Advanced/Extended Trigonometry Functions

Arguably, most Trigonometry requirements are served by the three staples of Sine, Cosine and Tangent almost exclusively. There are however, many more functions which can be required. Their use is sufficiently rare though, that native functions are probably a waste of firmware space and development when they can be synthesized from the other mathematical primitives in a language.

The following code is all written in MMBasic but that language is a good “pseudo-code” allowing easy transcribing to just about any other. A good discussion on all trig functions and how/why to use them can be found here:https://en.wikipedia.org/wiki/Trigonometric_functions

The below functions have been tested against Wolfram Alpha for correct function. Most are fine but three may be considered a “work in progress”. This status is clearly indicated against each function. Please feel free to correct those that currently do not work as expected.

Secant, CoSecant and CoTangent:

```
Function Sec(x As Float) As Float'OK
    Sec=1/Cos(x)
End Function

Function Cosec(x As Float) As Float'OK
    Cosec=1/Sin(x)
End Function

Function Cot(x As Float) As Float'OK
    Cot=1/Tan(x)
End Function
```

Hyperbolic function counter-parts:

```
Function Sinh(x As Float) As Float'OK
    Sinh=(Exp(x)-Exp(-x))/2
End Function

Function Cosh(x As Float) As Float'OK
    Cosh=(Exp(x)+Exp(-x))/2
End Function

Function Tanh(x As Float) As Float'OK
    Tanh=(Exp(-x)/Exp(x)+Exp(-x))*2+1
End Function

Function Sech(x As Float) As Float'OK
    Sech=2/(Exp(x)+Exp(-x))
End Function

Function Cosech(x As Float) As Float'OK
```

```
        Cosech=2/(Exp(x)-Exp(-x))
    End Function

    Function Coth(x As Float) As Float'OK
        Coth=Exp(-x)/(Exp(x)-Exp(-x))*2+1
    End Function
```

The Inverse counterparts

```
    Function Sin_1(x As Float) As Float'OK
        Sin_1=Atn(x/Sqr(-x*x+1))
    End Function

    Function Cos_1(x As Float) As Float'OK
        Cos_1=-Atn(x/Sqr(-x*x+1))+Pi/2
    End Function

    Function Sec_1(x As Float) As Float
        Sec_1=Acos(1/x)'formula from openai.com, still not convinced since
arcsec(0.5)=1.31696 on WA, but errors on Acos
    End Function

    Function Cosec_1(x As Float) As Float' x>1, OK
        Cosec_1=Atn(x/Sqr(x*x-1))+(Sgn(x)-1)*Pi/2
    End Function

    Function Cot_1(x As Float) As Float'formula from openai.com
        Cot_1=Atn(1 / x)
    End Function

    Function Sinh_1(x As Float) As Float' OK
        Sinh_1=Log(x+Sqr(x*x+1))
    End Function

    Function Cosh_1(x As Float) As Float' OK
        Cosh_1=Log(x+Sqr(x*x-1))
    End Function

    Function Tanh_1(x As Float) As Float' OK
        Tanh_1=Log((1+x)/(1-x))/2
    End Function

    Function Sech_1(x As Float) As Float
         Sech_1=Log((1+Sqr(1-x*x))/x)'formula from openai.com
    End Function

    Function Cosech_1(x As Float) As Float' OK
        Cosech_1=Log((Sgn(x)*Sqr(x*x+1)+1)/x)
```

```
    End Function
    Function Coth_1(x As Float) As Float' OK
        Coth_1=Log((x+1)/(x-1))/2
    End Function
```