AUTODESK UNIVERSITY 2015

AS10644

Taming Parametric Curves in Revit Family Editor

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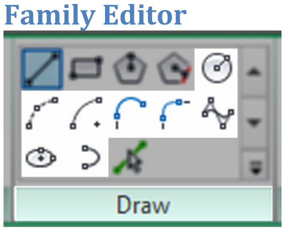
Quick Reference Sheet

Datasets

A collection of dataset files is provided to supplement this class and paper. All starting files for each exercise are provided and several “catch-up” files are also provided. In this way, you can use this paper as a hands-on guide after the class is complete and try each of the techniques I show you first-hand. You can download a copy of the dataset here:

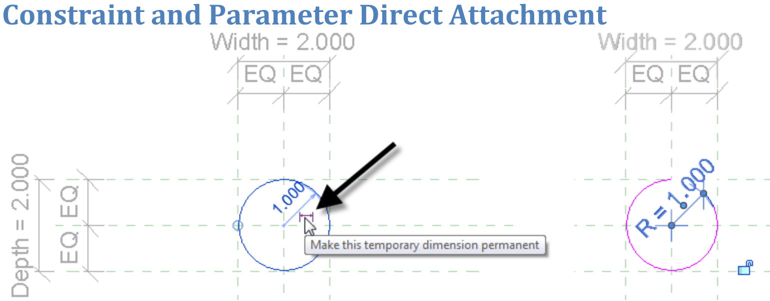
http://paulaubin.com/au/

Curvature in the Traditional Family Editor



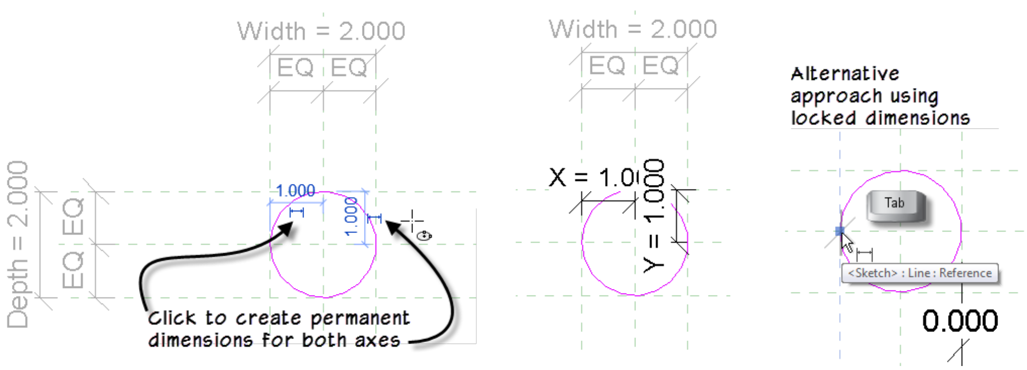
Curves available in sketch mode for solid and void forms in the traditional family editor

Constraint and Parameter Direct Attachment

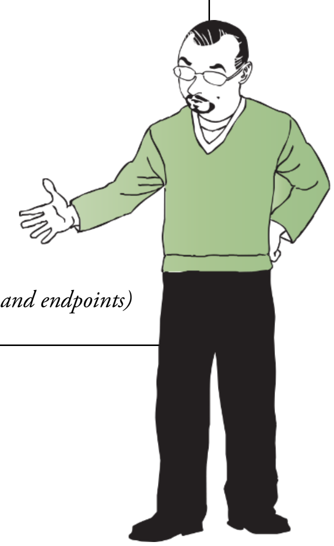


Create the dimension and a radius parameter

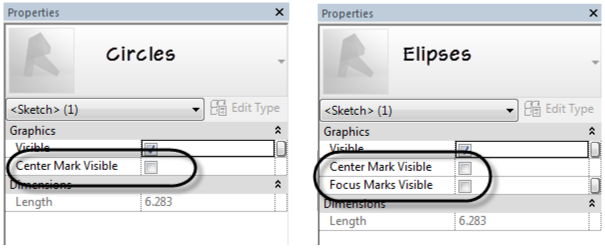
Create a Parametric Ellipse



Draw an ellipse and make the dimensions for both axes permanent (or alternatively, add dimensions between the references and endpoints)

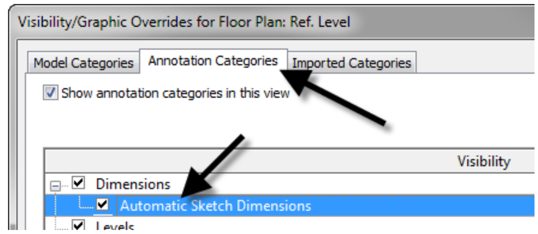


Center Mark Visible



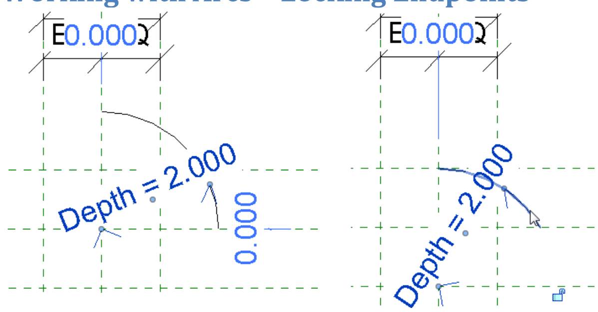
Enable the Center Mark or Focus Marks for Circles and Ellipses on the Properties palette

