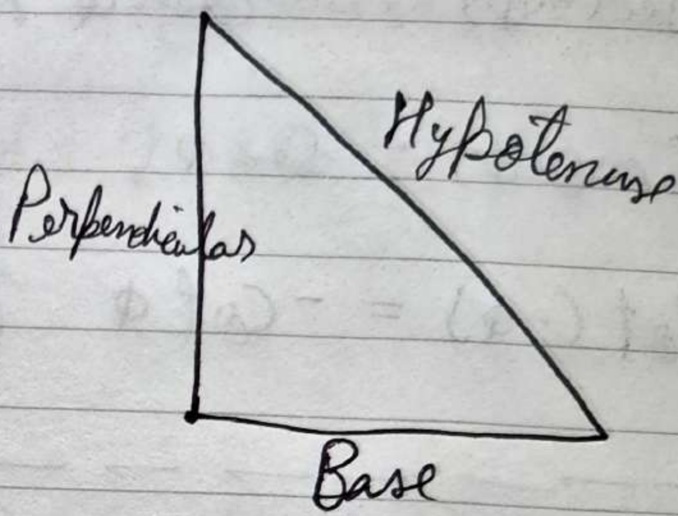
~~Vol of Sphere~~ $\cancel{\rightarrow \frac{4}{3}\pi r^3}$

~~Vol of Hemisphere~~ $\cancel{\rightarrow \frac{2}{3}\pi r^3}$

Trignometry

1) Sin A
2) Cos A
3) tan A
4) Cot A
5) Cosec A
6) Sec A



$$\text{Sin A} = \cancel{\frac{\text{Hypotenuse}}{\text{Base}}} \quad \frac{P}{H} = \frac{\text{Perpendicular}}{\text{Hypotenuse}}$$

$$\text{Cos A} = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{B}{H}$$

$$\text{Tan A} = \frac{\text{Sin A}}{\text{Cos A}} = \frac{P}{B}$$

$$\text{Cot A} = \frac{1}{\text{Tan A}} = \frac{\text{Cos A}}{\text{Sin A}} = \frac{B}{P}$$

$$\text{Cosec A} = \frac{1}{\text{Sin A}} = \frac{H}{P}$$

$$\text{Sec A} = \frac{1}{\text{Cos A}} = \cancel{B} \; \frac{H}{B}$$

$$\left.\begin{aligned}
\sin(-\theta) &= -\sin\theta \\
\cos(-\theta) &= \cos\theta \\
\tan(-\theta) &= -\tan\theta \\
\operatorname{cosec}(-\phi) &= -\operatorname{cosec}\theta \\
\sec(-\phi) &= \sec\phi \\
\cot(-\phi) &= -\cot\phi
\end{aligned}\right\}\text{Sign functions}$$

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

$$\tan^2 A + 1 = \sec^2 A$$

$$\cot^2 A + 1 = \operatorname{cosec}^2 A$$

$$\sin(A+B) = \sin A \cos B + \cos A \cdot \sin B$$
$$\sin(A-B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A+B) = \cos A \cos B - \sin A \sin B$$
$$\cos(A-B) = \cos A \cos B + \sin A \sin B$$

$$\tan(A+B) = [(\tan A + \tan B) / (1 - \tan A \tan B)]$$
$$\tan(A-B) = [(\tan A - \tan B) / (1 + \tan A \tan B)]$$

$$\sin 3A = 3\sin A - 4\sin^3 A$$
$$\cos 3A = 4\cos^3 A - 3\cos A$$
$$\tan 3A = [3\tan A - \tan^3 A] / [1 - 3\tan^2 A]$$

$$\sin 2A = 2\sin A\cos A = \boxed{2\tan A / (1+\tan^2 A)}$$

$$\cos 2A = \cos^2 A - \sin^2 A = 1 - 2\sin^2 A = 2\cos^2 A - 1$$
$$= \frac{(1-\tan^2 A)}{(1+\tan^2 A)}$$

$$\tan 2A = (2\tan A)/(1-\tan^2 A)$$

Law of Sines: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Law of Cosines:

