will now trim the mouse's surface by using the above sketch.

- In the *Home* tab of the toolbar, click on the *Trim Sheet* button 

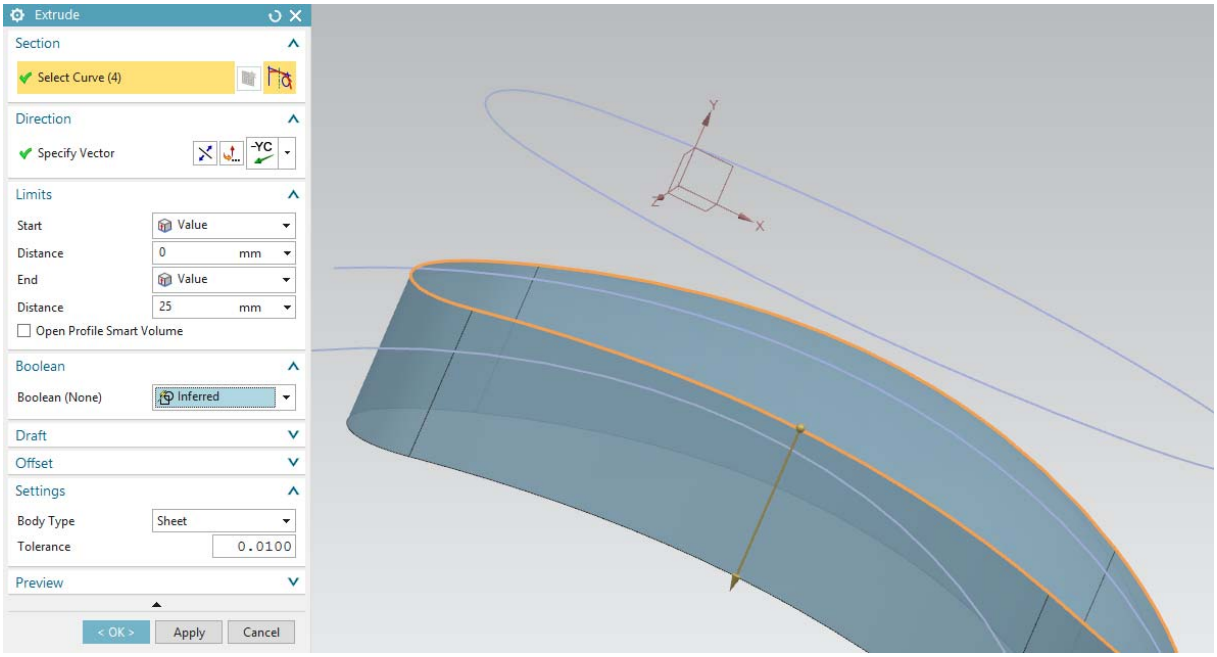
, under the *More* button 

of the *Feature* field.
- In the *Trim Sheet* dialog box, select as *Target* the mouse's surface.
- Select as *Boundary* the above sketch.
- Select as *Projection Direction* option *Along Vector* and select as projection vector the *–YC* axis.

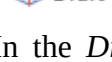


8 – Surface extrusion.

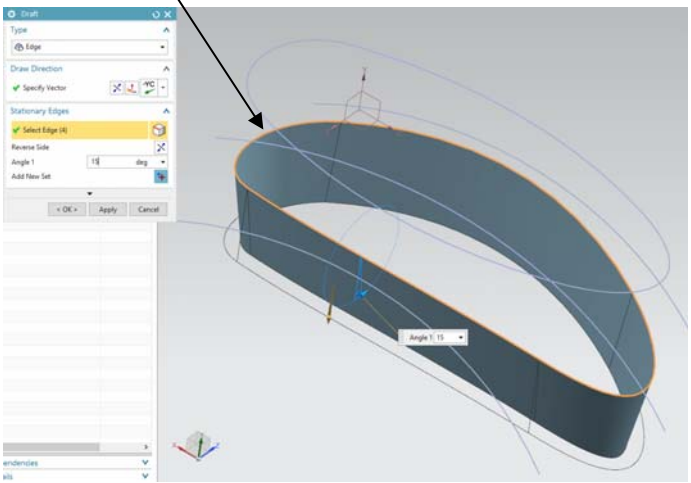
- Click on the *Extrude* button and extrude the above trimmed surface contour by **25 mm** along the *–YC* axis.
- In the *Settings* field, set the *Body Type* option to *Sheet*.



