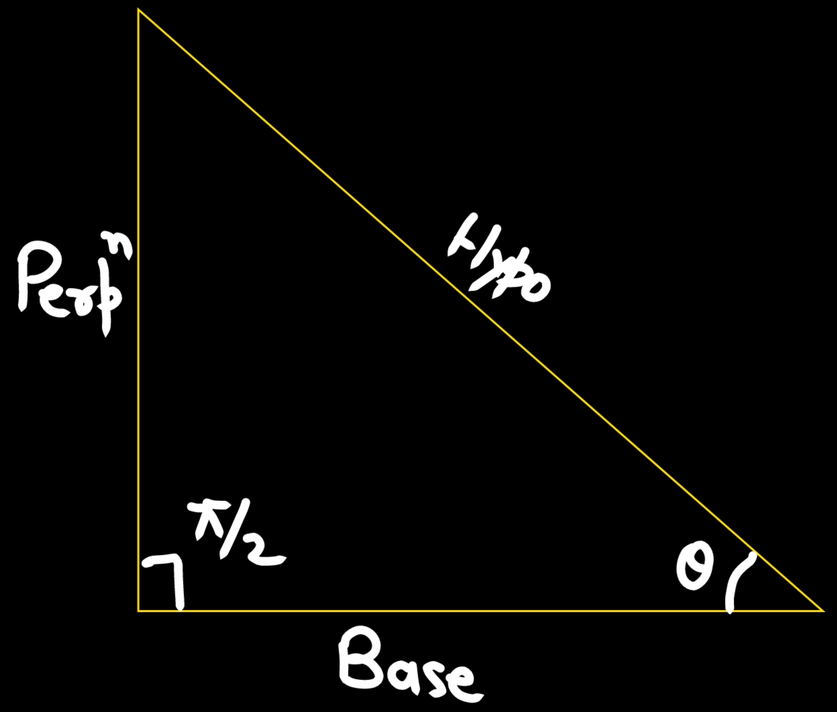
Trigonometric Ratio



$$H^2 = P^2 + B^2$$

$$\sin\theta = \frac{P}{H}$$

$$\cos\theta = \frac{B}{H}$$

$$\tan\theta = \frac{P}{B}$$

$$\cot\theta = \frac{B}{P}$$

$$\sec\theta = \frac{H}{B}$$

$$\operatorname{cosec}\theta = \frac{H}{P}$$

$$\frac{\sin\theta}{\cos\theta} = \frac{P/H}{B/H} = \frac{P}{H} \times \frac{H}{B}$$

