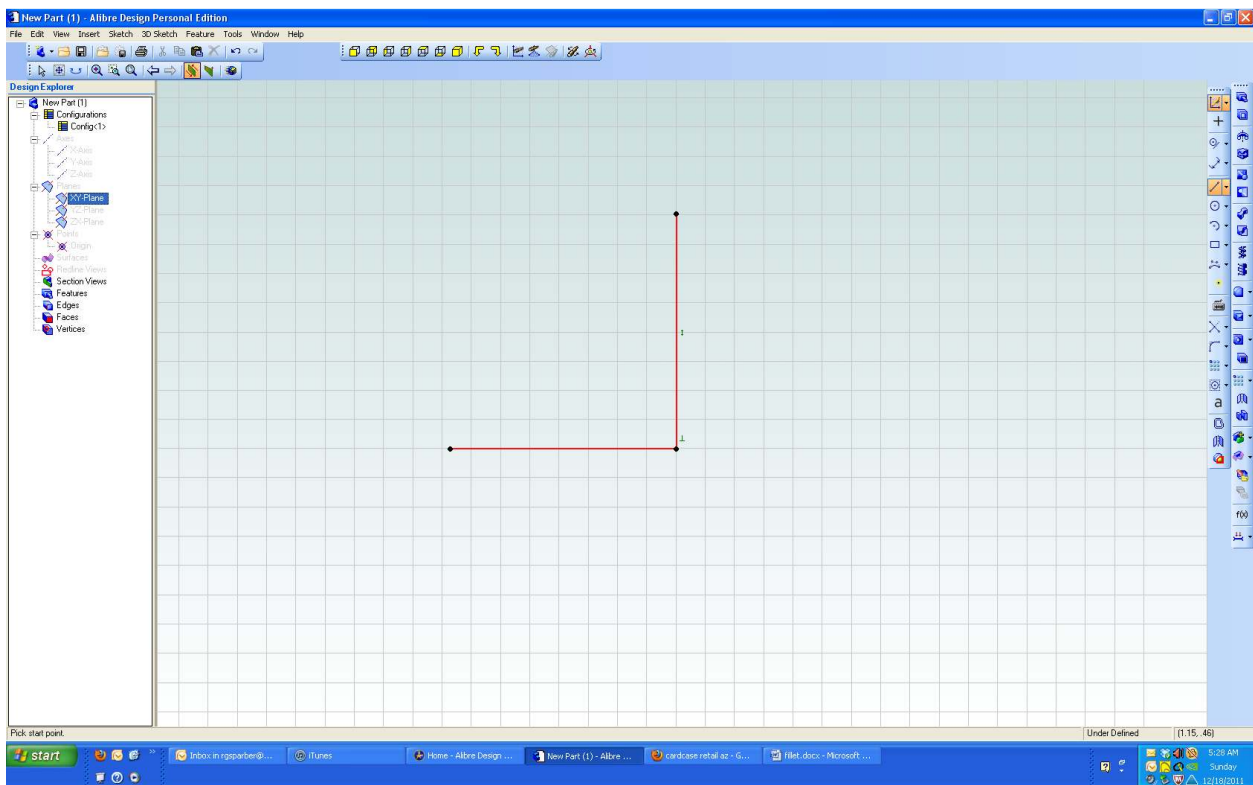# Thinking About the Fillet Tool, version 2
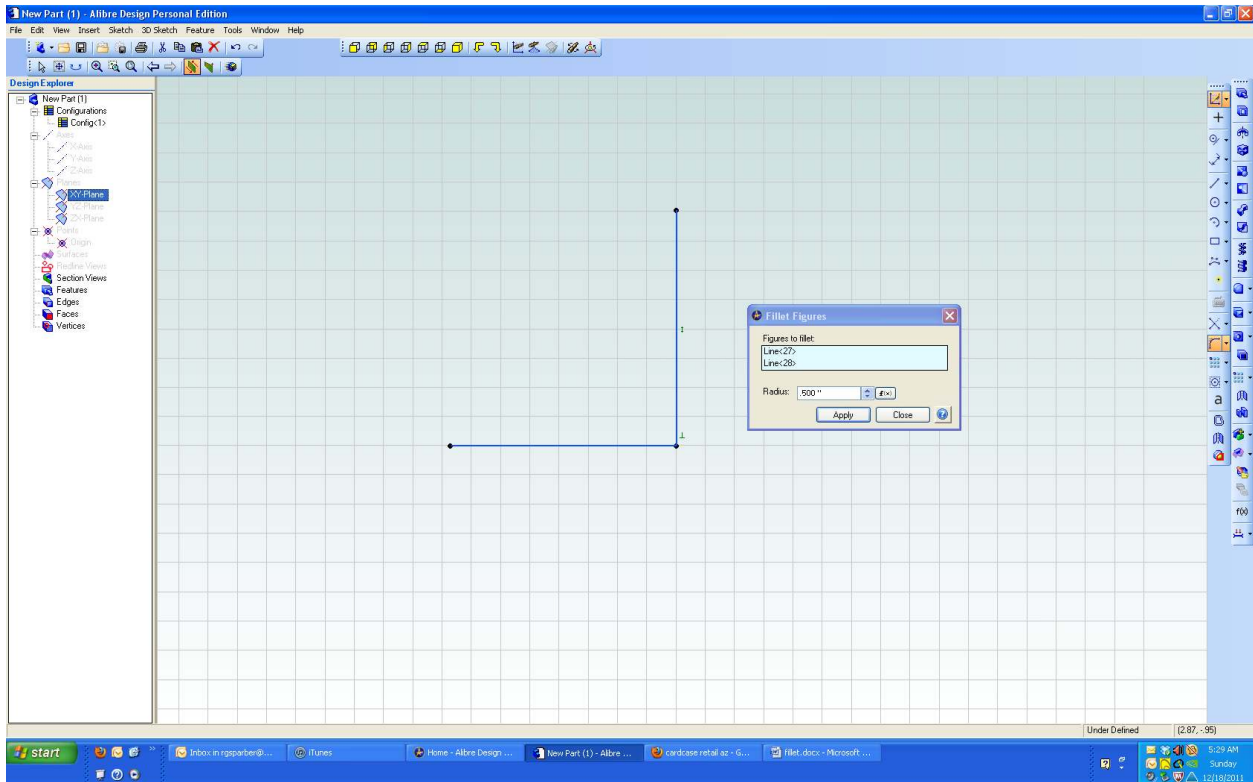
By R. G. Sparber

Copyleft protects this document.[1]

Alibre, and most other CAD programs have a fillet tool. It lets you draw an arc that is tangent to two lines. It sounds simple, and most of the time it is simple.
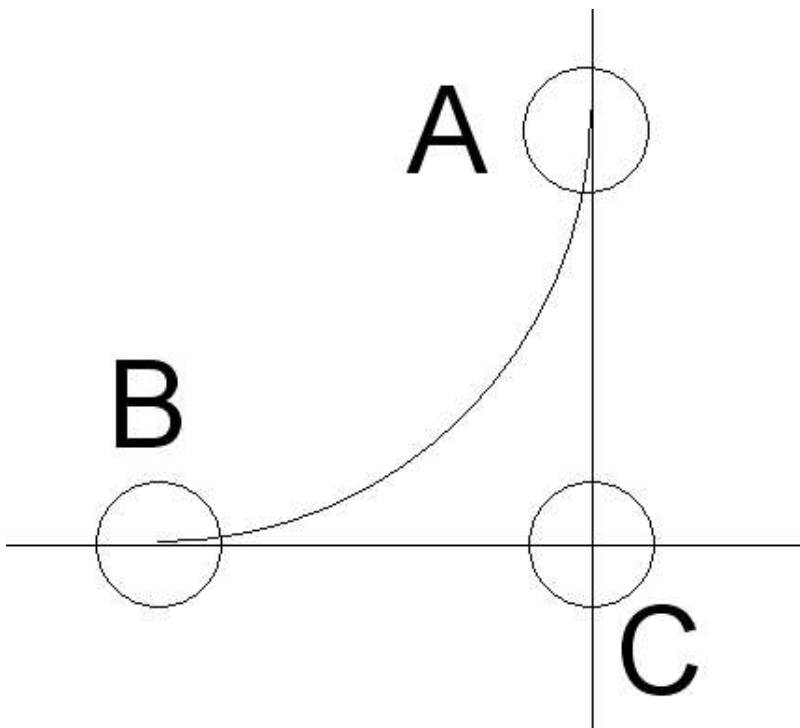

I have drawn a vertical line followed by a horizontal line.


I then brought up the fillet tool and clicked on each line. I'll use the default radius of 0.500". As each line is clicked, it turns from red to blue and its ID is put in the "Figures to fillet" dialog box.


