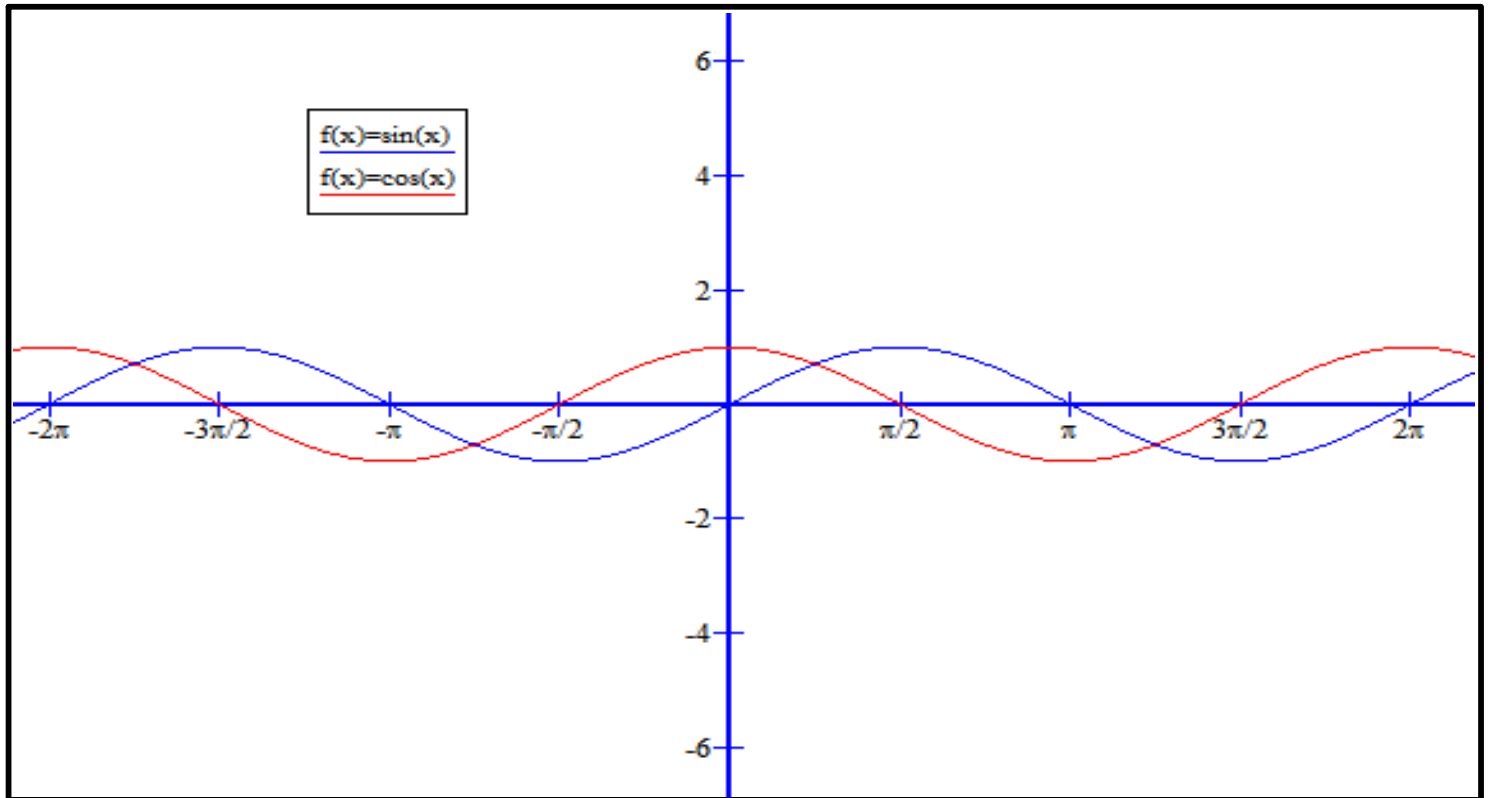


# GRAPHING $\tan(x)$ , $\cot(x)$ , $\sec(x)$ , and $\csc(x)$