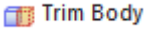
9 – Drafting a surface.

- Hide temporarily the (upper) mouse's surface and click on the *Draft* button 

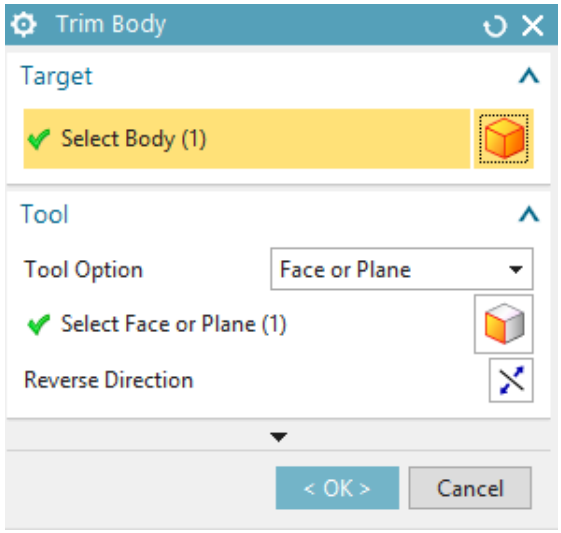
.
- In the *Draft* dialog box, select *Edge* as *Type* and the *–YC* direction.
- Select the upper edges of the last extrusion and use an angle of **15 degrees**.
- Make visible the mouse's surface.

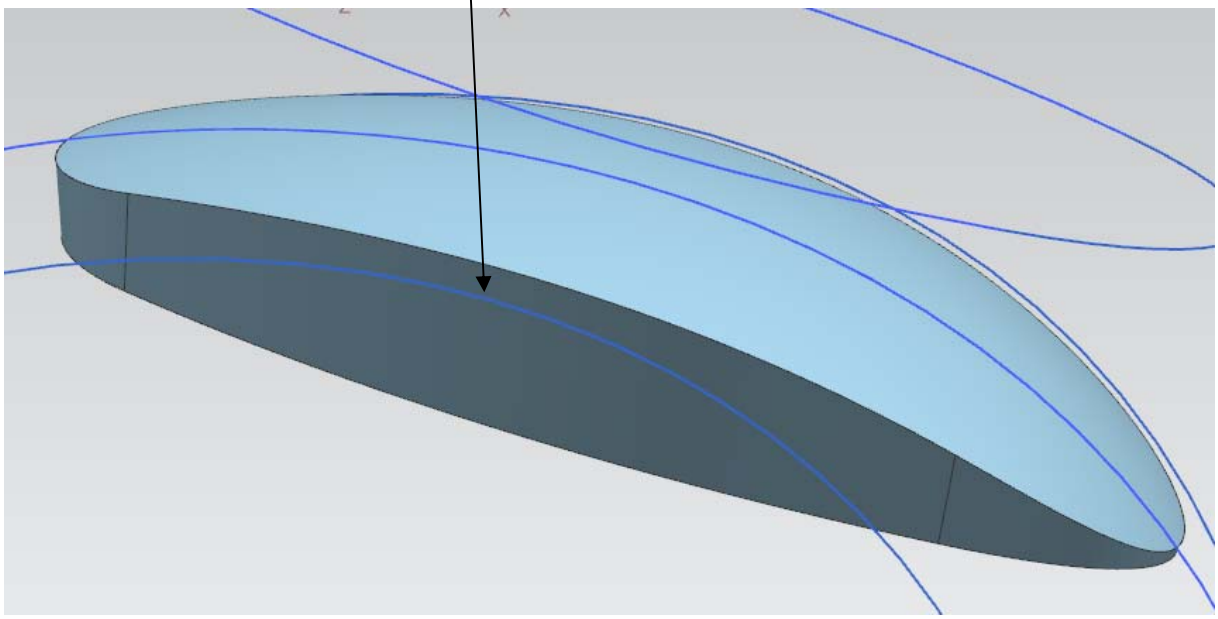


10 – Trimming the (drafted) extrusion.