Automatic Sketch Dimensions



Enable the display of Automatic Sketch Dimensions

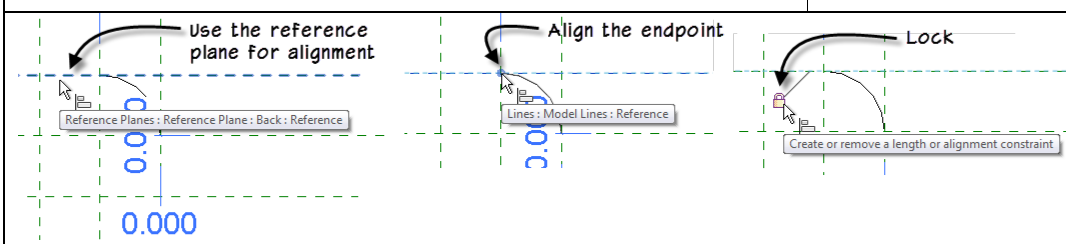
Working with Arcs – Locking Endpoints



Relying on automatic dimensions vs. applying locks

I tend not to use the locks that Revit displays when drawing a shape. I use the Align tool instead to be more precise about where and what I am locking.

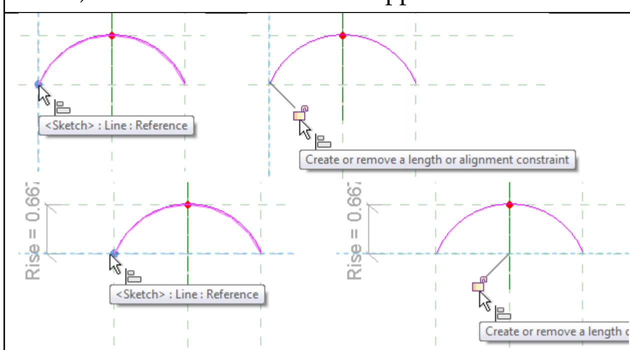
Use TAB as necessary.



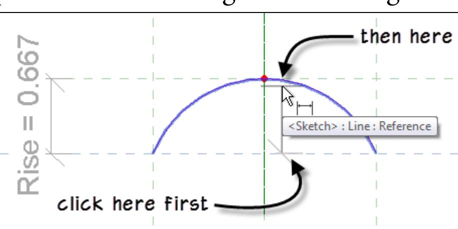
Align and lock endpoints

Create a Parametric Segmental Arch

Sometimes the key to success is in applying the labeled dimension directly to the geometry of the curve (like the circle and ellipse above) rather than the traditional approach of dimensioning the reference planes and then letting them flex the geometry.

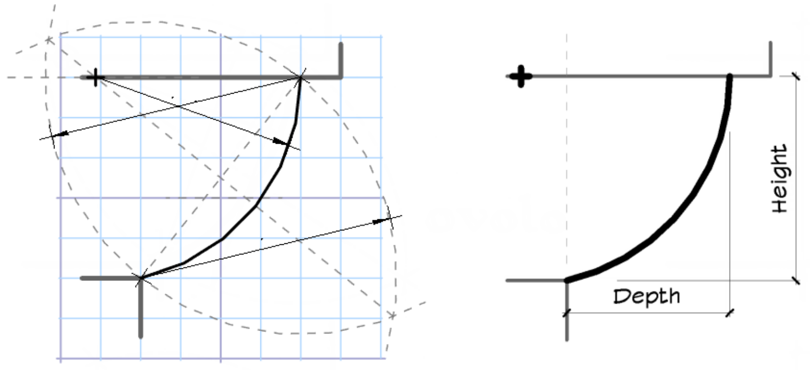


Align and lock the endpoints of the arc to the reference planes in both directions