When a corner is filleted, we get an arc that is tangent to the two lines that form the corner. Specifying which lines and the radius of the arc is sufficient to uniquely define the arc. This means that points A and B are defined.
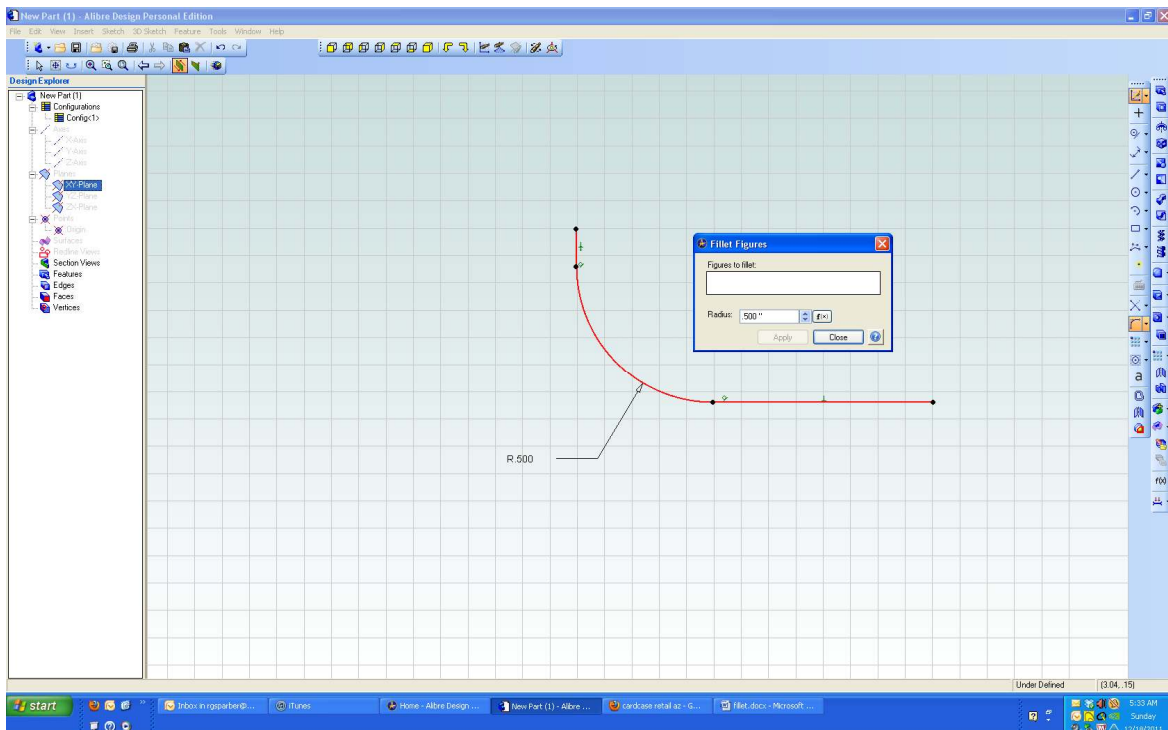
When the fillet is drawn, we replace line segment B-C and A-C with arc A-B. This is what you will see on the next page.
