CAD / CAM Projects

Modelling a Ring (or Bangle) in Pro/Engineer

If you're using this tutorial to model a bangle, then where the word 'ring' is used, substitute 'bangle'. The only places where a bangle is specifically mentioned is where alternative dimensions are suggested.

This tutorial assumes that you have worked through the key fob tutorial beforehand.

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Creating a folder to store your project in

Navigate to your 'CDT' folder.

Inside your CDT folder, create a folder called 'ring'.

Opening an internet connection

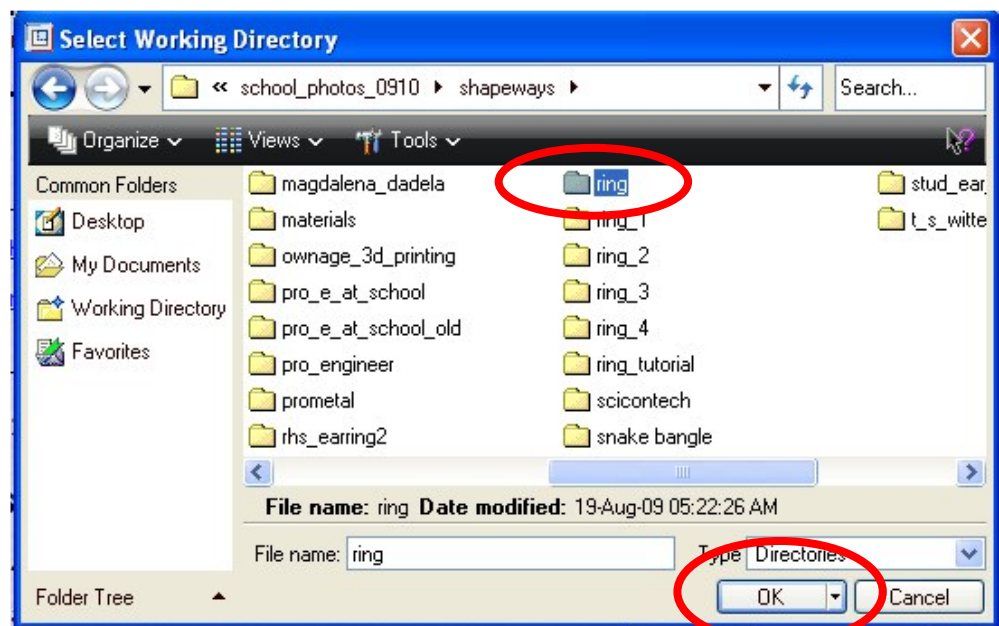Pro/ENGINEER requires an internet connection to be open before it is launched.

Launch Firefox, log in, and navigate to a web site (any one will do).

Setting the 'Working Directory' in Pro/ENGINEER

Launch Pro/ENGINEER.

In Pro/ENGINEER, go to **'File / Set Working Directory'**

Navigate to your 'CDT' folder. Highlight the 'ring' folder (but don't go in to it). Select 'OK'

The 'Select Working Directory' dialogue box. Please note that the content of your 'CDT' folder will be different from what is shown here.

Beginning your ring (or bangle)

In Pro/ENGINEER, go to **'File / New'**
The 'New' dialogue box opens. You'll notice that 'Part' is already selected - your ring will be a 'part'. In the 'Name' field, type in ring.

Now select 'OK'.