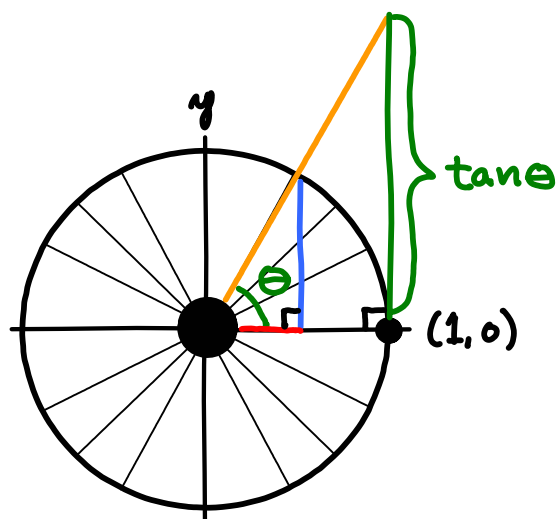
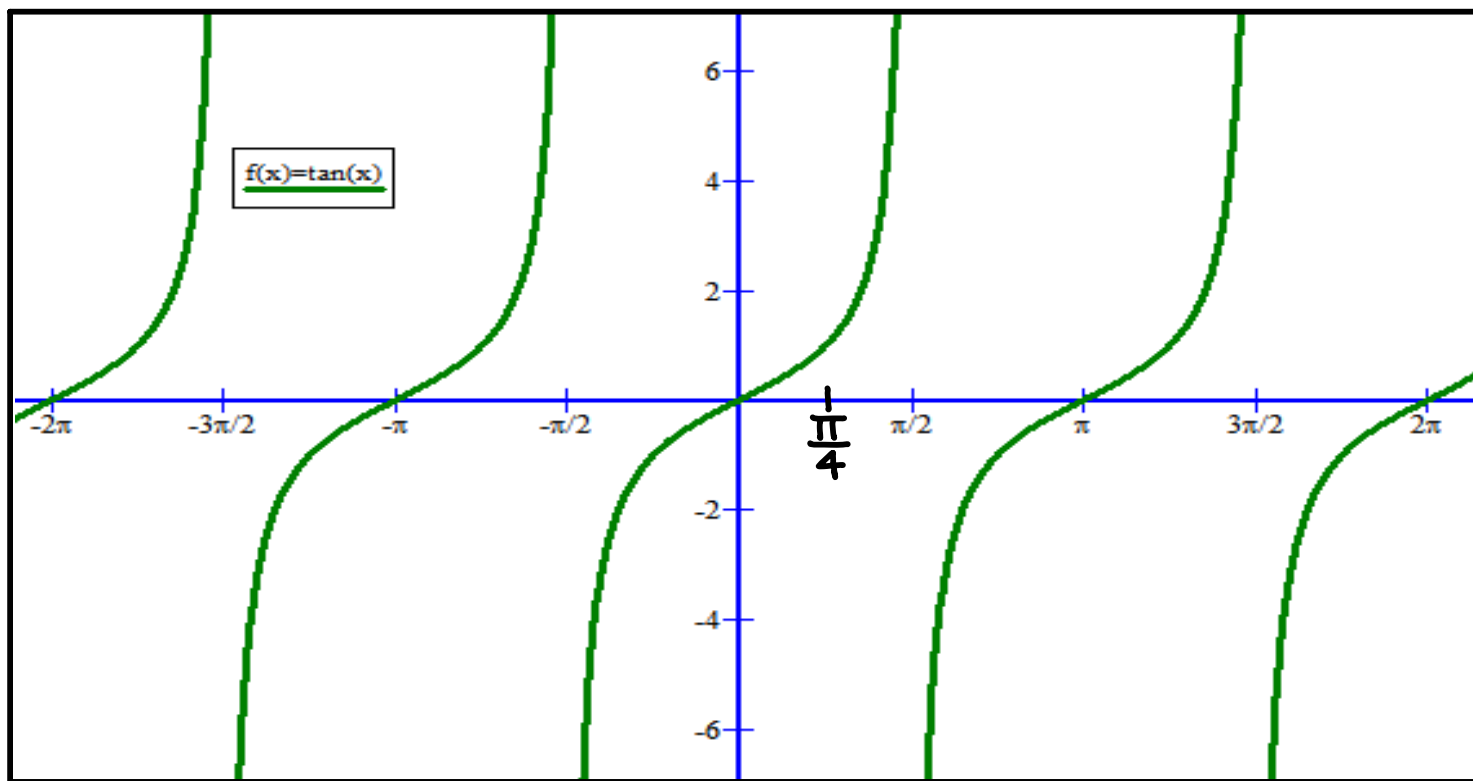
## DOMAINS, RANGES AND SYMMETRY