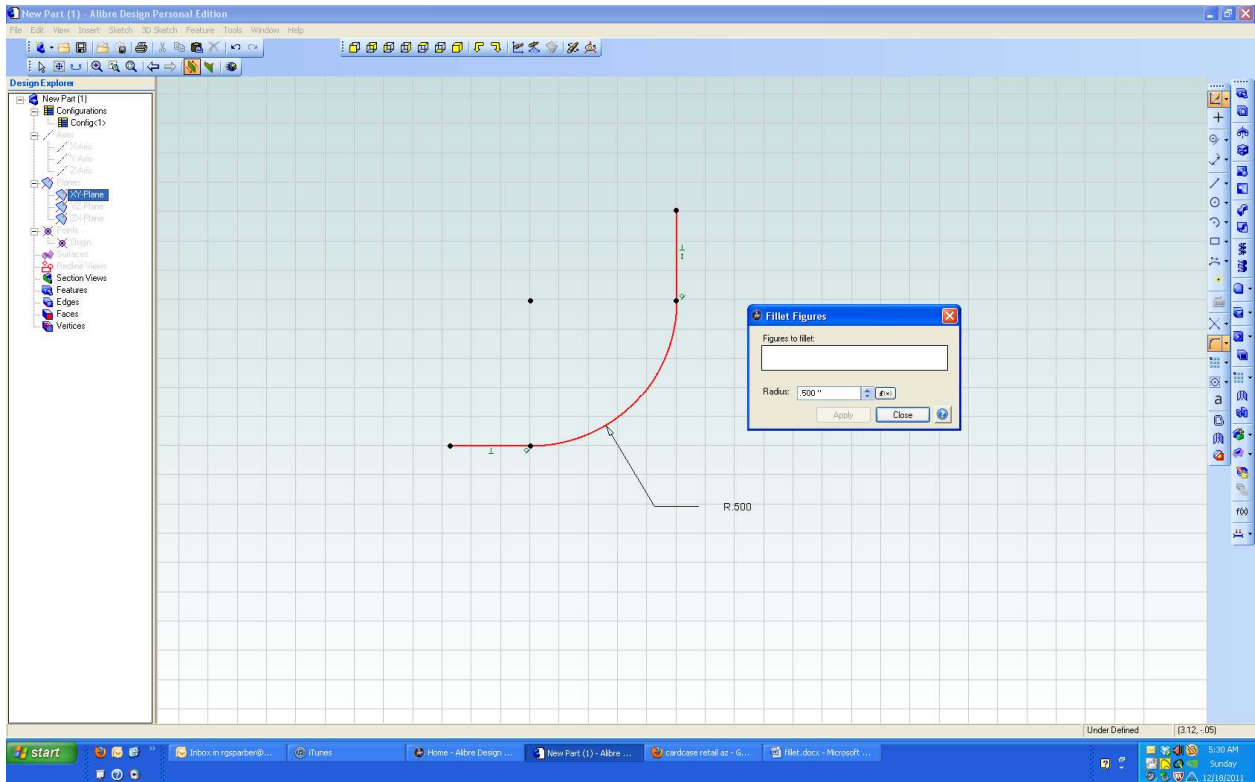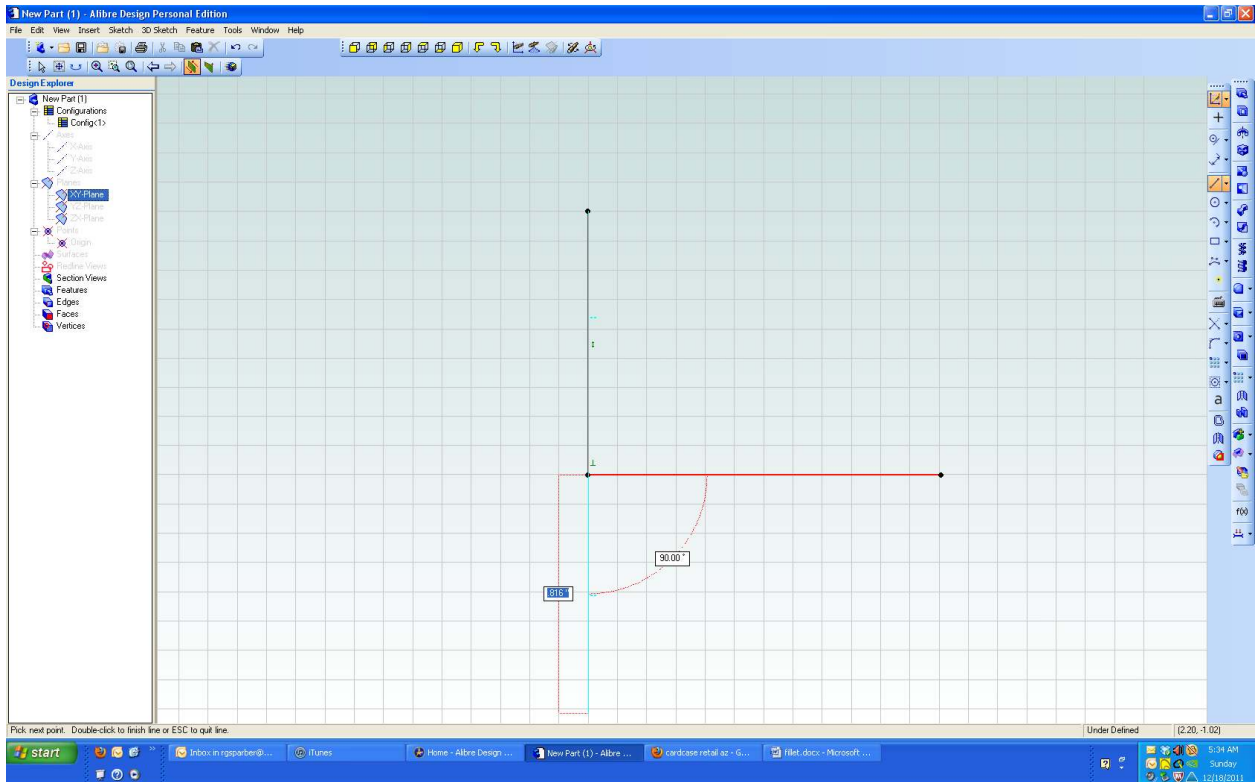
No big surprise here. My corner was replaced by an arc with radius 0.500".
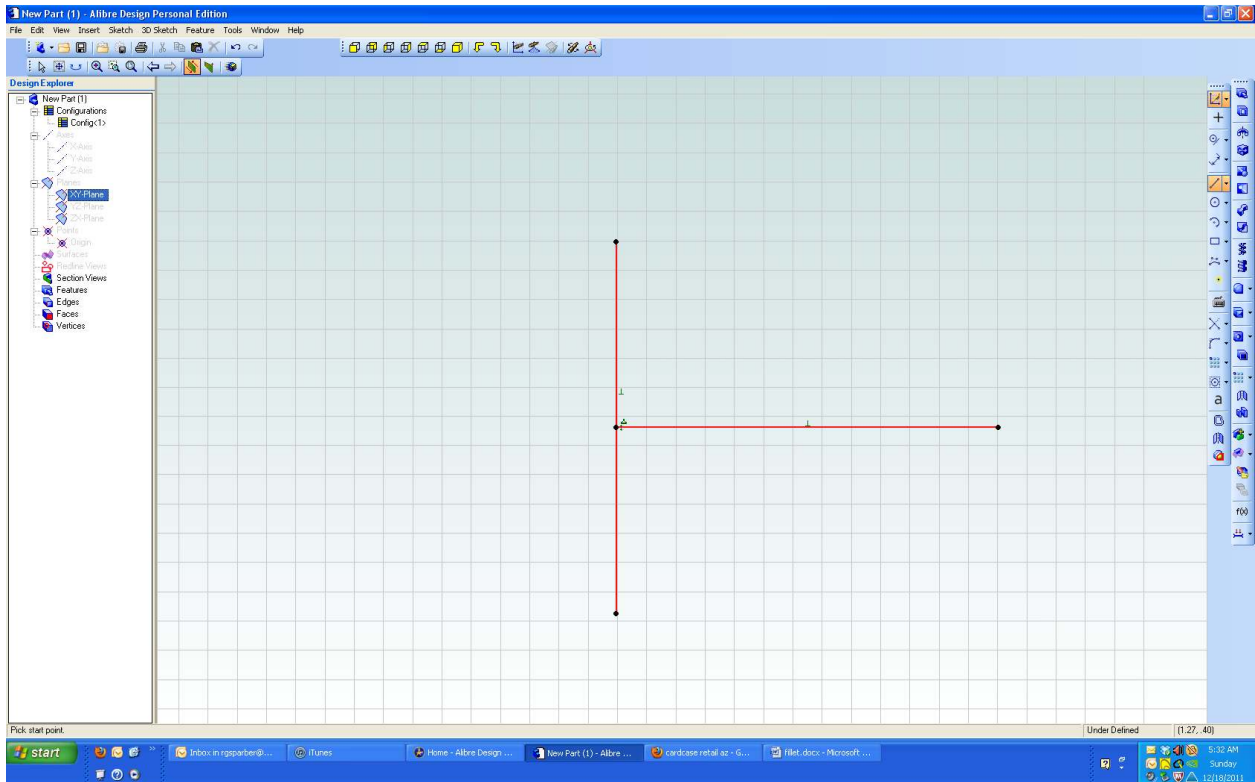
This time I have drawn a T. I want a fillet between the top half of the vertical line and the horizontal line. Alibre assumes that I no longer want the bottom half of the vertical line.
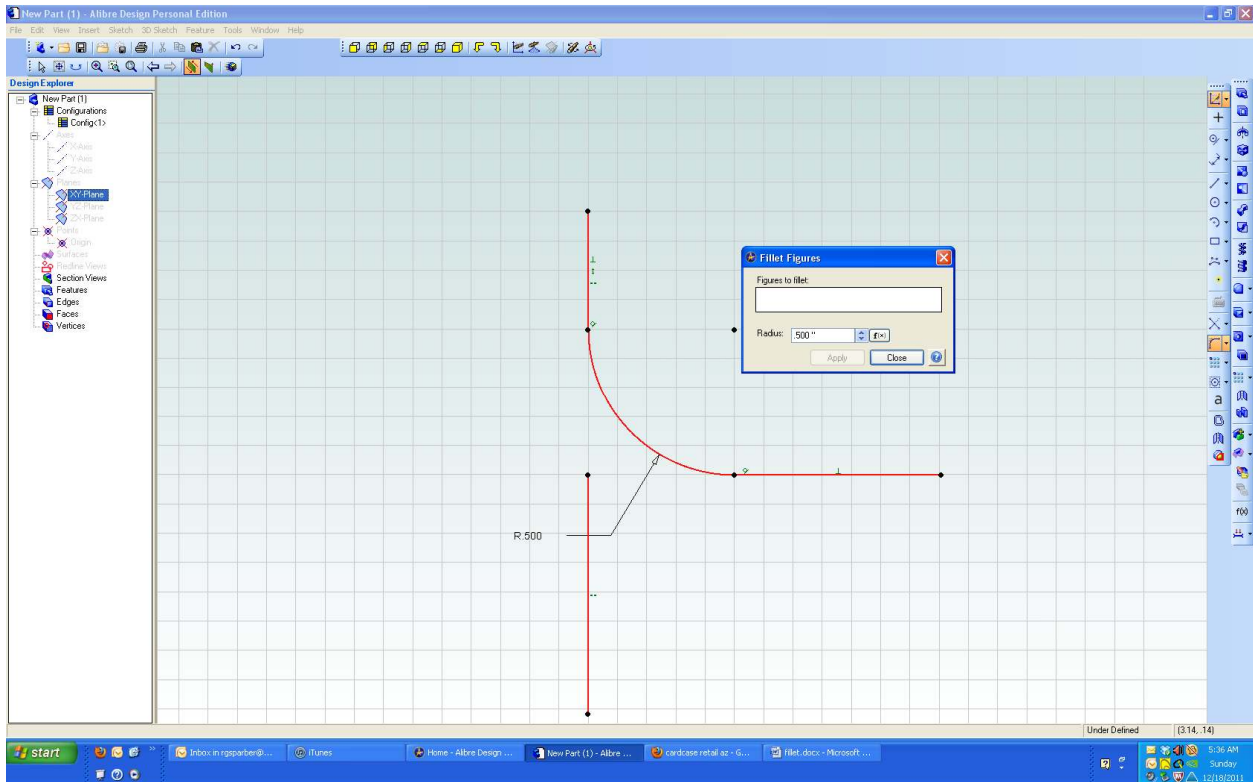