Pro/Engineer's main window will now change to grey, ready for you to begin drawing.
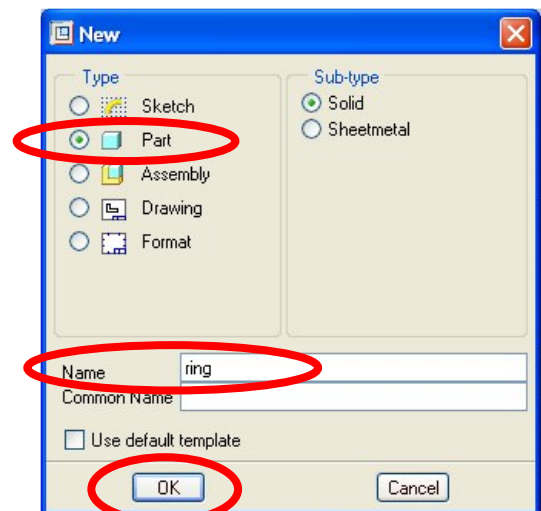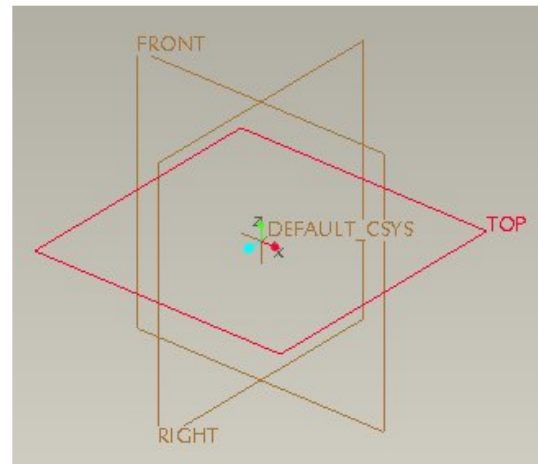

The 'New' dialogue box

cont.

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Starting a 'Sketch'

In the 3D window, hover your cursor over the top 'work plane'. You'll notice that it pre-highlights in turquoise. Now left-click on it to select it, and it will turn red.

With the front work plane still selected, click on the 'Sketch' icon, in the main toolbox (usually over to the right of the screen)...
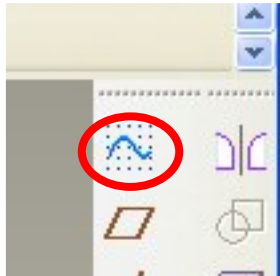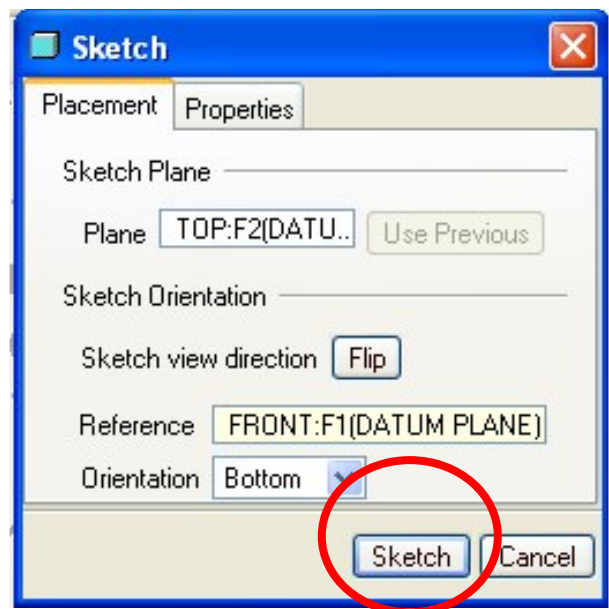
The 'Sketch' icon.

The top 'work plane', selected.

...The 'Sketch' dialogue box now opens, the top workplane spins around so that you're looking down on it, and the 3D window turns black. You're now in Pro/ENGINEER'S 'Sketcher'. Select 'Sketch' in the sketch dialogue box, and now you're ready to draw.

Select 'Sketch' in the Sketch dialogue box.

Sketching your ring - the cross-sectional shape

Start by drawing out a circle in the centre of the screen (by snapping on to the 'origin').

To do so, click on the circle icon in the toolbox.

Now hover your cursor over the 'origin' (where the vertical and horizontal lines in the 3D window meet) then left-click and drag out a circle.

Now select the 'select' icon, and a diameter dimension will appear at your circle. Double-click on the dimension and change the size to be a fit for your finger.

Now draw out another circle and make it 4mm larger in diamter than the first circle.

The 'circle' icon.

