

Modelling a Key Fob in Pro/Engineer

This tutorial assumes that your teacher has shown you some of Pro/ENGINEER's basic controls, such as zooming, undo and redo.

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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 'keyfob'.

Opening an internet connection

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

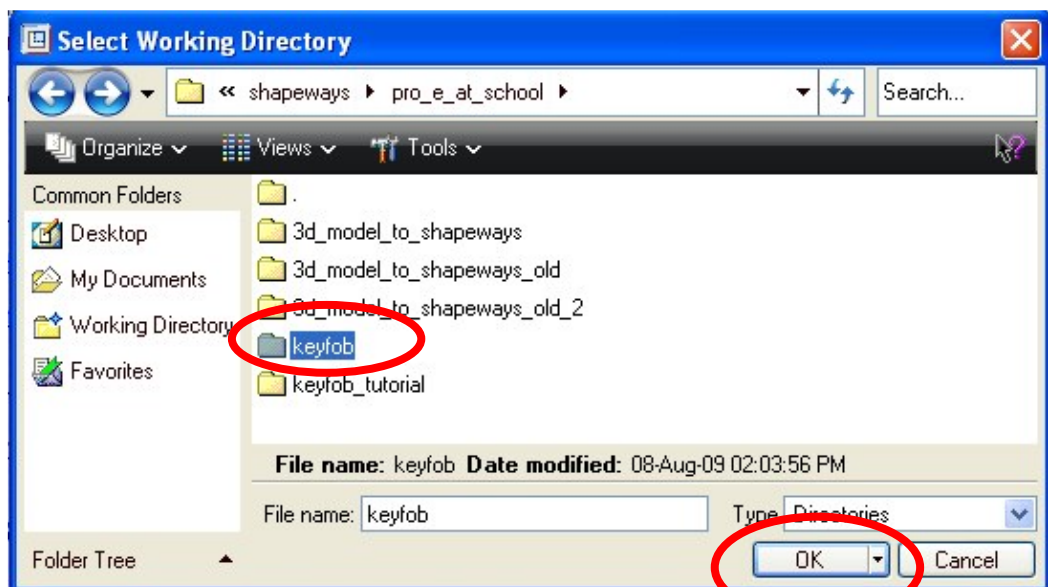
Launch Firefox, log in, and navigate to a web site (any one will do).

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 'keyfob' 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 key fob

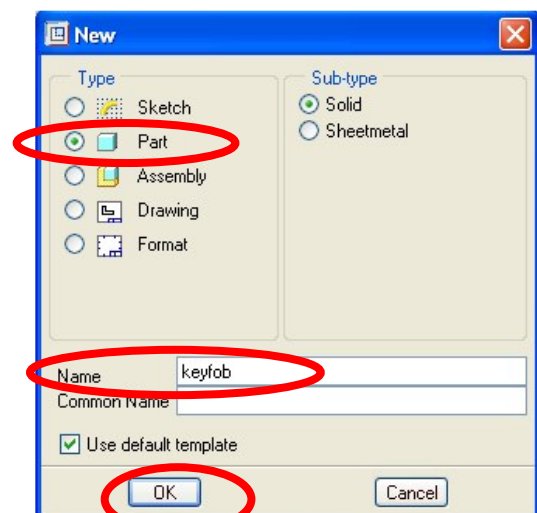
In Pro/ENGINEER, go to **'File / New'**

The 'New' dialogue box opens. You'll notice that 'Part' is already selected - your key fob will be a 'part'.

In the 'Name' field, type in keyfob. It's important that you don't leave any gaps in the names of Pro/ENGINEER files. If you wish, you can put an underscore between words, such as 'key_fob'.

Now select 'OK'.

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



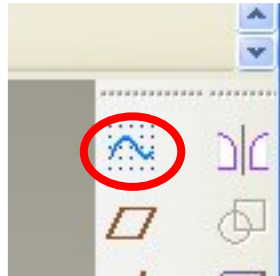
The 'New' dialogue box

cont.

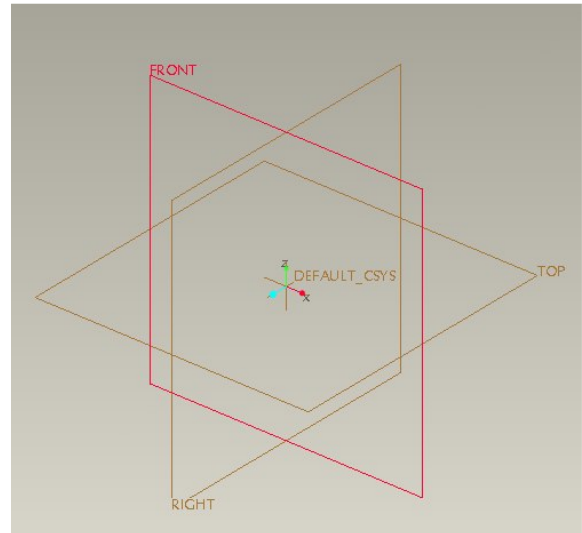
Starting a 'Sketch'

In the 3D window, hover your cursor over the front 'workplane'. 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 workplane still selected, click on the 'Sketch' icon, in the main toolbox (usually over to the right of the screen)...