Note that the bottom half of the vertical line is gone.

This time I will draw the same T but my vertical line was drawn as two lines rather than one.
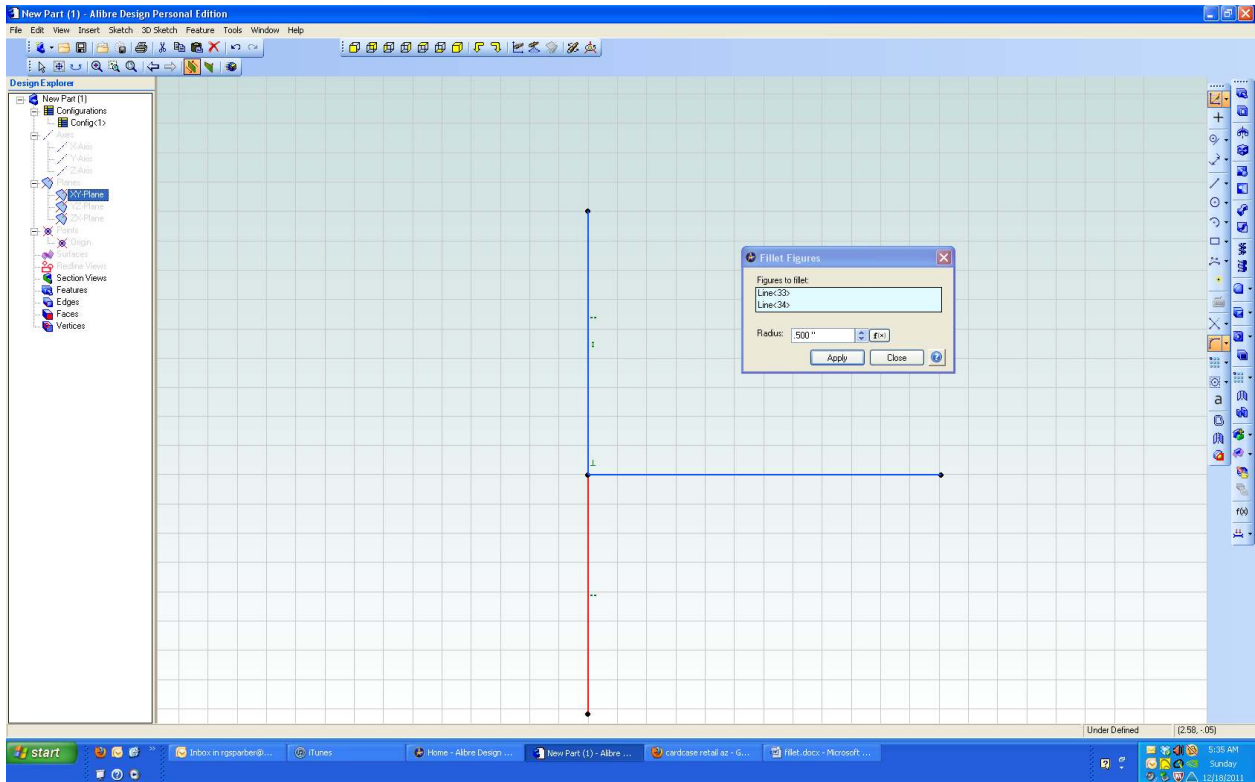
I again select my horizontal and vertical lines from within the fillet tool. But note that the separate vertical line below the horizontal line is red. This means that it has not been selected.
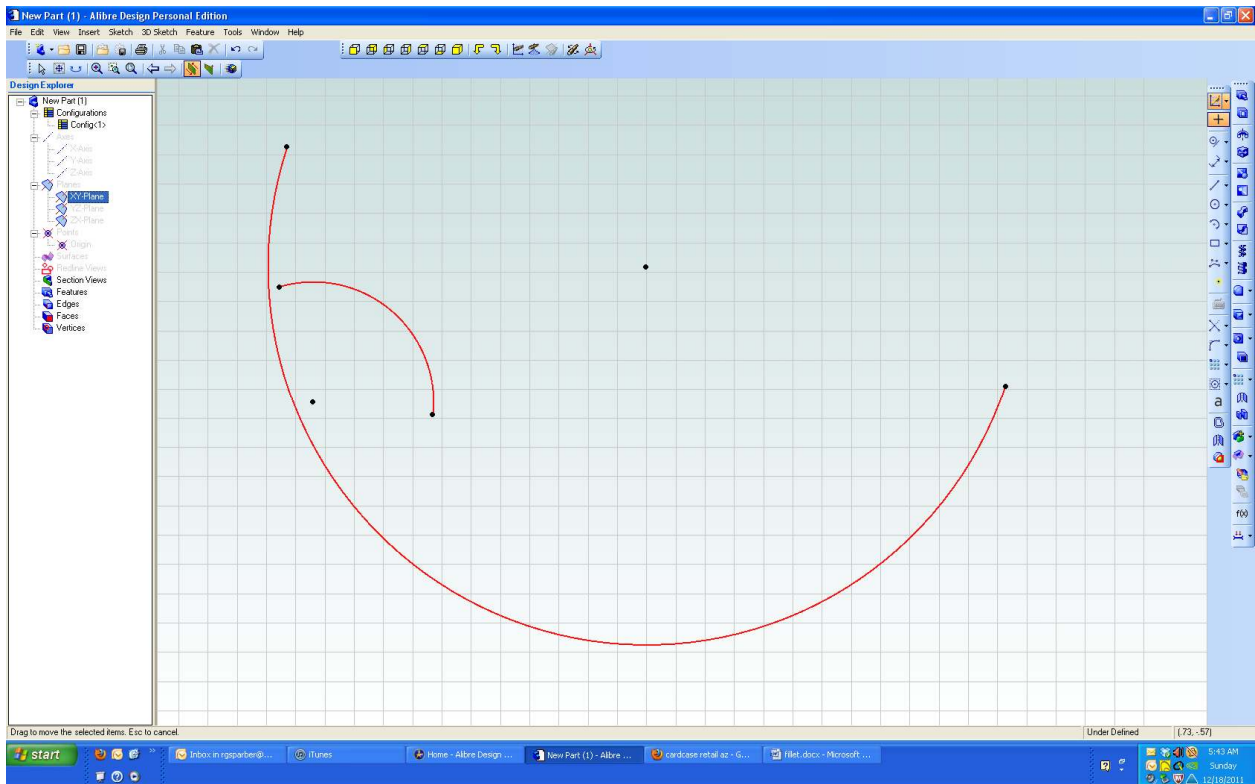