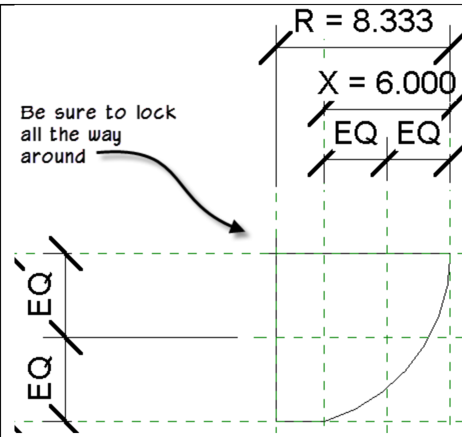


Dimension the arc directly

Create an Ovolo Curve

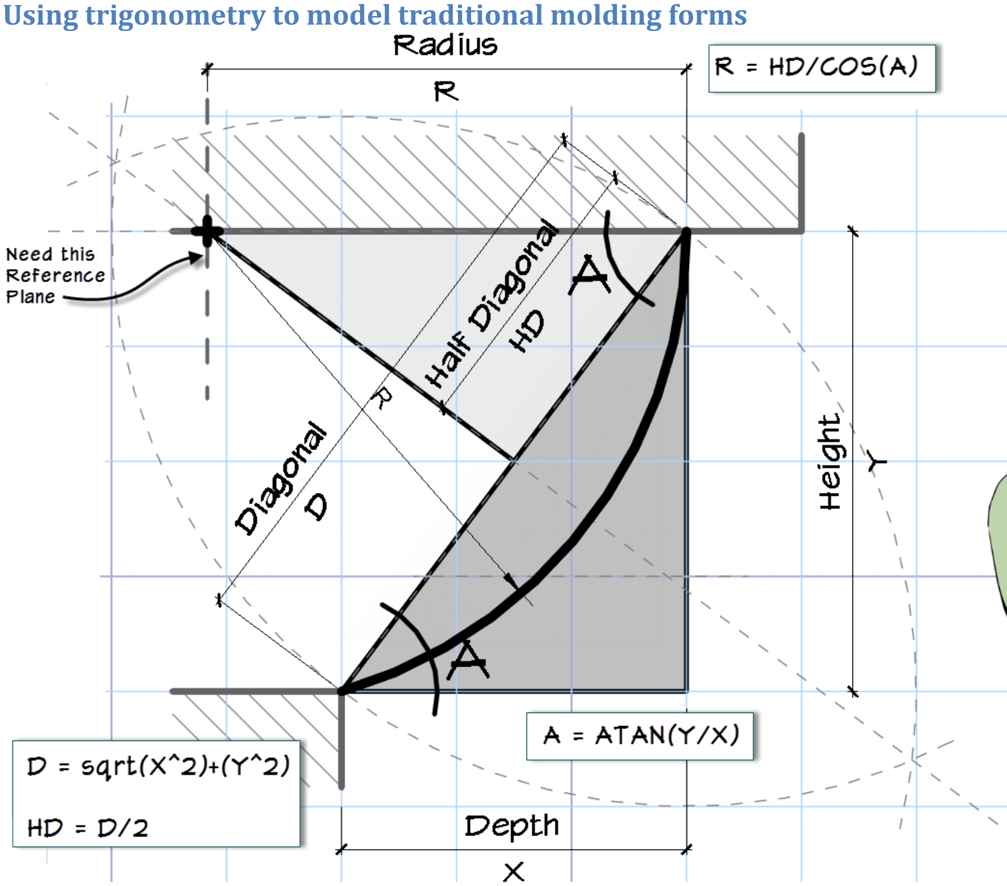


Constructing the Ovolo profile



Create the profile lines

Using trigonometry to model traditional molding forms



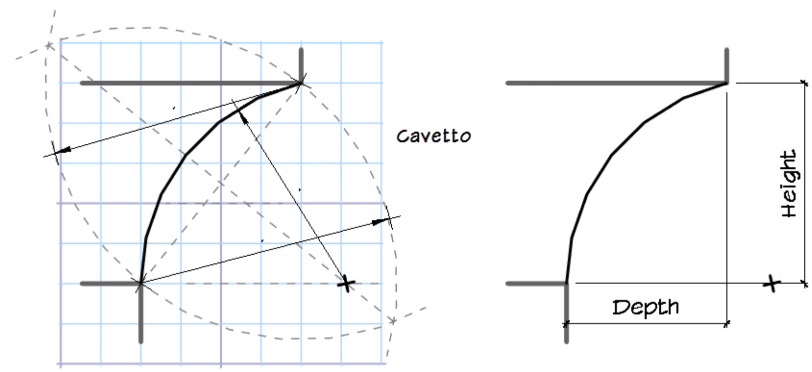
Applying trigonometry to locate the required reference planes

Two similar triangles derived from depth and height give us the location of the arc's center point and its radius.

