Hyperbolic Functions (1A)

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05/19/2011

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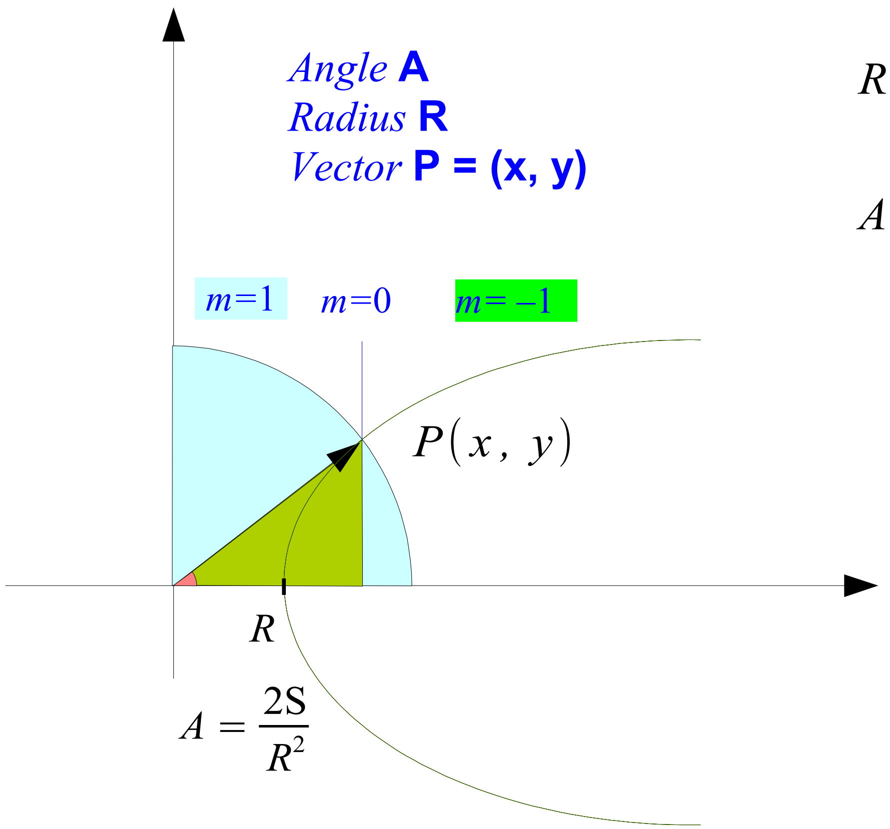


