Dr. ZABDAWI
MATH 185/134

Trigonometric Identities & Basics To Be Known By :

I) The trigonometric circle has a radius equals to unity ; r = 1 .

II) For angles : Counter Clock Wise is considered positive (CCW)
Clock Wise is considered negative (CW) .

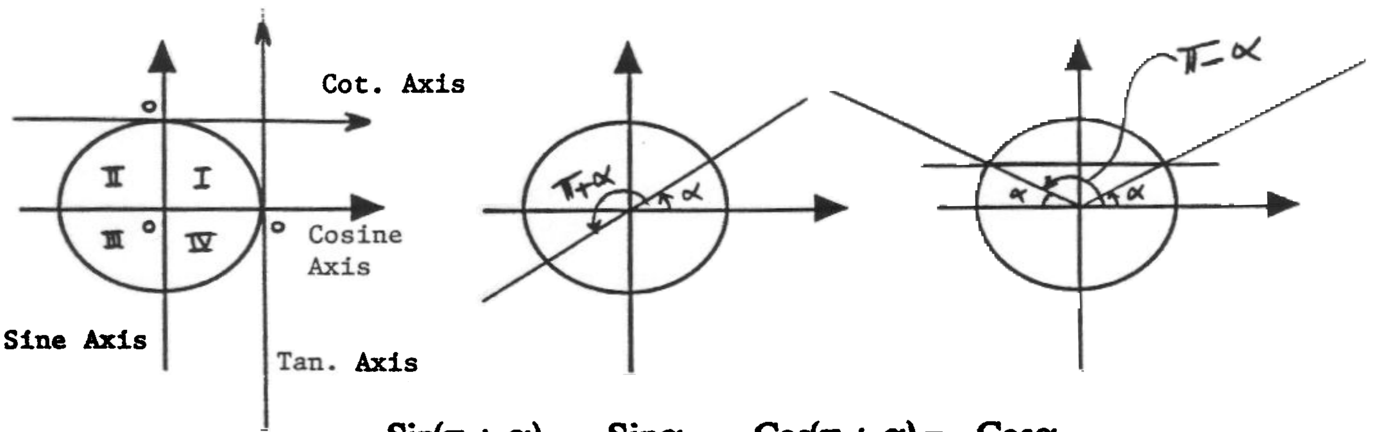
III) **SOHCAHTOA** :

$$\alpha^{rad} = \frac{\text{Arc Length}}{\text{Radius}}$$

$$\text{Sin}\alpha = \frac{\text{OPPOSITE}}{\text{HYPOTENEOUS}} \quad , \quad \text{Csc}\alpha = \frac{1}{\text{Sin}\alpha}$$

$$\text{Cos}\alpha = \frac{\text{ADJACENT}}{\text{HYPOTENEOUS}} \quad , \quad \text{Sec}\alpha = \frac{1}{\text{Cos}\alpha}$$

$$\text{Tan}\alpha = \frac{\text{OPPOSITE}}{\text{ADJACENT}} = \frac{\text{Sin}\alpha}{\text{Cos}\alpha} = \frac{1}{\text{Cot}\alpha}$$



$$\text{Sin}(\pi + \alpha) = -\text{Sin}\alpha \quad , \quad \text{Cos}(\pi + \alpha) = -\text{Cos}\alpha$$

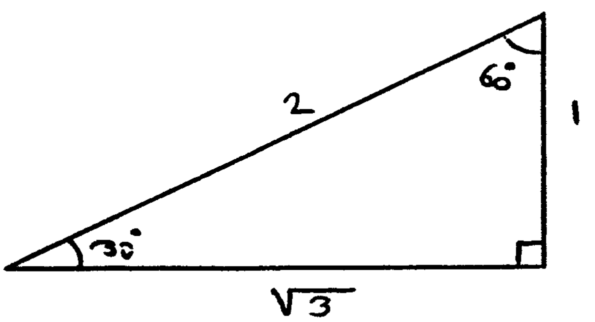
$$\text{Sin}(\pi - \alpha) = \text{Sin}\alpha \quad , \quad \text{Cos}(\pi - \alpha) = -\text{Cos}\alpha$$