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

$$\frac{\cos\theta}{\sin\theta} = \frac{B/H}{P/H} = \frac{B}{P}$$

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

$$\frac{1}{\sin\theta} = \frac{1}{P/H} = \frac{H}{P}$$

$$= \operatorname{Cosec}\theta$$

$$\frac{1}{\sin\theta} = \operatorname{Cosec}\theta$$

$$\sin\theta \cdot \operatorname{Cosec}\theta = 1$$

$$\frac{1}{\cos\theta} = \frac{1}{B/H} = \frac{H}{B}$$

$$= \sec\theta$$

$$\frac{1}{\cos\theta} = \sec\theta$$

$$\cos\theta \cdot \sec\theta = 1$$

$$\frac{1}{\tan\theta} = \frac{1}{P/B} = \frac{B}{P}$$

$$= \cot\theta$$

$$\tan\theta = \frac{1}{\cot\theta}$$

$$\tan\theta \cdot \cot\theta = 1$$

$\sin^2\theta + \cos^2\theta = 1$

LHS

$\sin^2\theta + \cos^2\theta$

$= \frac{P^2}{H^2} + \frac{B^2}{H^2}$

$= \frac{P^2+B^2}{H^2}$

$= \frac{H^2}{H^2}$

$= 1$ //

$\sec^2\theta - \tan^2\theta = 1$

LHS

$\sec^2\theta - \tan^2\theta$

$= \frac{H^2}{B^2} - \frac{P^2}{B^2}$

$= \frac{H^2-P^2}{B^2}$

$= \frac{B^2}{B^2}$

$= 1$ //

$\operatorname{Cosec}^2\theta - \cot^2\theta = 1$

LHS

$= \operatorname{Cosec}^2\theta - \cot^2\theta$

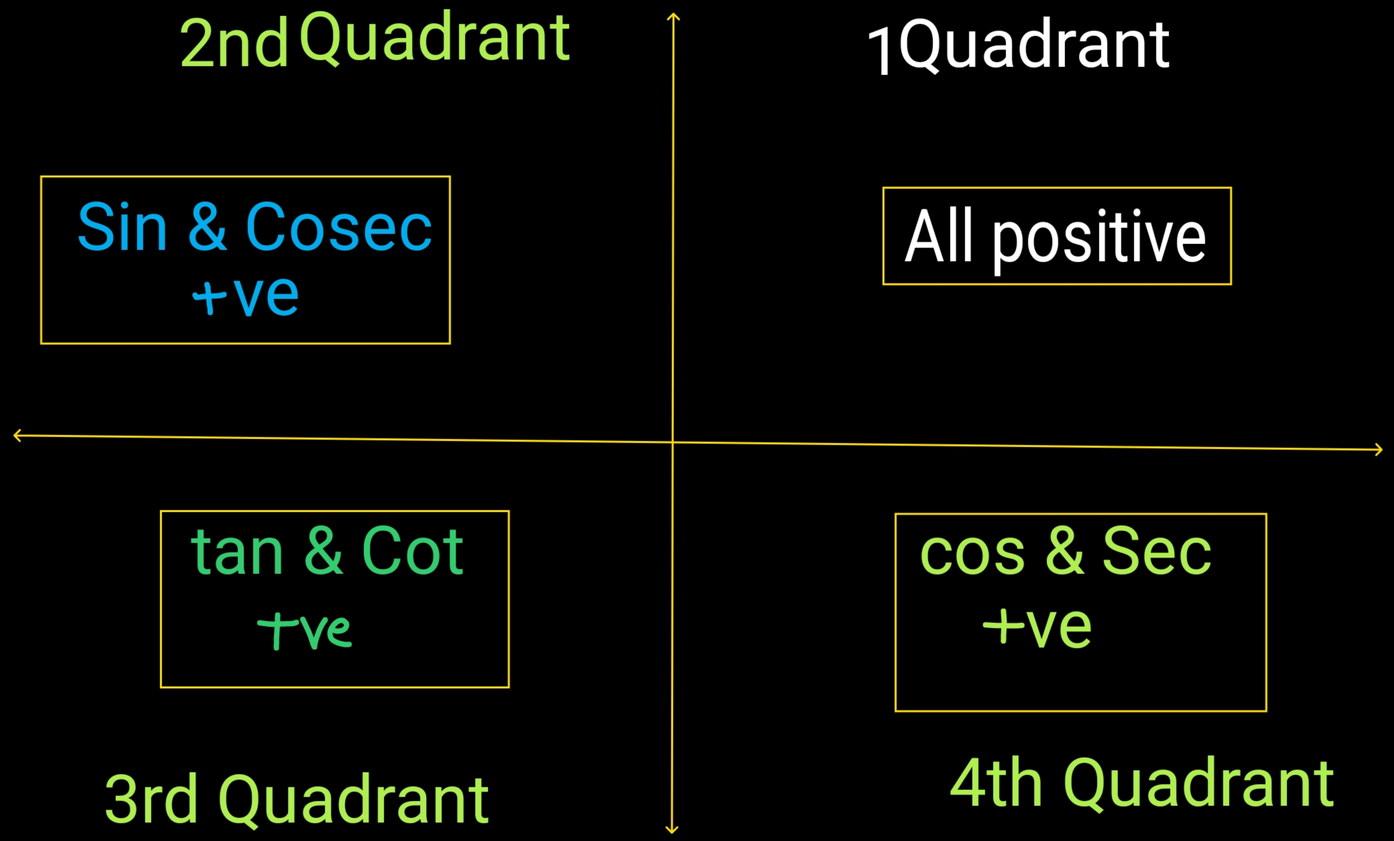
$= \frac{H^2}{P^2} - \frac{B^2}{P^2}$

$= \frac{H^2-B^2}{P^2}$

$= \frac{P^2}{P^2}$

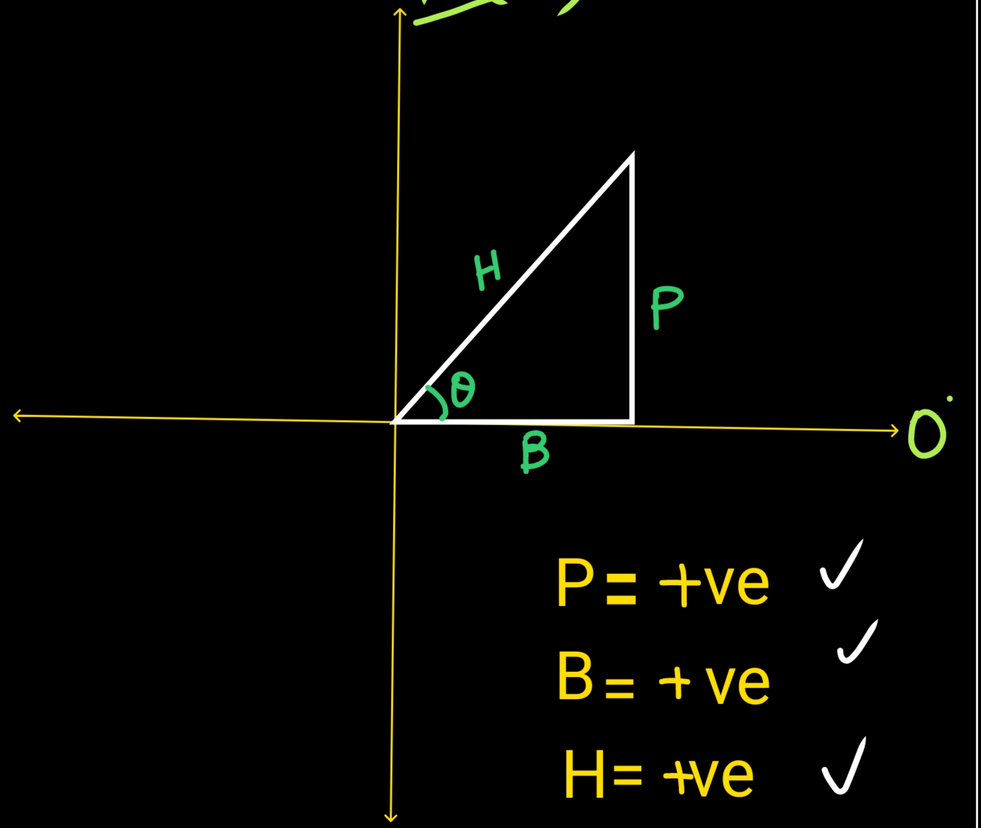
$= 1$ //

θ	0°	30° ($\pi/6$)	45° ($\pi/4$)	60° ($\pi/3$)	90° ($\pi/2$)
Sin	0	$1/2$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$1/\sqrt{3}$	1	$\sqrt{3}$	∞
Cot	∞	$\sqrt{3}$	1	$1/\sqrt{3}$	0
Sec	1	$2/\sqrt{3}$	$\sqrt{2}$	2	∞
Cosec	∞	2	$\sqrt{2}$	$2/\sqrt{3}$	1


2nd Quadrant
1Quadrant
Sin & Cosec
+ve
All positive
tan & Cot
+ve
cos & Sec
+ve
3rd Quadrant
4th Quadrant