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cdot \cos B$$

$$c^2 = a^2 + B^2 - 2ab \cdot \cos C$$

$$\sin^2\theta = \frac{1-\cos 2\theta}{2}$$

$$\cos^2\theta = \frac{1+\cos 2\theta}{2}$$

$$\tan^2\theta = \frac{1-\cos 2\theta}{1+\cos 2\theta}$$

$-1 \le \sin\theta \le 1$

$-1 \le \cos\theta \le 1$

$-\infty < \tan\theta < \infty$

$-\infty < \cot\theta < \infty$

$\sec\theta \ge 1$ & $\sec\theta \le -1$

$\operatorname{cosec}\theta \ge 1$ & $\operatorname{cosec}\theta \le -1$

$$\sin A \cdot \sin B = \frac{1}{2}[\cos(A-B) - \cos(A+B)]$$

$$\sin A \cdot \cos B = \frac{1}{2}[\sin(A+B) + \sin(A-B)]$$

$$\cos A \cdot \cos B = \frac{1}{2}[\cos(A-B) + \cos(A+B)]$$

$$\cos A \cdot \sin B = \frac{1}{2}[\sin(A+B) - \sin(A-B)]$$

$$\sin A + \sin B = 2\cdot\sin\left(\frac{A+B}{2}\right)\cdot\cos\left(\frac{A-B}{2}\right)$$

$$\sin A - \sin B = 2\cdot\sin\left(\frac{A-B}{2}\right)\cdot\cos\left(\frac{A+B}{2}\right)$$

$$\cos A + \cos B = 2\cdot\cos\left(\frac{A+B}{2}\right)\cdot\cos\left(\frac{A-B}{2}\right)$$

$$\cos A - \cos B = 2\cdot\sin\left(\frac{A+B}{2}\right)\cdot\sin\left(\frac{A-B}{2}\right)$$