This time my fillet tool does not delete the vertical line below the arc. It is a separate line so is not involved.
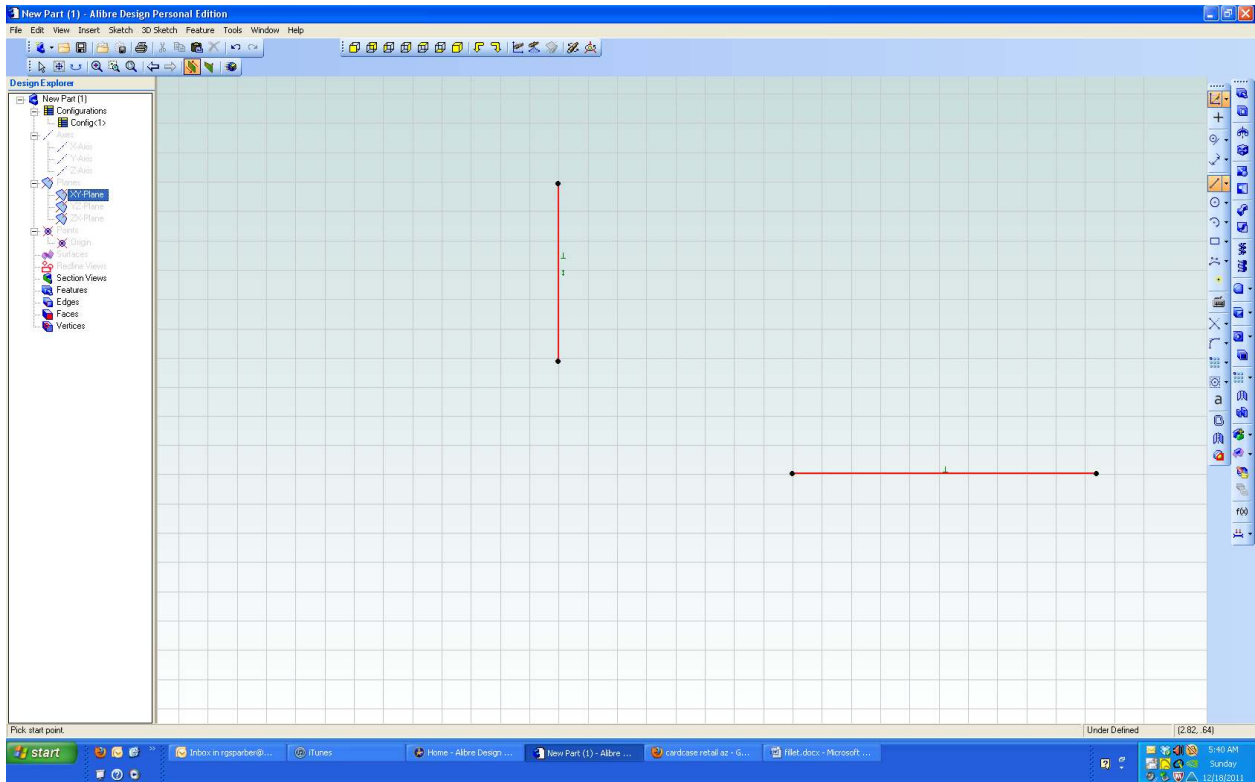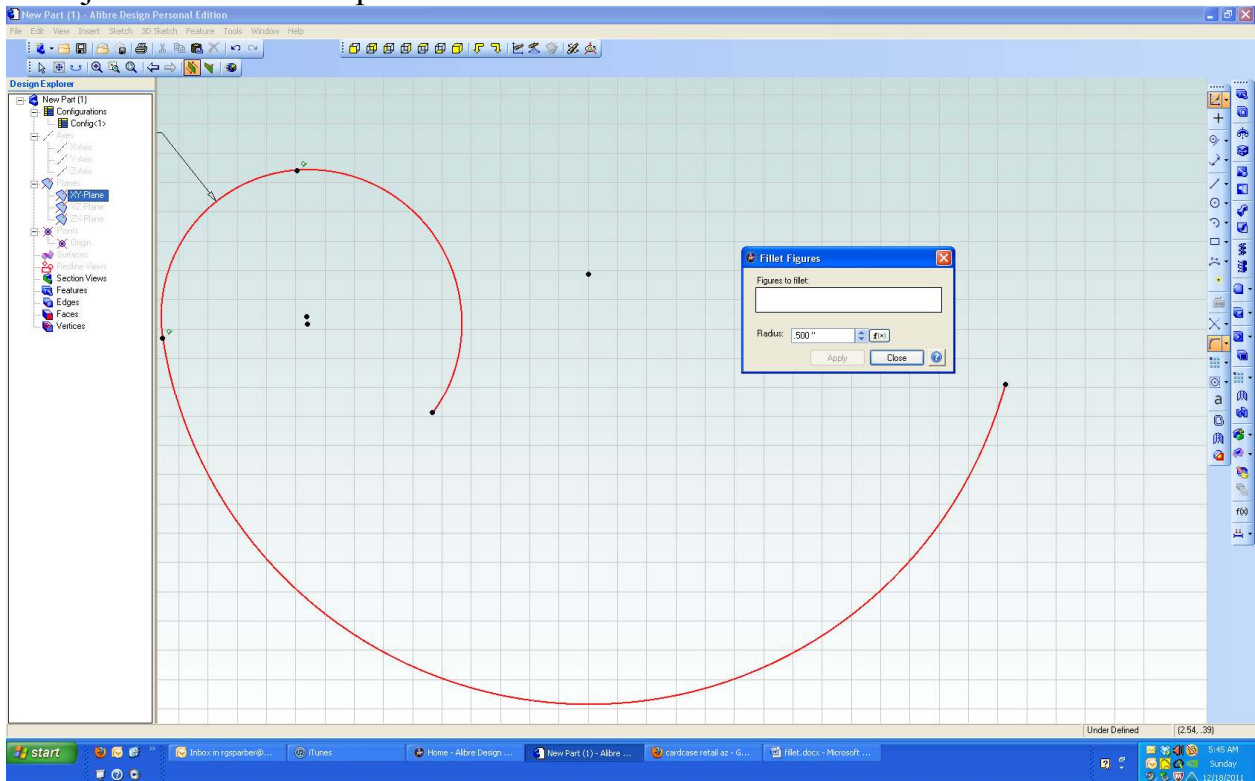
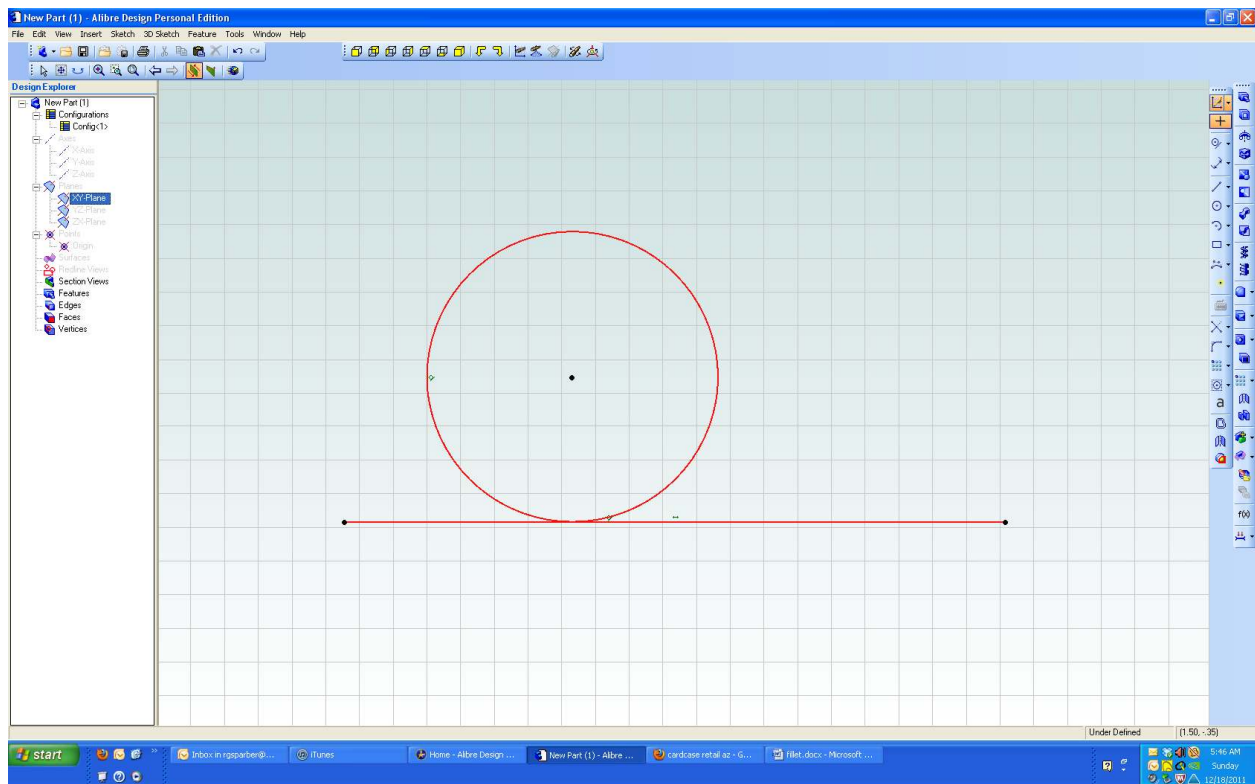I can even draw a fillet between lines that don't intersect.
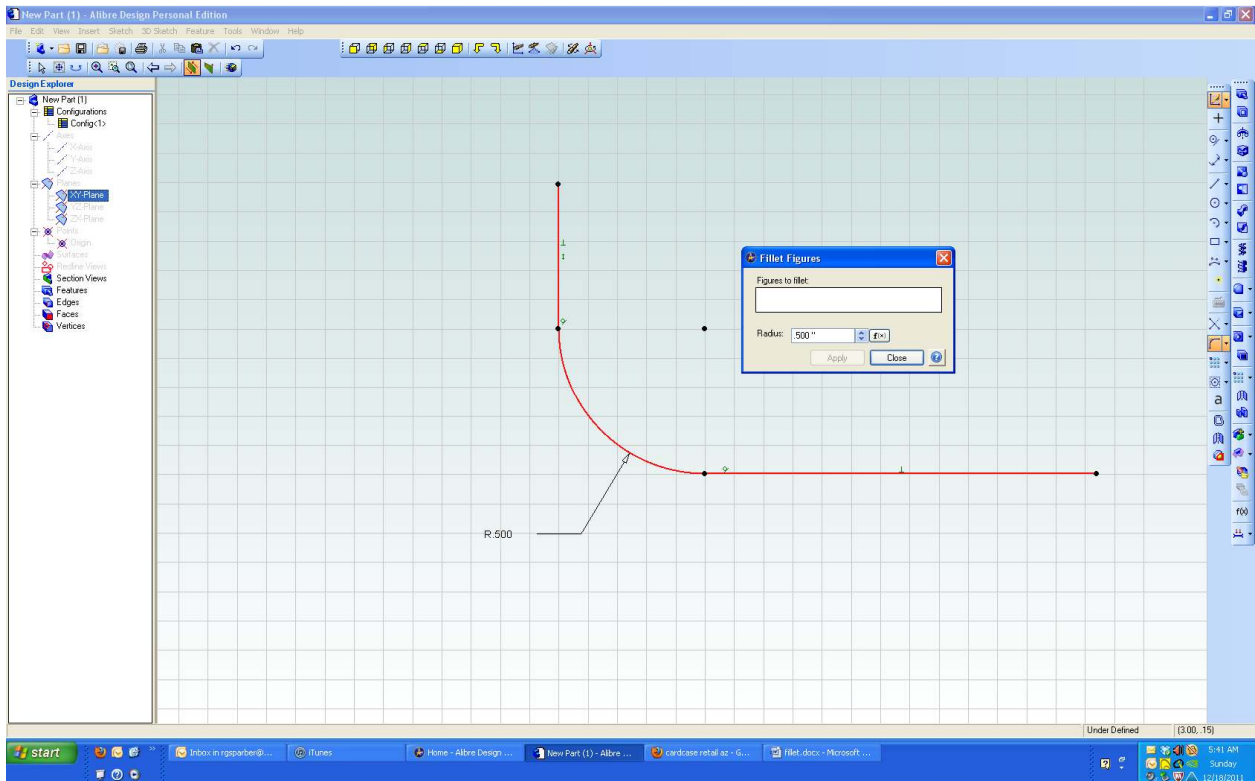
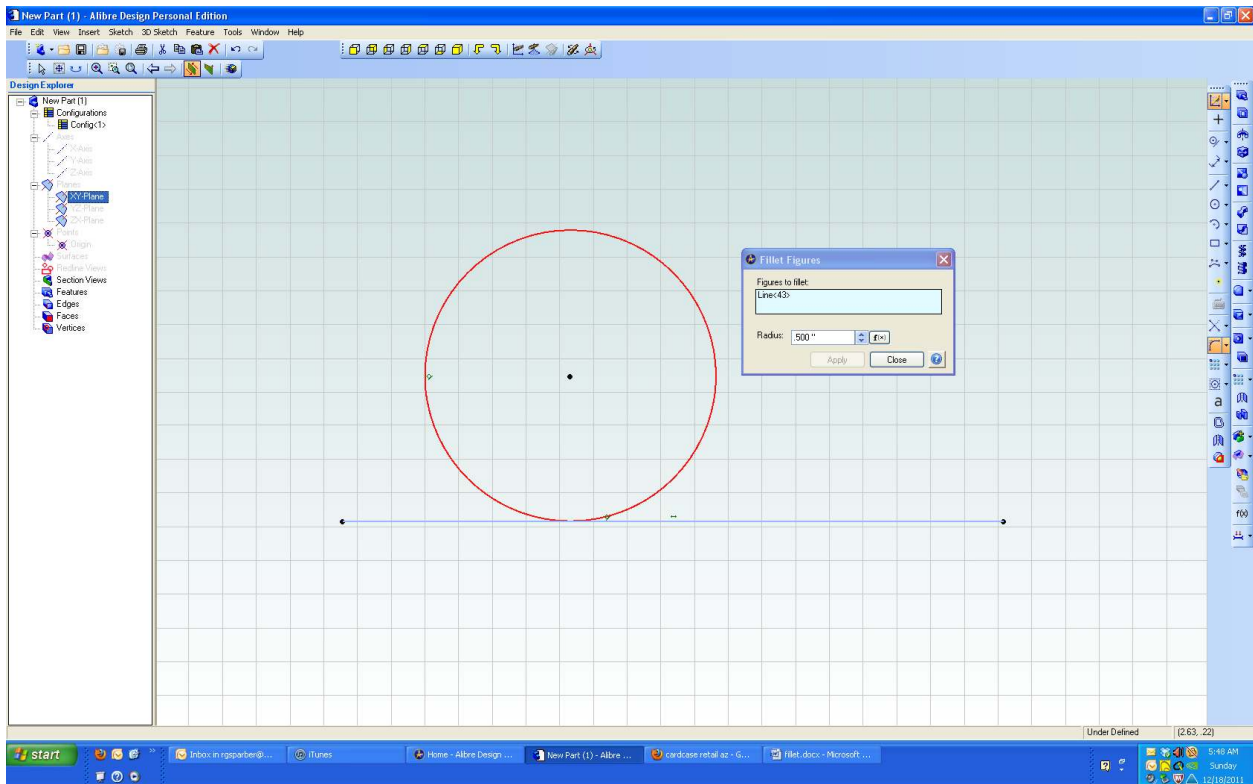The tool extends the lines as needed to connect to my arc.