- Create a datum plane parallel to the ZX-plane and located **38 mm** below it.
- Click on the *Trim Body* button 

.
- Select the (drafted) extrusion as *Target*.
- In the *Tool* field, select the above datum plane.
- **Note**: if needed, click on the *Reverse Direction* button  in order to keep the right part of the extrusion.

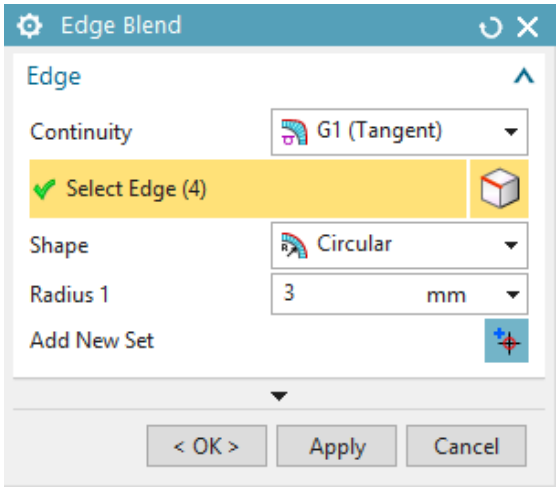




11 – Edge blending.

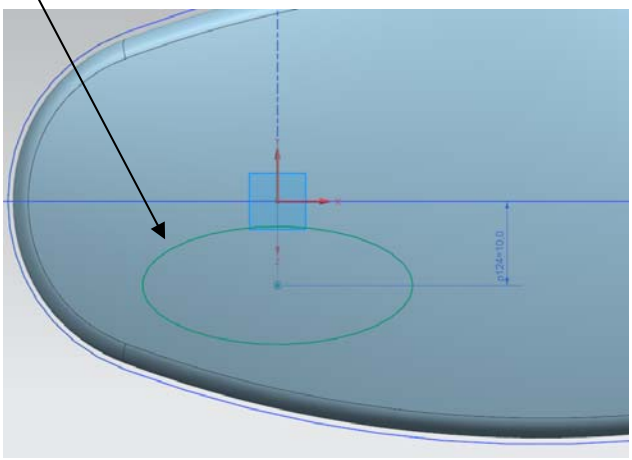
- Before blending edges, it is a good practice to *Sew* (i.e. connect) their corresponding surfaces.
- Click on *Menu →Insert →Combine →Sew...*
- Select as *Target* the (upper) mouse's surface and as *Tool* the (drafted and trimmed) extrusion.

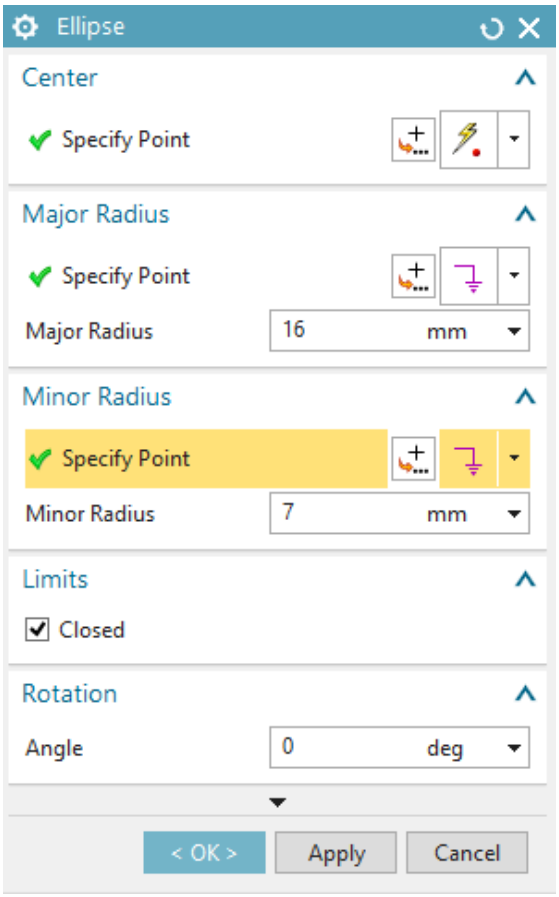
- Click on the *Edge Blend* button and select the edge connecting the mouse's surface with the extrusion.
- Enter a blend radius of **3 mm**.



