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

Click to create permanent dimensions for both axes

Draw an ellipse and make the dimensions for both axes permanent (or alternatively, add dimensions between the references and endpoints)
Enable the Center Mark or Focus Marks for Circles and Ellipses on the Properties palette

Enable the display of Automatic Sketch Dimensions

I tend not to use the locks that Revit displays when drawing a shape. I use the Align tool instead to draw more precisely.

Use TAB as necessary.

Relying on automatic dimensions vs. applying locks

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
Create an Ovolo Curve

Constructing the Ovolo profile

Using trigonometry to model traditional molding forms

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

Applying trigonometry to locate the required reference planes

\[ R = \frac{HD}{\cos(A)} \]

\[ D = \sqrt{X^2 + Y^2} \]

\[ HD = \frac{D}{2} \]

\[ A = \tan(Y/X) \]
Using a nested rig in a Profile family

Constructing the Cavetto profile

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.

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.

\[ X_1 = R \cdot \cos(B) \]
\[ Y_1 = R \cdot \sin(B) \]

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.

Controlling a Spline

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.

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

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

The Ionic Capital Volutes (Scrolls)

Create the Volute Profile Family

Snap the center at point 1

Pull it straight up and snap to the top reference plane

Draw the first arc centered on point 1 and 90°

Be sure to flex often as you work.
Complete the Profile
The file is called: X08_Finished Ionic Capital.rfa.

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._

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**

\[ c = \sqrt{a^2 + b^2} \]
\[ A = \arctan \left( \frac{a}{b} \right) \]
\[ B = \arctan \left( \frac{b}{a} \right) \]

**Known: a & c**

\[ b = \sqrt{c^2 - a^2} \]
\[ A = \arcsin \left( \frac{a}{c} \right) \]
\[ B = \arccos \left( \frac{a}{c} \right) \]

**Known: b & c**

\[ a = \sqrt{c^2 - b^2} \]
\[ A = \arcsin \left( \frac{b}{c} \right) \]
\[ B = \arccos \left( \frac{b}{c} \right) \]

One Side & One Angle

**Known: a & A**

\[ b = a \cdot \tan(A) \]
\[ c = a \cdot \sin(A) \]
\[ B = 90^\circ - A \]

**Known: b & A**

\[ a = b \cdot \tan(A) \]
\[ c = b \cdot \cos(A) \]
\[ B = 90^\circ - A \]

**Known: c & A**

\[ a = c \cdot \sin(A) \]
\[ b = c \cdot \cos(A) \]
\[ B = 90^\circ - A \]

**Known: a & B**

\[ b = a \cdot \tan(B) \]
\[ c = a \cdot \cos(B) \]
\[ A = 90^\circ - B \]

**Known: b & B**

\[ a = b \cdot \tan(B) \]
\[ c = b \cdot \sin(B) \]
\[ A = 90^\circ - B \]

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\[ a = c \cdot \cos(B) \]
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