x-intercept: where the graph of f intersects x-axis ($f(x)=0$)

y-intercept: where the graph of f intersects y-axis.

Example a) $f(x) = x^2 - 1$.

x-intercept:

$$0 = f(x) = x^2 - 1$$

$x = 1, -1$

x-intercepts $(1, 0)$ & $(-1, 0)$

y-intercepts $f(0) = -1$

$(0, -1)$

---

b) $g(x) = \frac{x^2-1}{x}$

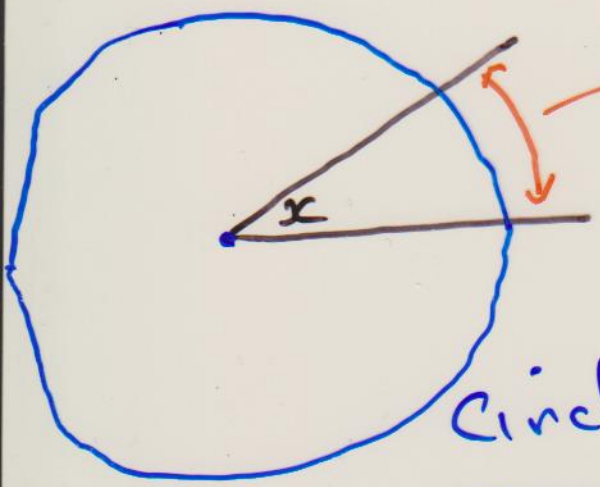
x-intercepts: $0 = \frac{x^2-1}{x}$

c) $h(x) = x^2 + 1$

There are no x-intercepts.

y-intercept is $(0, 1)$

What is a radian?



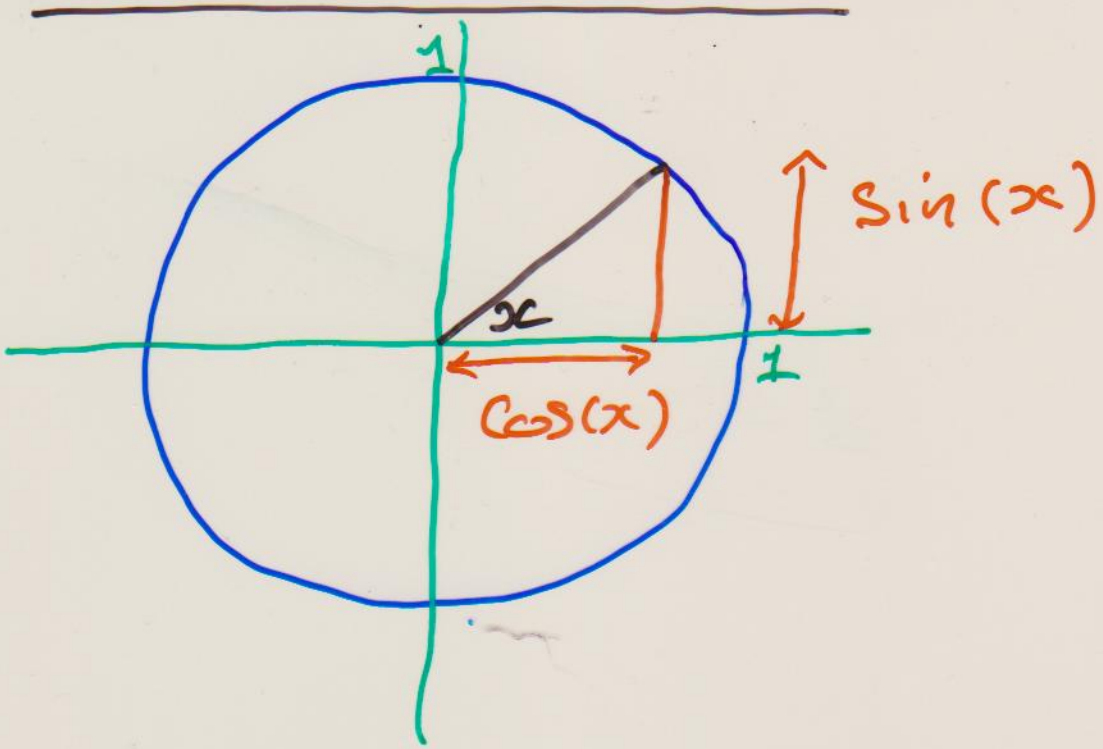
Circle of radius 1

$90° = \frac{2\pi}{4} = \frac{\pi}{2}$

$180° = \pi$

$360° = 2\pi$

Sine & Cosine



Note:

$$-1 \leq \sin(x) \leq 1$$

$$-1 \leq \cos(x) \leq 1$$

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

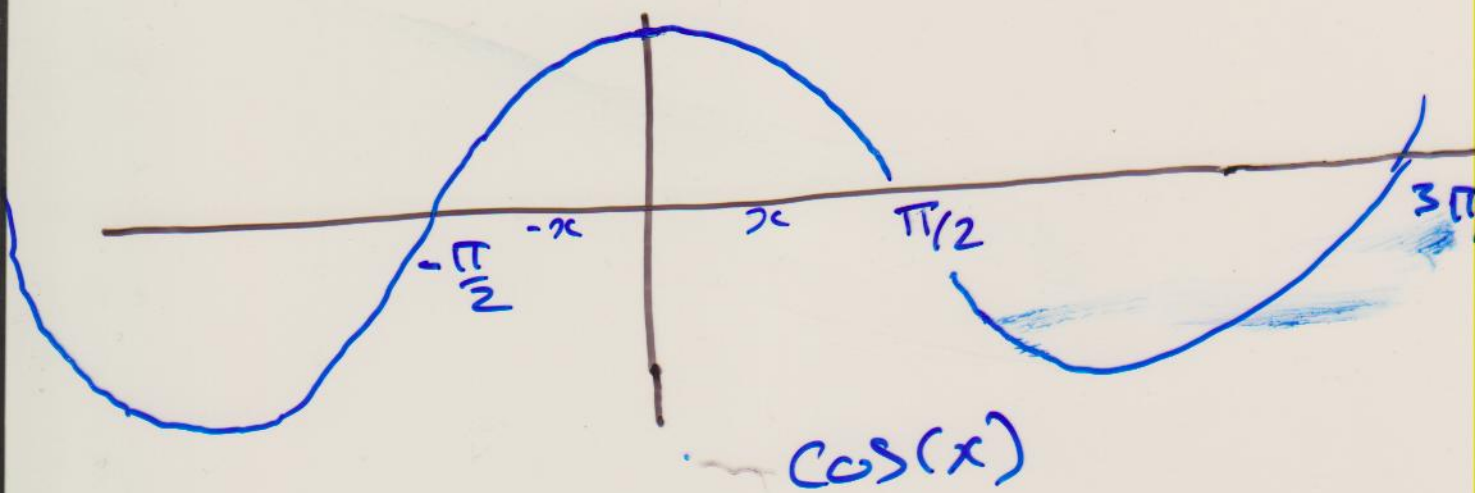
$$\cos(-x) = \cos(x)$$

$$\sin(x+2\pi) = \sin(x)$$

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

Graph of $\cos(x)$.