12.a – Mouse buttons (sketch).

- Create a new sketch in the ZX-plane of the *Datum Coordinate System*. Do not forget to set the z-axis of the sketch's coordinate system to point upwards.
- Draw an ellipse (*Ellipse* button ) of major radius **16 mm**, minor radius **7 mm** and rotation angle of **0 degrees**.
- Constraint the ellipse's centre to be located along the y-axis and lie **10 mm** from the x-axis.
- Construct a symmetric ellipse w.r.t. the x-axis and exit sketch mode.

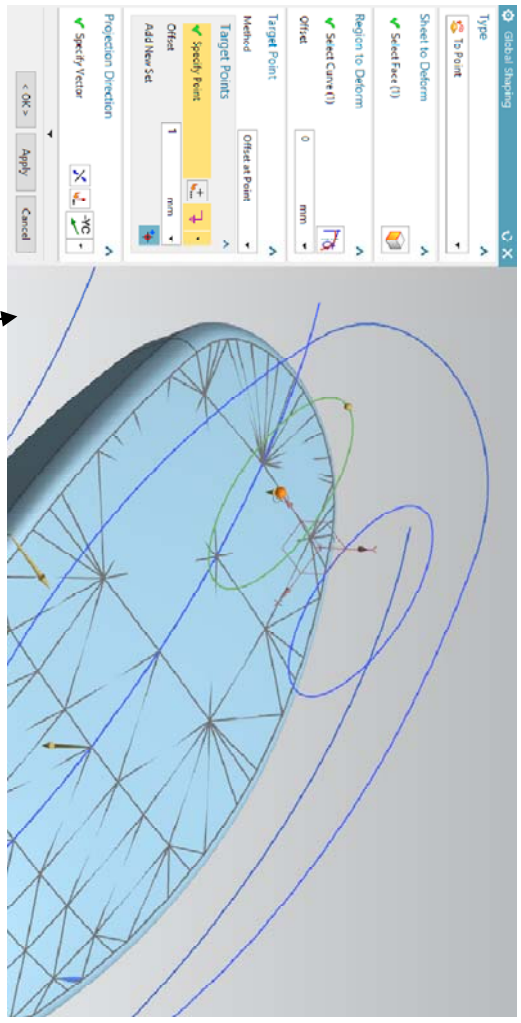




12.b – Mouse buttons.

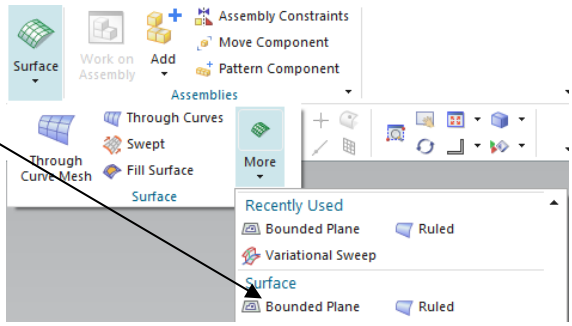
The (upper) mouse's surface will be deformed within the regions defined by the two above ellipses for figuring the mouse buttons.

