

# Hyperbolic Functions (1A)

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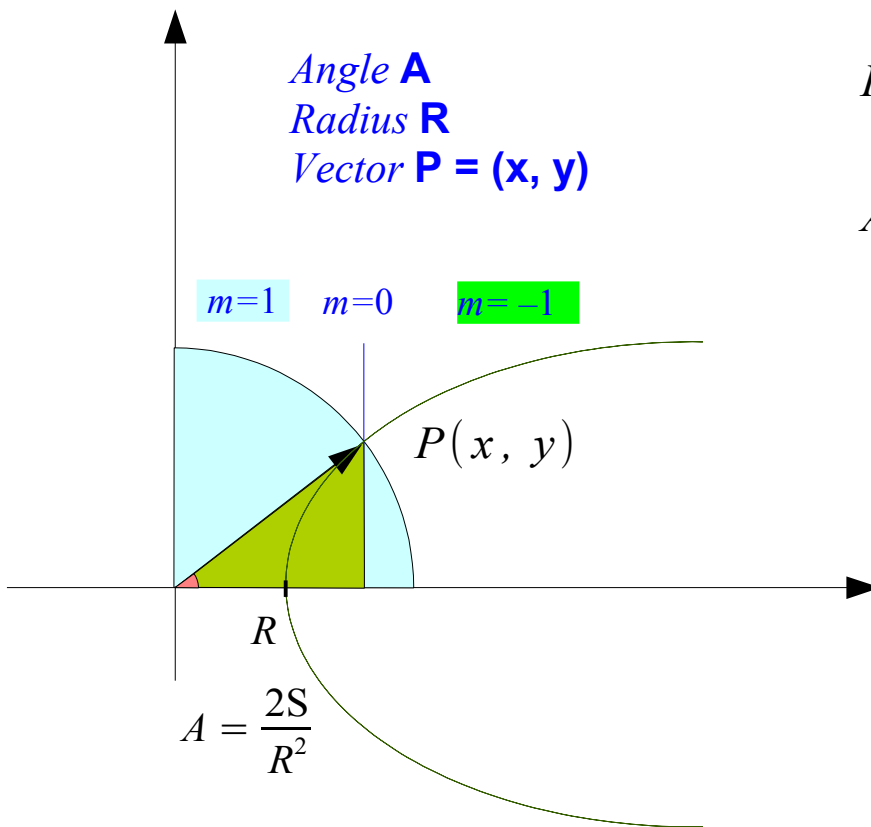
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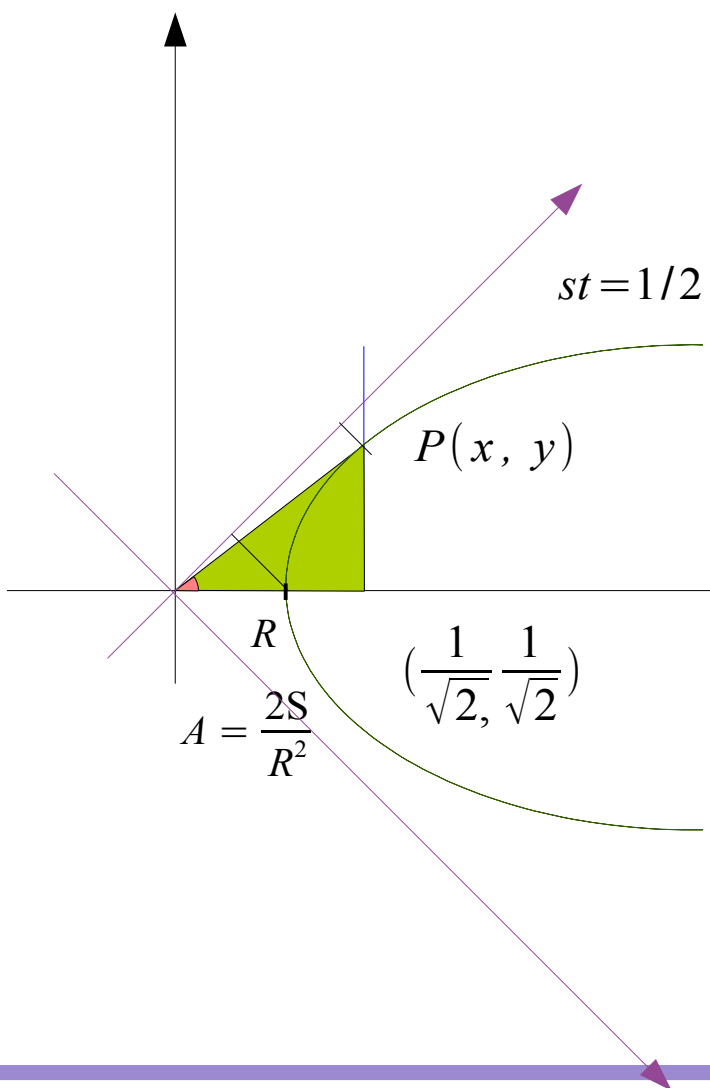


