Tips and Tricks # 34

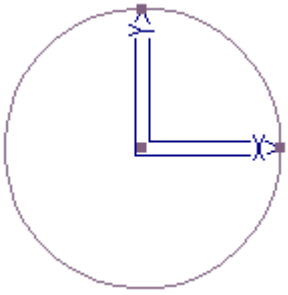
Drawing Domes and Spires.

Objective: This exercise is to show how to use the regular CAD tools to draw the required geometry for a dome and then this same process can be used to draw a spire or other such roof feature shape. We use this to subsequently create a 'Flat Pattern' from which a roof panel template can be made. The template would then be used to cut as many panels as required for complete coverage of the roof.

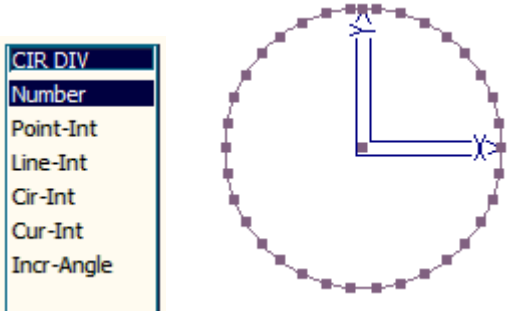
First you must know the physical dimensions. In our example below, we will draw a dome of 50 foot circumference. The Standing Seam metal panel that will be used to cover this is 18" at the widest part (seam to seam).

1. The circumference is 50', then the radius will be 7.9577' (based on C = 2πR where C is circumference and R is the radius) let's draw that. Use CAD > Circle > Insert > Radius=

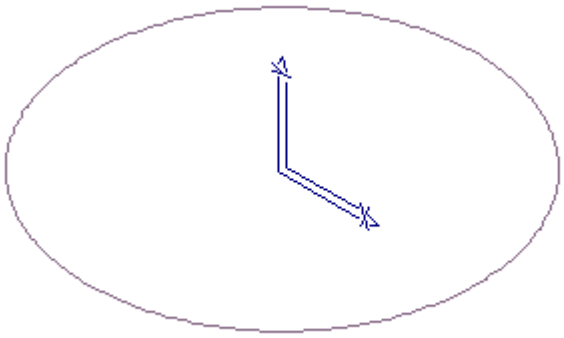
2. Place the circle at the origin of our model by typing the coordinates of 0,0.



3. Now divide this circle into multiples sections – CAD > Circle > Divide (from the right hand menu). Since the widest panel we can use is 18" (1.5 feet) we must use a panel that is less than or equal to that width, that divides exactly into our 50' circumference circle – 50/1.5 = 33.3333. So we will divide our circumference into 34 segments each being 1.47' wide or 1'5.6". This is teh base of our dome and the segments are the bottom of each panel.

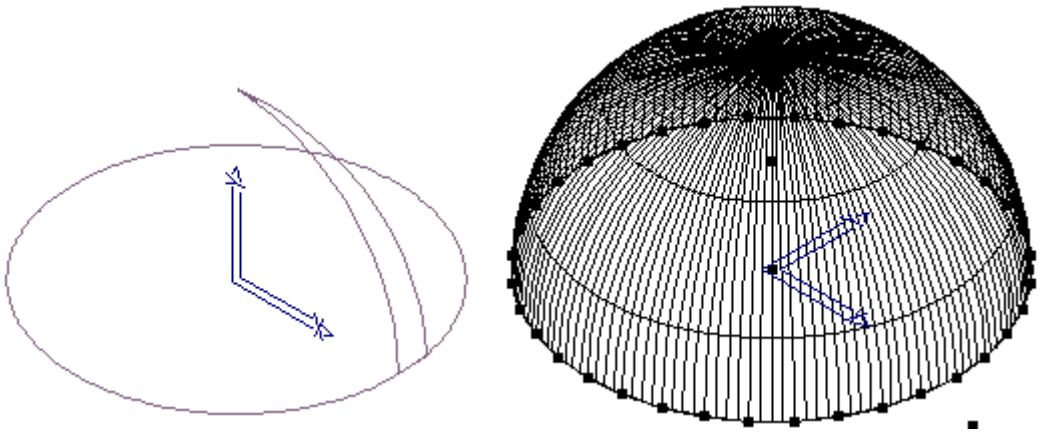


4. Now we must draw an arc (part of a circle) that represents the edge of the standing seam. Change vies to your Isometric view. Now change the construction plane to be front. Do this by selecting CAD > CPL > Select > Front from the right hand menu.