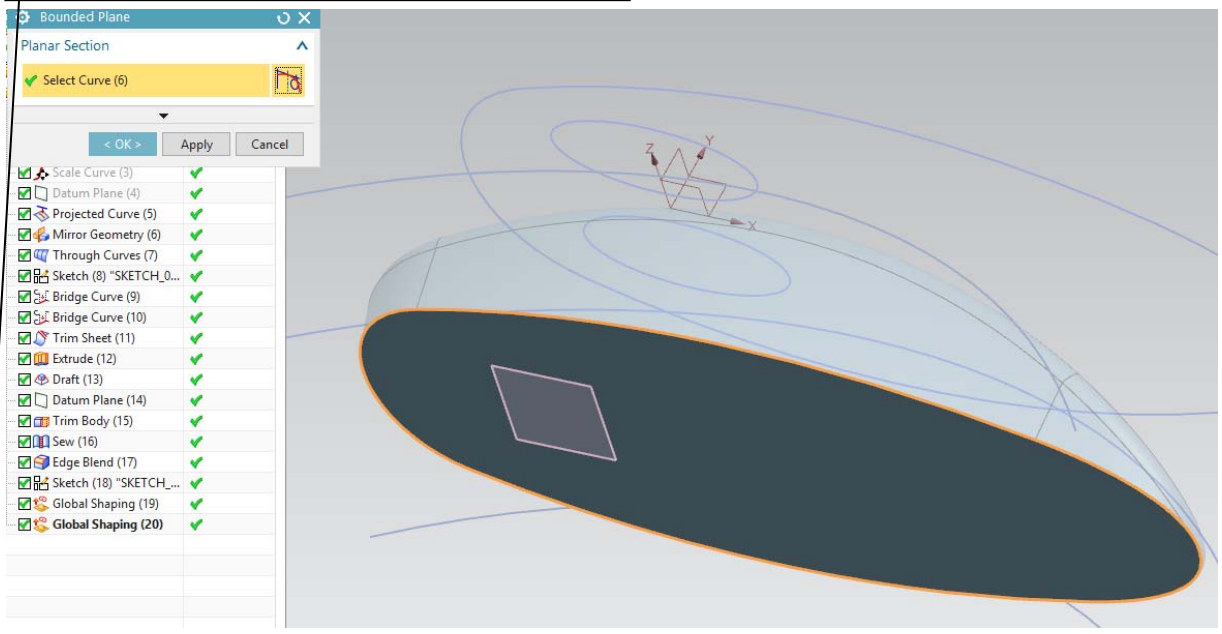
- Click on *Menu →Edit →Surface →Global Shaping*.
- In the *Global Shaping* dialog box, select the (upper) mouse's surface as *Sheet to Deform*.
- Select as *Region to Deform* a first ellipse.
- In the *Target Point* field, select a **1 mm** *Offset* and use the *–YC* axis as *Projection Direction*.
- Click *Apply* and redo the above operations for the second ellipse.