$$R = (x^2 + y^2)^{1/2}$$

$$A = \tan^{-1}\left(\frac{y}{x}\right)$$

$$R = (x^2 - y^2)^{1/2}$$

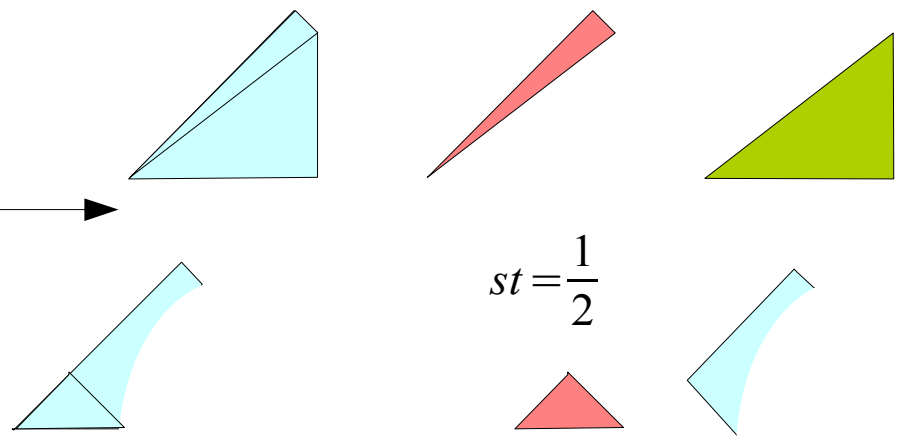
$$A = \tan^{-1}\left(\frac{y}{x}\right)$$