All change

$90^\circ (\pi/2)$



P = +ve ✓

B = +ve ✓

H = +ve ✓

$\sin\theta = P/H$

$\cos\theta = B/H$ ✓

$\tan\theta = P/B$ ✓

$\cot\theta = B/P$ ✓

$\sec\theta = H/B$ ✓

$\operatorname{cosec}\theta = H/P$

$(90-\theta)$ will lie in 1st Quadrant

$\sin(90-\theta) = \cos\theta$

$\cos(90-\theta) = \sin\theta$

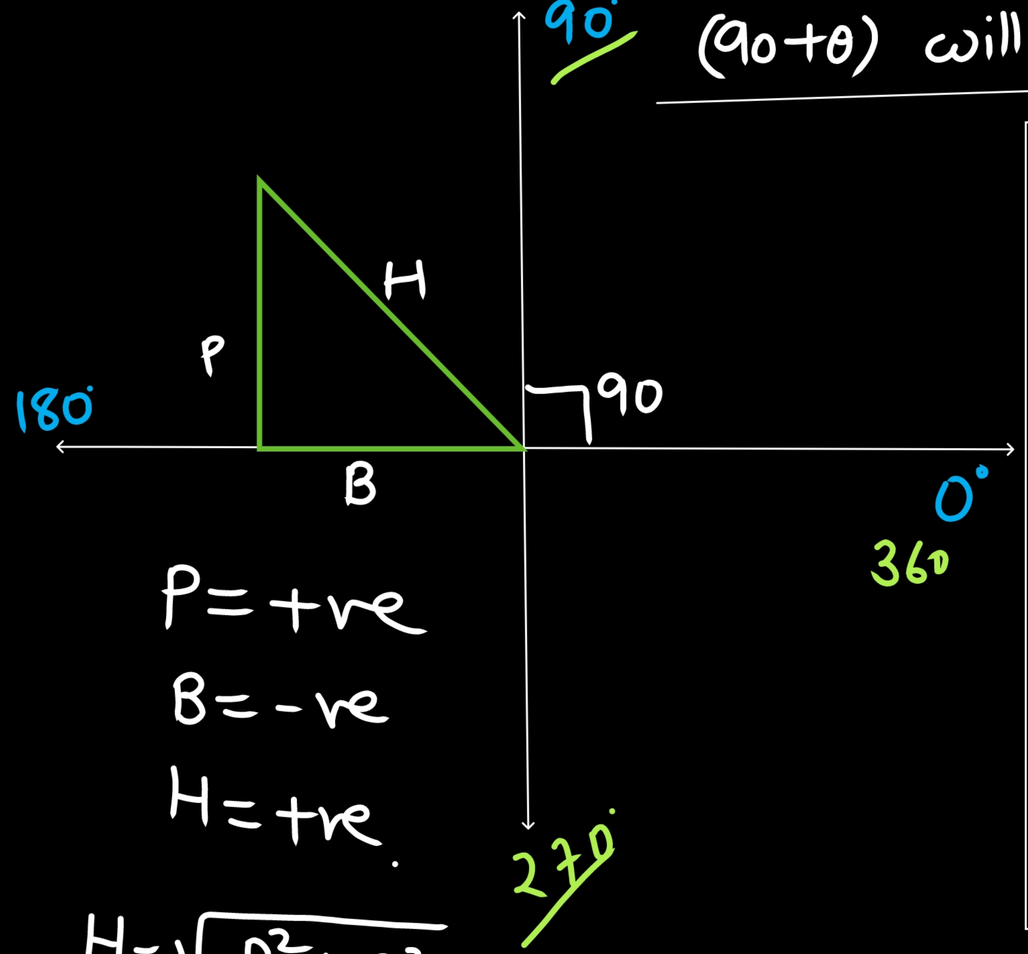
$\tan(90-\theta) = \cot\theta$

$\cot(90-\theta) = \tan\theta$

$\sec(90-\theta) = \operatorname{cosec}\theta$

$\operatorname{cosec}(90-\theta) = \sec\theta$

(90+θ) will lie in 2nd Quadrant



P = +ve

B = -ve

H = +ve

$H = \sqrt{P^2 + B^2}$

$\sin(90+\theta) = +\cos\theta$

$\cos(90+\theta) = -\sin\theta$

$\tan(90+\theta) = -\cot\theta$

$\cot(90+\theta) = -\tan\theta$

$\sec(90+\theta) = -\operatorname{cosec}\theta$

$\operatorname{cosec}(90+\theta) = +\sec\theta$

(180−θ) ⟶ 2nd Quadrant

$\sin(180-\theta) = +\sin\theta$

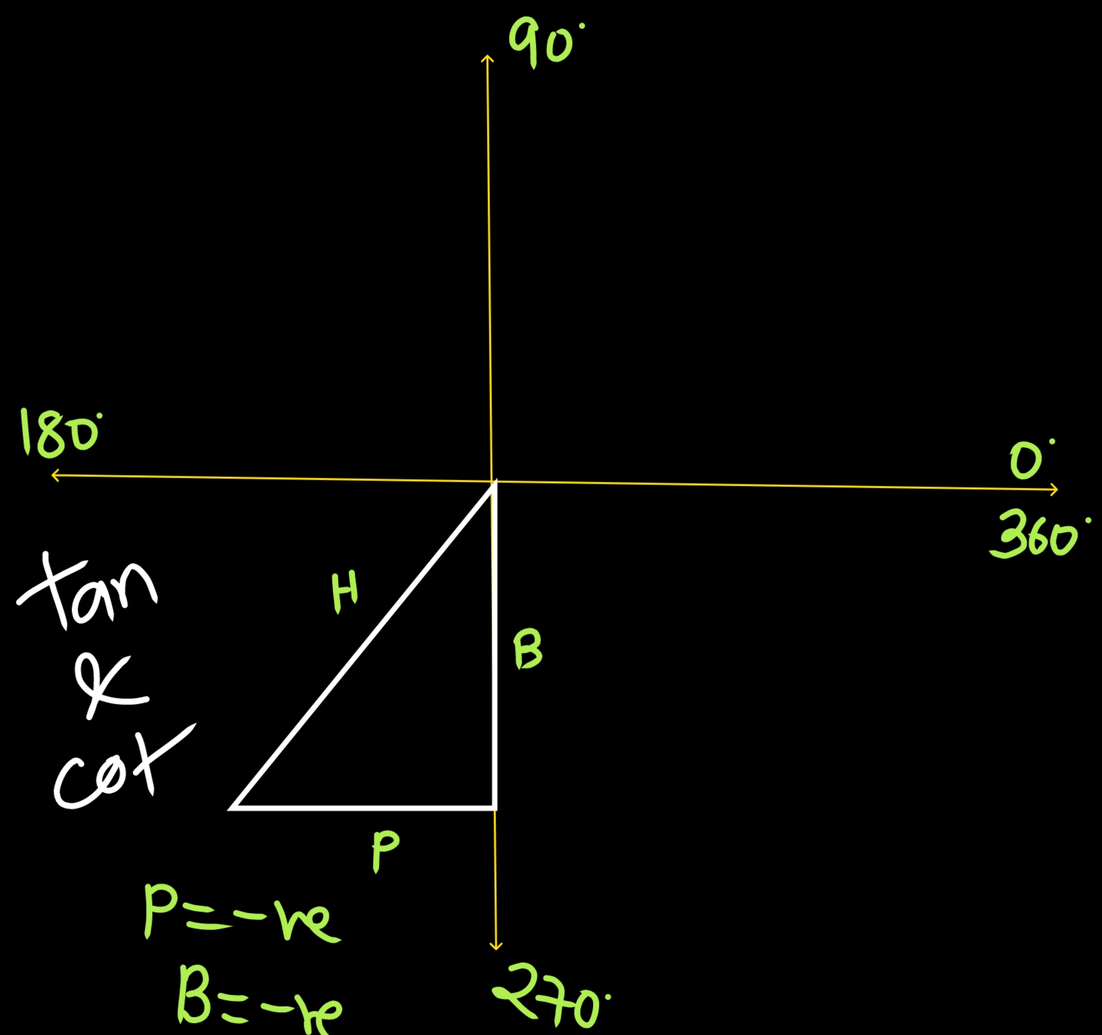
