XIth Math I

Trigonometry 1

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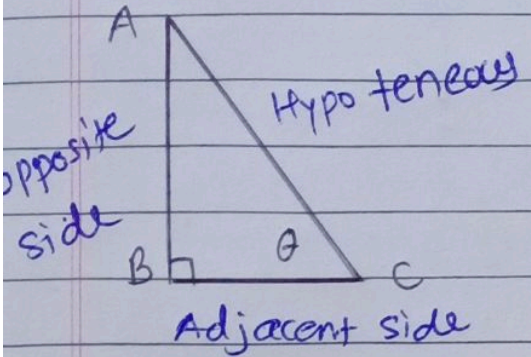
Imp formulas.



$\sin\theta = \frac{\text{opposite side}}{\text{Hypotenuse}}$ $\quad \operatorname{cosec}\theta = \frac{\text{Hypotenuse}}{\text{opposite side}}$

$\cos\theta = \frac{\text{Adjacent side}}{\text{Hypotenuse}}$ $\quad \sec\theta = \frac{\text{Hypotenuse}}{\text{Adjacent side}}$

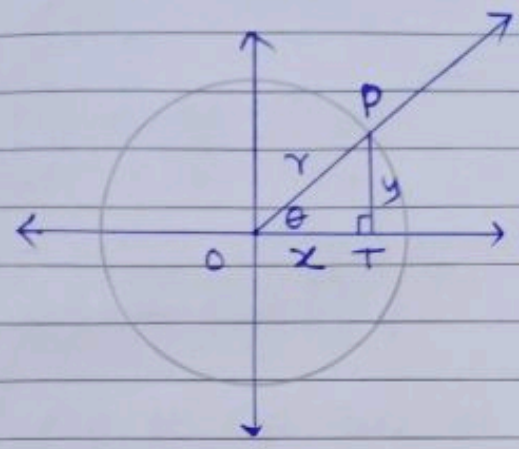
$\tan\theta = \frac{\text{opposite side}}{\text{Adjacent side}}$ $\quad \cot\theta = \frac{\text{Adjacent side}}{\text{opposite side}}$

① $\sin\theta = \frac{1}{\operatorname{cosec}\theta}$ ② $\operatorname{cosec}\theta = \frac{1}{\sin\theta}$ ③ $\sin\theta \times \operatorname{cosec}\theta =$

④ $\cos\theta = \frac{1}{\sec\theta}$ ⑤ $\sec\theta = \frac{1}{\cos\theta}$ ⑥ $\sec\theta \times \cos\theta = 1$

⑦ $\tan\theta = \frac{1}{\cot\theta}$ ⑧ $\cot\theta = \frac{1}{\tan\theta}$ ⑨ $\tan\theta \times \cot\theta = 1$

⑩ $\tan\theta = \frac{\sin\theta}{\cos\theta}$ ⑪ $\cot\theta = \frac{\cos\theta}{\sin\theta}$.



OT = Adjacent side = x
PT = opposite side = y
OP = Radius = r

		If $r=1$
$\sin\theta$	$\frac{\text{opposite side}}{\text{Hypotenuse}} = \frac{y}{r}$	$\sin\theta = \frac{y}{r} = \frac{y}{1} = \boxed{y}$
$\cos\theta$	$\frac{\text{Adjacent side}}{\text{Hypotenuse}} = \frac{x}{r}$	$\cos\theta = \frac{x}{r} = \frac{x}{1} = \boxed{x}$
$\tan\theta$	$\frac{\text{opposite side}}{\text{Adjacent side}} = \frac{y}{x}$	$\tan\theta = \boxed{\frac{y}{x}}$
$\operatorname{cosec}\theta$	$\frac{\text{Hypotenuse}}{\text{opposite side}} = \frac{r}{y}$	$\operatorname{cosec}\theta = \frac{r}{y} = \boxed{\frac{1}{y}}$
$\sec\theta$	$\frac{\text{Hypotenuse}}{\text{Adjacent side}} = \frac{r}{x}$	$\sec\theta = \frac{r}{x} = \boxed{\frac{1}{x}}$
$\cot\theta$	$\frac{\text{Adjacent side}}{\text{opposite side}} = \frac{x}{y}$	$\cot\theta = \boxed{\frac{x}{y}}$