### GRAPHING TANGENT $y = \tan(x)$

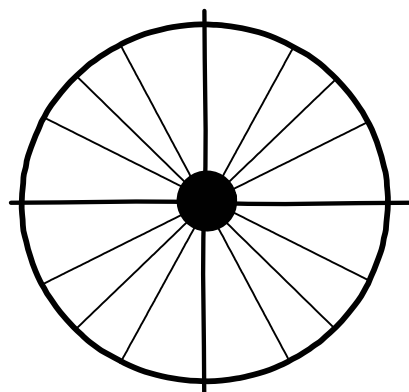


- $y = \tan(x) = \frac{\sin x}{\cos(x)}$
- $\cos(x) = 0 \Rightarrow \tan(x)$  undefined  $\Rightarrow$  vertical asymptote
- $\sin(x) = 0 \Leftrightarrow \tan(x) = 0$

# DOMAIN AND RANGE OF TANGENT



TANGENT IS  $\pi$  PERIODIC



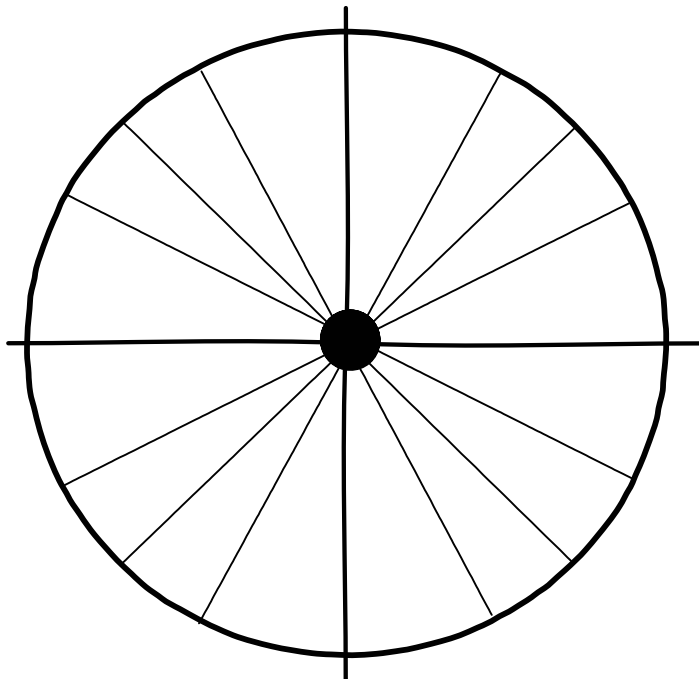
$$\tan \theta = \tan(\theta + n\pi) \quad n \in \mathbb{Z}$$