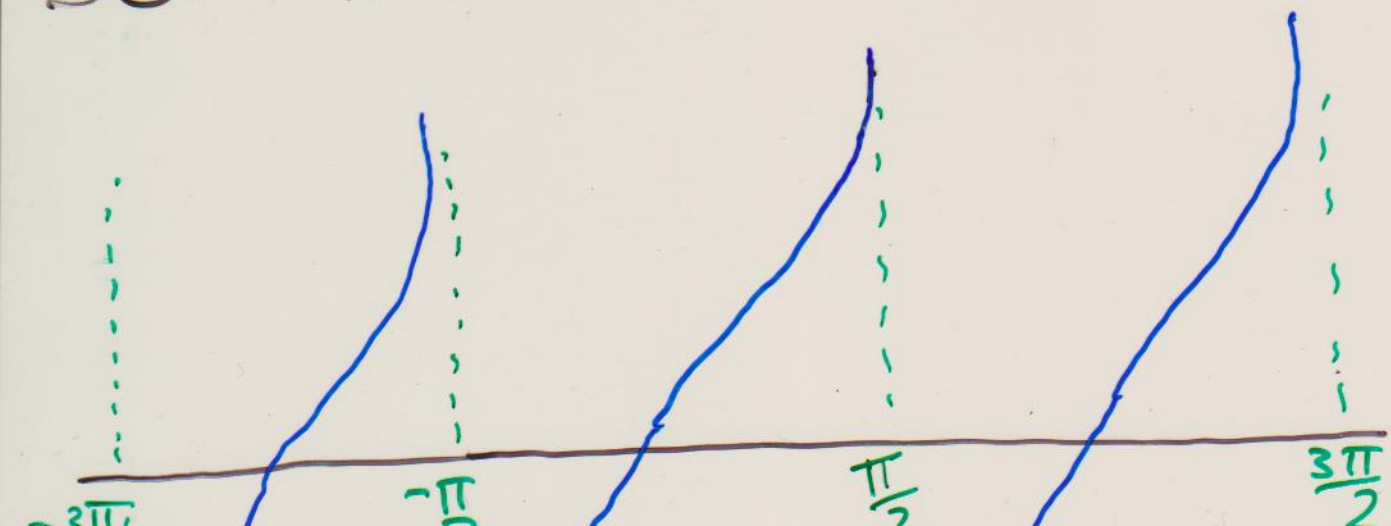
Domain $= \mathbb{R}$



Tangent:

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

Domain $= \mathbb{R} - \left\{ \pm \frac{\pi}{2}, \pm \frac{3\pi}{2}, \cdots \right\}$



Applications: In signal processing complicated functions are decomposed as a "sum" of sines and cosines.

Functions Defined in Pieces

Example

The cost $c(t)$ be the cost of parking my car for t hours at Dublin airport. Domain $= [0, \infty)$

$$c(t) = \begin{cases} 2 & 0 \le t < 1 \\ 4 & 1 \le t < 2 \\ 8 & 2 \le t < 24 \end{cases}$$

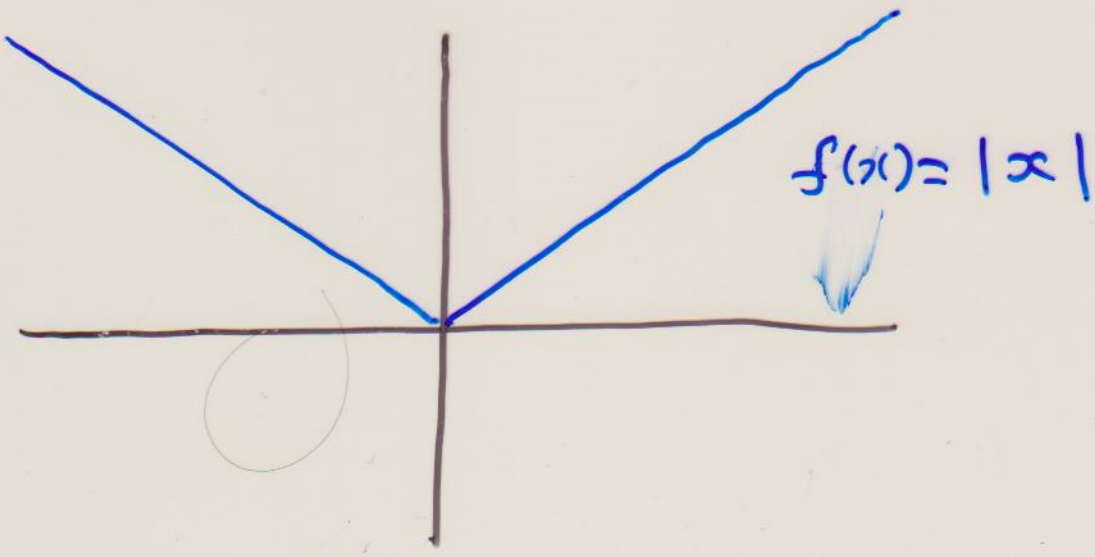
Example Absolute value.

$$|-3| = 3$$

$$|4| = 4$$

Domain = $\mathbb{R}$

$$|x| = \begin{cases} x & x \geq 0 \\ -x & x < 0 \end{cases}$$



Symmetries

- A function f is <u>even</u> if

Example

- $\cos(x) = \cos(-x)$ so cosine is even.

- $\sin(x) = -\sin(x)$ so sine is odd.