The fillet tool draws an arc between *lines*. Lines don't have to be straight; they must just have two end points and be one dimensional.

So what about this case?

I have a line and a circle. I want to put a fillet on either side of the tangent point.
Seems like a reasonable request.

I click on my line and the tool put its ID in the "Figures to fillet" window as expected. But when I try to click on my circle, it won't respond. What is going on here?

Consider the definition of the fillet tool: it draws an arc between lines.

Now consider the definition of a line: a one dimensional object with two end points.

A circle is a two dimensional object with no end points. So, by definition, the fillet tool does not have to accept a circle as part of a fillet operation. Fair enough. My guess is that they could have programmed in this special case but chose not to.

We are not dead in the water here. We just can't use the fillet tool to draw our arc.
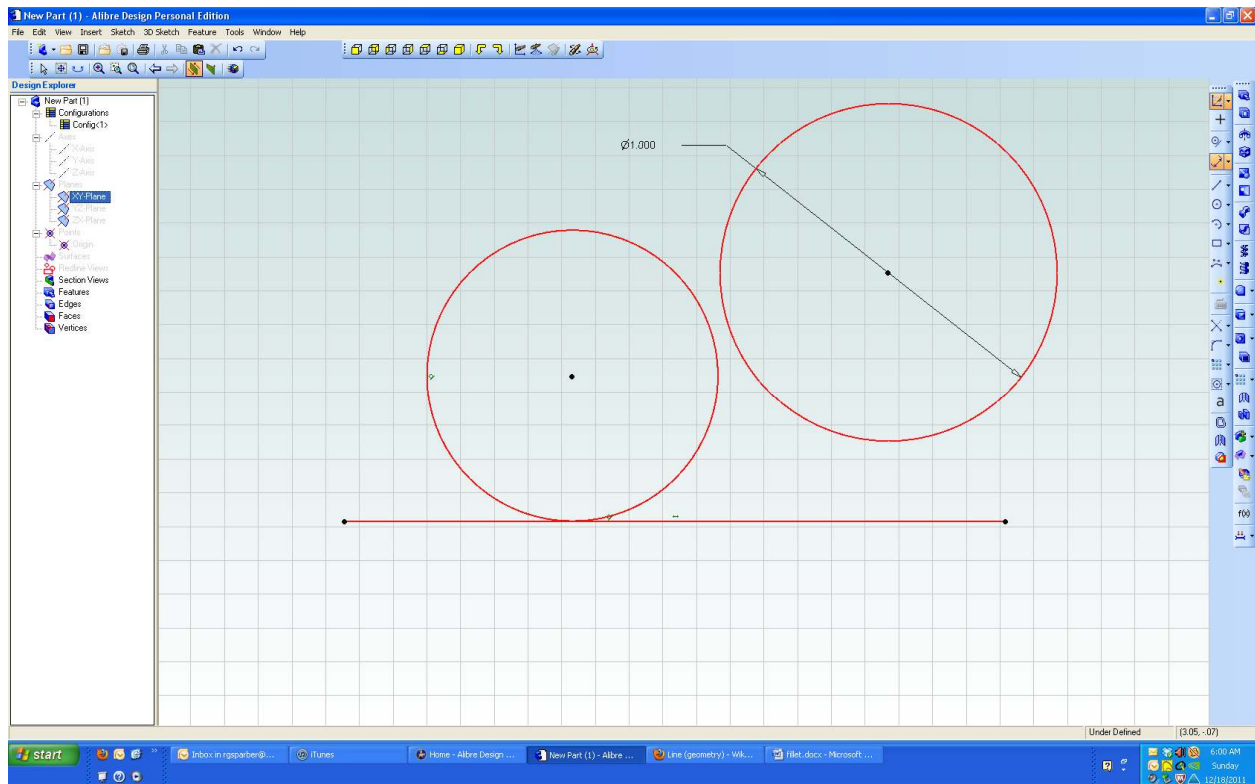
One work-around is to draw a new circle with the desired radius. I must dimension it to lock its size.
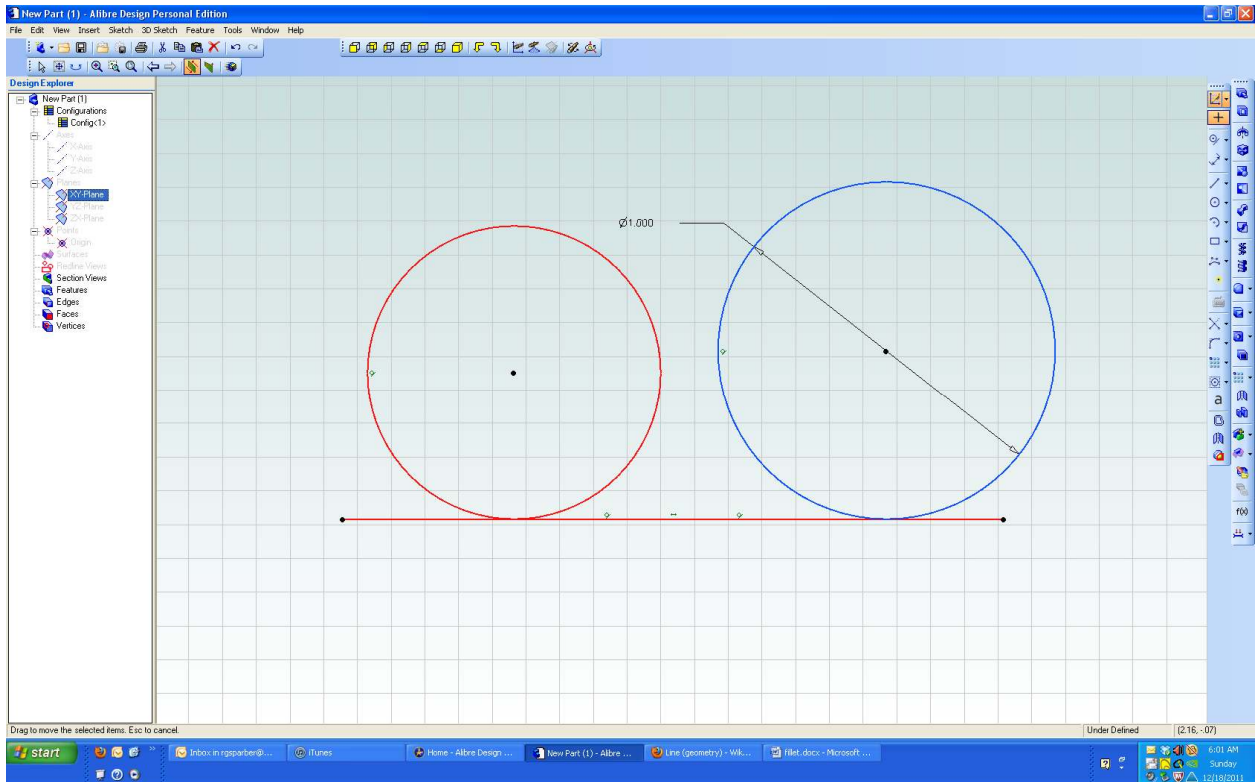
Using the tangent constraint tool, I first click on the horizontal line. This tells the program what I want to *not* move. Next I click on my new circle. The new circle is drawn down to the line and locked to it.
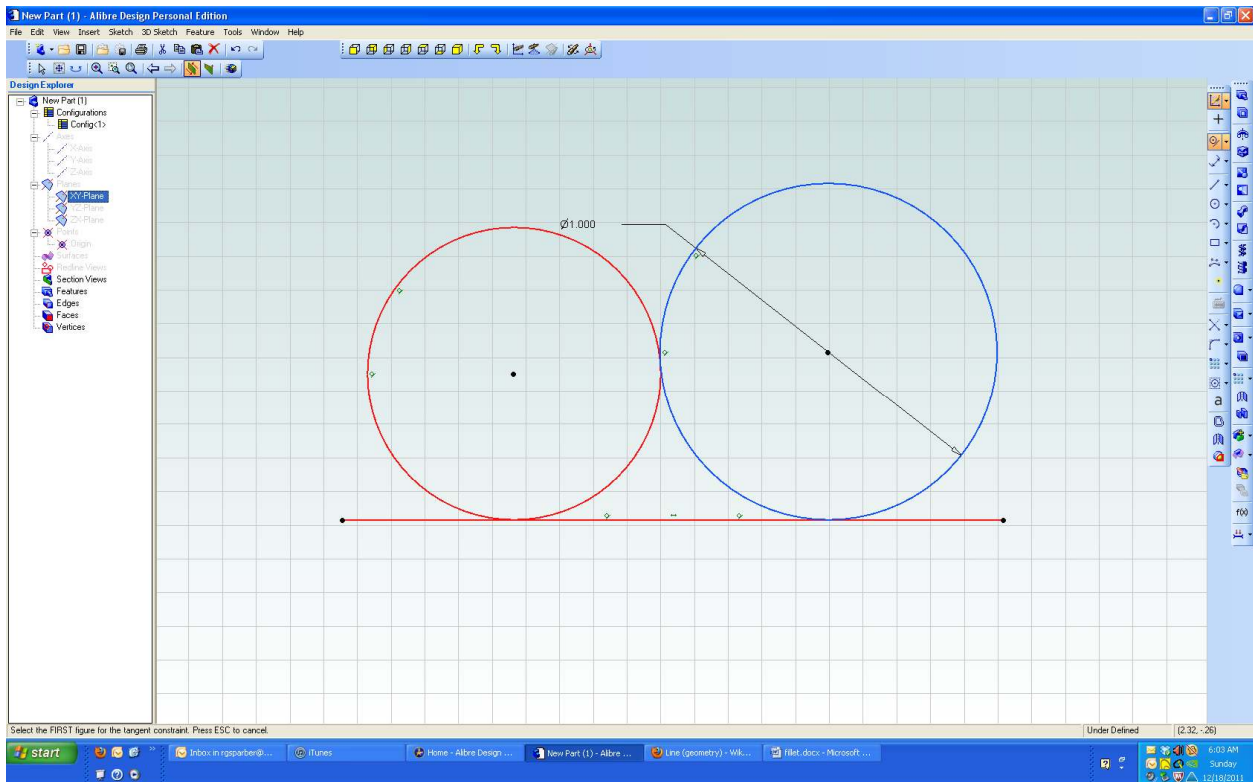
Still using the tangent constraint tool, I click on the original circle to say I want this *not* to move, and then click on my new circle. This causes the new circle to move to the original circle and be locked to it while remaining locked to the line.