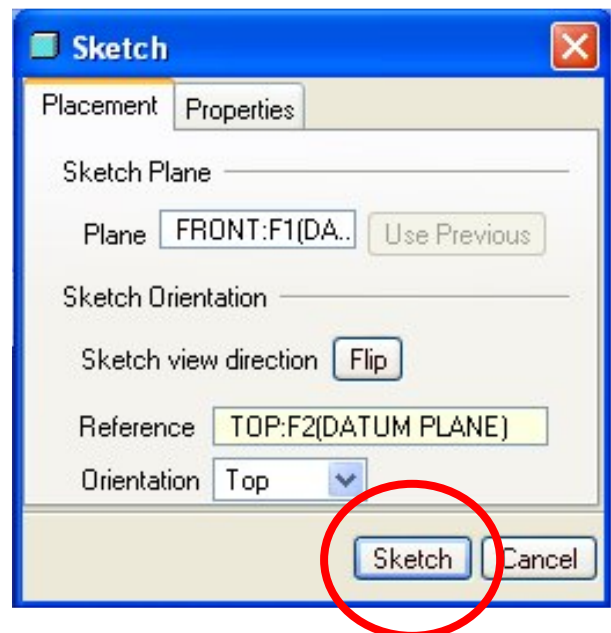


The 'Sketch' icon.



The front 'workplane', selected.

...The 'Sketch' dialogue box now opens, the front workplane spins around to face you, 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.



Delete 'Sketch' in the Sketch dialogue box.

Sketching your key fob - a simple rectangle to start with

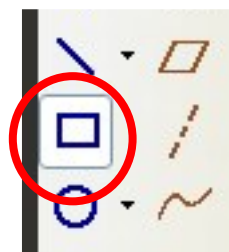
No matter what shape you have in mind for your key fob, start by drawing out a rectangle.

Click on the rectangle 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 rectangle - in the bottom left quadrant of the screen. Make your rectangle approximately twice as high as it is wide. (see image on the next page)

Now select the 'select' icon, and dimensions will appear at your rectangle

Continued on next page.



The 'rectangle' icon.



The 'select' icon.

The rectangle, with dimensions visible.



Sketching your key fob - adjusting the dimensions of your rectangle

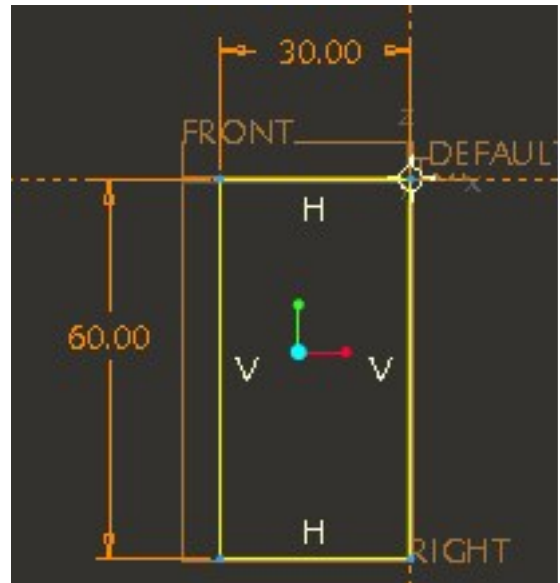
Zoom in a bit on your rectangle. To do this, hover your cursor over the middle of the rectangle and turn the wheel on your mouse.

Now, left-click on each dimension and drag it away a bit from the rectangle. This simply makes your sketch a bit more tidy.

Now double-click on each dimension in turn, and change the sizes to be 60mm high and 30mm wide. The rectangle will automatically re-size itself as you do this.

This rectangle is approximately the right overall size for your key fob.

Dimensions tidy and correct.



Sketching your key fob - troubleshooting

It's never too early to check that your sketch is coming along OK, with no errors - even when it's just a simple rectangle.

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.

It's a good idea to use the 'diagnostics' tools often, as you draw your sketch, so that you can fix problems as they happen. It's much easier to do this than try to figure out the problem when you've completed your sketch.



'Shaded Closed Loops'

'Highlight Open Ends'

'Overlapping Geometry'

'Feature Requirements'

continued on next page...

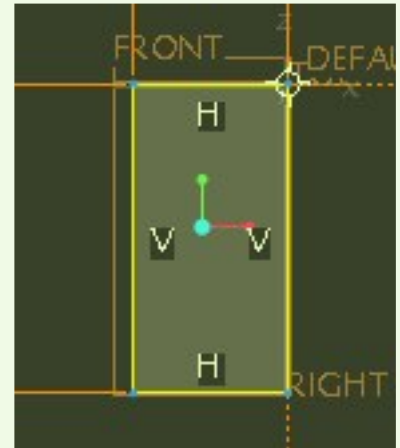
Sketching your key fob - troubleshooting (continued)

Shaded Closed Loops



With this button depressed, the inside of your shape should turn grey (known as a 'valid' sketch).

If it doesn't, it means that all the lines that make up your shape must have a gap between them, or one line drawn on top of another line. Use the 'Highlight Open Ends' and 'Overlapping Geometry' tools to check this.