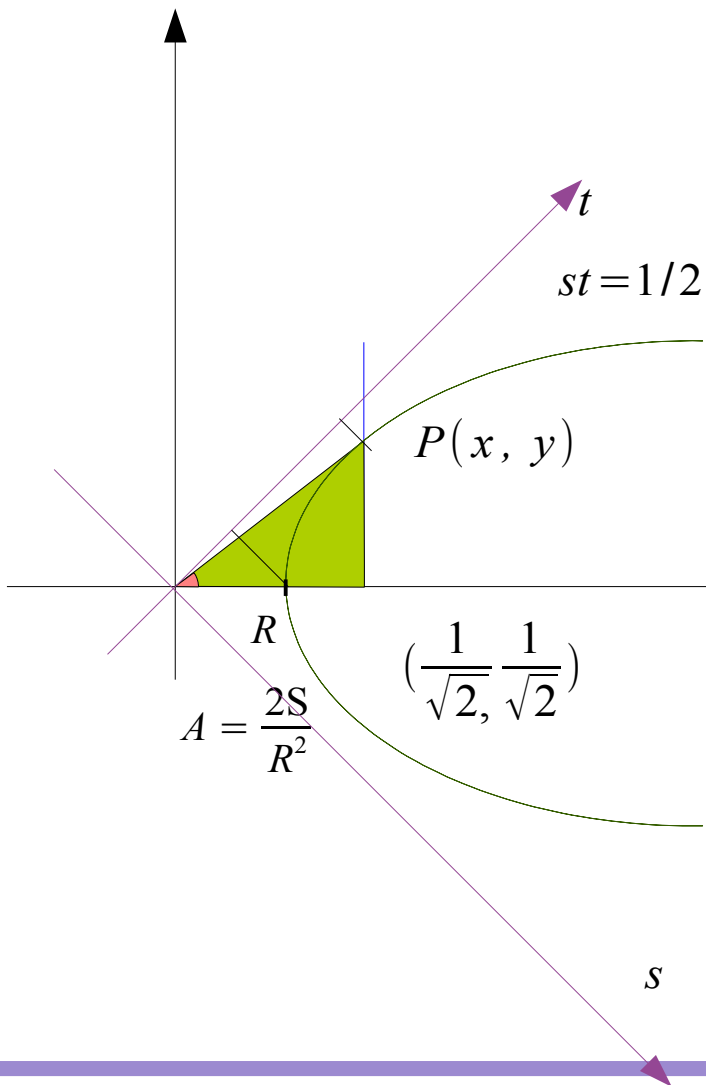


$$x - y = s\sqrt{2}$$

$$x + y = t\sqrt{2}$$

$$st = \frac{1}{2}$$



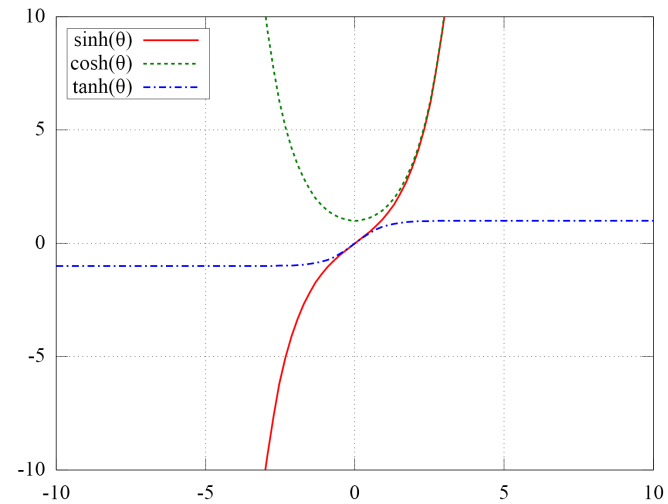
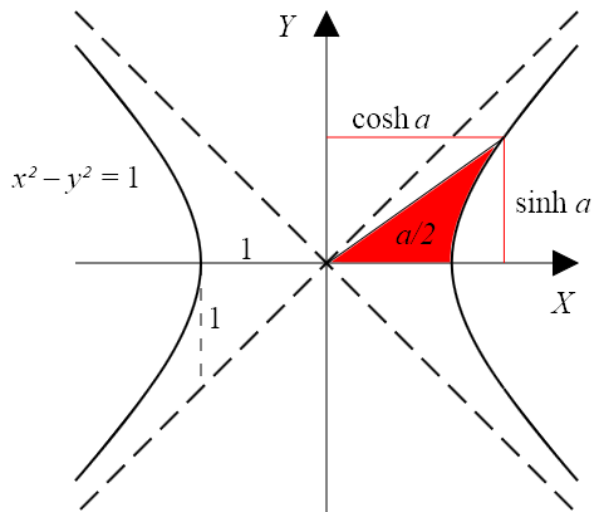


$$x - y = s\sqrt{2}$$

$$x + y = t\sqrt{2}$$

$$st = \frac{1}{2}$$

$$2A = 2 \int_{\frac{1}{\sqrt{2}}}^{\frac{(x+y)}{\sqrt{2}}} \frac{ds}{2s} = \ln(x+y) = \ln(x \pm \sqrt{x^2 - 1})$$



$$x^2 - y^2 = 1 \quad (\sinh \alpha, \cosh \alpha)$$

$$\cosh^2 \alpha - \sinh^2 \alpha = 1$$

$$\frac{1}{4}(e^\alpha + e^{-\alpha})^2 - \frac{1}{4}(e^\alpha - e^{-\alpha})^2 = 1$$

$$\sinh \alpha = \frac{1}{2}(e^\alpha - e^{-\alpha})$$

$$\cosh \alpha = \frac{1}{2}(e^\alpha + e^{-\alpha})$$

$$\tanh \alpha = \frac{(e^\alpha - e^{-\alpha})}{(e^\alpha + e^{-\alpha})}$$

$$e^{+ix} = \cos x + i \sin x$$

$$e^{-ix} = \cos x - i \sin x$$

$$\cos x = \frac{1}{2}(e^{+ix} + e^{-ix}) \Rightarrow \mathbf{\cosh ix}$$

$$i \sin x = \frac{1}{2}(e^{+ix} - e^{-ix}) \Rightarrow \mathbf{i \sinh ix}$$

$$i \frac{\sin x}{\cos x} = \frac{(e^{+ix} - e^{-ix})}{(e^{+ix} + e^{-ix})} \Rightarrow \mathbf{i \tanh ix}$$

$$e^{+ix} = \mathbf{\cosh ix + \sinh ix}$$

$$e^{-ix} = \mathbf{\cosh ix - \sinh ix}$$

## References

- [1] <http://en.wikipedia.org/>
- [2] CORDIC FAQ, [www.dspguru.com](http://www.dspguru.com)
- [3] R. Andraka, A survey of CORDIC algorithms for FPGA based computers
- [4] J. S. Walther, A Unified Algorithm for Elementary Functions