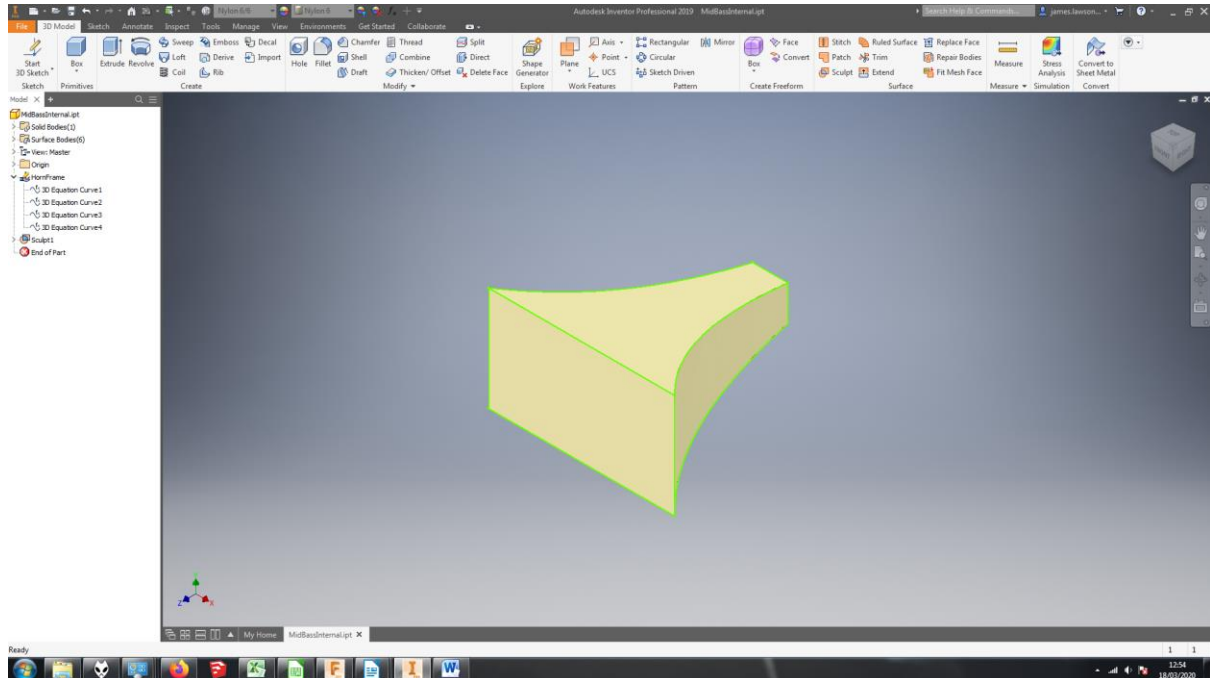


Drawing rectangular horn profiles in inventor



- Specify x , y , z coordinates in terms of a 3rd variable, t , which increases linearly.
- We know that the area of our horn expands exponentially; we also know the starting area (throat area) and the final area (mouth area).
- For simplicity of construction we have decided to have a linear vertical expansion
- The throat is square
- We have set the mouth height such that the vertical angle is around 20 degrees giving approximately 40 degree vertical directivity (quasi conical horn)

We will attempt to define four equation defined curves describing the horn side wall edges.

The area, A , along the expansion is given by:

$$A = A_0 e^{tk}.$$

Where A_0 is the throat area, k , is a dimensionless expansion coefficient and, t , the distance from the throat. It is possible to find k using the following equation:

$$k = \ln\left(\frac{A_t}{A_0}\right) / t$$

It is apparent that k is defined at the design phase of the horn.

As we know the starting vertical height ($\sqrt{A_0}$) the height at any point along the expansion is given by:

$$H = t(\tan \theta) + \sqrt{A_0}$$

The y coordinates are;

$$y = \pm \frac{H}{2} = \frac{t(\tan \theta) + \sqrt{A_0}}{2}.$$

Knowing the area along the expansion and the height we can define the width:

$$W = \frac{A}{H} = \frac{A_0 e^{tk}}{t(\tan \theta) + \sqrt{A_0}}.$$

The x coordinates follow as for the y;

$$x = \pm \frac{A_0 e^{tk}}{2(t(\tan \theta) + \sqrt{A_0})}$$

Parameters for midbass horn (units cm):