$$\tan(-x) = -\tan(x)$$

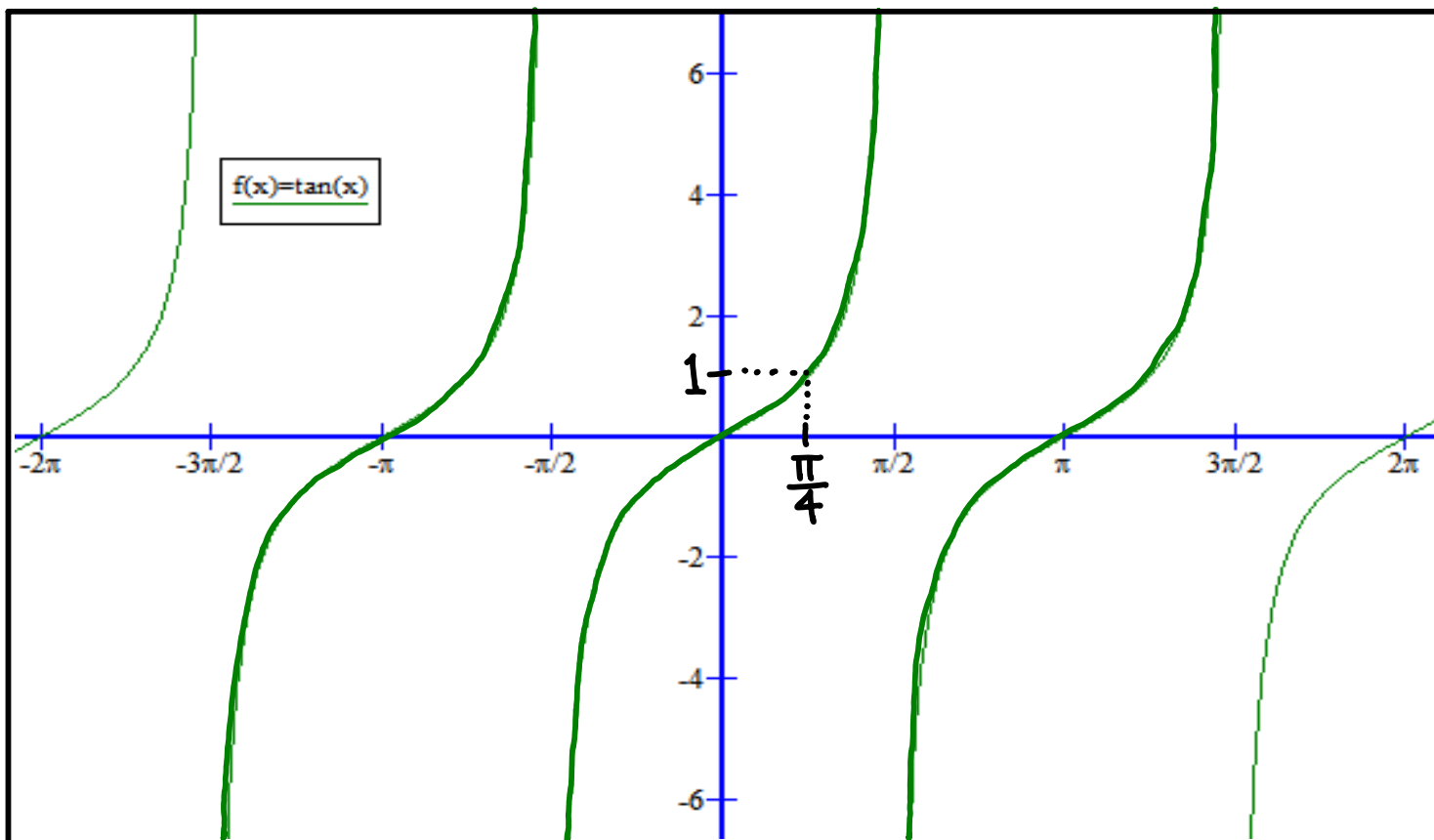
TANGENT HAS ODD SYMMETRY

