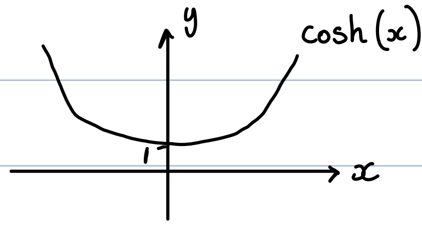
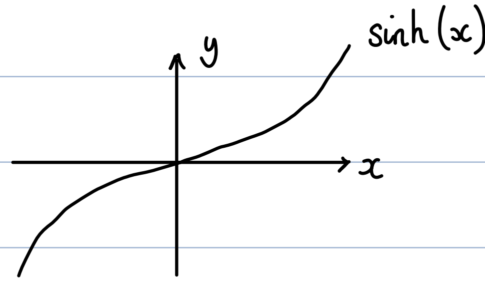
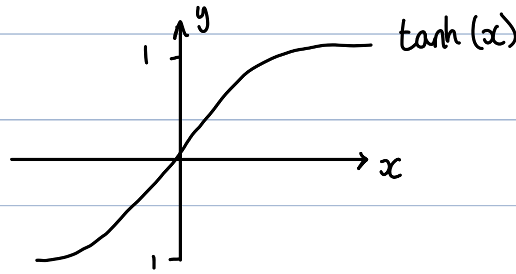
$\cosh = \frac{1}{2}(e^x + e^{-x})$



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



$\tanh = \dfrac{\sinh}{\cosh}$



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

$\sinh(A+B) = \sinh(A)\cosh(B) + \cosh(A)\sinh(B)$

$\cosh(A+B) = \cosh(A)\cosh(B) + \sinh(A)\sinh(B)$

Graph of cosh(x) called a catenary :

→ Shape of chain hanging under gravity

- Used in structural design

$$e^{+j\theta} = \cos\theta + j\sin\theta$$
$$e^{-j\theta} = \cos\theta - j\sin\theta$$

$$\therefore \quad \cos\theta = \frac{1}{2}\left(e^{+j\theta} + e^{-j\theta}\right)$$

$$\sin\theta = \frac{1}{2j}\left(e^{j\theta} - e^{-j\theta}\right)$$

let $\theta = jx$

$$\cos jx = \frac{1}{2}\left(e^{x} + e^{-x}\right) = \cosh x$$

$$\sin jx = \frac{1}{2j}\left(e^{-x} - e^{x}\right) = j\sinh x$$

$$\tan jx = j\tanh x$$

$$\cos^n\theta = \left[\frac{1}{2}\left(e^{j\theta} + e^{-j\theta}\right)\right]^n, \quad \sin^n\theta = \left[\frac{1}{2j}\left(e^{j\theta} - e^{-j\theta}\right)\right]^n$$

Complex Arguments for sin, cos, etc.

$$\sin(z) = \sin(x + jy)$$
$$= \sin(x)\cos(jy) + \cos(x)\sin(jy)$$

so $\sin(z) = \sin(x)\cosh(y) + j\cos(x)\sinh(y)$

and $\cos(z) = \cos(x)\cosh(y) - j\sin(x)\sinh(y)$

find values of z such that $\cos z = 2$

$$\cos(x + jy) = 2$$

$$\cos(x)\cosh(y) - j\sin(x)\sinh(y) = 2 + j0$$

① $\cos(x)\cosh(y) = 2$ ② $\sin(x)\sinh(y) = 0$

from ② either $y = 0$ or $x = 0$