$\cos(180-\theta) = -\cos\theta$

$\tan(180-\theta) = -\tan\theta$

$\cot(180-\theta) = -\cot\theta$

$\sec(180-\theta) = -\sec\theta$

$\operatorname{cosec}(180-\theta) = +\operatorname{cosec}\theta$



$(180^\circ + \theta)$ → 3rd Quadrant

$\sin(180+\theta) = -\sin\theta$

$\cos(180+\theta) = -\cos\theta$

$\tan(180+\theta) = +\tan\theta$

$\cot(180+\theta) = +\cot\theta$

$\sec(180+\theta) = -\sec\theta$

$\operatorname{cosec}(180+\theta) = -\operatorname{cosec}\theta$

$(270-\theta)$ ⟶ 3rd Quad.

$\sin(270-\theta) = -\cos\theta$

$\cos(270-\theta) = -\sin\theta$

$\tan(270-\theta) = +\cot\theta$

$\cot(270-\theta) = +\tan\theta$

$\sec(270-\theta) = -\operatorname{cosec}\theta$

$\operatorname{cosec}(270-\theta) = -\sec\theta$

$$\sin 120^\circ = \sin(90^\circ + 30^\circ)$$
$$= +\cos 30^\circ$$
$$= \sqrt{3}/2$$

$$\sin 120^\circ = \sin(180^\circ - 60^\circ)$$
$$= +\sin 60^\circ$$
$$= \sqrt{3}/2$$