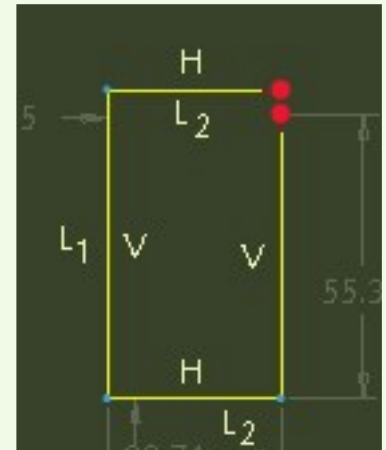
With the 'Shaded Closed Loop' tool in use, your shape should turn grey.

Highlight Open Ends



With this button depressed, any gaps in your lines will become visible.

In the example to the right, the red dots highlight a gap in the top right corner of the shape.



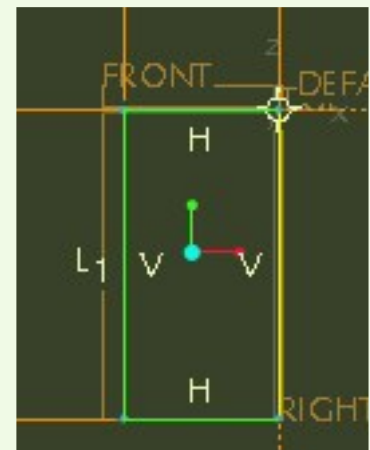
With the 'Highlight Open Ends' tool in use, any gaps in your shape will be seen.

Overlapping Geometry



With this button depressed, any situations where one line has been drawn on top of another line are highlighted in green.

In the example to the right, an additional line has been drawn on top of the left side line. This affects the line underneath and the connecting lines top and bottom.



With the 'Overlapping Geometry' tool in use, where a line is on top of another line, all the lines affected are highlighted in green.

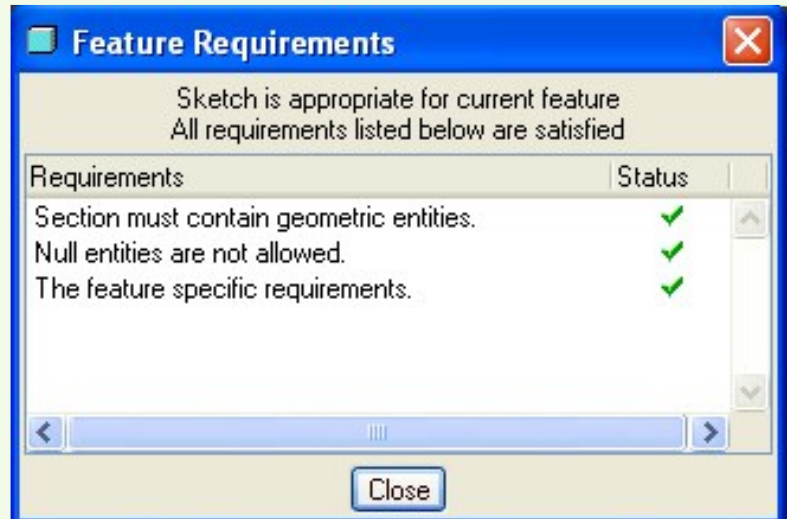
Sketching your key fob - troubleshooting (continued)

Feature Requirements



With this button depressed, Pro/Engineer will indicate if the type of sketch you're using is appropriate to the job in hand.

Usually, you won't need to use this tool.



With the 'Feature Requirements' tool in use, Pro/ENGINEER will check if you're using the right type of sketch.

Sketching your key fob - drawing the shape you really want...

The rectangle you've drawn is only a guide to help you get the overall size of your key fob about right. Now you can use the other drawing tools to get the shape you really want.

However, keep your shape simple, at least for your first key fob.

The 'Spline' tool

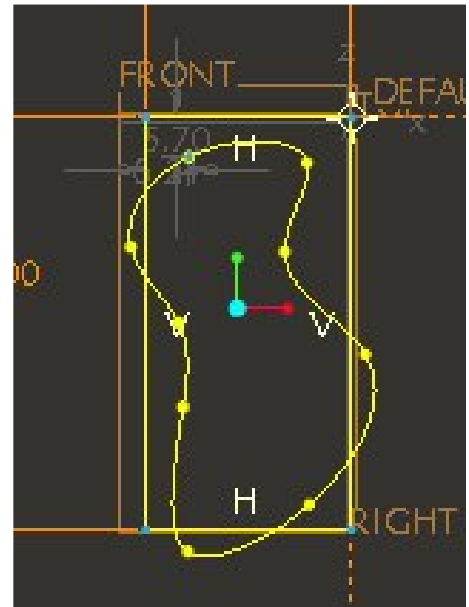
The spline lets you draw curvy shapes.



When using it, make sure you don't 'snap' your line to the perimeter of the rectangle, because this will make it harder to subsequently modify your curvy shape.

Once you've drawn out the curvy shape, and snapped the end of the line to its starting point, it is possible to select the individual points on the curve and drag with the mouse to adjust the shape.

A curvy shape drawn with the 'spline' tool.