In $\triangle OTP$, by Pythagoras theorem

$$\boxed{r^2 = x^2 + y^2}$$

$$\frac{r^2}{r^2} = \frac{x^2}{r^2} + \frac{y^2}{r^2} \quad \ldots [\text{divided by } r^2]$$

$$1 = \left(\frac{x}{r}\right)^2 + \left(\frac{y}{r}\right)^2$$

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

$$\therefore \boxed{\sin^2\theta + \cos^2\theta = 1}$$

$$r^2 = x^2 + y^2$$

$$\frac{r^2}{x^2} = \frac{x^2}{x^2} + \frac{y^2}{x^2} \quad \ldots [\text{divided by } x^2]$$

$$\left(\frac{r}{x}\right)^2 = 1 + \left(\frac{y}{x}\right)^2$$

$$\boxed{\sec^2\theta = 1 + \tan^2\theta}$$

$$r^2 \neq x^2 + y^2$$

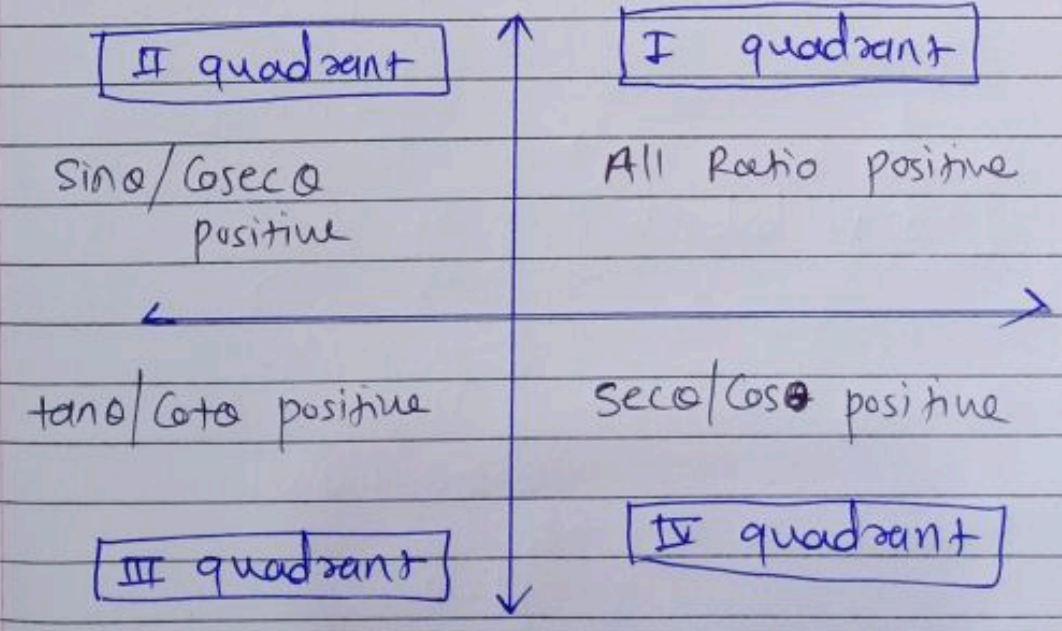
$$\frac{r^2}{y^2} = \frac{x^2}{y^2} + \frac{y^2}{y^2} \quad \ldots [\text{divided by } y^2]$$

$$\left(\frac{r}{y}\right)^2 = \left(\frac{x}{y}\right)^2 + 1$$

$$\text{Cosec}^2\theta = \text{Cot}^2\theta + 1$$

$$\boxed{\text{Cosec}^2\theta = 1 + \text{Cot}^2\theta}$$

Signs of trigonometric function in different quadrants



$\sin(-\theta) = -\sin\theta$ $\quad$ $\operatorname{Cosec}(-\theta) = -\operatorname{Cosec}\theta$

$\cos(-\theta) = \cos\theta$ $\quad$ $\sec(-\theta) = \sec\theta$

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

	0°	30° $\pi/6$	45° $\pi/4$	60° $\pi/3$	90° $\pi/2$	180° π	270° $3\pi/2$	360° 2π
$\sin\theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
$\cos\theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	-1	0	1
$\tan\theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	ND	0	ND	0
$\operatorname{Cosec}\theta$	ND	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1	ND	-1	ND
$\sec\theta$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	ND	-1	ND	1
$\cot\theta$	ND	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	ND	0	ND