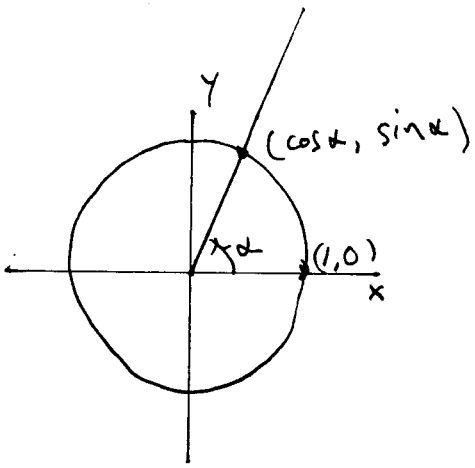
# 2.1 Right triangle definition of trig functions




$\sin\alpha = y$ $\quad$ $\csc\alpha = \frac{1}{y}$

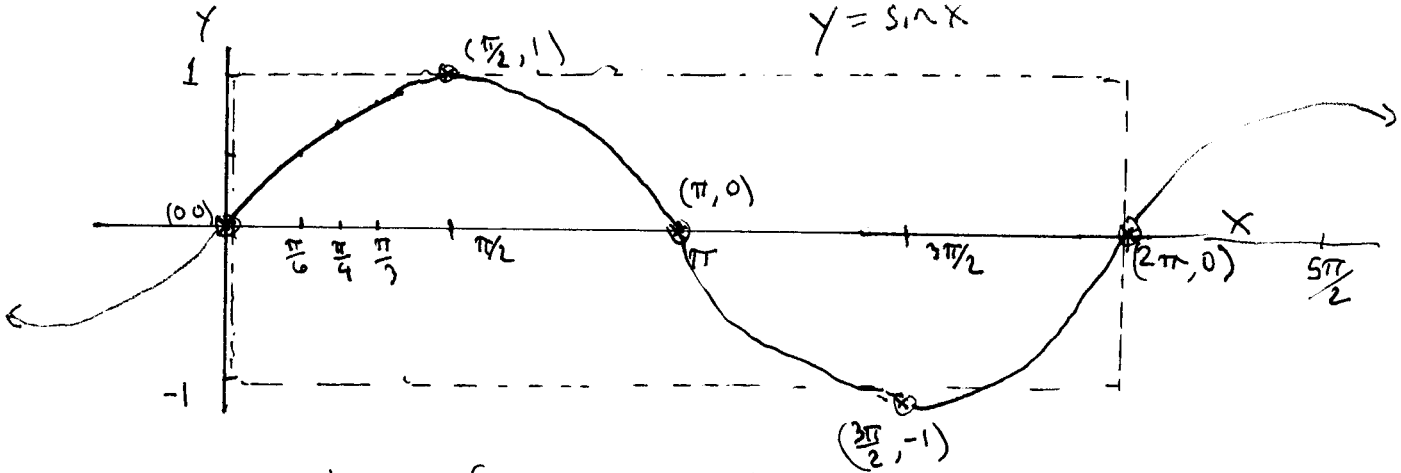
$\cos\alpha = x$ $\quad$ $\sec\alpha = \frac{1}{x}$

$\tan\alpha = \frac{y}{x}$ $\quad$ $\cot\alpha = \frac{x}{y}$

## The Graph of the function $y = \sin x$

$x$ = input to the function, $y$ = output of the function

(= angle) in radians




domain of sine $= (-\infty, \infty)$

range of sine $= [-1, 1]$

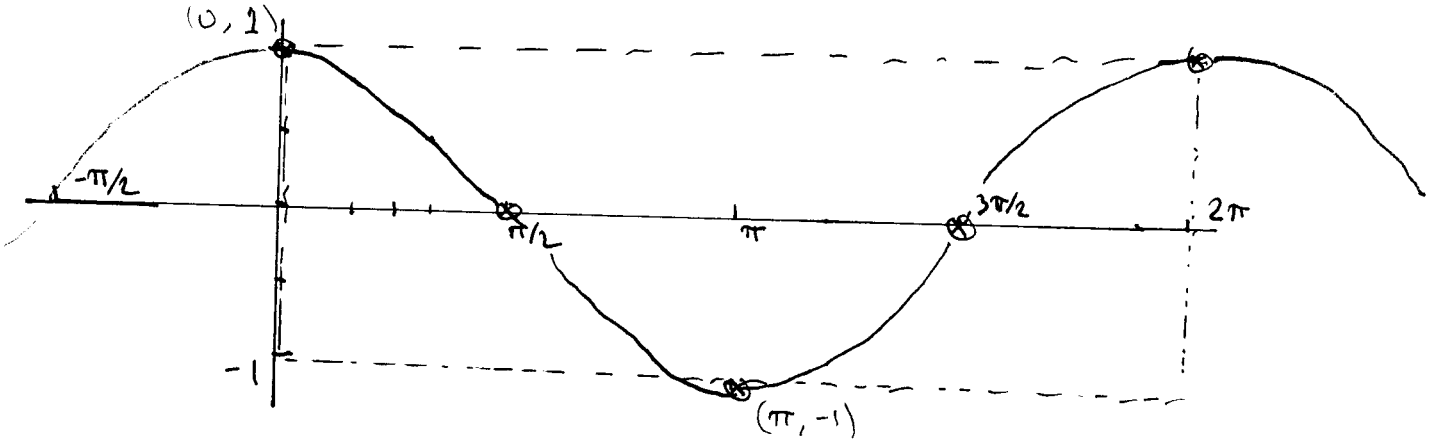
$\sin(x + 2\pi) = \sin x$ $\quad$ i.e. sine is periodic with period $2\pi$