(For a bangle, these dimensions should be approx. 68mm and 74mm)

The two circles, with dimensions visible.

The 'select' icon.

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Sketching your ring - troubleshooting

Remember to 'troubleshoot' your sketch using the 'diagnostics' tools, before selecting the black tick to 'OK' your sketch.

Locate the 'diagnostic' icons - usually in the toolbar running across the screen above the 3D window. They allow you to check if all is well.

Refer to the key fob tutorial for detailed information about the diagnostics tools.

'Shaded Closed Loops'

'Highlight Open Ends'
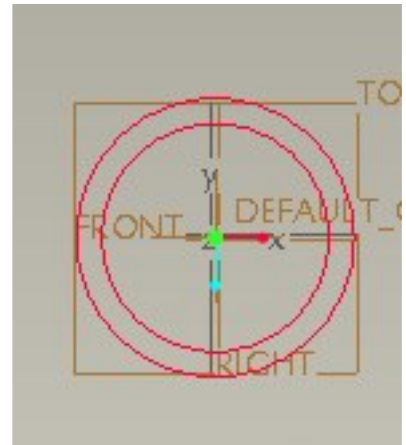
'Overlapping Geometry'

'Feature Requirements'
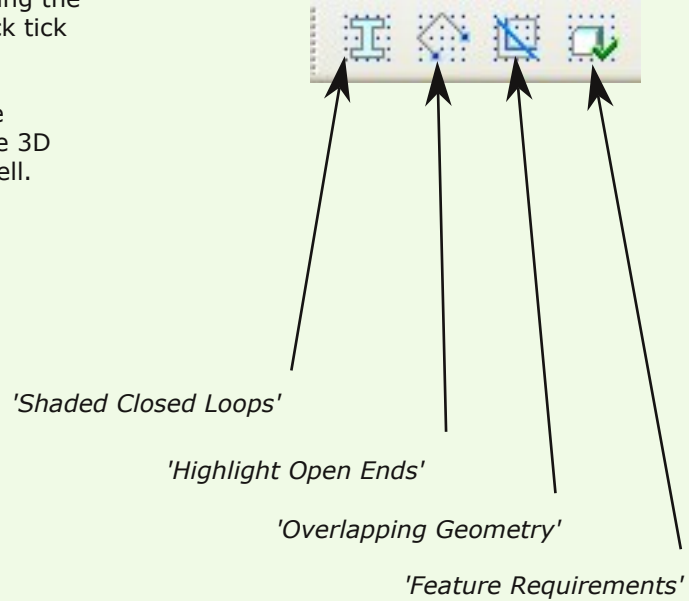
Sketching your ring - sketch done

Only when you're confident that there aren't any faults in your sketch should you click on the 'Done' tool (the 'tick' symbol). If all is well, your sketch will now be ready to 'extrude'.

The completed sketch, ready to extrude.

Saving your work

In Pro/ENGINEER, you can't save your sketch while you're working in the 'sketcher'. You always have to select 'done' (the black tick), and come out of the sketcher, even when you haven't finished your sketch, to be able to save your file.

Now that you're out of the 'sketcher' go to
'File / Save'
The Save dialogue box will appear. All you do is select 'OK', and alter nothing.
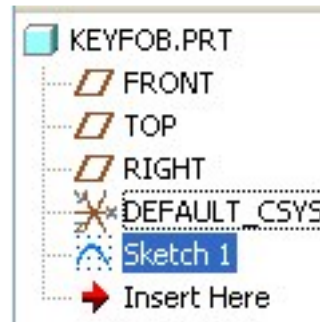
Extruding your sketch

Make sure your sketch is selected, over in the menu tree to the left of the screen (it will be listed as sketch 1), then select the 'Extrude' tool.