$$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)}$$

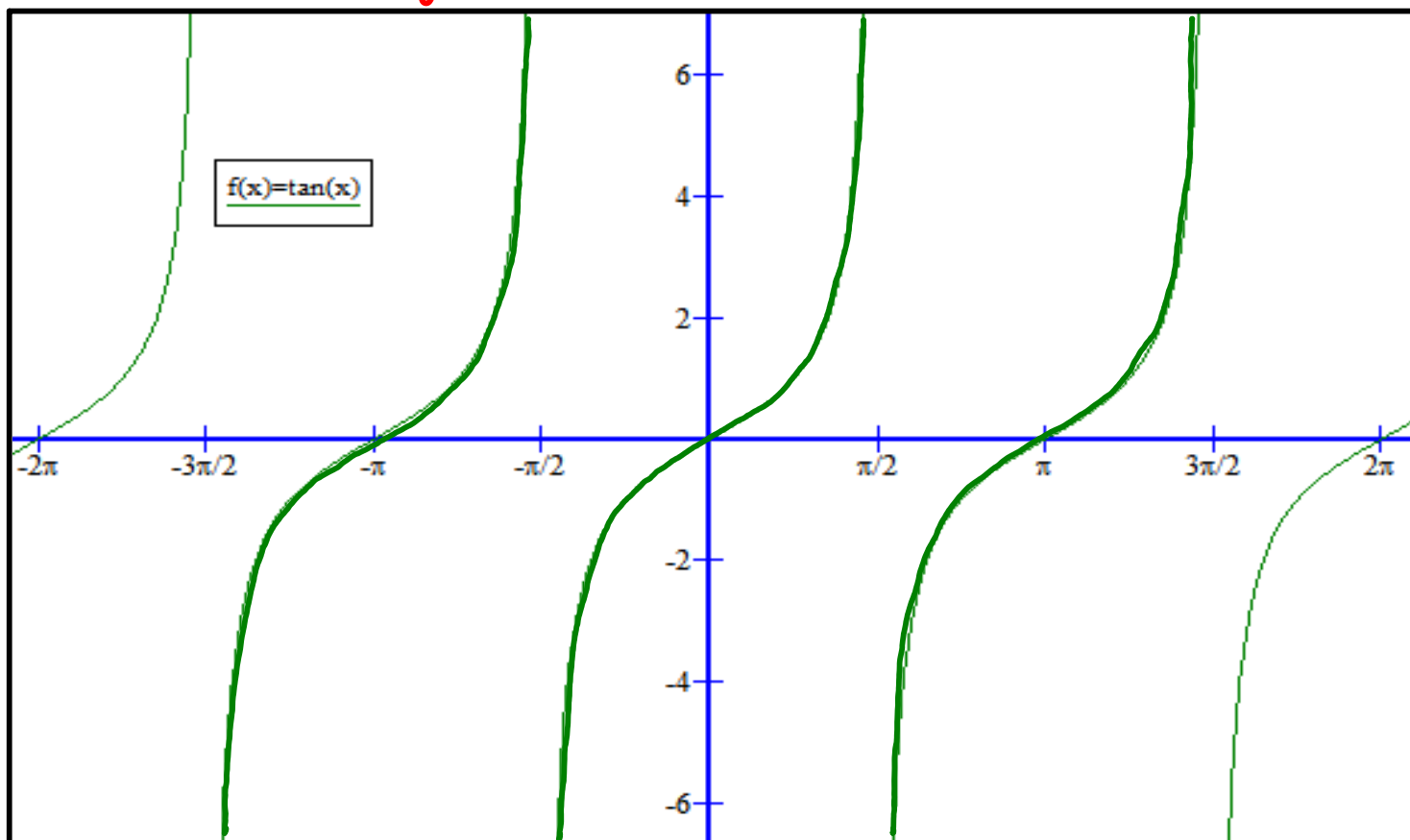