$$\sin 150 = \sin(90 + 60)$$

$$= +\cos 60$$

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

$$\sin 150 = \sin(180 - 30)$$

$$= +\sin 30$$

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

$$\sin 240^\circ$$

$$= \sin(180 + 60^\circ)$$

$$= -\sin 60^\circ$$

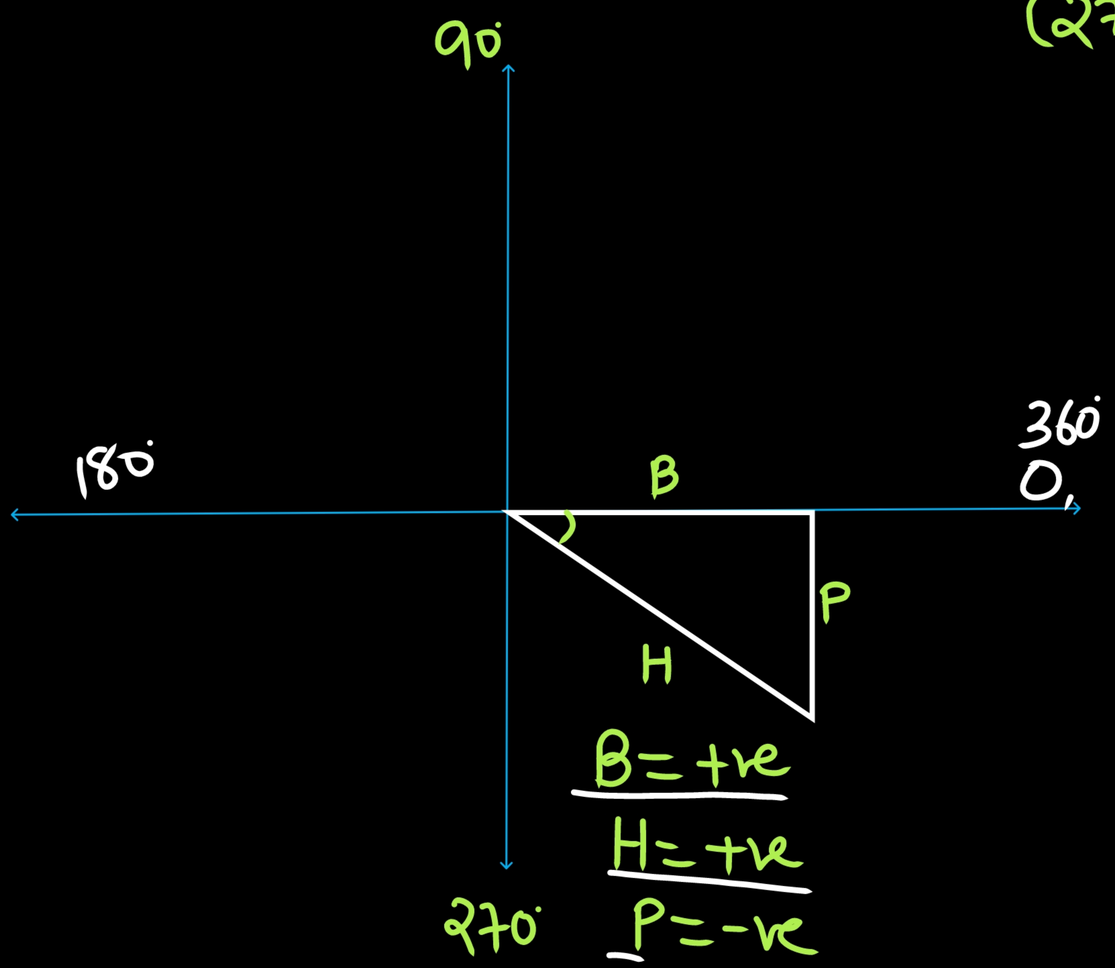
$$= -\sqrt{3}/2$$

$$\sin 240^\circ$$

$$= \sin(270 - 30^\circ)$$

$$= -\cos 30^\circ$$

$$= -\sqrt{3}/2$$



B = +ve

H = +ve

P = -ve

(270 + θ) → 4th Quad

$\sin(270+\theta) = -\cos\theta$

$\cos(270+\theta) = +\sin\theta$

$\tan(270+\theta) = -\cot\theta$

$\cot(270+\theta) = -\tan\theta$

$\sec(270+\theta) = +\operatorname{cosec}\theta$

$\operatorname{cosec}(270+\theta) = -\sec\theta$

(360 - θ) → 4th Quad

