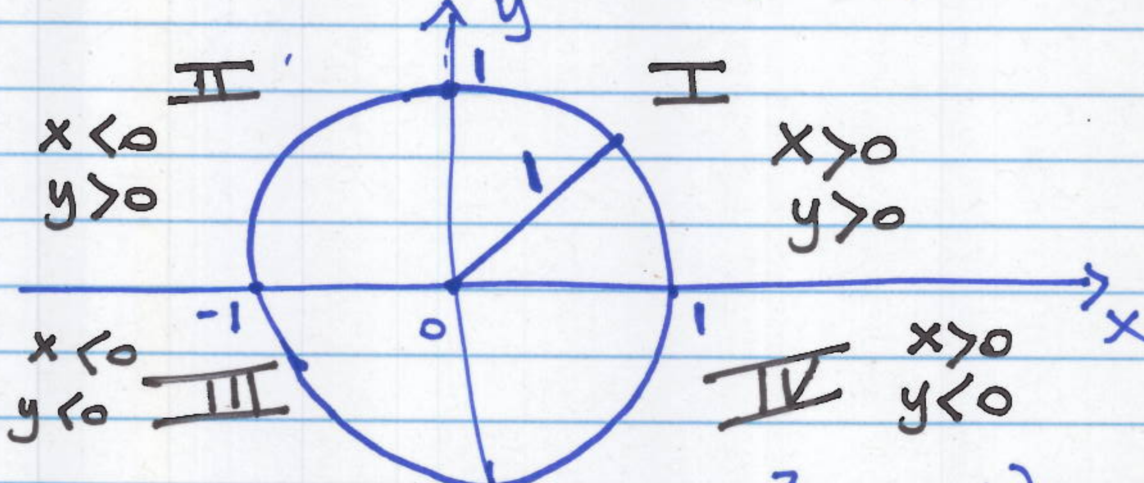
Chap 5 — Trigonometric functions of real numbers.

5.1 Unit Circle: a Circle of radius 1 centered at the origin $(0,0)$ in xy-plane



General Equation of Circle $(x-h)^2+(y-k)^2=r^2$

Center (h,k) radius r

Unit Circle: $x^2+y^2=1$

Show that $P\left(\frac{\sqrt{3}}{2},\frac{\sqrt{3}}{2}\right)$ is on the Unit Circle?

$$\left(\frac{\sqrt{3}}{2}\right)^2+\left(\frac{\sqrt{3}}{2}\right)^2\overset{?}{=}1$$

$$\frac{3}{4}+\frac{3}{4}=1$$ No. is not on the Unit Circle.

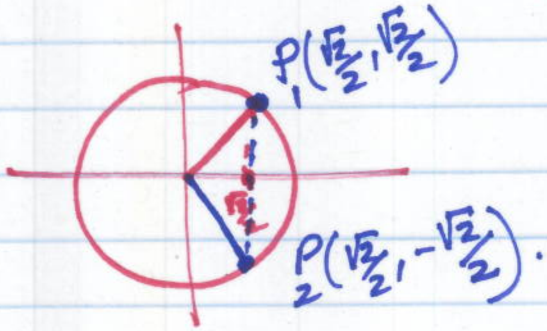
$$P\left(\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2}\right) \longrightarrow \left(\frac{\sqrt{2}}{2}\right)^2 + \left(-\frac{\sqrt{2}}{2}\right)^2 \stackrel{?}{=} 1$$