$\sin(-x) = -\sin x$ $\quad$ i.e. sine is an odd function.

amplitude $= 1$

## Graph of cosine

$y = \cos x$




domain $= (-\infty, \infty)$

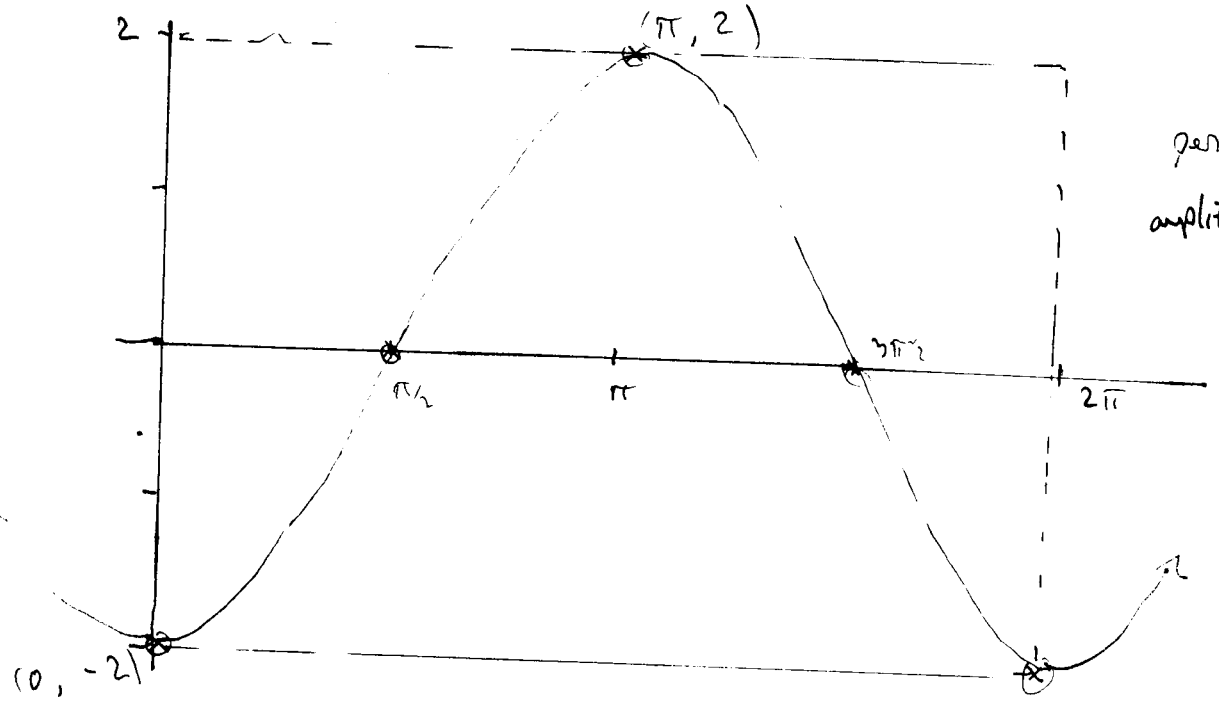
range $= [-1, 1]$

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

$\cos(-x) = \cos x$ i.e. cosine is an <u>even</u> function

amplitude $= 1$

ex. Graph $y = -2\cos x$.