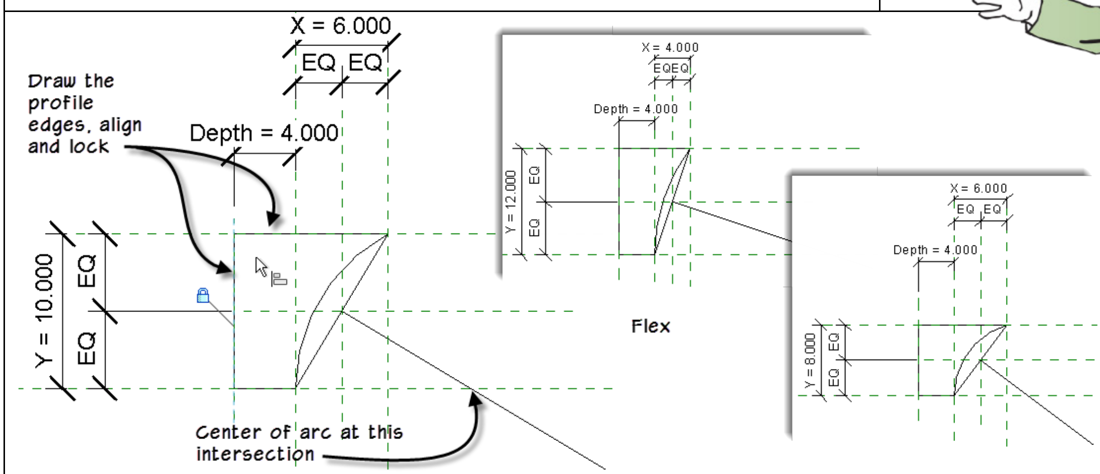
Using a nested rig in a Profile family

Use a detail item “rig” with instance parameters. Lock the rig’s “shape handles” to the reference planes in the host family.

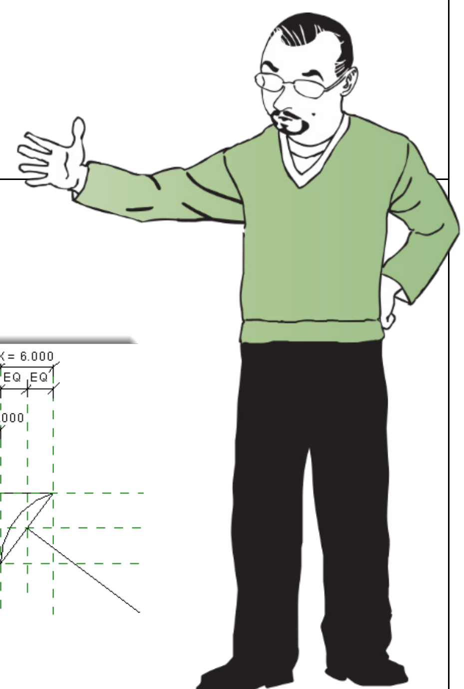
Lock the curve geometry to the **nested lines** in the detail rig.



