$$\frac{d}{dx}\sin x = \lim_{\Delta x \to 0} \frac{\sin(x+\Delta x)-\sin(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0} \frac{\sin(x)\cos(\Delta x)+\cos(x)\sin(\Delta x)-\sin(x)}{\Delta x}$$

$$= \lim_{\Delta x \to 0}[\sin(x)\cdot \underbrace{\frac{\cos(\Delta x)-1}{\Delta x}}_{\parallel \atop 0} + \cos(x)\underbrace{\frac{\sin(\Delta x)}{\Delta x}}_{\parallel \atop 1}]$$

$$= \cos x$$

hw2: $prove: \lim_{\Delta x \to 0} \frac{\cos(\Delta x)-1}{\Delta x} = 0$

hw3: $prove: \sin(x+y) = \sin x \cos y + \cos x \sin y$

$\cos(x-y) = \cos x \cos y - \sin x \sin y$

2. *Euler's formule*

$e^{i\theta} = \cos\theta + i\sin\theta$

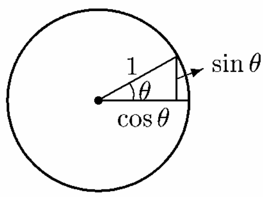
$pf: e^{i\theta} = x+iy$

$e^{-i\theta} = x-iy$

$1 = e^{i\theta}\cdot e^{-i\theta} = (x+iy)(x-iy) = x^2+y^2$

$x^2+y^2 = 1$

$Pick's + hm$



$$\begin{cases} x=\cos\theta, \quad y=\sin\theta \\ or \\ x = s\,in\theta, \quad y=\cos\theta \end{cases}$$

$e^{i\cdot\theta} = 1 = \cos\theta^\circ + i\sin\theta^\circ$

$so: e^{i\theta} = \cos\theta + i\sin\theta$