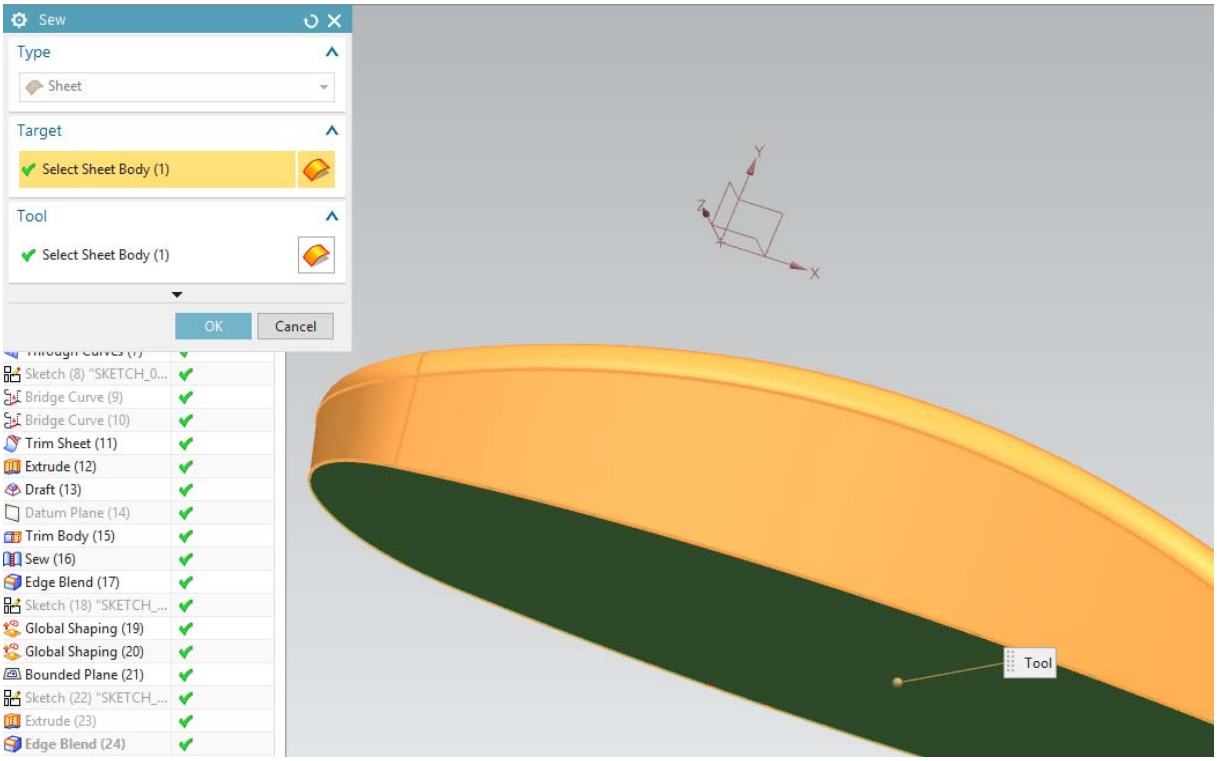


13 – Closing the mouse bottom.

- Click on the *Bounded Plane* button.
- Select the bottom curves of the mouse in order to close its bottom.
- Sew (*Menu →Insert →Combine →Sew*) this new plane with the remaining of the mouse.
- Add an edge blend of **1 mm** between this plane and the remaining of the mouse.
- Finally, hide all the sketches.

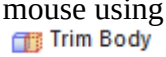


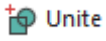




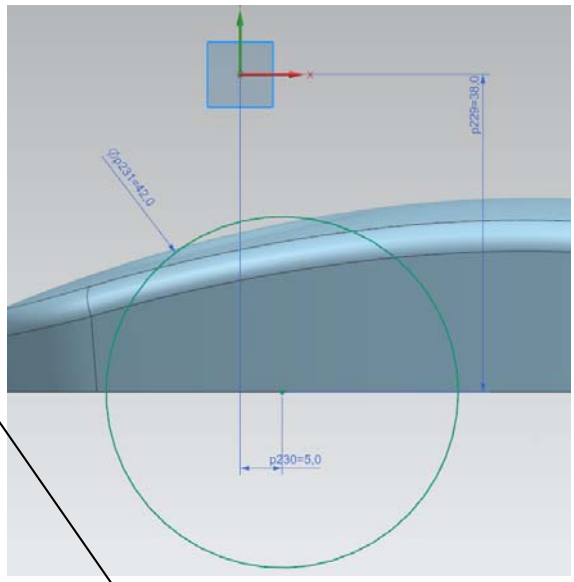
14 – Designing the mouse's wheel.

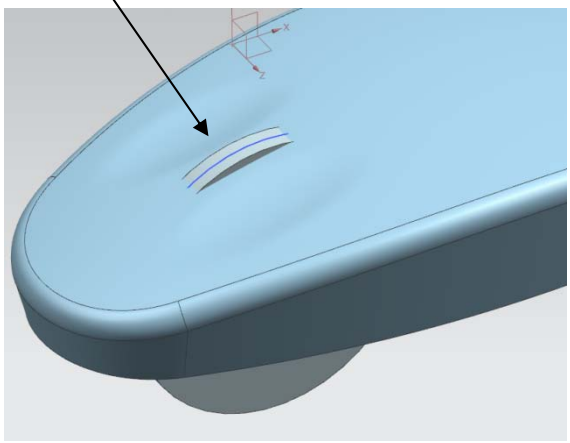
- In the XY-plane, draw a circle centred at coordinates **(5, -38)** and of **42 mm** in diameter.
- Extrude the circle by **2 mm** from either side of the curve in order to obtain a cylinder (check if the *Body Type* option is set to *Solid* and the *Boolean* option to *None*).