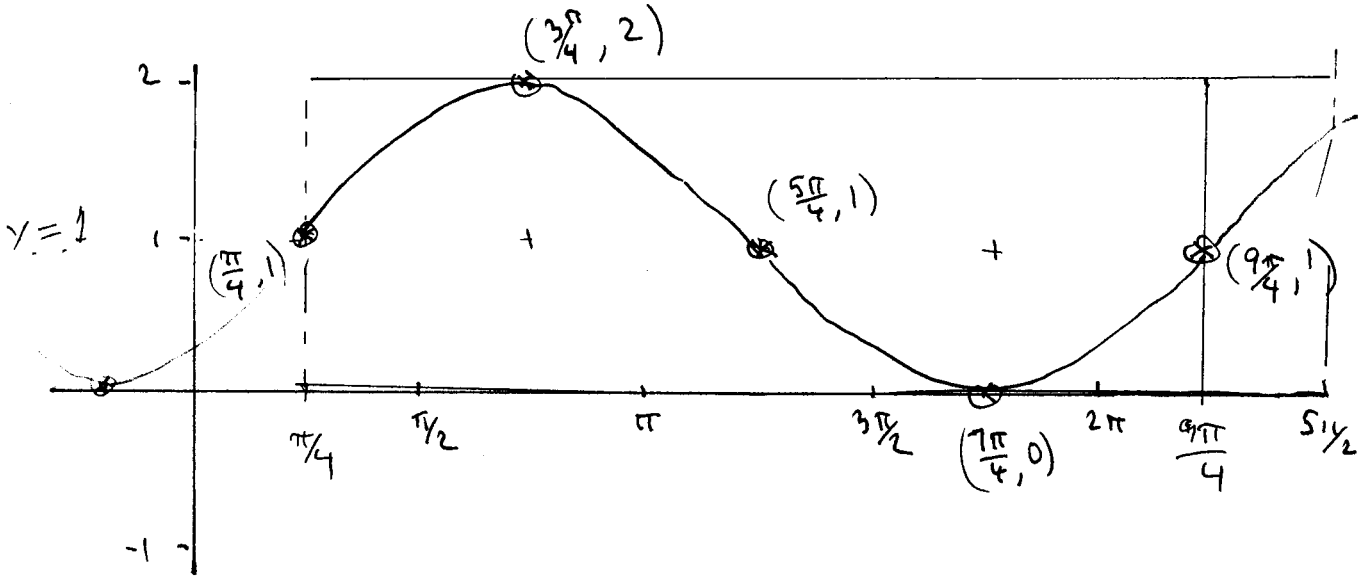



period $= 2\pi$

amplitude $= |-2| = 2$

## Phase shift

ex: Graph $y = \sin\left(x - \frac{\pi}{4}\right) + 1$ will be shifted right by $\pi/4$ and up 1.




**Generalization:** If you want to graph

$$y = A\sin(x - C) + D$$

the graph will be a generalized sine wave

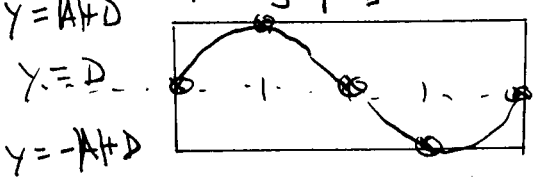
with amplitude $= |A|$

period $= 2\pi$

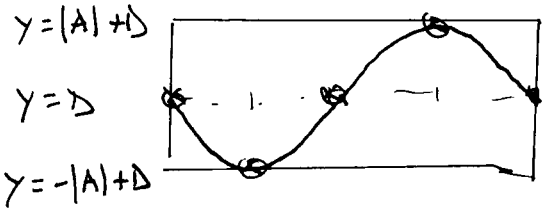
phase shift $= C$

vertical shift $= D$

when A is positive the graph is

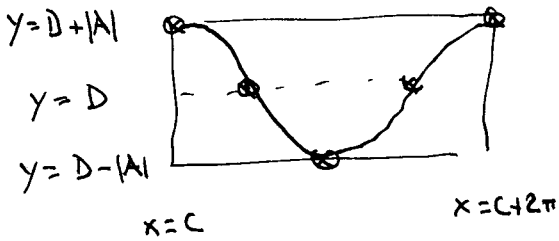



when A is negative:

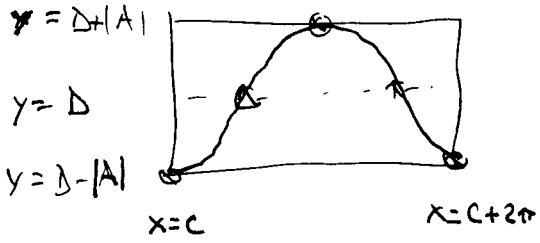


For $y = A\cos(x-C) + D$

A positive




A negative




Remarks: (1) We want to be able to use the equation to determine the graph, i.e. equation → graph

but we also want to be able to use the graph to determine the equation, i.e equation ← graph.

(2) In the next section, we will learn to handle generalized sine and cosine functions with four parameters, that is,

$$y = A\sin B(x-C) + D \quad \text{and}$$

$$y = A\cos B(x-C) + D \,.$$