Value $\left\{\frac{\pi}{2}\right.$ 90°

Quadrant II

$\boxed{\text{Sin}}$

Sin +ve | Cos -ve
Cosec +ve | Sec -ve

tan -ve | Cot -ve

Quadrant I

$\boxed{\text{All +ve}}$

Sin +ve | Cos +ve
Cosec +ve | Sec +ve

tan +ve | Cot +ve

π } Value

180°

Values: $\underbrace{0, 2\pi}$ 0°

360°

Quadrant III

$\boxed{\text{Tan}}$

Sin -ve | Cos -ve
Cosec -ve | Sec -ve

tan +ve | Cot +ve

Quadrant IV

$\boxed{\text{Cos}}$

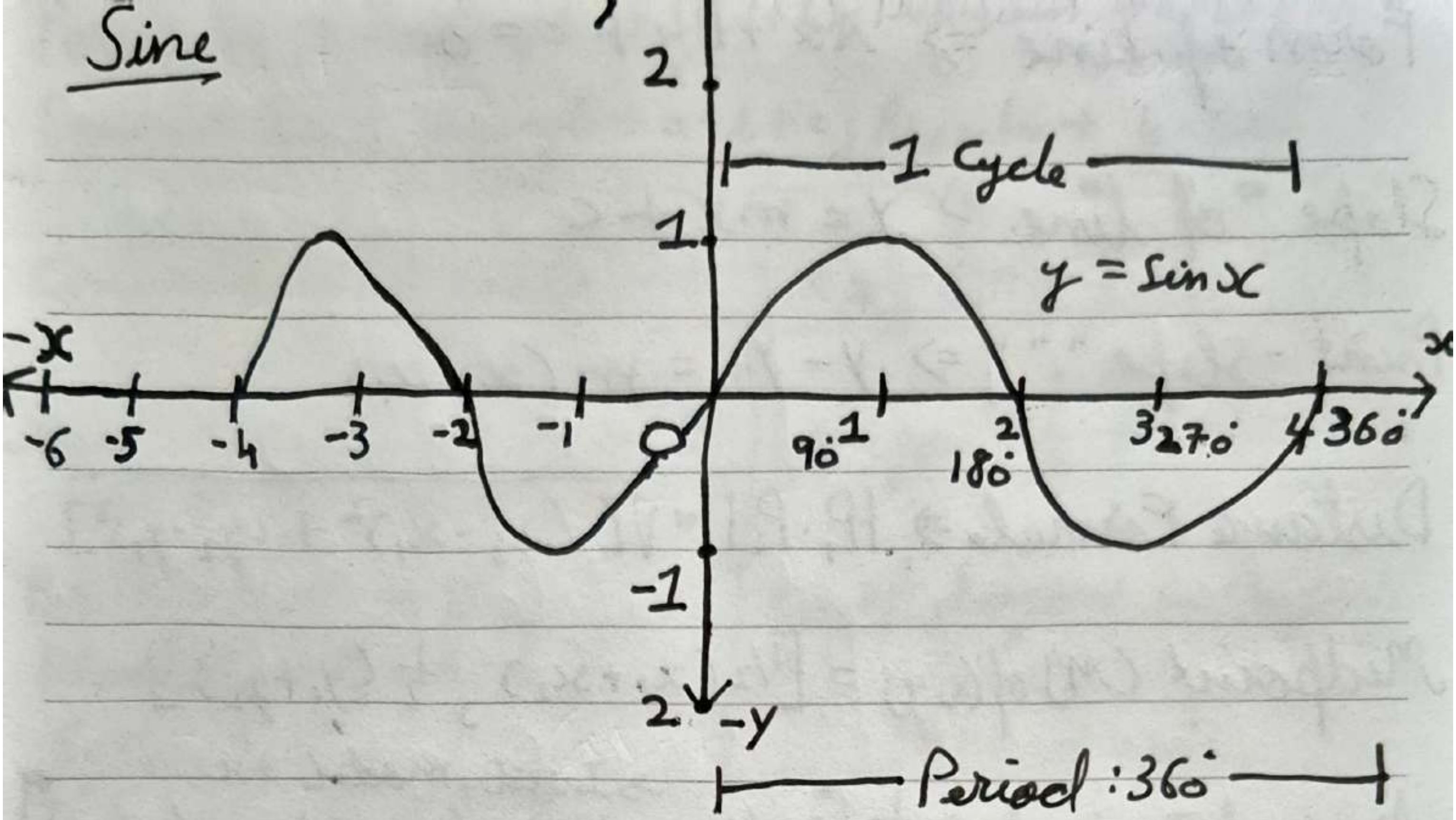
Sin -ve | Cos +ve
Cosec -ve | Sec +ve

tan -ve | Cot -ve

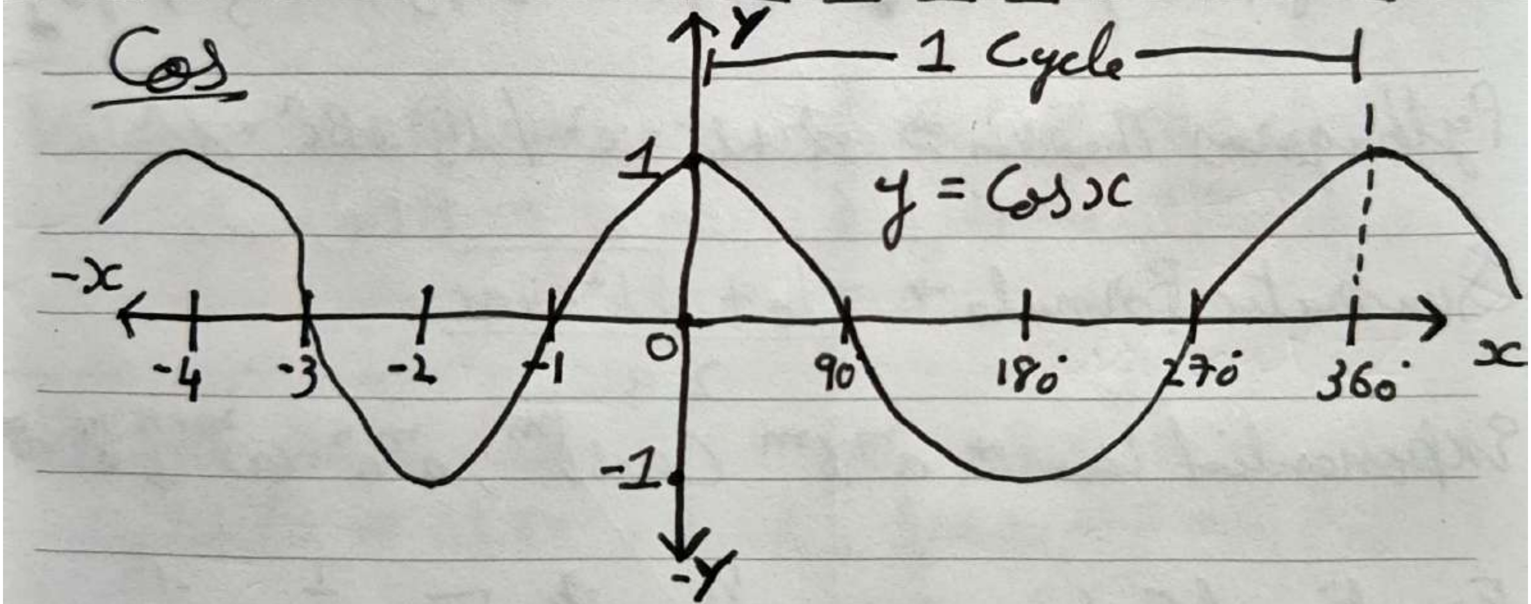
Value $\left\{\frac{3\pi}{2}\right.$ 270°