The 'Circle' tool

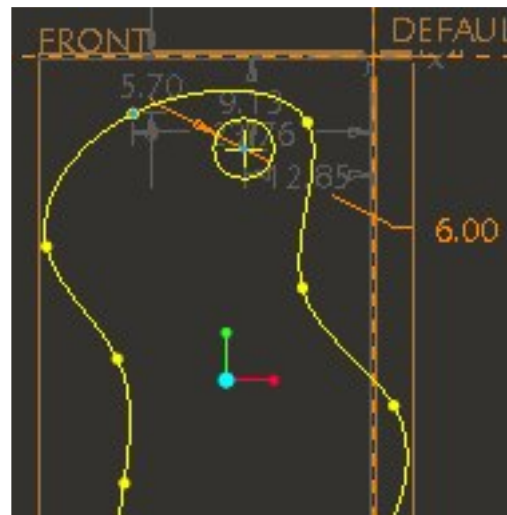
Draw a circle, 6mm in diameter, which will become the hole for the key ring to fit through.



The 'Circle' tool

Draw a circle, 6mm in diameter, which will become the hole for the key ring to fit through.

A circle drawn to create a hole for the key ring, and the rectangle removed.



cont.

Sketching your key fob - removing the original rectangle

The 'Delete Segment' tool

The 'Delete Segment' tool (more commonly known as the 'Trim' tool) is an eraser. When using it, simply click on the lines that make up the rectangle, to delete them, segment at a time.



You may find that you need to zoom in close to remove tiny lengths of line.

Sketching your key fob - final troubleshooting

Lines that cross over

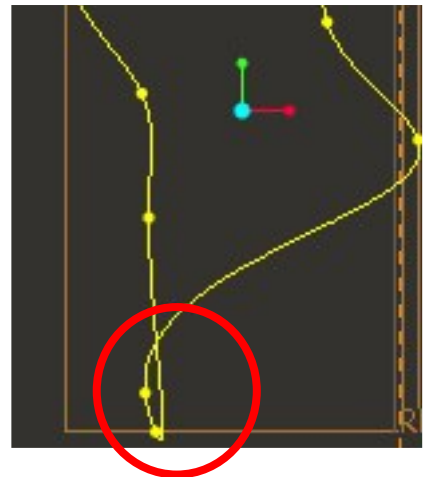
A common mistake made by beginners is to allow lines to cross over. You must not allow this. If you have this situation, then adjust your spline line.

Using the diagnostics tools

Make sure you run through all the diagnostics tools again, before accepting your sketch as finished. Check back the earlier troubleshooting info on pages 4 & 5.



Lines may not cross over



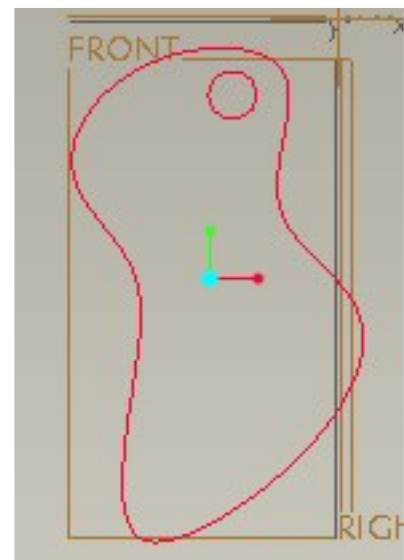
Sketching your key fob - sketch done

The 'Done' tool

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'.



The completed sketch, ready to extrude.



Saving your work

In Pro/ENGINEER, you can't save your work 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

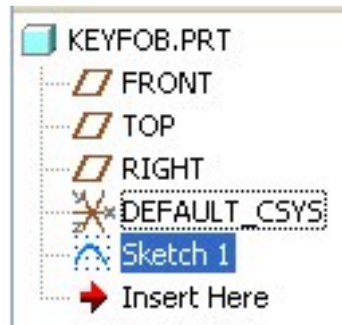
The 'Extrude' tool

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.

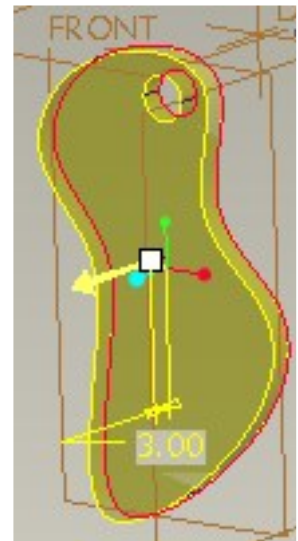
Go to next page for more...



The sketch, selected in the menu tree

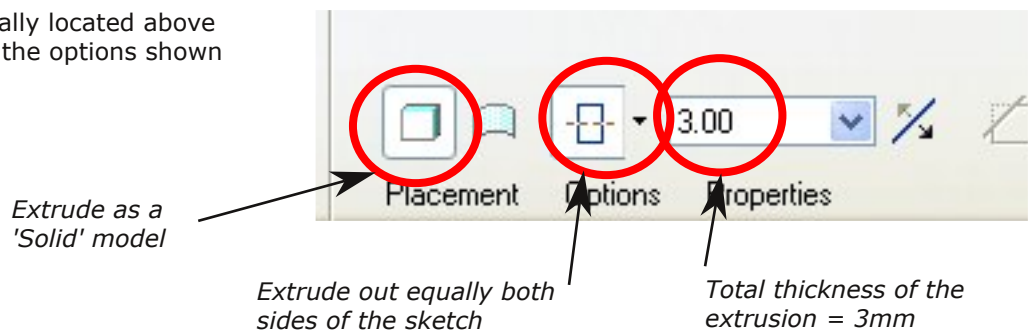


The 'Extrude' tool



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.