My new circle now contacts the line at one point and contacts the old circle at one point. This means that my new circle has been transformed into two arcs. One arc is the fillet and the other arc is the rest of the old circle.
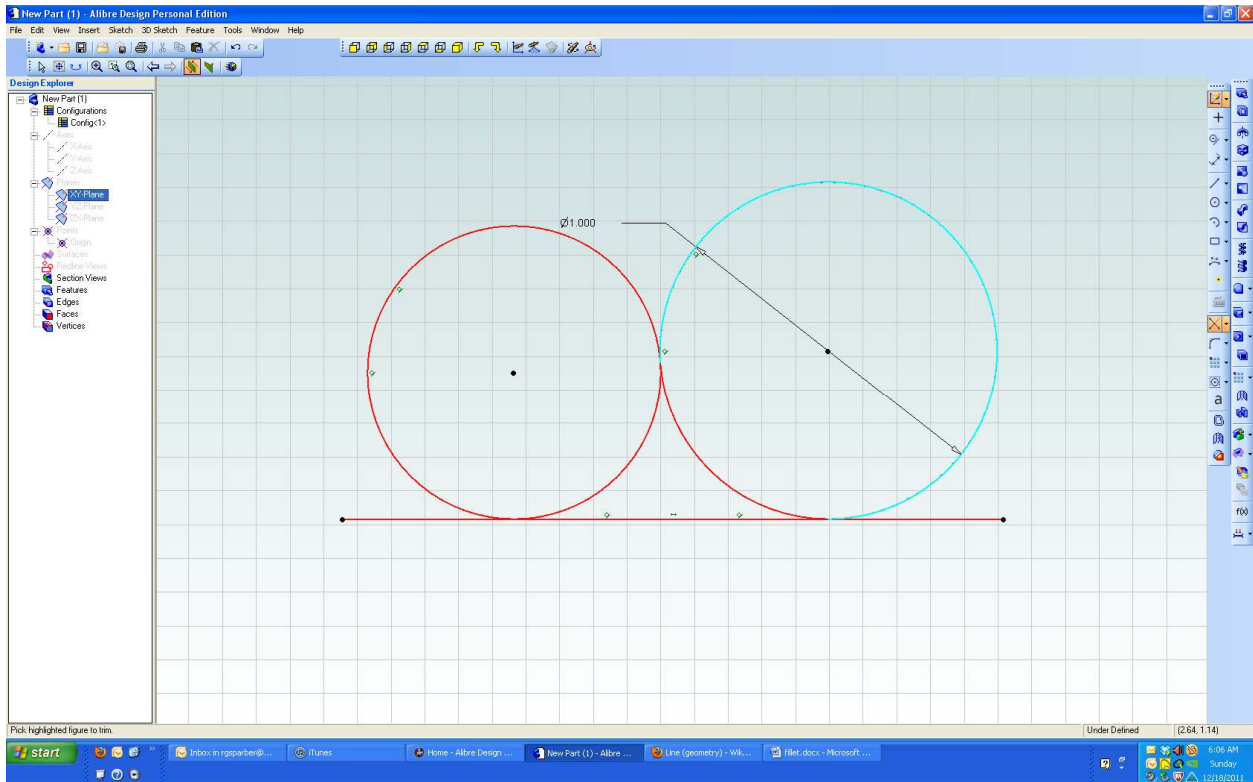
Using the line trim tool, I move my cursor over the part of the old circle I no longer want. Note how it turns blue. The fillet I want remains unselected so is red.
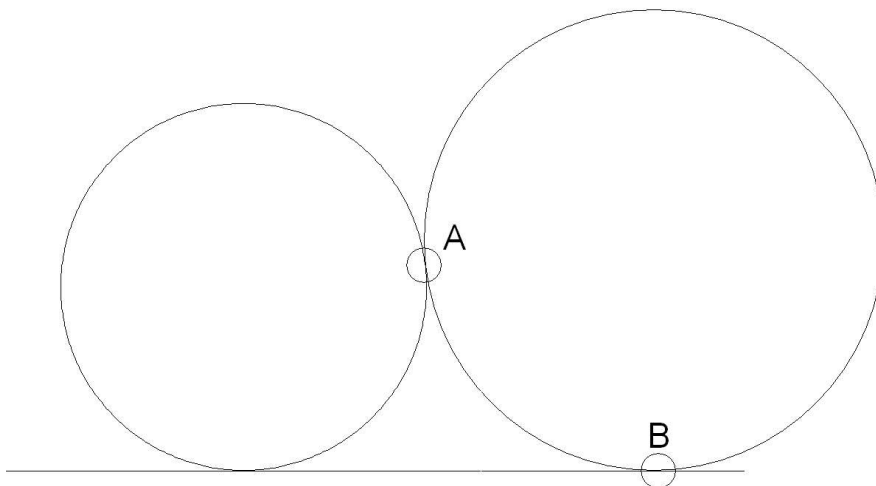