Constructing the Cavetto profile

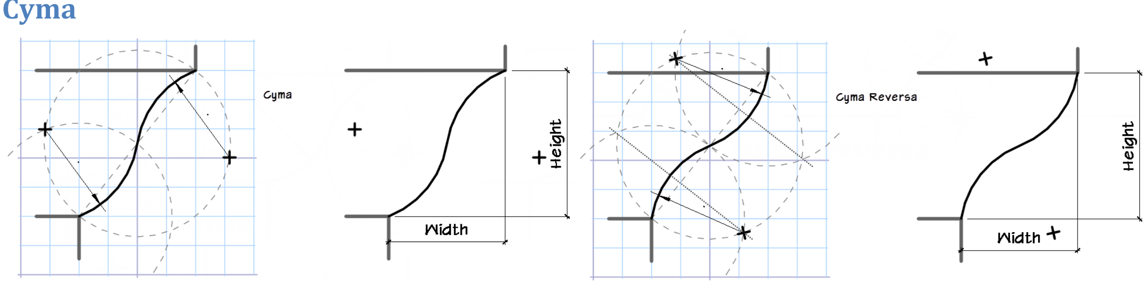


Create the profile shape and align and lock as necessary

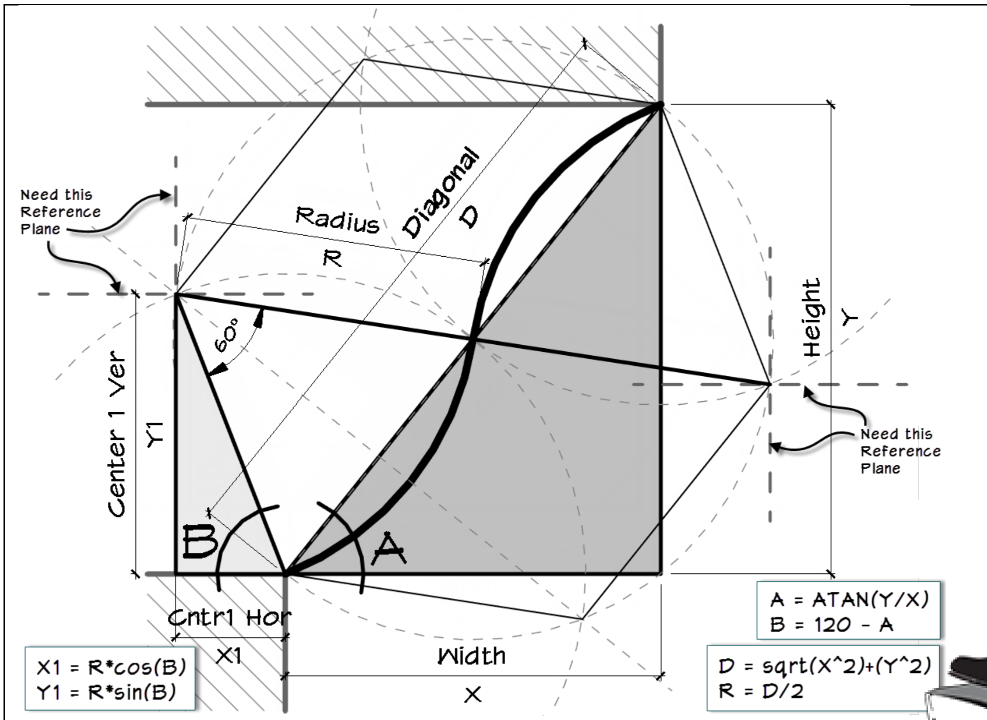


Complex Curves and Compound Curves

Cyma

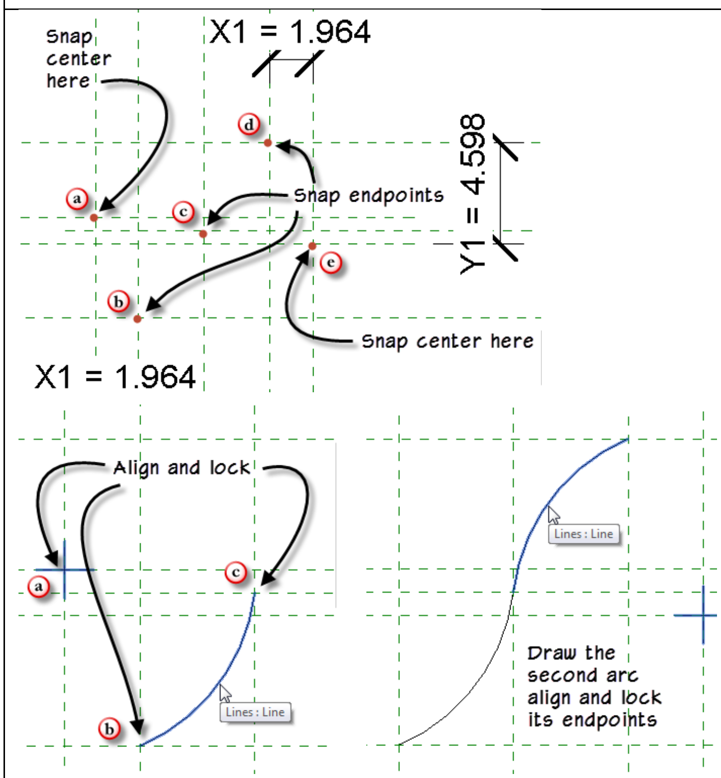


Constructing Cyma and Cyma Reversa profiles



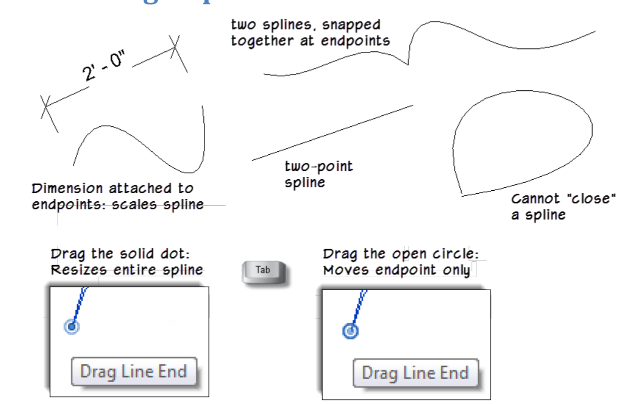
Applying trigonometry to locate the required Cyma reference planes

Cyma and Cyma Reversa curves fit into a regular hexagon. This gives us an easy way to calculate the angles and triangles required to locate the center points with formulas.