$$\Rightarrow \tan(-\theta) =$$



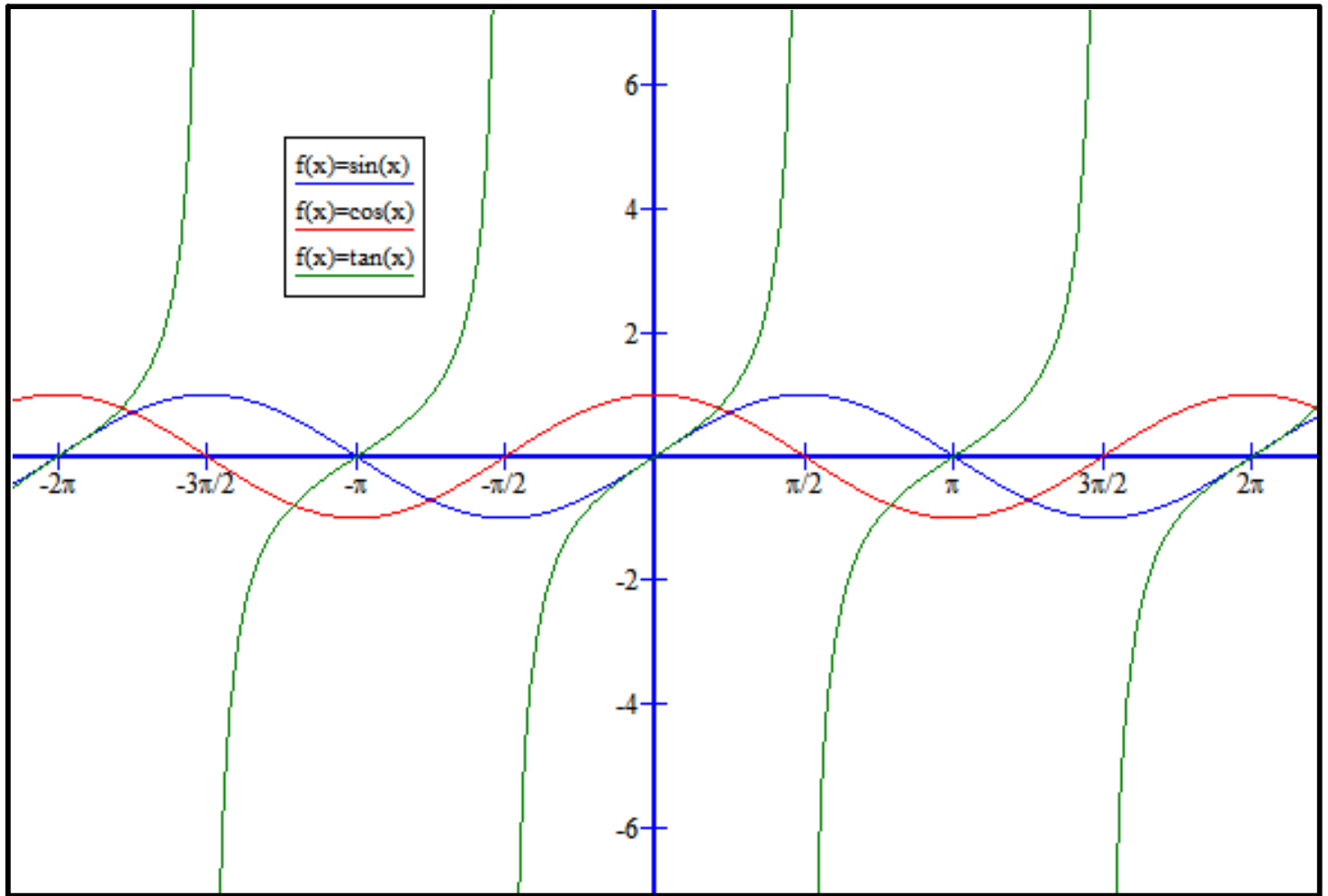
EXAMPLE:  $y = 4 \tan x$