Angles in Degree	0°	30°	45°	60°	90°	180°	270°	360°
Angles in Radians	0	$\frac{\pi}{6}$	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π
Sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
Cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	-1	0	1
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Not defined	0	Not defined	1
Cot	Not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0	Not defined	0	Not defined
Cosec	Not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1	Not defined	-1	Not defined
Sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	Not defined	-1	Not defined	1

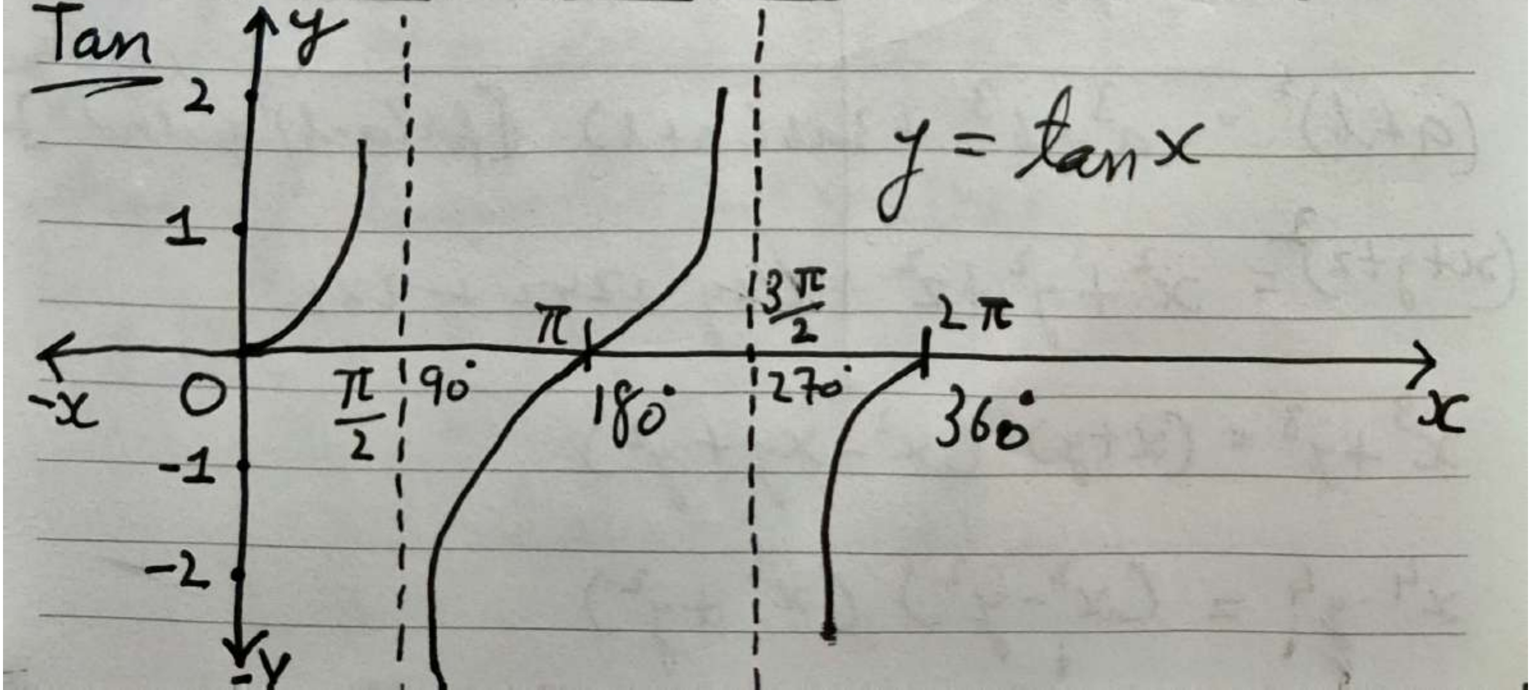
Sine


1 Cycle
y = Sin x
Period : 360°
90°
180°
270°
360°

Cos


1 Cycle
y = Cos x
90°
180°
270°
360°

Tan


y = tan x
π/2
90°
π
180°
3π/2
270°
2π
360°

Form of Line $\Rightarrow Ax + By + c = 0$

Slope of line $\Rightarrow y = mx + c$

Point - slope " " " $\Rightarrow y - y_1 = m(x - x_1)$

Distance Formula $\Rightarrow |P_1 \cdot P_2| = \sqrt{[(x_2 - x_1)^2 + (y_2 - y_1)^2]}$

Midpoint (M) of $(x, y) = [\frac{1}{2}(x_1 + x_2), \frac{1}{2}(y_1 + y_2)]$

Area of Triangle $\Rightarrow \frac{1}{2}\left[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\right]$ → Inside module +ve

Pythagoras Theorem $\Rightarrow a^2 + b^2 = c^2 \,/\, AB^2 + BC^2 = AC^2$

Quadratic Formula $\rightarrow \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Exponential Law $\rightarrow a^m \cdot b^m \; (a \cdot b)^m ; \; a^m a^n = (a)^{m+n}$

Fractional Exponent $\rightarrow a^{1/2} = \sqrt{a} \; ; \; \frac{1}{a} = a^{-1}$

$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$ {for $(a-b)^3$ just Put -ve Every

$(x+y+z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2xz$

$x^3 + y^3 = (x+y)(x^2 - xy + y^2)$

$x^4 - y^4 = (x^2 - y^2)(x^2 + y^2)$

Perimeter → Rectangle → $2(l+b)$; Trapezium → $a+b+c+d$

Square → $4a$; Triangle → $a+b+c$; Rhombus → $4 \cdot$ Side

---

Circumference of circle → $2\pi r$ ($\pi = 3.14$)

Area : Triangle → $\frac{1}{2} \cdot h \cdot B$

Circle → πr^2

Parallelogram → $B \cdot H$

Rhombus → $\frac{1}{2}(d_1 \cdot d_2)$

Square → L^2

Trapezoid → $\frac{1}{2} \cdot (B_1 + B_2) \cdot H$

Polygon → $\frac{1}{2} \cdot$ Perimeter $\cdot$ apothem

no. of diagons in Polygon $= \frac{1}{2} \cdot n(n-3)$

n → no. of sides

Rectangle Area → $L \cdot B$

Volume: Cube → a^3

Cone → $\frac{1}{3} \cdot \pi r^2 h$

Sphere → $4/3 \, \pi r^3$

Cuboid → $l \cdot b \cdot h$

Cylinder → $\pi r^2 h$

Surface Area: Cube → $S = 6l^2$, Cone → $CSA = \pi r l$

Cylinder → $CSA = 2\pi r h$, Sphere → $S = 4\pi r^2$

Equations of a circle → $(x-h)^2 + (y-k)^2 = r^2$

Area of triangle in matrix :

$$\Delta ABC = \frac{1}{2} \begin{vmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{vmatrix}$$

Condition of Co-linearity of 3 points.