Your sketch will then change to show it extruding. However, to see your object in 3D, you need to click down on the wheel of the mouse and drag a bit.
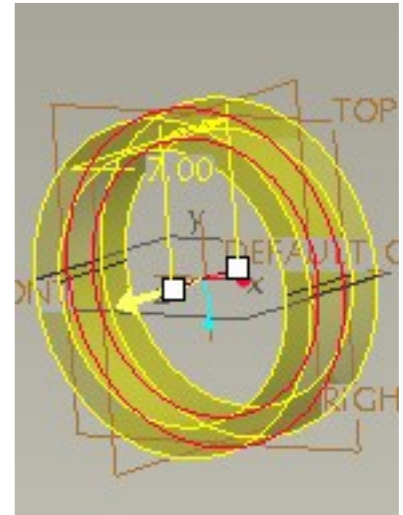
Go to next page for more...
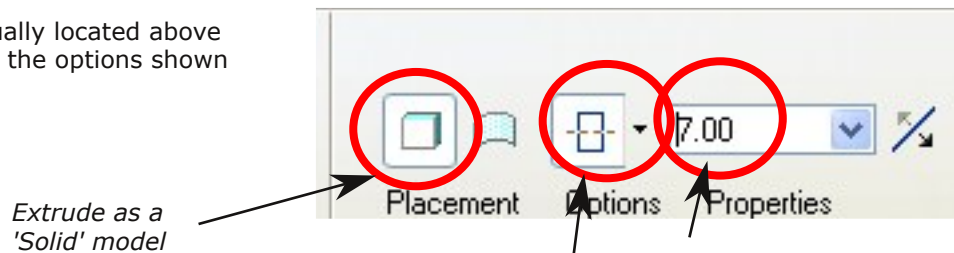

The sketch, selected in the menu tree

The 'Extrude' tool

Your sketch should appear to extrude, though you'll need to click on the wheel of the mouse, and drag a bit to see this.

In the 'dashboard' (usually located above the 3D window), select the options shown here.

Extrude as a 'Solid' model

Extrude out equally both sides of the sketch

Total length of the extrusion. You may decide to make your ring larger. If you're modelling a bangle, you might try 20mm.

Completing the extrusion

In the 'dashboard' select the green tick symbol to accept the extrusion.

The basic 3D form of your ring should now appear, all in grey.

You're now ready to round the edges and cut some holes in it.

Save you work before continuing.

Select the green tick to accept the extrusion

The basic 3D form, ready to have edges rounded and cut some holes

'My sketch didn't extrude properly'

The most common reason why sketches don't extrude properly is that the designer hasn't gone through all the diagnostic tools before selecting the 'done' tick in the sketcher.

If you need to, reactivate your sketch, by selecting it in the menu tree (to the left of the 3D window). Right click on the word 'Sketch1' and select 'Edit Definition'. You'll then be able to fix your sketch.

For full details, refer back to the key fob tutorial.

Rounding the edges of your ring

Rounding your edges is essential, to ensure that your ring is comfortable to wear, and take on and off.

Select the edges
Select the first edge you'd like rounded by hovering your cursor over the edge then left-clicking on it. Now hold down the control button -'Ctrl' - on the keyboard, and left-click to select all the other edges you'd like rounded. Once you've done this, you're ready to select the 'Round' tool.

The 'Round' tool
Select the 'round' tool from the vertical menu - usually more than halfway down the right side of the screen. If Pro/ENGINEER is able to calculate the rounding of all your edges it will now indicate yellow lines showing you how much rounding it recommends.
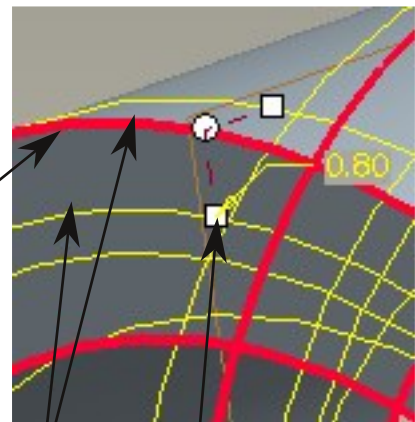
In the screenshot, a round of 0.8mm has been selected.