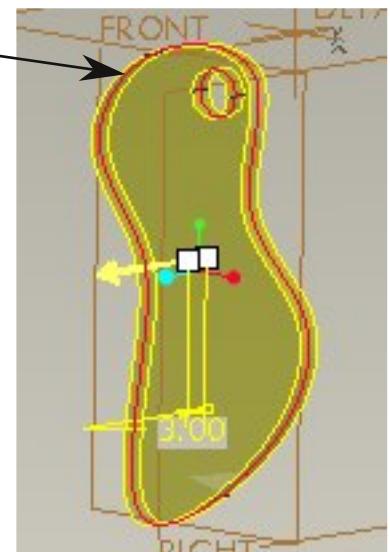
Extrude as a 'Solid' model

Extrude out equally both sides of the sketch

Total thickness of the extrusion = 3mm

Your extrusion should now look something like this

If not, it probably means that there's a problem with your sketch, and you'll need to go back and modify it. Go to the 'My sketch didn't extrude properly!' instructions on the next page.



continued on the next page

Completing the extrusion

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

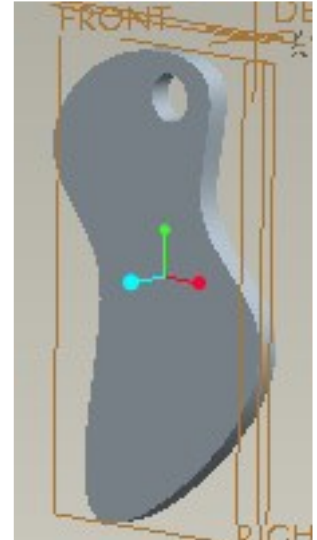
The basic 3D form of your key fob should now appear, all in grey.

You're now ready to round the edges and apply some lettering.



Select the green tick to accept the extrusion

The basic 3D form, ready to have edges rounded and lettering applied



'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.

The next section shows you how to get back to your sketch, to allow you to run the diagnostic tools again and modify your sketch.

If, after you've done that, your sketch still isn't extruding correctly, consult your teacher.

Modifying your sketch after you've extruded it

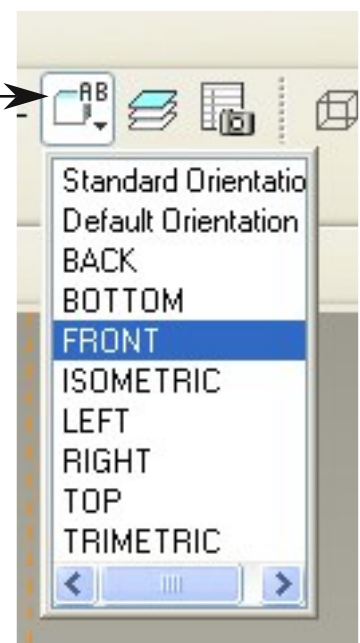
Orienting the view to FRONT elevation

First, orient your sketch so you're looking straight at it (ie front view)...

Click on the 'Named View List' button - on the main horizontal toolbar near the top of the screen - it's the one with the letters AB beside it. Now select 'FRONT'.

Your key fob should now rotate in to front view and you're ready to modify it...

The 'Named View List' button



continued on the next page...

Modifying your sketch after you've extruded it (continued)

Reactivating your sketch - 'Edit Definition'

In the menu tree on the left side of the screen, locate 'Extrude 1', and click on the tiny plus (+) sign to the left of it. The text 'Sketch 1' will now appear.

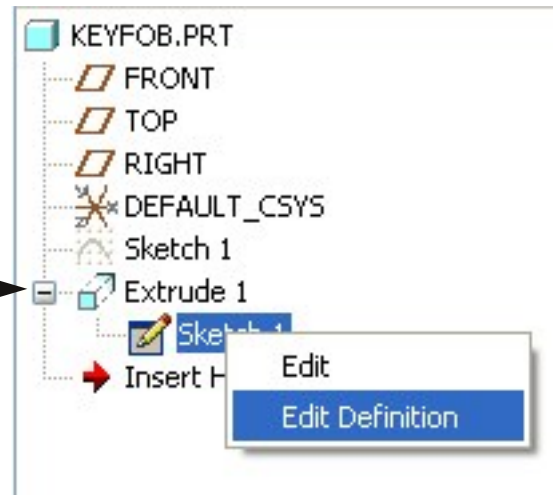
Now right-click on the text 'Sketch 1' and select 'Edit Definition'. Your sketch should now reactivate.

Go through the diagnostic tools carefully, to try to find the fault.

If you still can't find it, consult your teacher.

When you're done, select the black 'Done' tick, and the 3D form of your key fob should regenerate.