$$R = (x^2 + y^2)^{1/2}$$

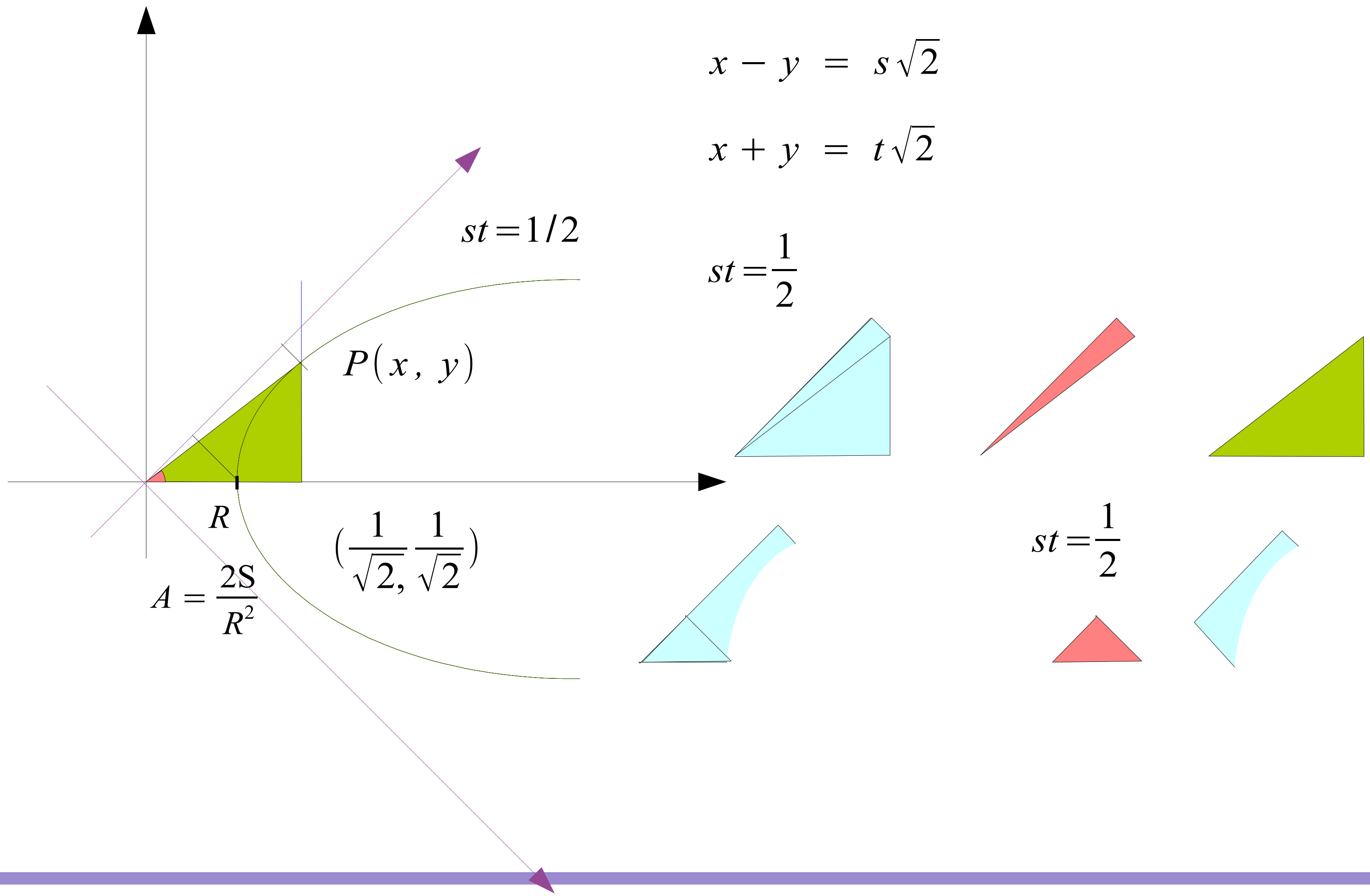
$$A = \tan^{-1}\left(\frac{y}{x}\right)$$