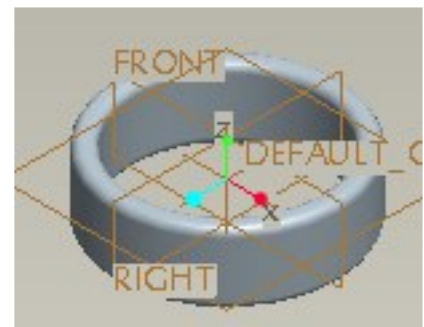Click on the green tick to complete the round, then save your file again.

The 'Round' tool

The selected edges are red

The size of the round is indicated in yellow.

Dragging one of the white handles increases or decreases the size of the rounding.

Rounded edges
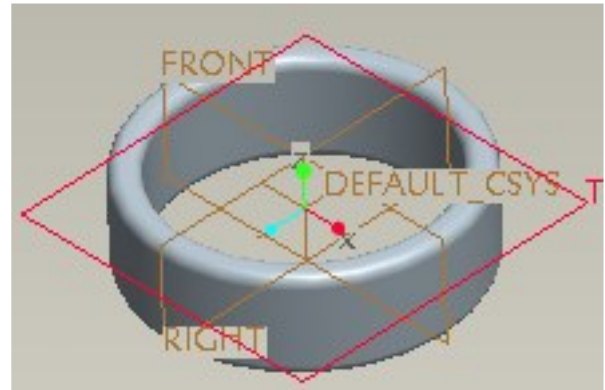
Adding an 'Axis'

In order to cut a 'pattern' of repeating holes around your ring, you need to add an 'axis'.

First, orient your ring so you're looking down on it, and select the 'top' workplane.

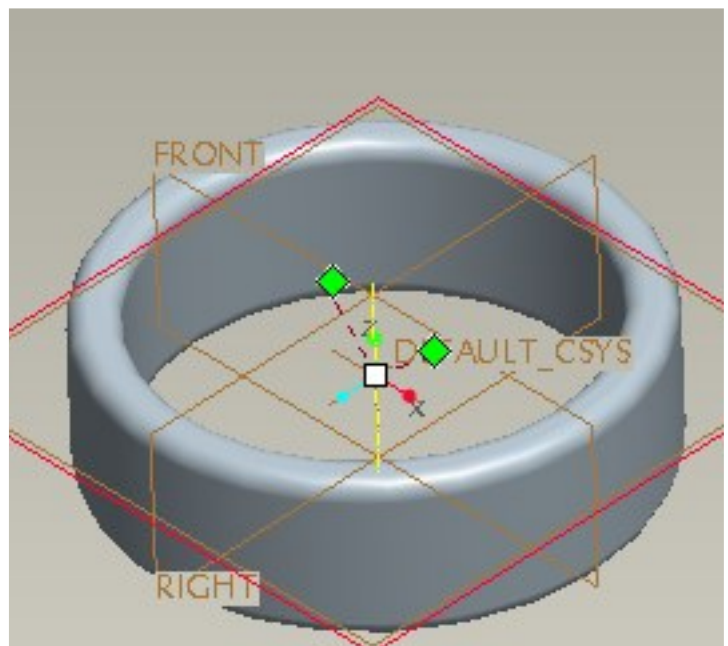Now select the axis tool. The 'Datum Axis' dialogue box opens, but ignore it for now...