Click on the tiny plus symbol here and 'Sketch 1' will appear below 'Extrude 1'.



Right-click on 'Sketch 1' and select 'Edit Definition'.

Rounding the edges of your key fob

Rounding your edges is optional

Although it's not essential, it's a good idea to round the edges of your key fob. Your key fob will feel more comfortable in your hand, and won't damage your pocket lining.

A potential problem

If you've created a complex form, especially one that has tight curves in it, you may have difficulty rounding the edges, as Pro/ENGINEER will have difficulty doing the calculations. The rule is - The tighter the curves of your edges, the smaller the radius of the rounding you'll be obliged to use to get it to work.

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.

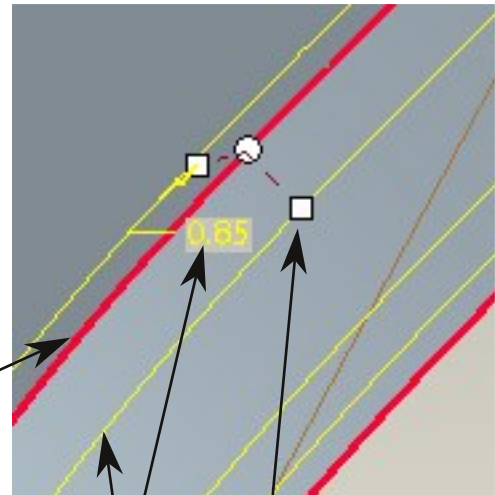
The 'Round' tool

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. It's best to accept this figure to start with, so click on the green tick to do so.



The 'Round' tool

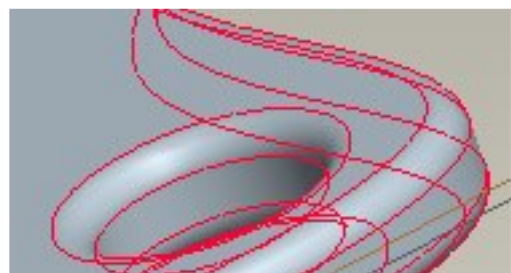
The selected edges are red



The size of the round suggested by Pro/ENGINEER is indicated in yellow.

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

Rounded edges



Adding some text to your key fob

Adding text is easy. First, make sure you're not in the middle of another command, then proceed.

Selecting a surface to put a sketch on

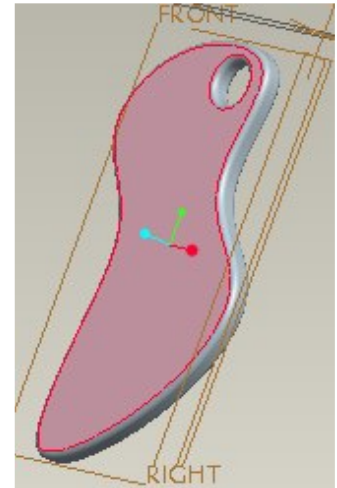
First you need to tell Pro/ENGINEER which surface you want the text to be added to. In this case, left-click on the front surface of your key fob, and (if you've clicked near, but not too near, the edge) the surface will turn pink.

The 'Sketch' tool

Now select the sketch tool, and your key fob will spin around so that the front surface is facing you, and the 'Sketch' dialogue box will appear. Select 'Sketch' in the dialogue box.



The 'Sketch' tool



The front surface selected. ready add a sketch on to it.

The 'Text' tool

Select the text tool - the button with the letter 'A' in the tool bar.



The 'Text' tool

Now, your first left-click with the mouse will show Pro/ENGINEER where you want the bottom left of your text to be. The second click will define the height of the text. Then, the 'Text' dialogue box will appear, and you type in the text you want, and select 'OK'.

Make sure your text isn't too near any curved edges, as this can be problematic. If it is, then select the 'undo' button, and try again.

When you're happy, select the black 'Done' tick.