Draw the curves

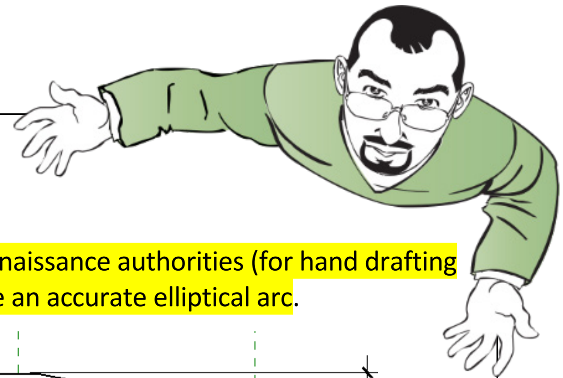
Controlling a Spline



Working with Splines

Align and lock the two endpoints of a spline and the shape of the curve will scale proportionally

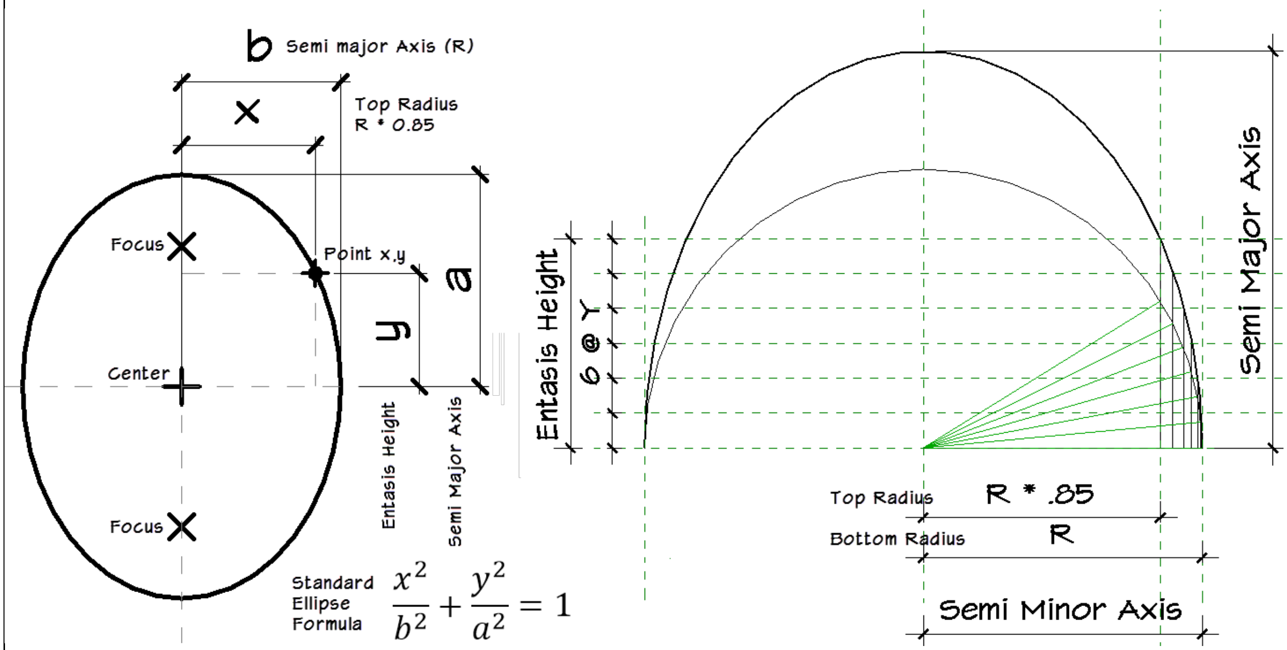
as it is flexed.



Build a Smooth Shaft with Elliptical Entasis

Create a Parametric Elliptical Arc

The challenge is to take the construction technique recommended by the renaissance authorities (for hand drafting the entasis curve) and convert this to the inputs that Revit requires to create an accurate elliptical arc.

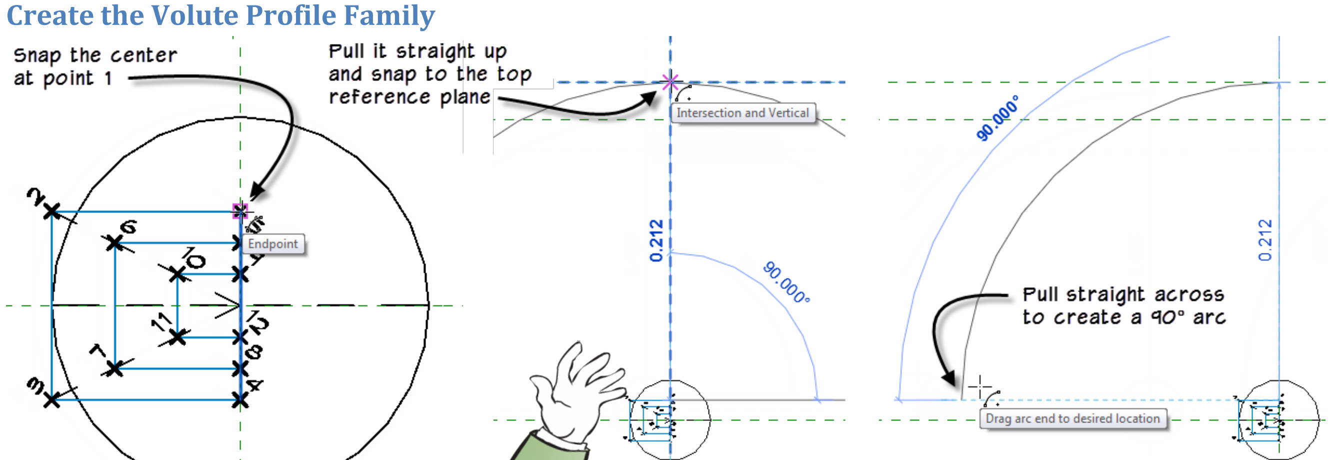


$$\frac{x^2}{b^2} + \frac{y^2}{a^2} = 1$$

Applying the standard formula for an ellipse to the entasis and our known variables