The 'Axis' tool

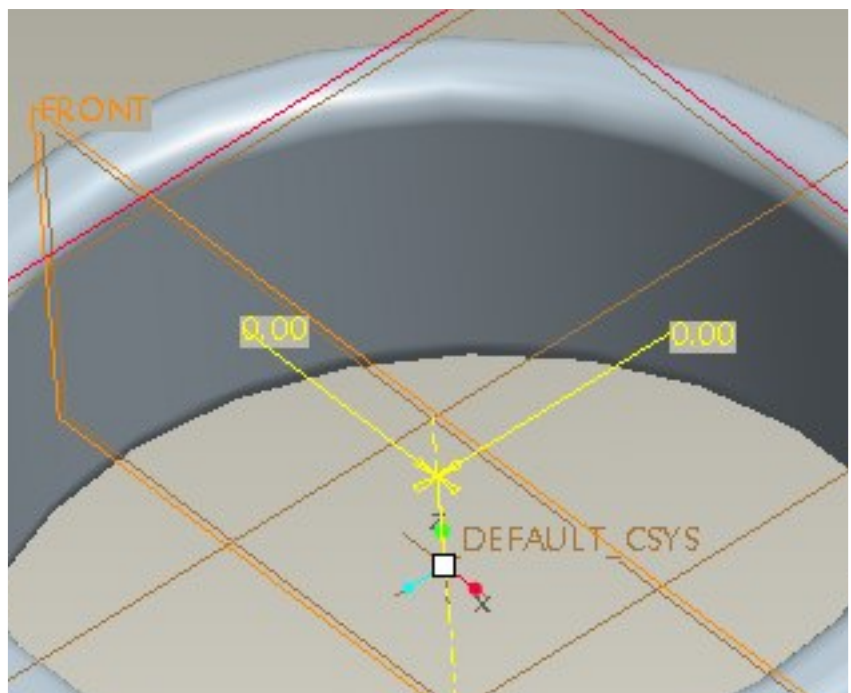*The ring with the top workplane selected.*

In the 3D window, two green handles appear. Move one of the handles so that it snaps on to the 'front' workplane, and the other so it snaps on to the 'right' work plane.

The green handles, ready to be snapped on to the front and right workplanes.

Once the green handles have been snapped to the front and right workplanes, the axis should appear as a dashed yellow line. There should also be two yellow dimensions, and they should each be 0.00 in size.

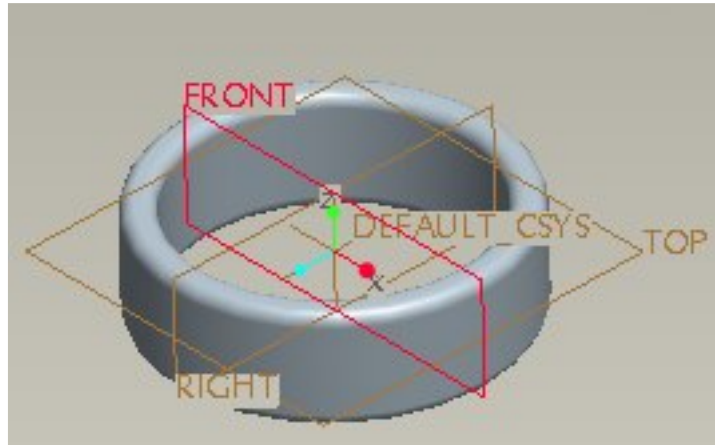Now select 'OK' in the 'Datum Axis' dialogue box.

The axis, indicated as a dashed line in yellow.

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Starting a sketch for the hole in your ring

A new sketch will be needed to allow you to cut a hole through the ring.

Hover your cursor over the front work plane and select it...

The ring with the front workplane selected.

Now select the sketch symbol. The 3D window will turn black as you enter the 'sketcher' and your object will rotate to face the front work plane. The 'Sketch' dialogue box will also appear.

Select 'Sketch' in the Sketch dialogue box.

The 'Sketch' tool

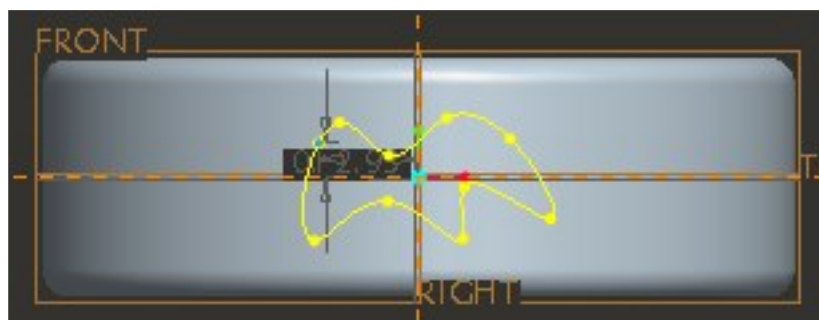*Select 'Sketch' in the Sketch dialogue box.*

Sketching the shape of the hole in your ring

Use one of the sketch tools - circle, rectangle, spline etc. to sketch out a shape for a hole.