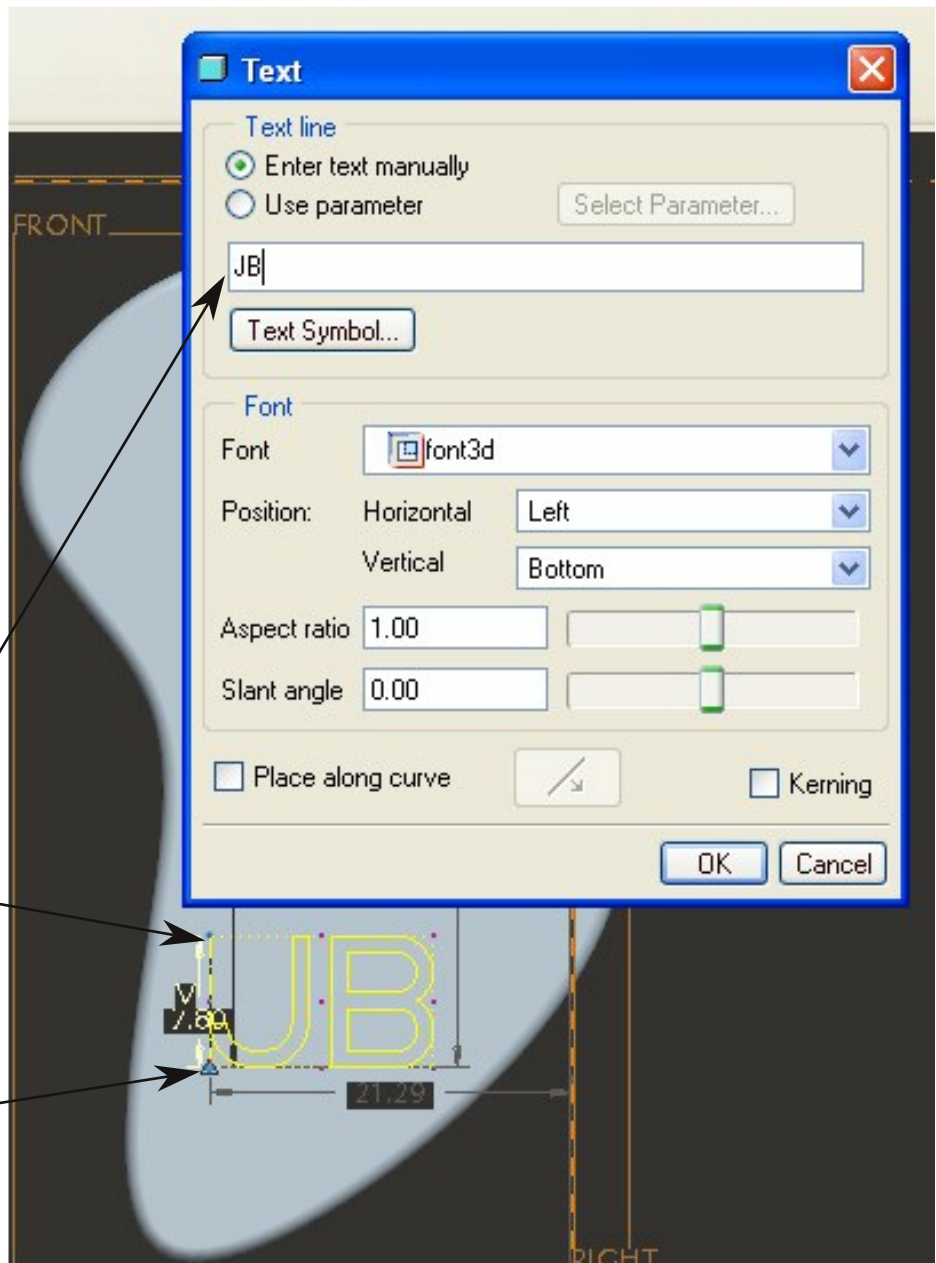
You're now ready to extrude your lettering.

Go to the next page.

Fill in the text you want here.

Second click with the mouse here, to define the height the text will be.

First click with the mouse here



continued on the next page...

Adding some text to your key fob (continued)

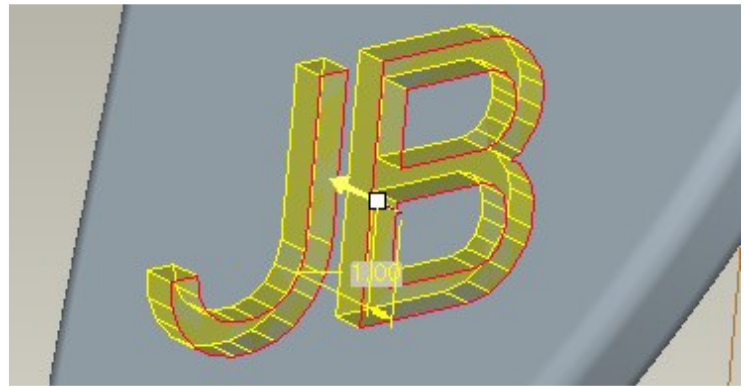
Extruding your text sketch

Make sure you have your text sketch selected, (its lines will be red if you have it selected), then select the 'Extrude' tool.



The 'Extrude' tool

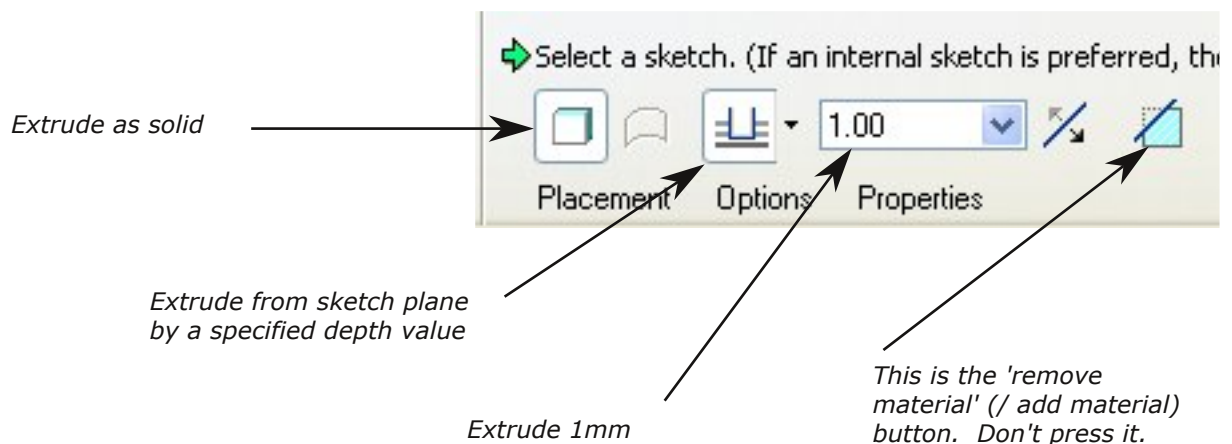
In the dashboard tool bar, usually located above the 3D window, type in 1mm for the length of extrusion. Make sure you also have the options selected as per the screenshot shown here.