$\sin(360-\theta) = -\sin\theta$

$\cos(360-\theta) = +\cos\theta$

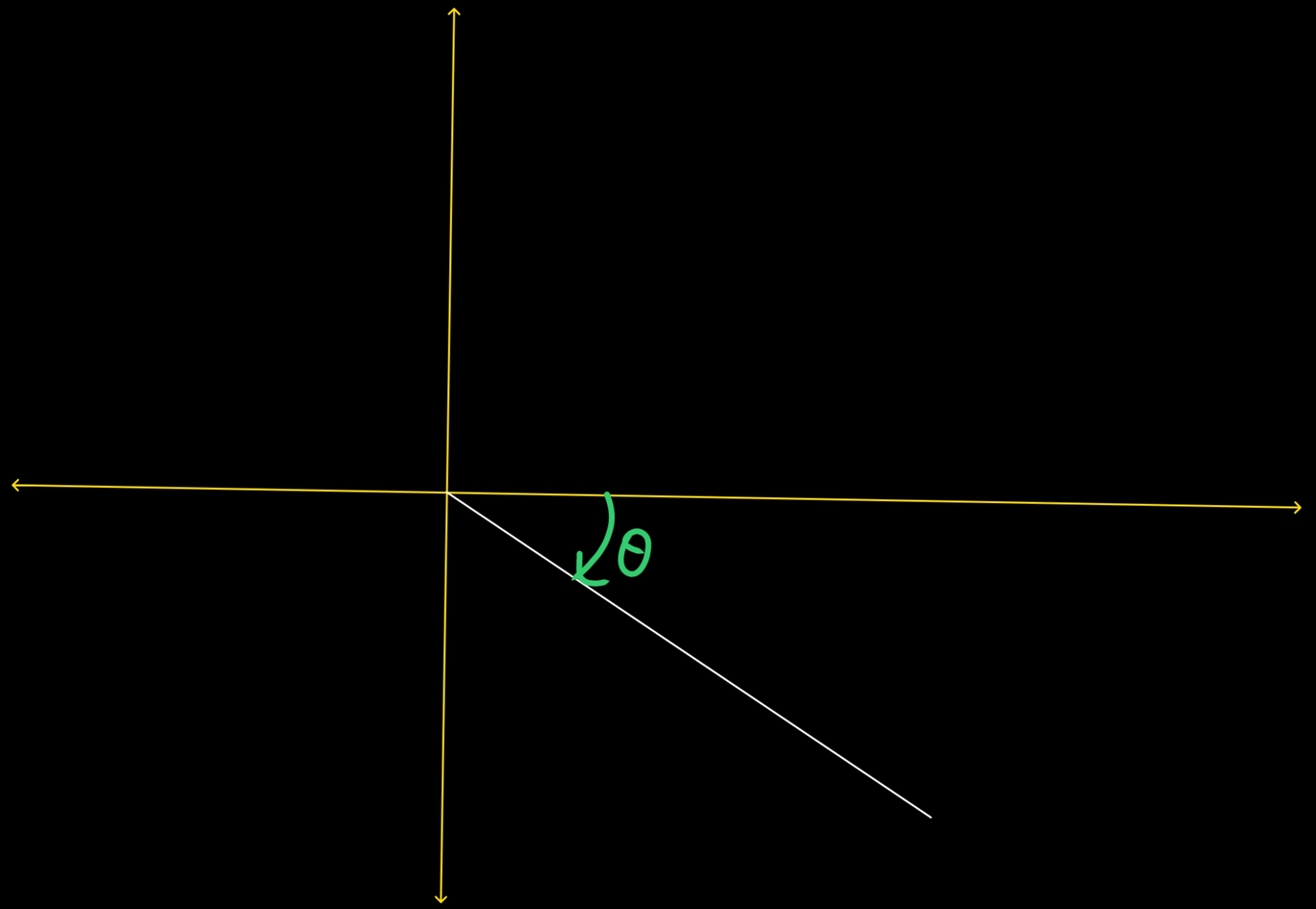
$\tan(360-\theta) = -\tan\theta$

$\cot(360-\theta) = -\cot\theta$

$\sec(360-\theta) = +\sec\theta$

$\operatorname{cosec}(360-\theta) = -\operatorname{cosec}\theta$

	I	II	II	III	III	IV	IV	IV
	$90-\theta$	$90+\theta$	$180-\theta$	$180+\theta$	$270-\theta$	$270+\theta$	$360-\theta$	$(-\theta)$
Sin	$+\cos\theta$	$+\cos\theta$	$+\sin\theta$	$-\sin\theta$	$-\cos\theta$	$-\cos\theta$	$-\sin\theta$	$-\sin\theta$
Cos	$+\sin\theta$	$-\sin\theta$	$-\cos\theta$	$-\cos\theta$	$-\sin\theta$	$+\sin\theta$	$+\cos\theta$	$+\cos\theta$
tan	$+\cot\theta$	$-\cot\theta$	$-\tan\theta$	$+\tan\theta$	$+\cot\theta$	$-\cot\theta$	$-\tan\theta$	$-\tan\theta$
Cot	$+\tan\theta$	$-\tan\theta$	$-\cot\theta$	$+\cot\theta$	$+\tan\theta$	$-\tan\theta$	$-\cot\theta$	$-\cot\theta$
Sec	$+\operatorname{cosec}\theta$	$-\operatorname{cosec}\theta$	$-\sec\theta$	$-\sec\theta$	$-\operatorname{cosec}\theta$	$+\operatorname{cosec}\theta$	$+\sec\theta$	$+\sec\theta$
Cosec	$+\sec\theta$	$+\sec\theta$	$+\operatorname{cosec}\theta$	$-\operatorname{cosec}\theta$	$-\sec\theta$	$-\sec\theta$	$-\operatorname{cosec}\theta$	$-\operatorname{cosec}\theta$.



$$\sin(-\theta) = -\sin\theta$$

$$\cos(-\theta) = +\cos\theta$$

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

$$\cot(-\theta) = -\cot\theta$$

$$\sec(-\theta) = +\sec\theta$$

$$\operatorname{cosec}(-\theta) = -\operatorname{cosec}\theta$$