Position the sketch so that roughly equal amounts of the hole are each side of the vertical centre line.

Make sure your sketch won't weaken the ring by cutting out material too close to its edge.

Sketch out a shape for a hole

Sketching the shape of the hole in your ring - troubleshooting

Use all four 'diagnostics' tools to check there are no problems with your sketch.

The 'diagnostics' tools

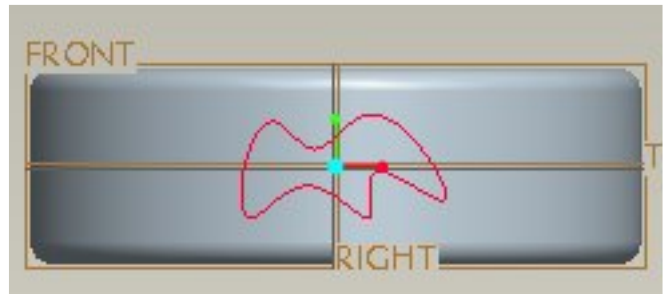## Sketching the shape of the hole in your ring - sketch done

Only when you're confident that there aren't any faults in your sketch, click on the 'Done' tool (the 'tick' symbol).

If all is well, your sketch will now be ready to 'extrude'.

Before doing so, save your work.

Select 'Done' to accept the sketch

The completed sketch, ready to extrude.
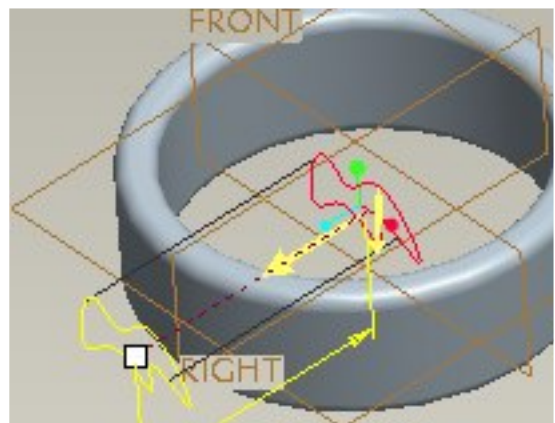
Extruding the hole from your sketch

Make sure your sketch is selected, over in the menu tree to the left of the screen (it will be listed as sketch 2), then select the 'Extrude' tool.

Your sketch will then change to show it extruding. However, to see your object in 3D, you need to click down on the wheel of the mouse and drag a bit.

Now, set the 'dashboard' settings as shown below.

The sketch, selected in the menu tree

The 'Extrude' tool

Your sketch should appear to extrude, though you'll need to click on the wheel of the mouse, and drag a bit to see this.

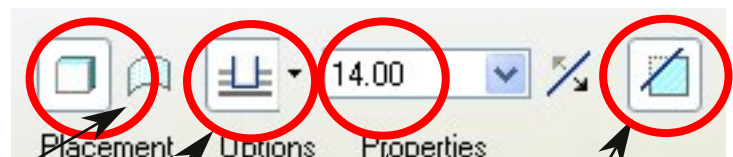In the 'dashboard' (usually located above the 3D window), select the options shown here.

Continued on the next page...

Extrude as a 'Solid' model

Extrude out in one direction only

Total length of the extrusion. This value will be larger if you're modelling a bangle.