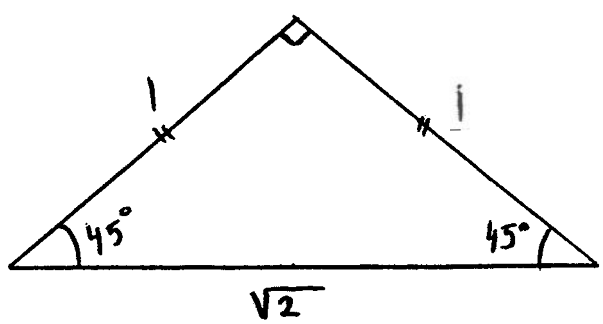
IV)

Degrees	Radians	Degrees	Radians
0°	0	30°	π/6
45°	π/4	60°	π/3
90°	π/2	180°	π
270°	3π/2	360°	2π

α^{rad}	0	π/4	π/2	π	3π/2	2π
Cos	1	$\frac{\sqrt{2}}{2}$	0	−1	0	1
Sin	0	$\frac{\sqrt{2}}{2}$	1	0	−1	0
Tan	0	1	∞	0	−∞	0
Cot	∞	1	0	−∞	0	∞

V) **The two fundamental triangles that you need to know are :**





VI) Cofunctions

$$\sin\left(\frac{\pi}{2} - \alpha\right) = \cos\alpha \quad , \quad \cos\left(\frac{\pi}{2} - \alpha\right) = \sin\alpha$$

$$\tan\left(\frac{\pi}{2} - \alpha\right) = \cot\alpha \quad , \quad \cot\left(\frac{\pi}{2} - \alpha\right) = \tan\alpha$$

$$\sec\left(\frac{\pi}{2} - \alpha\right) = \csc\alpha \quad , \quad \csc\left(\frac{\pi}{2} - \alpha\right) = \sec\alpha$$

VII) Range For Inverse Functions

FUNCTION	RANGE
$Y = \sin^{-1}X$	$\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$
$Y = \tan^{-1}X$	$\left(\frac{-\pi}{2}, \frac{\pi}{2}\right)$
$Y = \csc^{-1}X$	$\left[\frac{-\pi}{2}, \frac{\pi}{2}\right]$, $Y \neq 0$

FUNCTION	RANGE
$Y = \cos^{-1}X$	$[0, \pi]$
$Y = \cot^{-1}X$	$(0, \pi)$
$Y = \sec^{-1}X$	$[0, \pi]$, $Y \neq \frac{\pi}{2}$

VIII) Trigonometric Identities :

$$\mathrm{Sin}^2\alpha + \mathrm{Cos}^2\alpha = 1$$

$$1 + \mathrm{Tan}^2\alpha = \mathrm{Sec}^2\alpha$$

$$1 + \mathrm{Cot}^2\alpha = \mathrm{Csc}^2\alpha$$

$$\mathrm{Sin}(\alpha + \beta) = \mathrm{Sin}\alpha\mathrm{Cos}\beta + \mathrm{Cos}\alpha\mathrm{Sin}\beta$$

$$\mathrm{Sin}(\alpha - \beta) = \mathrm{Sin}\alpha\mathrm{Cos}\beta - \mathrm{Cos}\alpha\mathrm{Sin}\beta$$

$$\mathrm{Sin}2\alpha = 2\mathrm{Sin}\alpha\mathrm{Cos}\alpha$$

$$\mathrm{Cos}(\alpha + \beta) = \mathrm{Cos}\alpha\mathrm{Cos}\beta - \mathrm{Sin}\alpha\mathrm{Sin}\beta$$