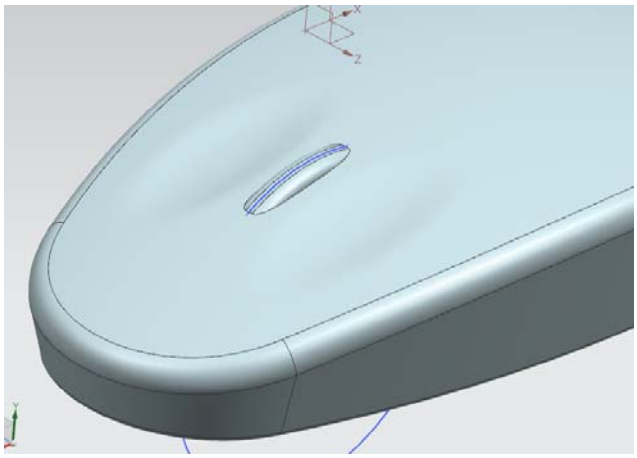
- Apply an edge blend of **1.5 mm** on both edges of the cylinder.
- Trim the cylinder by the bottom of the mouse using the *Trim Body* button 

.
- Finally, unite 

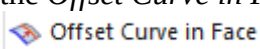
the trimmed cylinder with the mouse.







15 – Hole around mouse's wheel.

- In the *Curve* tab of the toolbar, click on the *Offset Curve in Face* button 

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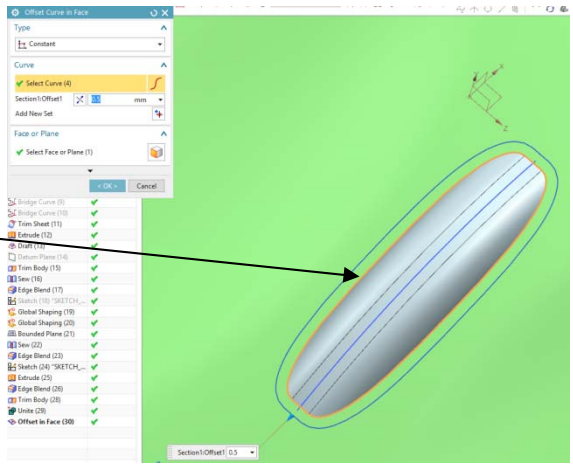
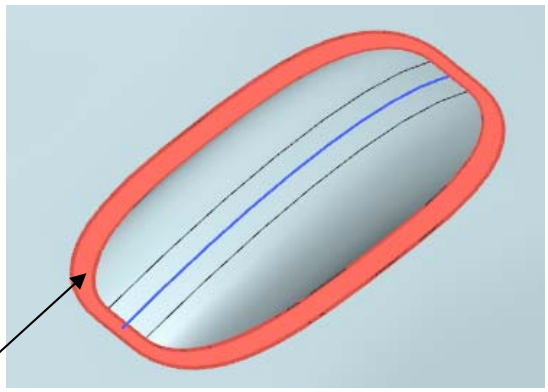
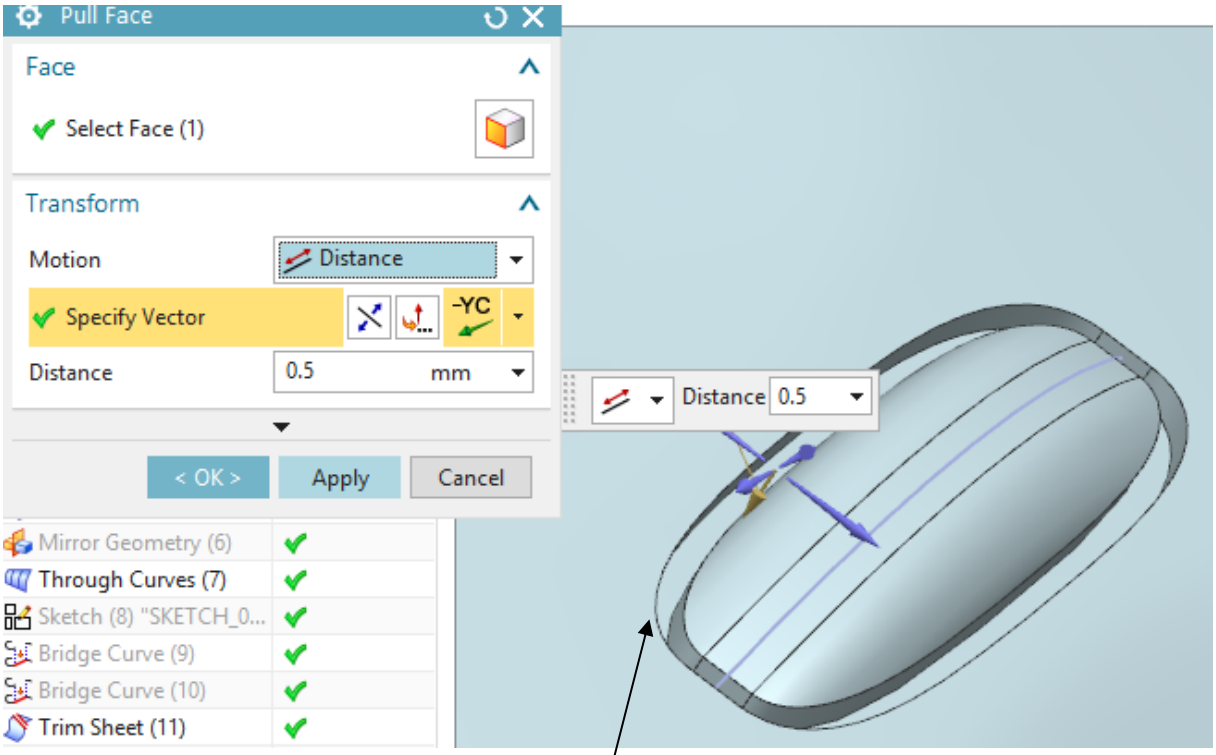
- In the *Offset Curve in Face* dialog box, set the *Type* option to *Constant* and select the intersection curve between the mouse's wheel and its upper face. Set the *Offset* option to **0.5 mm**.