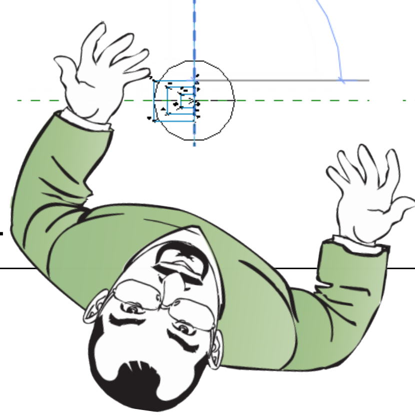
The Ionic Capital Volutes (Scrolls)

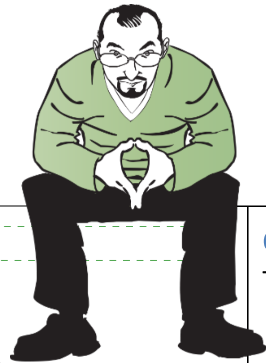
Create the Volute Profile Family

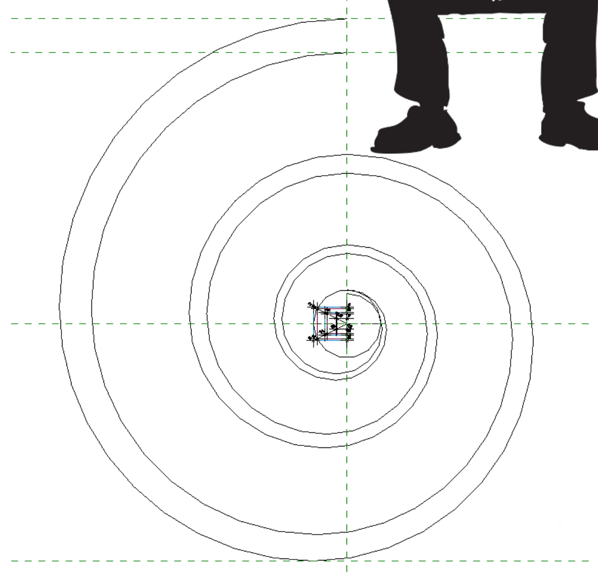


Draw the first arc centered on point 1 and 90°

Be sure to flex often as you work.



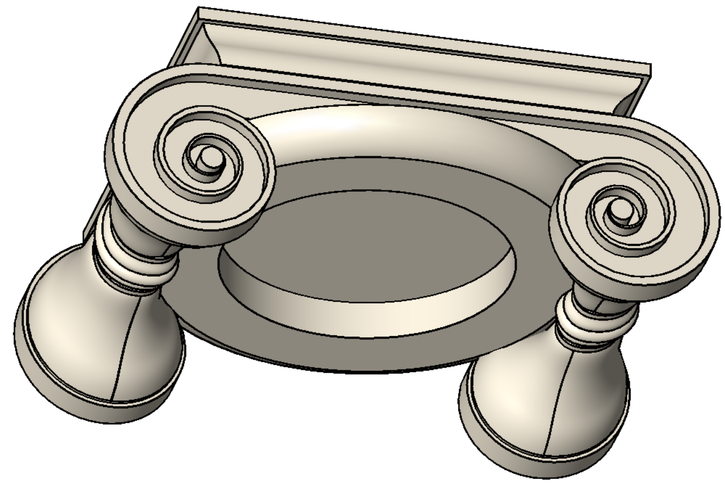




All of the arcs complete

Complete the Profile

The file is called: *X08_Finished Ionic Capital.rfa*.



The profile used in a more proper context

Further Study

You can find more information and tutorials in:

Renaissance Revit: Creating Classical Architecture with Modern Software. This book can be thought of as a "deep dive" into the family editor. It starts with the basics, but gets very advanced as well. The entire book is on family creation (in both traditional and massing family editors) using classical architectural examples.

The Aubin Academy Revit Architecture: 2016 and beyond. Chapter 11 is devoted to the subject of the family editor.

The Aubin Academy Master Series: Revit MEP. Chapters 12 and 13 are devoted to the subject of the family editor.

Also available: ***BIM Collaboration with Autodesk Navisworks***.