Text extruding 1mm

Click on the green tick to complete the process.

The 'dashboard', set to extrude text



Your key fob is now complete, so save the file.

You can now go on to the 'Preparing your 3D model for 3D printing' tutorial.

On the other hand, there are a few other things you could do to your key fob if you wish...

A few other things you can do to your key fob...

Making your text cut through your key fob

Make your text cut through your key fob, instead of stick out

To do this, right-click on 'Extrude 2', in the left hand menu tree, and select 'Edit Definition'.

Now, drag the white handle (at the extruded letters) down and right through (and out the other side of) the key fob.

In the dashboard press the 'Remove Material' button.

Click on the green tick, and your text should now form a hole in your key fob.



The 'Remove Material' button (pressed down)



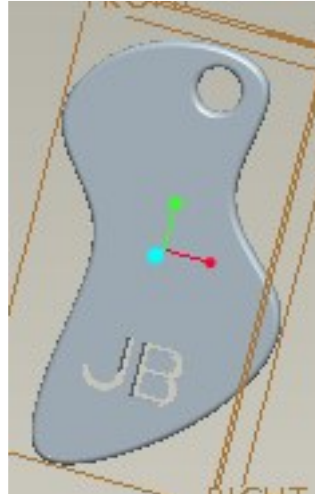
The text extruded through the key fob, ready to remove material

Making your text cut through your key fob (continued)

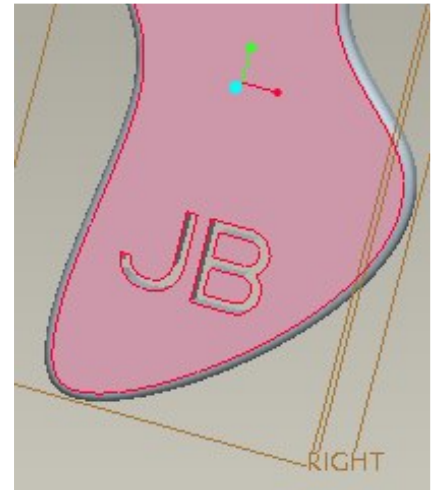
Tidying up your text - removing loose bits

You'll notice that the inner parts of the letter 'B' are now completely disconnected from the rest of the key fob. Left like this, they would fall out during manufacture.

If your lettering has any of these loose bits, you must remove them by adding a sketch to the front surface of the key fob and extruding...



Notice that the inner parts of the letter 'B' will fall out once manufactured. You must remove them now.

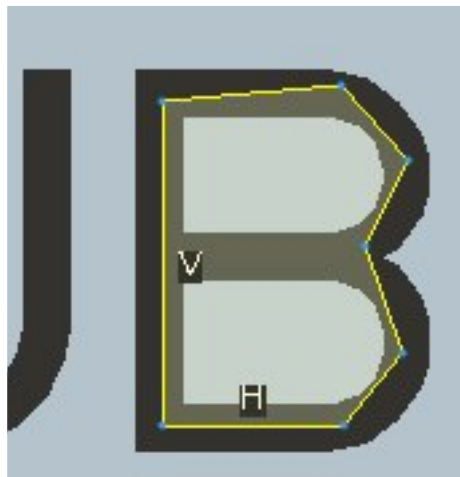


Select the front surface of the key fob, and add a new sketch to it.

You'll notice that the inner parts of the letter 'B' are now completely disconnected from the rest of the key fob. Left like this, they would fall out during manufacture.

If your lettering has any of these loose bits, you must remove them by adding a sketch to the front surface of the key fob and extruding.

Remember to select the 'remove material' button in the dashboard.



Sketch to remove 'loose' bits of the letter 'B'.



Using the extrude tool to remove 'loose' bits of the letter 'B'.

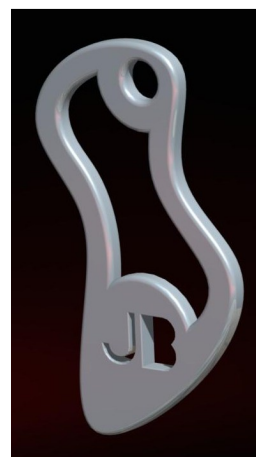
Remember to select the 'remove material' option in the dashboard.

Making some more holes to your key fob

The less material you use, the less expensive your key fob will be to manufacture, because you pay by volume of material used.

Add a sketch to the front surface of the key fob, draw out some holes, using the circle tool or the spline tool, then extrude to remove material.

Now, save your work, and you're ready to upload it to Shapeways.



The completed key fob, with an additional hole cut through.