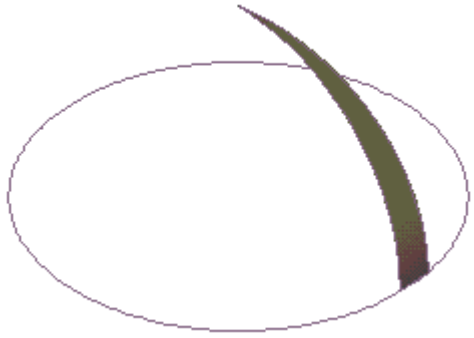


The CPL icon will flip up to be as shown above. We can now construct the sheet edge. CAD > Arc > Insert > Radius= and use the radius we used for our base – 7.96'. The software prompts for a start point, type 0,0 (our origin) and then snap (middle button) to one of the perimeter points, typically the one on the x axis. Then draw another arc using the same function and snap to the origin and the next point around the circumference.

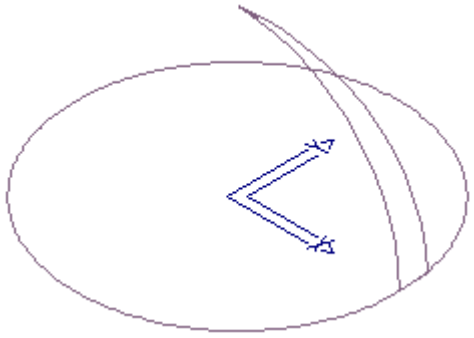
6. You could continue adding them one at a time or you could use the group copy function to add all segments shown below right. However, for our example we really only need one pair of arcs. This will define the panel.



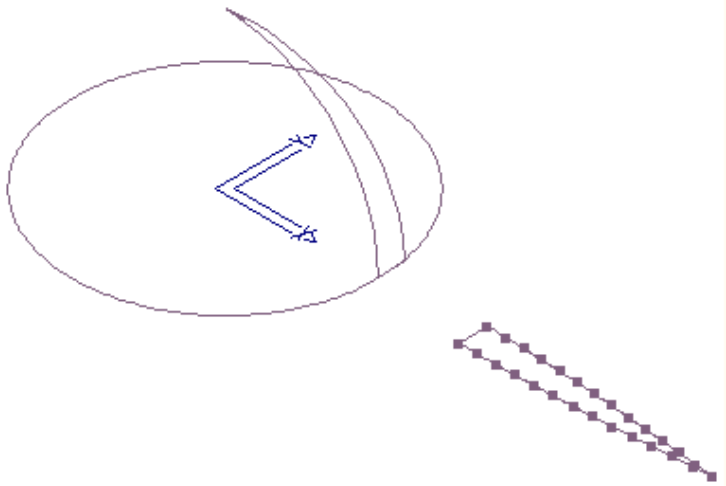
7. Next use the surface function to insert a ruled surface between the two arcs. CAD > Surface > Ruled Surface (Rul-Sur) > Insert > 2 Ent (2 entities). Select the first arc, then select the second arc. A ruled surface is inserted between the arcs. The surface may be confirmed by using the Rendering tool from the Pulldown menu – Render > Shaded and then add the line work – Render > Add Hide Lines.



8. Now we can develop a flat pattern of this surface. Before we do this we should get the CPL back to the surface of our circumference. To do this go to CAD > CPL > Select > Top.

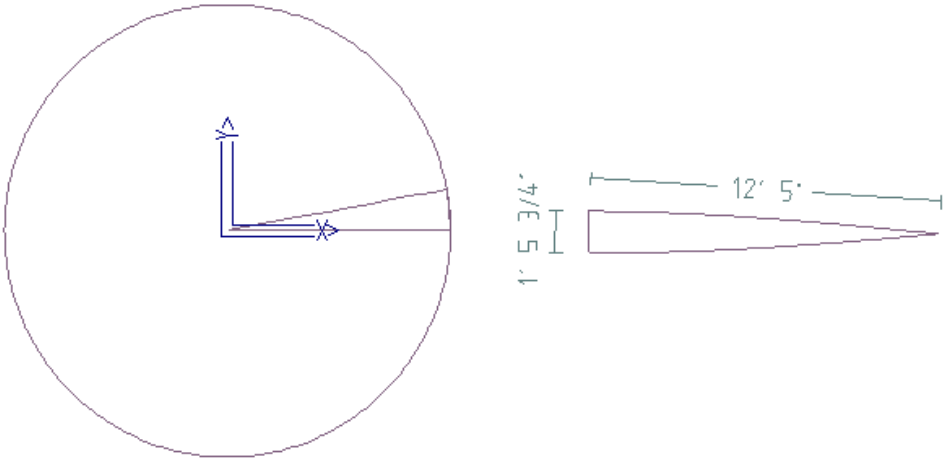


9. To develop the flat pattern, select Tools > More > Create Flat Pattern and then select Ruled Surface (Rul-Sur) and follow your prompts. Select the base point near the bottom circumference as the reference edge, then select a point next to the circumference circle and the pattern will be automatically drawn.