Remove material
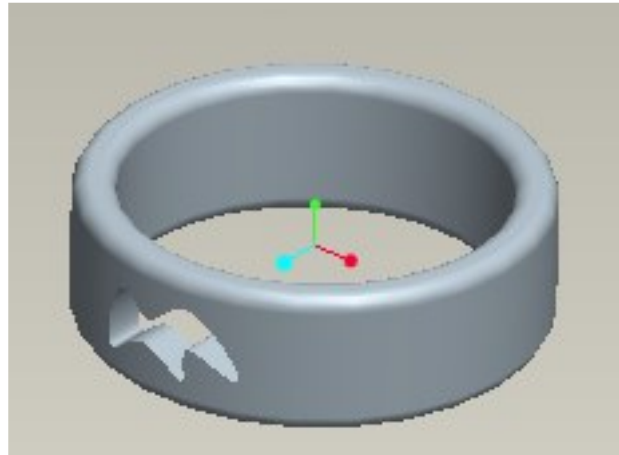
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Completing the extrusion

In the 'dashboard' select the green tick symbol to accept the extrusion.

The hole will now be cut in the ring.

You're now ready to 'pattern' the hole (duplicate the hole around the ring).

Select the green tick to accept the extrusion

A hole formed by removing material

Patterning the hole
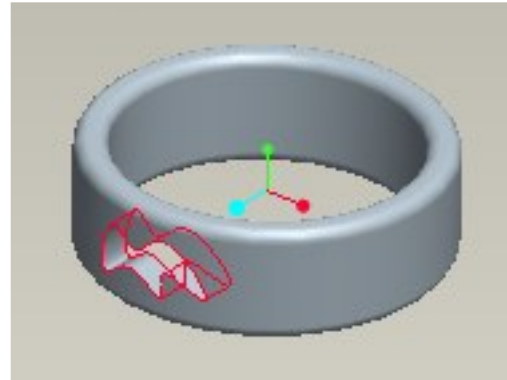
Selecting the hole 'Feature'

The hole is known as a 'feature' in Pro/Engineer. It is called 'Extrude 2', and in order to pattern it you need to have it selected.

In the dashboard select 'Extrude 2' and the outline of your hole should turn red.

Now, select the 'Pattern' tool.

Select 'Extrude 2' in the menu tree

The Pattern tool

A hole formed by removing material

Selecting 'Axis' in the dashboard

You will patten the hole feature around the central axis you created earlier in the tutorial.

In the dashboard, first select 'Axis' instead of the default 'Dimension'.

In the dashboard select 'Axis'

Selecting the Axis in the menu tree

In the menu tree, select the Axis you made earlier. In the screenshot here it is called 'A3', but yours may have a different number.

Once you've selected the axis, the dashboard updates to indicate how many copies of the hole will be cut in the ring. You may have more than the default 4, and alter the angle separating each hole. A good setting is 6 holes spaced at 60 degrees.

Continued on the next page...

Select the Axis in the menu tree

In the dashboard, you can now decide how many copies of the hole will be cut in the ring. Instead of 4 holes at 90 degree spacing, you could have 6 holes at 60 degree spacing, for instance.
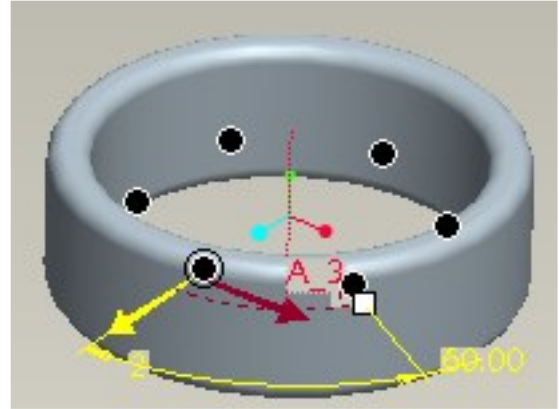
Patterning the hole (continued)

Completing the Pattern

Once you've updated the dashboard with how many holes you want, and at what angle you'd like them spaced out, the quantity will preview in the 3D window.

Now, select the green 'tick' to accept the pattern.

The pattern previewing in the 3D window - in this case 6 holes at 60 degree spacing

The ring is now complete.

Save your file.

You could try rounding the edges of the holes, but because of the tight curves, Pro/Engineer will only allow you to put a tiny round on them.

Six holes cut in the ring