Quadrant IV $\quad \frac{2}{4} + \frac{2}{4} = 1$ ✓

determine the Unknown

$P\left(\frac{\sqrt{2}}{2}, y\right)$ is on the Unit Circle

We Know $\left(\frac{\sqrt{2}}{2}\right)^2 + y^2 = 1$



$$y^2 = 1 - \frac{1}{2}$$

$$y^2 = \frac{1}{2}$$

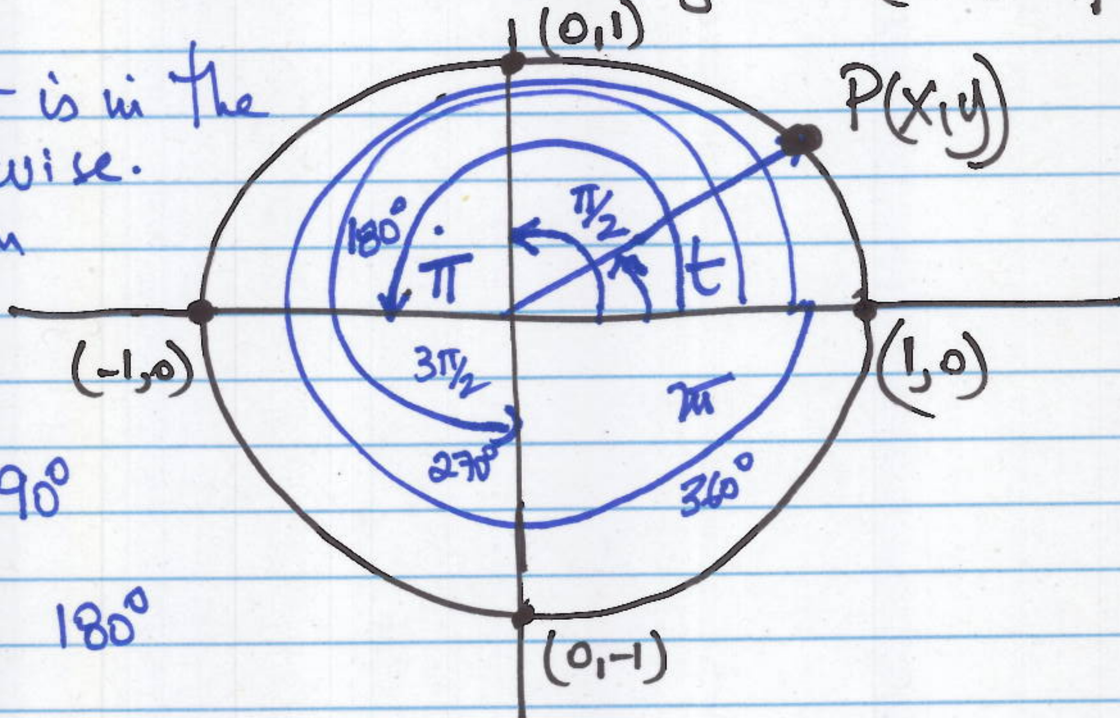
$$y = \pm\sqrt{\frac{1}{2}} = \pm\frac{\sqrt{2}}{2}$$

terminal points on the Unit Circle.

Let $t > 0$ real number

Let's mark off a distance t along the Unit Circle starting at $(1,0)$ if $t>0$

the movement is in the anti clockwise. direction



$t = \pi/2$ 90°

$t = \pi$ 180°

$t = 3\pi/2$ 270°

$t = 2\pi$ 360°

The point $P(x,y)$ obtained in this way is called.

the terminal point determined by the real number t.

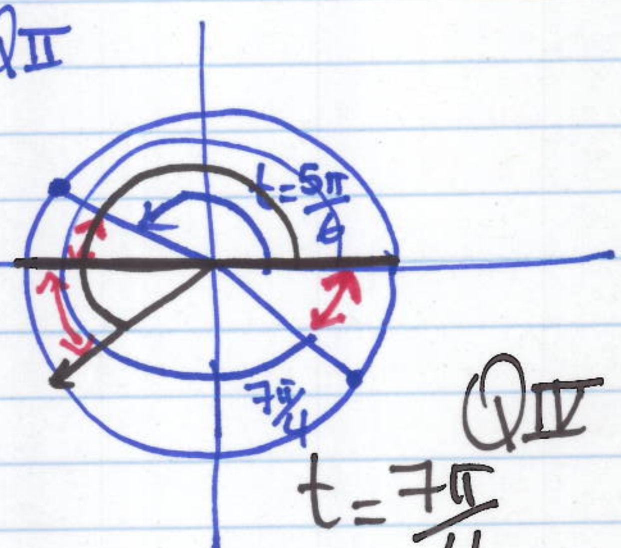
* The reference number

let t be a real number, the reference number $\bar{t}$ associated with t is the <u>Shortest distance</u> along the Unit-Circle with x-axis

Examples: $\bar{t}$ helps to know the quadrant in which the terminal point determined by t lies

$t = \frac{5\pi}{6} \sim 150^\circ$ QII

$\bar{t} = \pi - \frac{5\pi}{6} = \boxed{\pi/6}$



$t = \frac{7\pi}{6}$ QIII 210°

$\bar{t} = \frac{7\pi}{6} - \pi = \boxed{\frac{\pi}{6}}$

QIV

$t = \frac{7\pi}{4}$

$\bar{t} = 2\pi - \frac{7\pi}{4}$

$= \boxed{\pi/4}$

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Sec 5.1 Find the reference number for each t

$t = \frac{4\pi}{3}$ $\bar{t} = \frac{4\pi}{3} - \pi = \boxed{\pi/3}$

QIII

$t = 7\pi/3$ $\bar{t} = 7\pi/3 - 2\pi = \boxed{\pi/3}$

QI

$t = \frac{17\pi}{6} = 3\pi - \frac{17\pi}{6} = \boxed{\pi/6}$ QII

QIV $\boxed{\pi/4}$

$t = -\frac{41\pi}{4} + 6(2\pi) = -\frac{41\pi}{4} + \frac{48\pi}{4} = \frac{7\pi}{4} = 2\pi - \frac{7\pi}{4}$