Other Autodesk University courses: I have taught this family editor lab before in previous years here at AU. I have also taught an advanced follow-up lab. Both class have papers and materials available for download from my website: www.paulaubin.com/au

If you prefer video training, I have several Revit video courses at: **www.lynda.com/paulaubin**. Check out: *Revit Essential Training*, *Revit Family Editor*, ***Revit Family Curves and Formulas*** and *Revit Advanced Modeling*.

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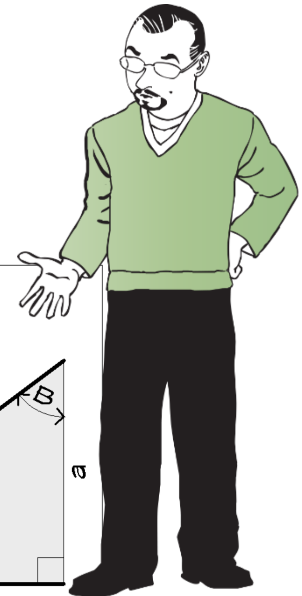
If you have any questions about this session or Revit in general, you can use the contact form at **www.paulaubin.com** to send me an email.

Follow me on Twitter: **@paulfaubin**

Thank you for attending. Please fill out your evaluation.

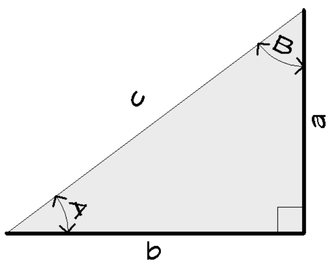


Trigonometry Cheat Sheet for Revit (Thanks to Klaus Munkholm of revitforum.org)

Which parts are known?

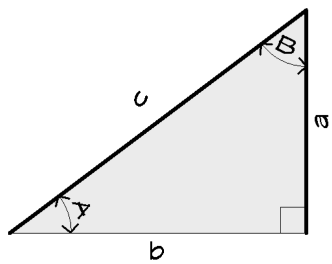
Two Sides

Known: a & b



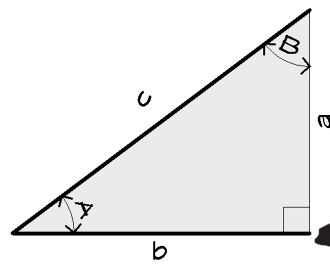
c = sqrt(a^2 + b^2)
A = atan(a / b)
B = atan(b / a)

Known: a & c



b = sqrt(c^2 - a^2)
A = asin(a / c)
B = acos(a / c)

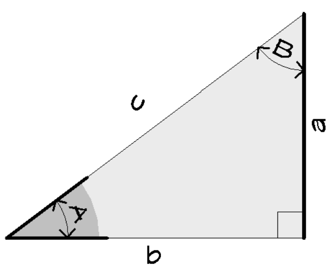
Known: b & c



a = sqrt(c^2 - b^2)
A = acos(b / c)
B = asin(b / c)

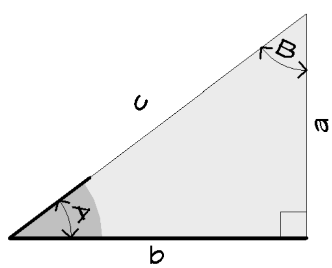
One Side & One Angle

Known: a & A



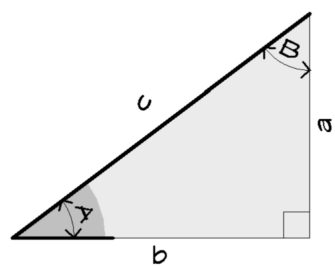
b = a / tan(A)
c = a / sin(A)
B = 90° - A

Known: b & A



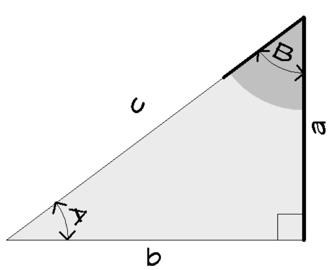
a = b * tan(A)
c = b / cos(A)
B = 90° - A

Known: c & A



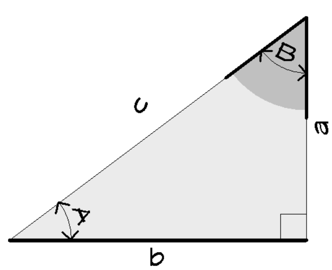
a = c * sin(A)
b = c * cos(A)
B = 90° - A

Known: a & B



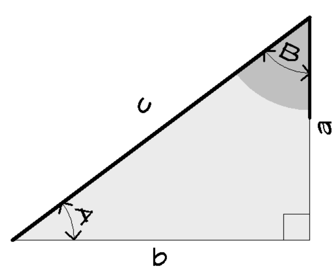
b = a * tan(B)
c = a / cos(B)
A = 90° - B

Known: b & B



a = b / tan(B)
c = b / sin(B)
A = 90° - B

Known: c & B



a = c * cos(B)
b = c * sin(B)
A = 90° - B