EXAMPLE:  $y = \tan(2x) + 1$

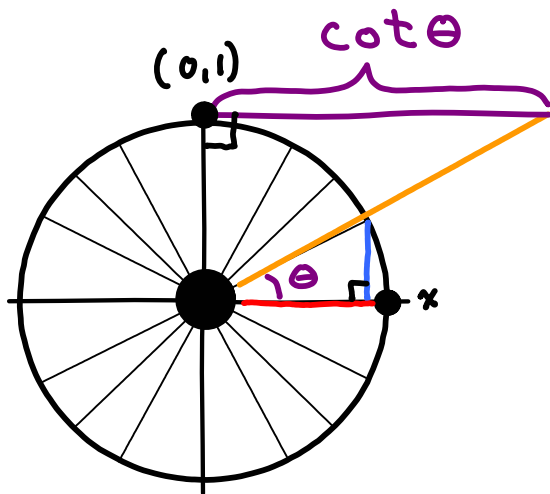
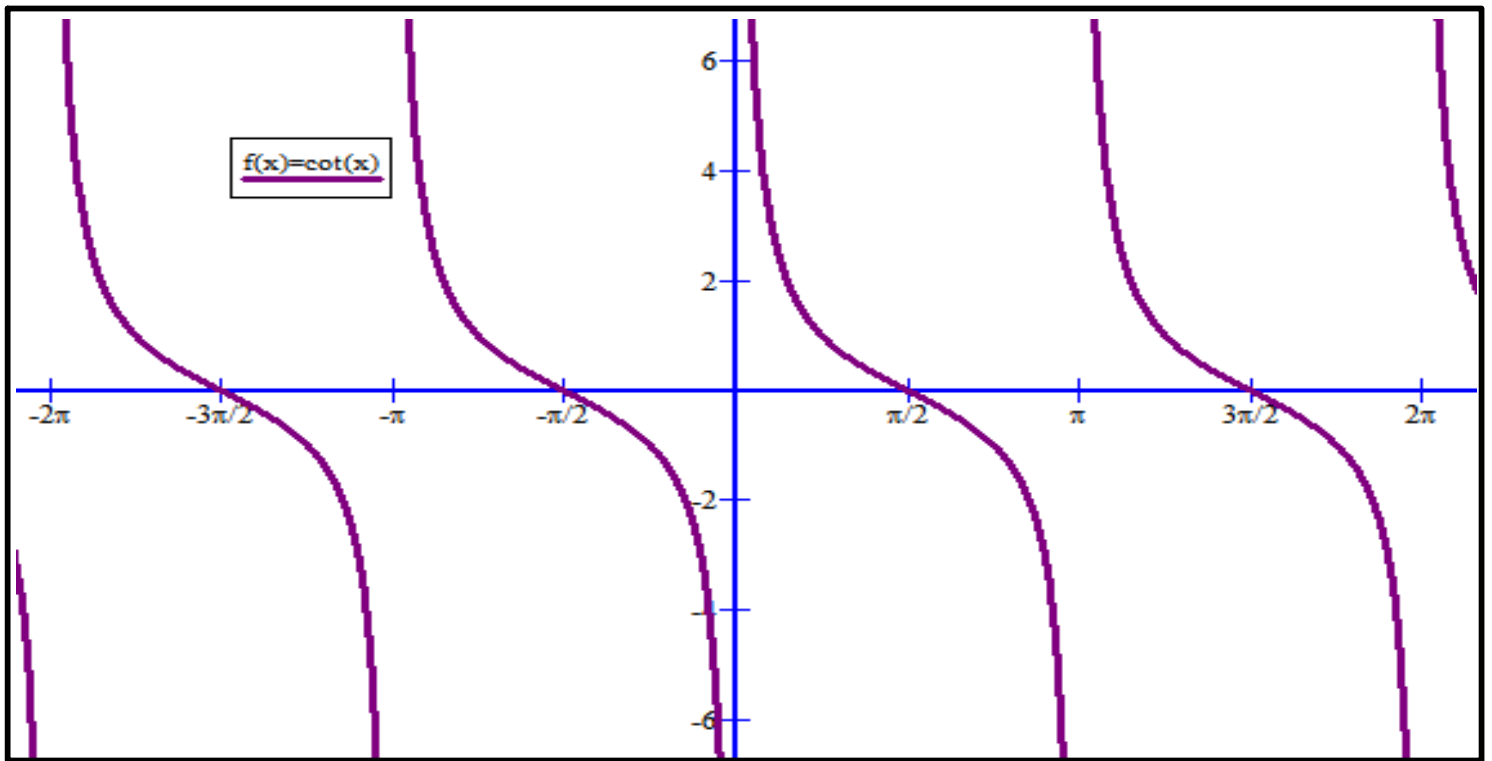