Our larger circle contacts the smaller circle at only one point which is marked A. Our larger circle contacts our line also at only one point which is marked B. The program automatically breaks up our large circle into two arcs. One will be our fillet and is line A-B. The rest of the large circle can be erased as will be done next.
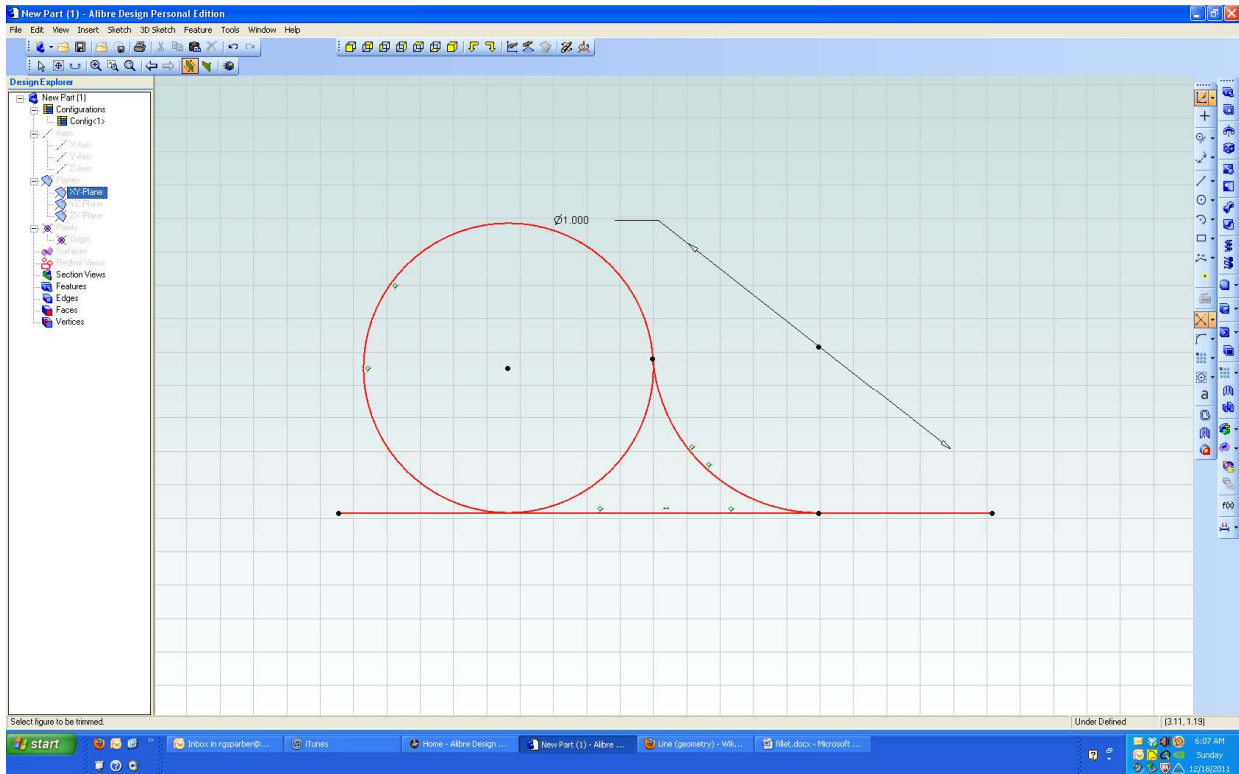
I hit delete and am left with my new fillet plus some unwanted line segments. My old circle has also been transformed into two arcs. I want to delete the arc nearest the fillet.
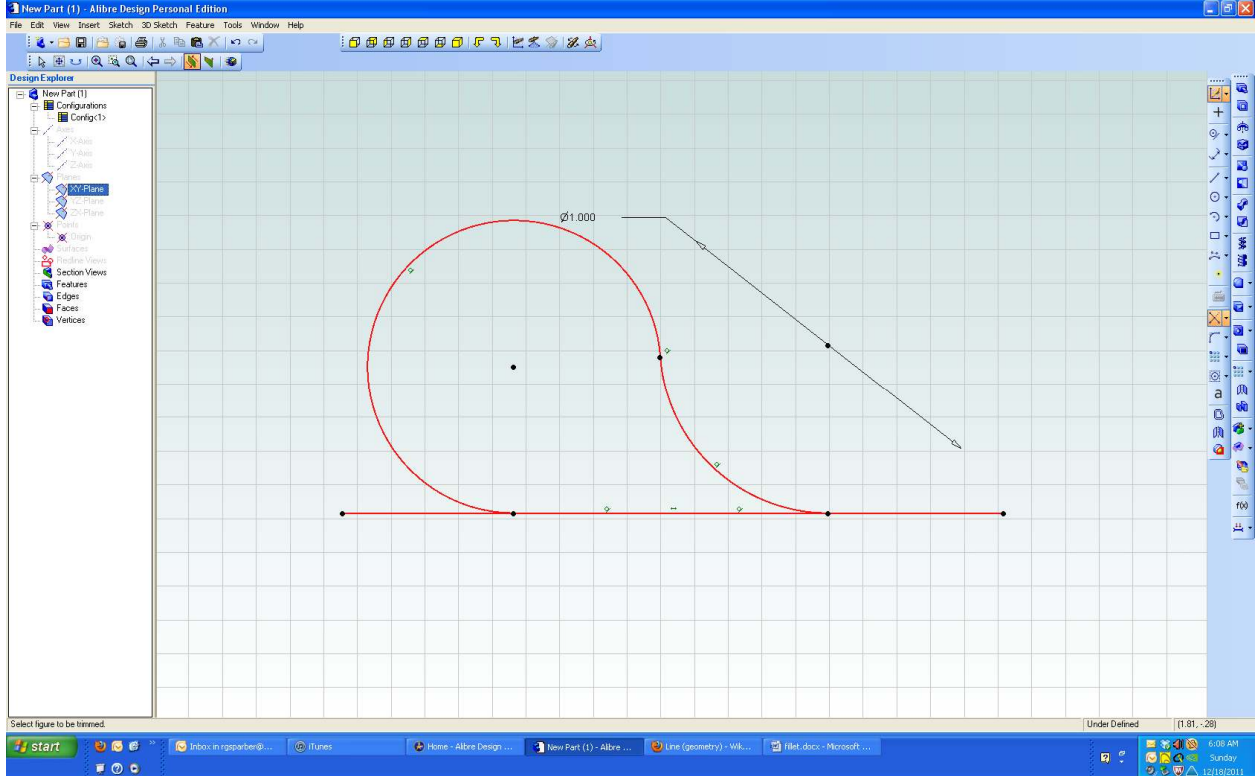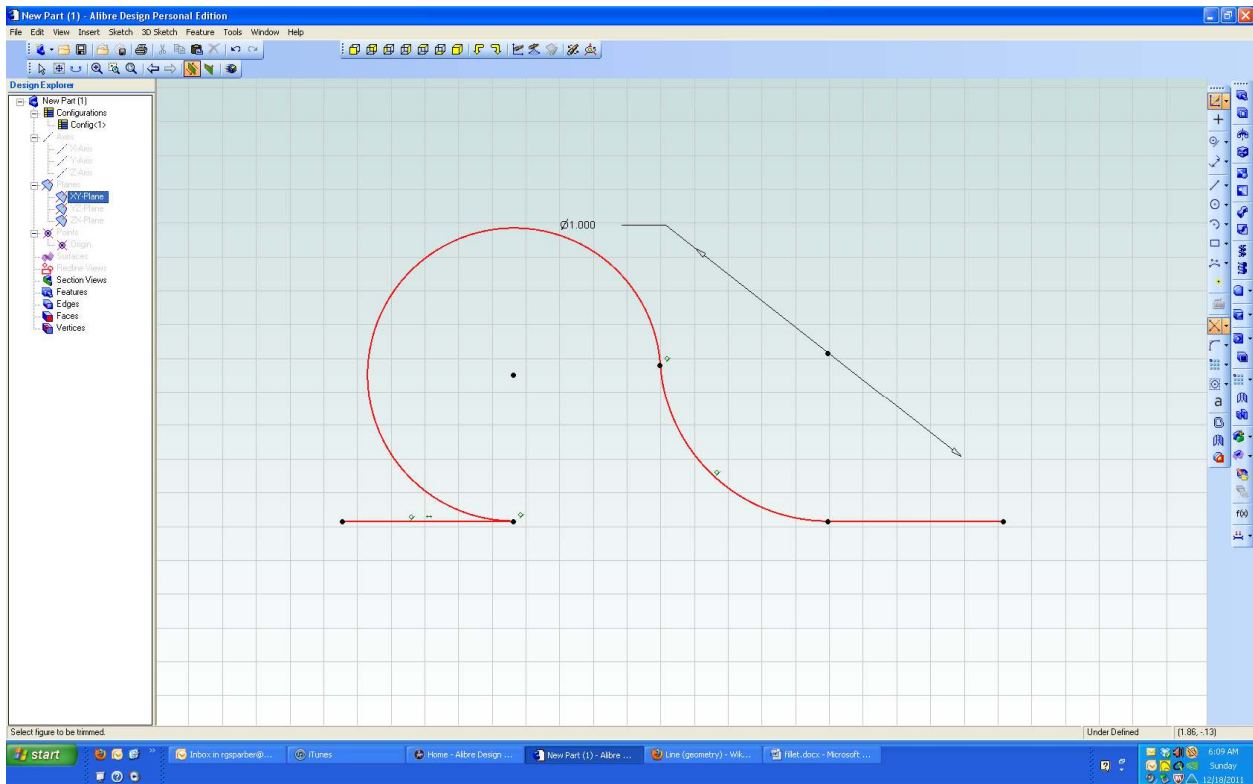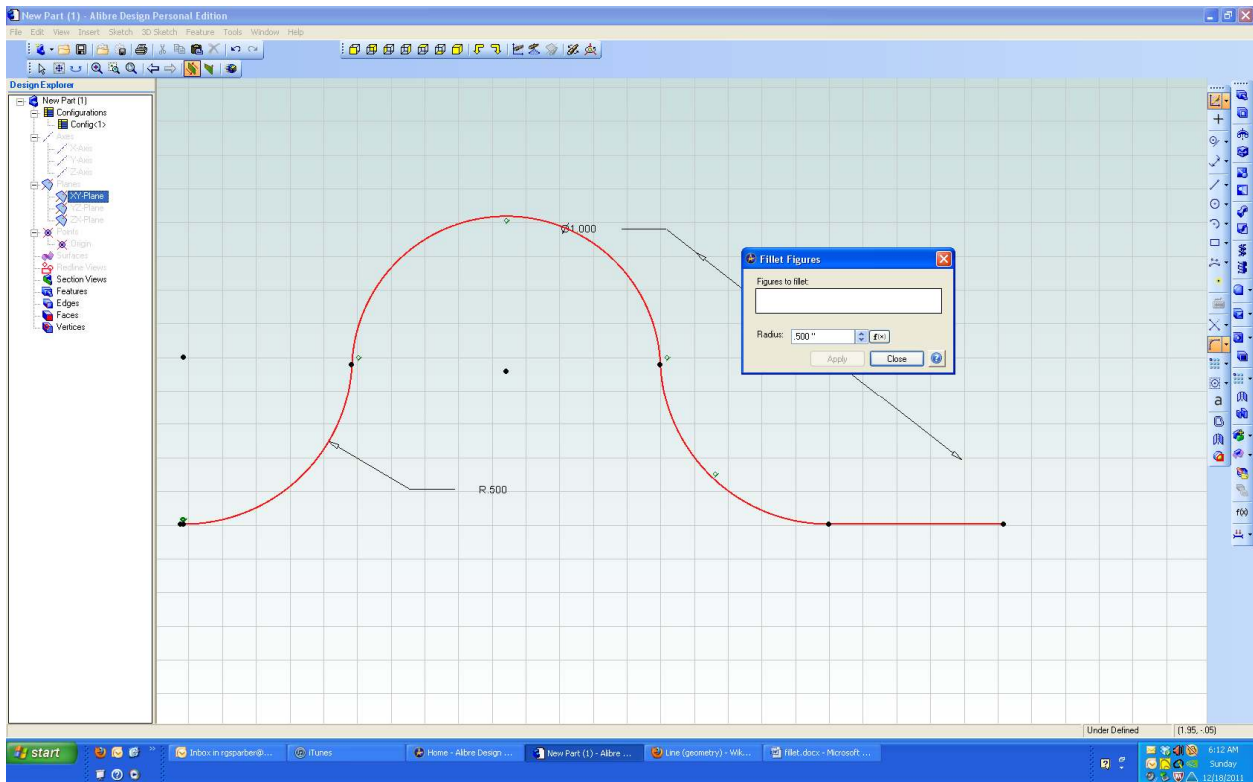
My last step was to remove the unwanted line segment. I now have a fillet from my circle to my horizontal line.

Note that the other side of what used to be our circle now meets our definition of two lines. I have my arc and a bit of my old horizontal line. I can use my fillet tool now. I did have to extend my horizontal line to make room for the fillet.
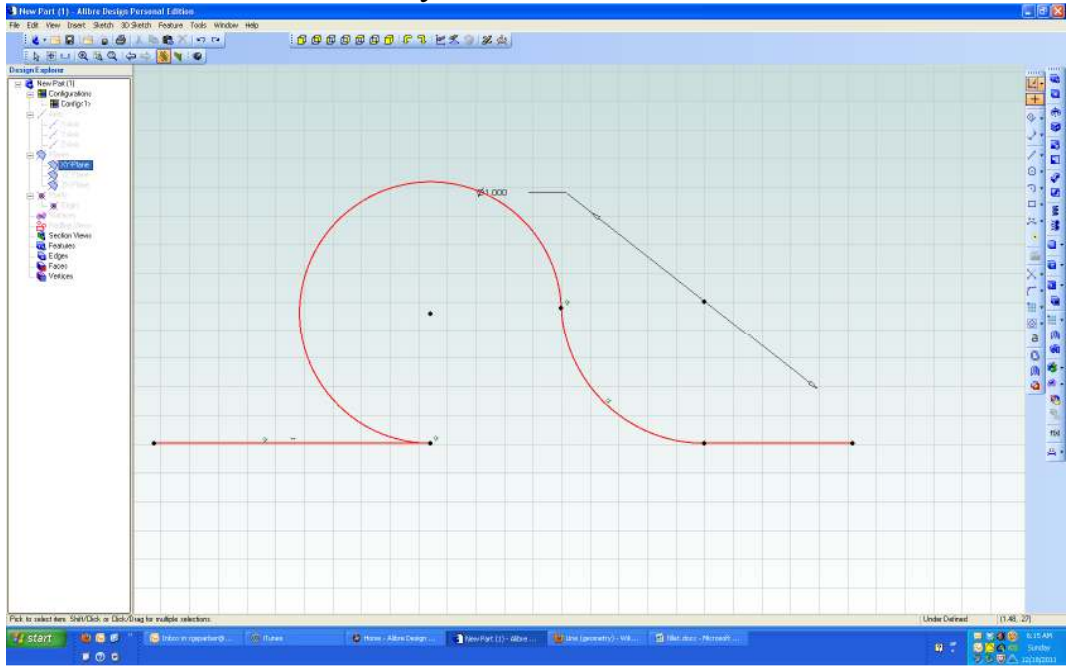
And there is my second fillet as formed by the fillet tool.

Acknowledgements

I wish to thank Brian Lamb for bringing this puzzle to my attention.

I welcome your comments and questions.

Rick Sparber
Rgsparber@aol.com
Rick.Sparber.org