$$\mathrm{Cos}(\alpha - \beta) = \mathrm{Cos}\alpha\mathrm{Cos}\beta + \mathrm{Sin}\alpha\mathrm{Sin}\beta$$

$$\mathrm{Cos}2\alpha = \mathrm{Cos}^2\alpha - \mathrm{Sin}^2\alpha$$

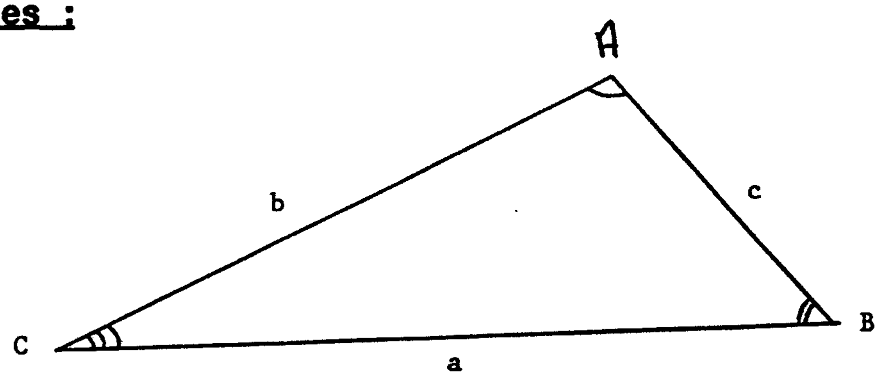
$$\mathrm{Cos}2\alpha = 2\mathrm{Cos}^2\alpha - 1$$

$$\mathrm{Cos}2\alpha = 1 - 2\mathrm{Sin}^2\alpha$$

$$\mathrm{Tan}(\alpha + \beta) = \frac{\mathrm{Tan}\alpha + \mathrm{Tan}\beta}{1 - \mathrm{Tan}\alpha\mathrm{Tan}\beta}$$

$$\mathrm{Tan}(\alpha - \beta) = \frac{\mathrm{Tan}\alpha - \mathrm{Tan}\beta}{1 + \mathrm{Tan}\alpha\mathrm{Tan}\beta}$$

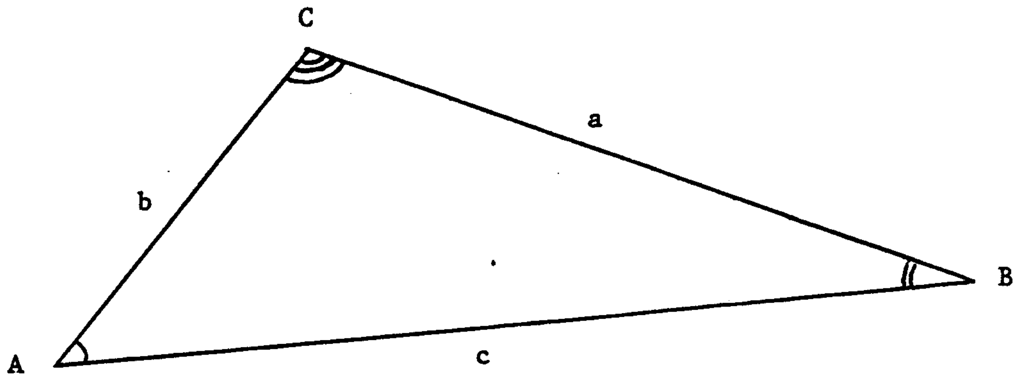
IX) Law of Sines :



Any Arbitrary Triangle

$$\frac{\text{Sin}A}{a} = \frac{\text{Sin}B}{b} = \frac{\text{Sin}C}{c}$$

X) Law of Cosines :



Any Arbitrary Triangle

$$a^2 = b^2 + c^2 - 2bc\text{Cos}A$$

$$b^2 = a^2 + c^2 - 2ac\text{Cos}B$$

$$c^2 = a^2 + b^2 - 2ab\text{Cos}C$$