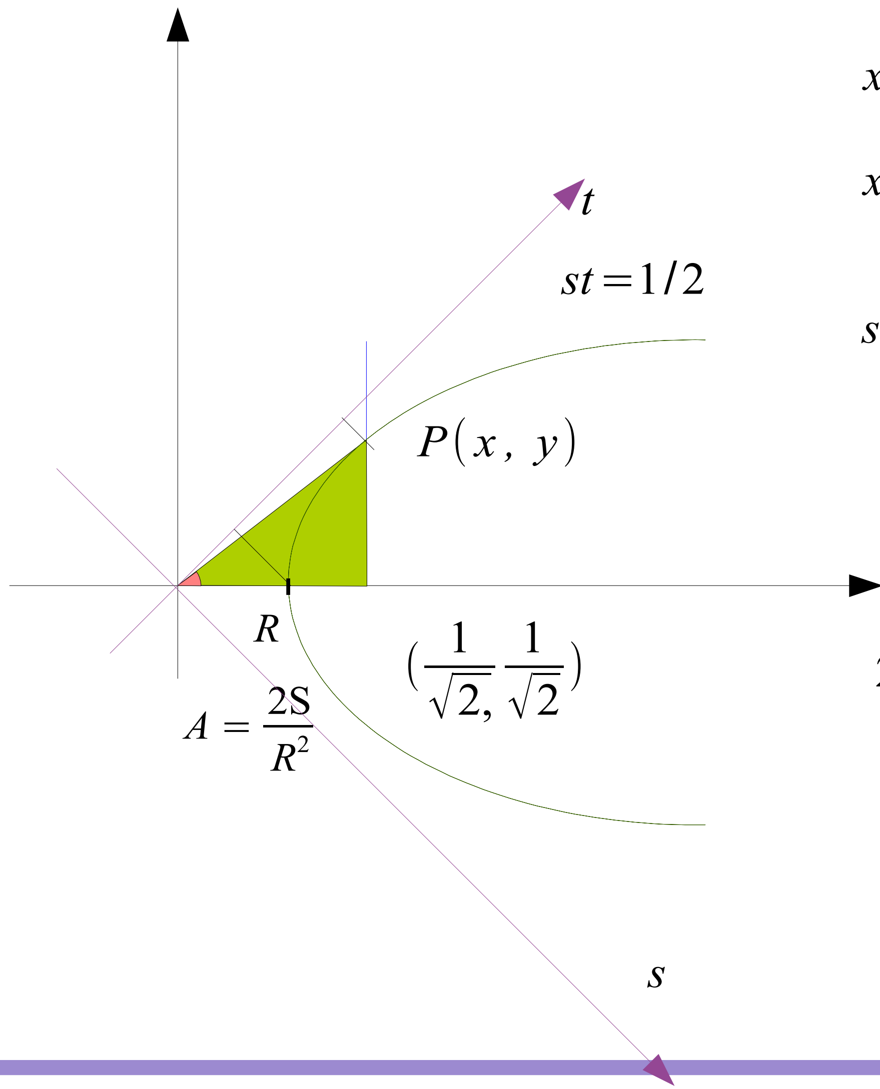
$$R = (x^2 - y^2)^{1/2}$$

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

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

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



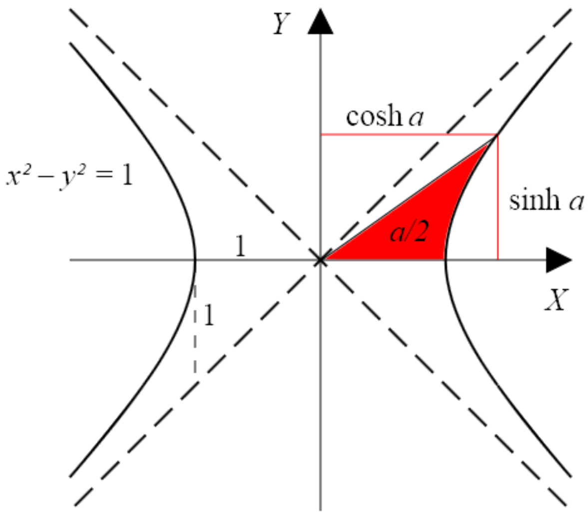


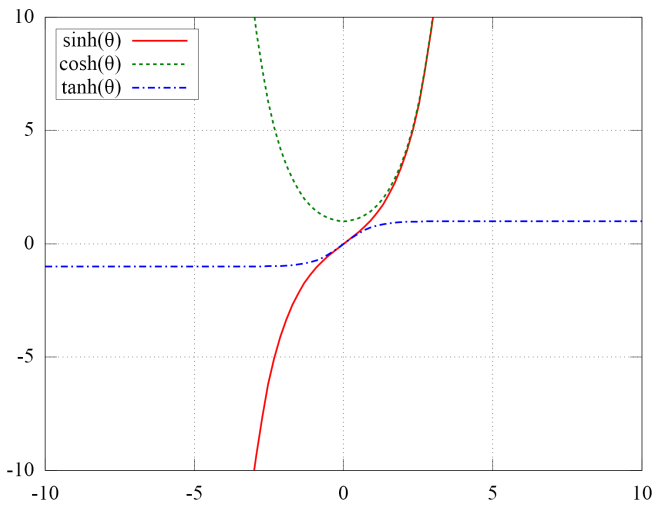
$$x - y = s\sqrt{2}$$

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

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

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





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

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

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

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

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

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

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

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

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

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

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

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

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

References

[1] http://en.wikipedia.org/
[2] CORDIC FAQ, 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