# GRAPHING COTANGENT $y = \cot(x)$

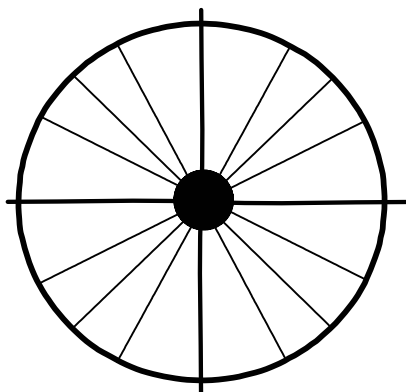


- $y = \cot(x) = \frac{\cos(x)}{\sin(x)}$
- $\sin(x) = 0 \Rightarrow \cot(x)$  undefined  $\Rightarrow$  vertical asymptote
- $\cos(x) = 0 \Leftrightarrow \tan(x) = 0$

# DOMAINS AND RANGE OF COTANGENT



COTANGENT IS  $\pi$  PERIODIC



$$\cot(\theta) = \cot(\theta + n\pi) \quad n \in \mathbb{Z}$$

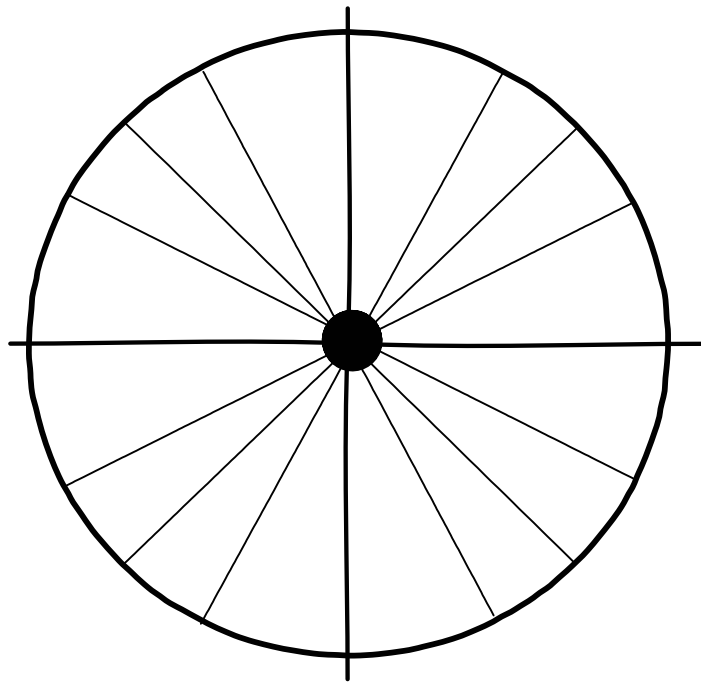
$$\cot(-x) = -\cot(x)$$

COTANGENT HAS ODD SYMMETRY

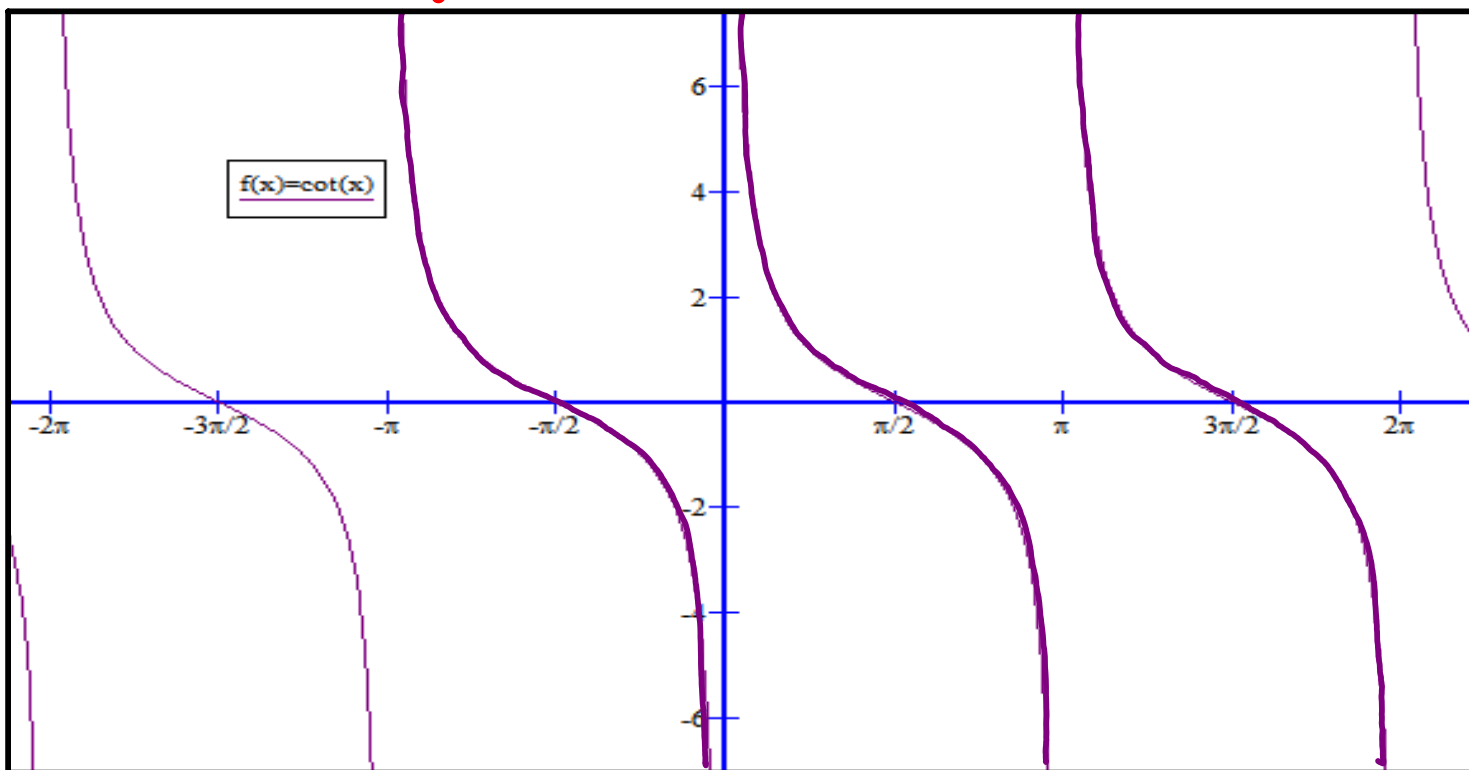
$$\cot(\theta) = \frac{\cos\theta}{\sin\theta}$$

$$\cot(-x) =$$

$$\cot(-x) =$$



EXAMPLE:  $y = -\cot(x - \pi/2)$



EXAMPLE:  $y = \cot(2x - \pi/2)$