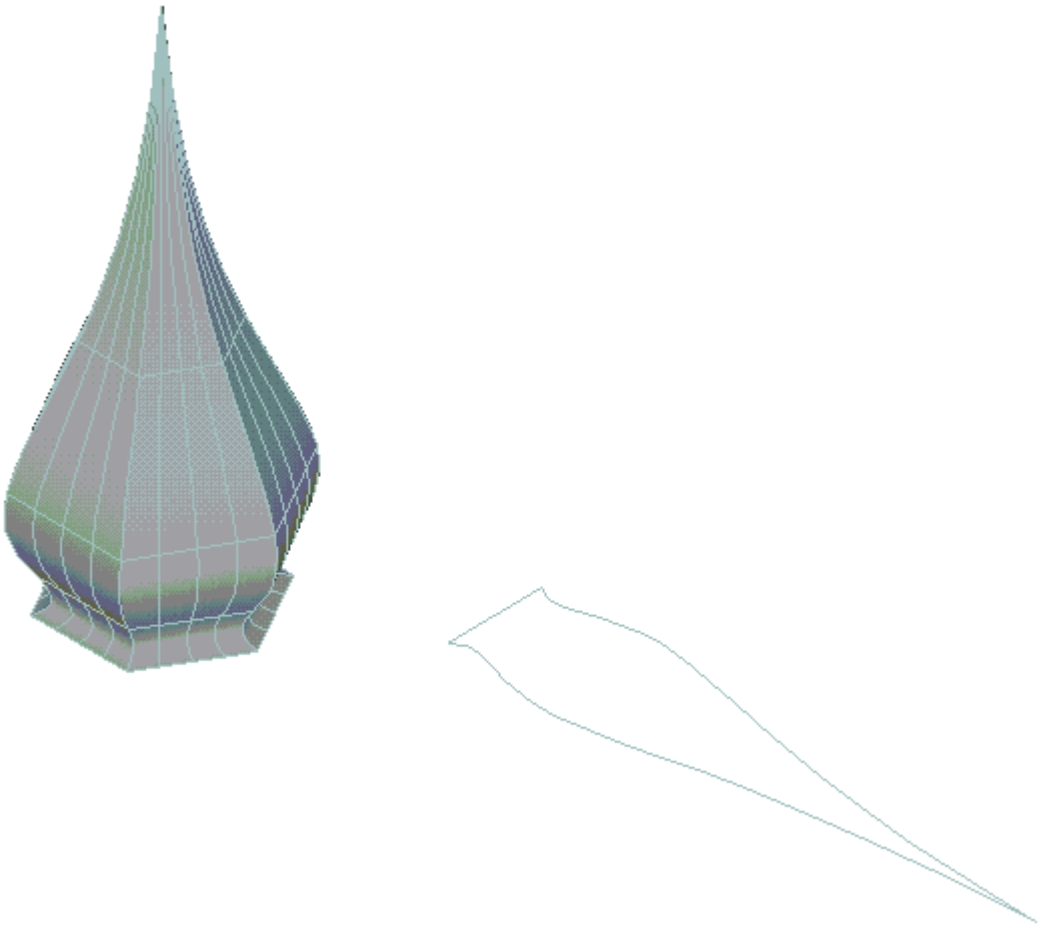


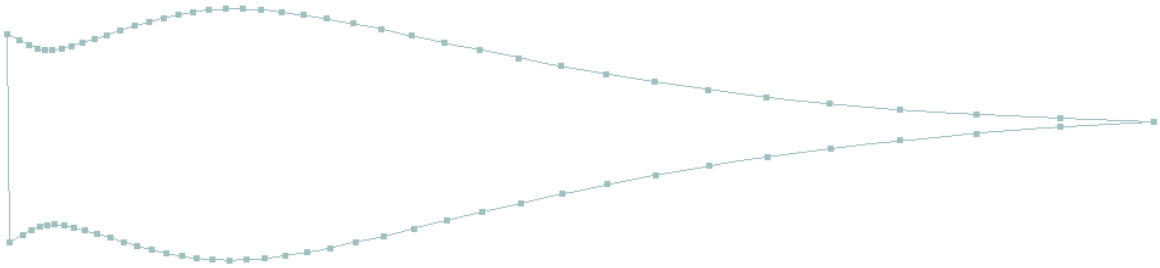
This is the precise shape of your standing seam panel, less the additional material required to form the seams, at full size. You may now use this to create a working drawing for the workshop by adding various dimensions. You may also plot this to full size and use it as a template, or you can plot it on clear film and use an overhead projector to project the shape on to a template

material . Walk back until the base dimension and length dimension are exactly as you have dimensioned the shape and you are ready to mark and cut.



This same process works for all manner of complex roof geometry, like the spire below.





10. All you have to do is draw the primary shapes using the advanced CAD functions similar to what was described above, and the Flat Pattern function figures what it would be on the flat. You may need to use many new functions in addition to arcs and circles, such as lines and curves.

Then you add the seam allowance and you're all set to fabricate your standing seam panel. One should also bear in mind that most standing seam machines will not go all the way to a fine tip point at the top, so one must cut back a required amount to allow the seamer to go through the end of the panel, then you will design a cap to cover the gap that is left on the top of the dome or spire.

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