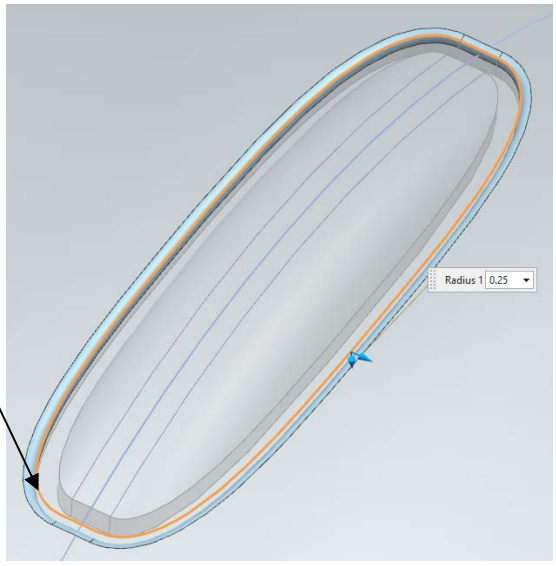


- Divide the upper face of the mouse into two parts using the offset curve as boundary. For this, click on the "*Menu →Insert →Trim →Divide face* button Divide Face... .
- Click on the *Pull Face* button Pull Face located under the *Home* tab of the toolbar, under the *More* button of *synchronous Modelling*.
- In the *Pull Face* dialog box, select the small face surrounding the mouse's wheel.
- Specify the *–YC* vector and a *Distance* of **0.5 mm**.

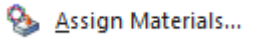




- Apply an edge blend of **0.25 mm** on the shown edge.
- Finally, hide any visible sketch.



16 – Materials and visualization.

- Select the *Assign Material* button 

located in *Menu →Tools →Materials* and select *Polycarbonate* as material.

- In the *Render* tab of the toolbar, click on the *True Shading* button 

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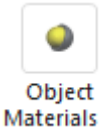
- Select all the mouse **surfaces** but the external (visible) faces of the wheel.
- Click on the *Object Materials* button 

and select the *Blue Glossy Plastic* button.

- Eventually, hide the *Datum Coordinate System*.
- You should obtain an object as shown at the beginning of this tutorial.