Alright so I need some help making this process easier… **(I apologize for the long read)**

Every now and again I find myself working on something involving tubes and it's always a headache to figure out the line for the cut or for grinding.

(Example: You have a piece of metal tubing 4cm in diameter and u want to weld it to another piece of metal tubing that measures 6cm in diameter at a 60 degree angle)

Normally I just eyeball it and grind till I get it close enough but that doesn't always work out very well. So instead of just getting more frustrated I tried thinking about ways I could come up with a guide… I remembered a process I saw one time dealing with cutting out patterns for a hovercraft skirt. They took the profile of the skirt inflated, then reflected it off a certain angle, and then marked the intersection of lines of a certain spacing… eventually following that process you'd have a template for the section of skirt for the hovercraft… anyways so I took the same idea basically and after playing with it for awhile I found out how to make it suit my needs for coming up with a guide for cutting tubes at an angle to be joined flush with another tube.

How it Works: (if you follow along with the picture it'll make more sense…)

1. Draw a center line across the page.
2. Off that center line draw another center line at the angle you wish to have cut.
3. Now on that first center line, draw a circle with the diameter of tubing you're going to be cutting.
4. Then draw the side view of the circle off to the left side.
5. Next, off that second center line draw a circle with a diameter of the piece you'll be joining too.
6. Then draw one last circle with the same diameter of the piece you're going to be cutting, place it perpendicular to the second centerline from the center of the second circle you drew.
7. Now you need to find the circumference of the circle your cutting. ($2\pi(r)=C$)
8. There are 360 degrees in a circle and a nice even number to divide it by I found to be 12, which will give you 12 parts 30 degrees apart.
9. So take the circumference and also divide that by 12 (the answer is the spacing between the parallel lines we'll draw next)
10. Next draw 12 parallel lines starting at the end of your page. (spacing is in step 9)
11. After that, on the other side of the page draw a 45 degree line. (that's for later)
12. Now divide the two circles with the same diameter by 12 or every 30 degrees. (these act as starting points)
13. From those points on the circle, project them across onto the side view and the other circle. (as seen on the red lines in the picture)
14. The rest explains it's self if you look at the Picture.

When you're finished you'll have a weird looking curve and if you wrap that around the tube your cutting It'll show you your cut line.

So here's the part I need help with… I want to make this process quicker and easier to make it more practical. Right now I'm thinking about an equation that will produce the same results given certain variables (diameters and angle). But ideally I'd like some way of making some sort of simple program that I can just plug in the data and it'll show me the cut line. Every step relates to each other in some way to produce the final result… it's just a matter of how you string it all together. This is the best I've come up with so far, but there has got to be an easier way or at least a more practical way. Now I've looked around online for techniques people use to do this but I haven't really found anything. So if someone knows of something that would work better that would be great as well.

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