Hyperbolic Functions

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PREPARED BY KYLE CHUNG

Hyperbolic Functions

Trigonometric identities	Hyperbolic identities
$\cos\theta = \frac{e^{i\theta} + e^{-i\theta}}{2}$	$\cosh \theta = \frac{e^{\theta} + e^{-\theta}}{2} = \cos(i\theta)$
$\sin \theta = \frac{e^{i\theta} - e^{-i\theta}}{2i}$	$\sinh \theta = \frac{e^{\theta} - e^{-\theta}}{2} = -i \sin(i\theta)$
$\tan \theta = \frac{\sin \theta}{\cos \theta}$	$\tanh \theta = \frac{\sinh \theta}{\cosh \theta}$
$\sec \theta = \frac{1}{\cos \theta}$	$\operatorname{sech} \theta = \frac{1}{\cosh \theta}$
$\csc\theta = \frac{1}{\sin\theta}$	$\operatorname{csch} \theta = \frac{1}{\sinh \theta}$
$\cot \theta = \frac{1}{\tan \theta}$	$\coth \theta = \frac{1}{\tanh \theta}$

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Hyperbolic Functions

Trigonometric identities	Hyperbolic identities
$\cos^2\theta + \sin^2\theta = 1$	$\cosh^2 \theta - \sinh^2 \theta = 1$
$\sin(\theta_1 \pm \theta_2) = \sin \theta_1 \cos \theta_2 \pm \cos \theta_1 \sin \theta_2$	$\sinh(\theta_1 \pm \theta_2) = \sinh \theta_1 \cosh \theta_2 \pm \cosh \theta_1 \sinh \theta_2$
$\cos(\theta_1 \pm \theta_2) = \cos\theta_1 \cos\theta_2 \mp \sin\theta_1 \sin\theta_2$	$\cosh(\theta_1 \pm \theta_2) = \cosh \theta_1 \cos h s \theta_2 \pm \sinh \theta_1 \sinh \theta_2$
$1 + \tan^2 \theta = \sec^2 \theta$	$1 - \tanh^2 \theta = \operatorname{sech}^2 \theta$

Osborn's rule: Any formula involving *sin* and *cos* has an analogous formula involving *sinh* and *cosh*, which is the same in every way except that the product of two *sines* must be replaced by minus the product of two *sinhs*.

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