Parameter	Value
A0	348.7
θ	20.1444027775595
k	0.027509921150574

Parametric equations to enter into 3D sketch equation curve:

Equation curve 1:

$$x(t) = 0.5 * A_0 * \exp(t * k) / (t * \tan(\theta) + \sqrt{A_0})$$

$$y(t) = (t * \tan(\theta) + \sqrt{A_0}) * 0.5$$

$$x(t) = t$$

Equation curve 2:

$$x(t) = -0.5 * A_0 * \exp(t * k) / (t * \tan(\theta) + \sqrt{A_0})$$

$$y(t) = (t * \tan(\theta) + \sqrt{A_0}) * 0.5$$

$$x(t) = t$$

Equation curve 3:

$$x(t) = 0.5 * A_0 * \exp(t * k) / (t * \tan(\theta) + \sqrt{A_0})$$

$$y(t) = (t * \tan(\theta) + \sqrt{A_0}) * -0.5$$

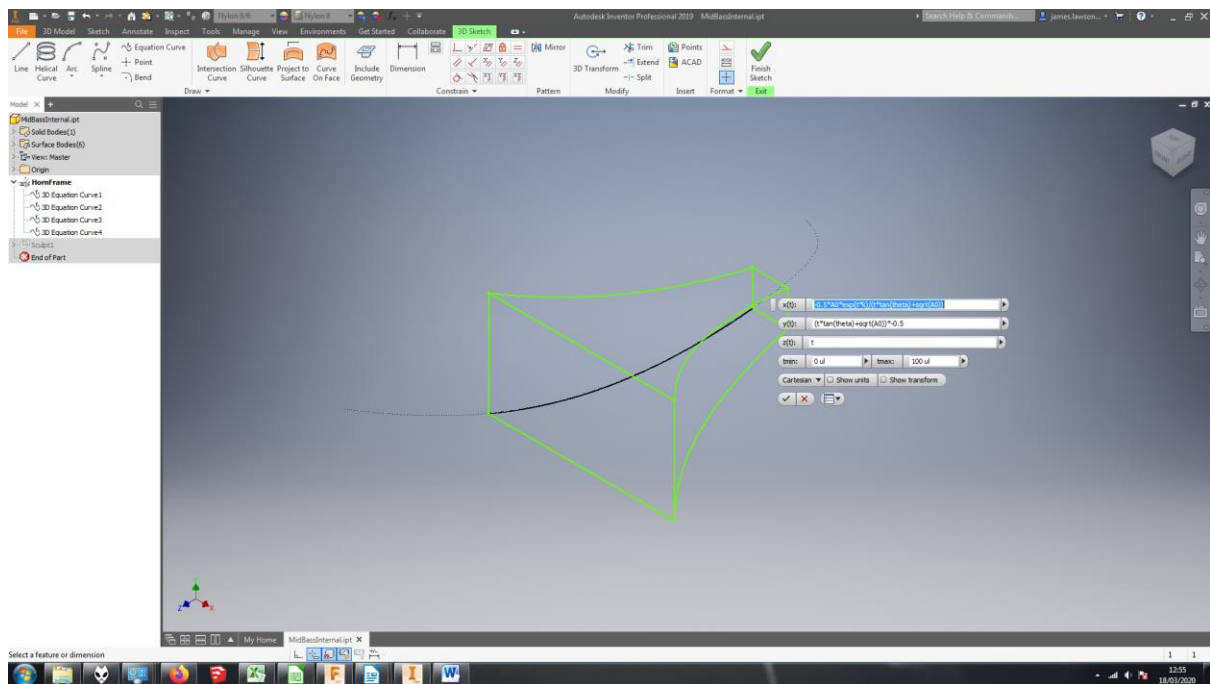
$$x(t) = t$$

Equation curve 4:

$$x(t) = -0.5 * A_0 * \exp(t * k) / (t * \tan(\theta) + \sqrt{A_0})$$

$$y(t) = (t * \tan(\theta) + \sqrt{A_0}) * -0.5$$

$$x(t) = t$$



The wireframe model can be converted to a solid using the patch command (repeatedly – remember to share the sketch so it does not disappear) and the sculpt command once all the faces have been generated. The sketch can be hidden once sculpted.