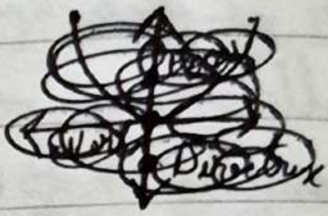
$$\begin{vmatrix} X_1 & Y_1 & 1 \\ X_2 & Y_2 & 1 \\ X_3 & Y_3 & 1 \end{vmatrix} = 0$$

Also; $|A| \geq 0$ A

$|AB| = |A||B|$

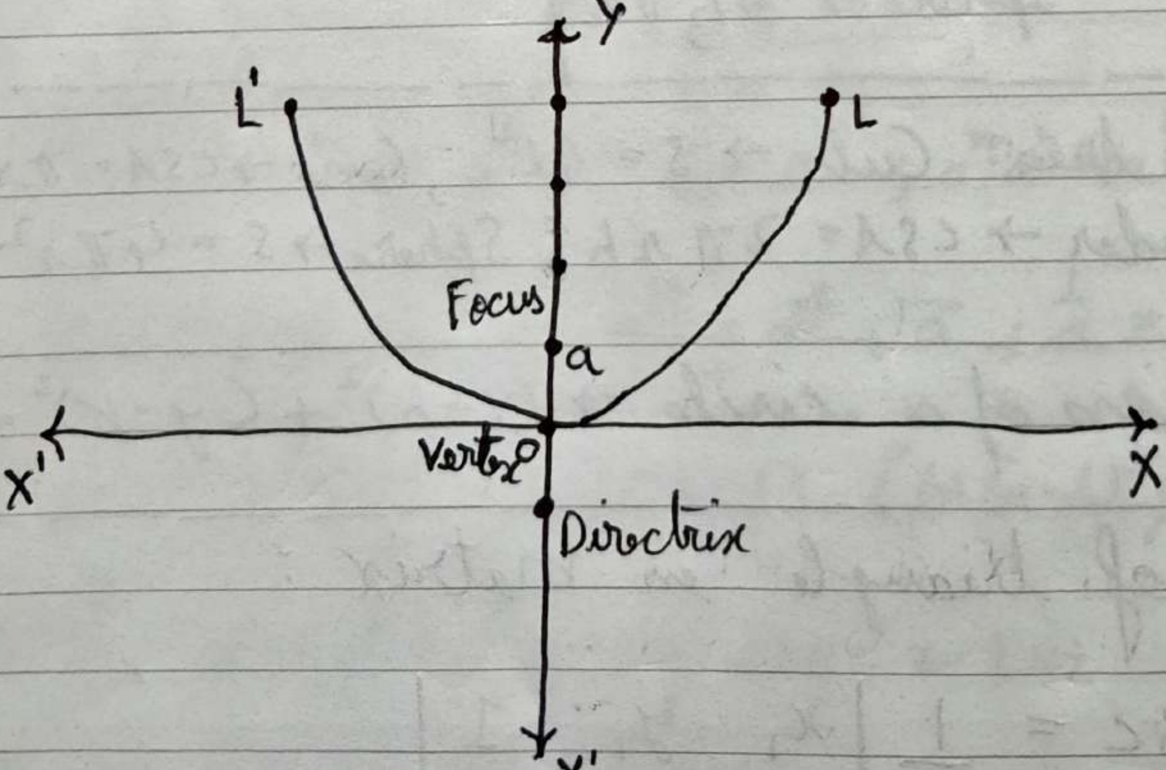
$[a, \infty), [B, \infty]$

Equation of Standard Parabola:



$Y^2 = 4ax$, where vertex is $(0,0)$, focus is $(a,0)$ & Directrix is $x+a=0$, axis is $Y=0$.

Length of Latus Rectum is $4a$, ends of latus rectum are $L(a, 2a)$ & $L'(a, -2a)$



Standard Parabola

~~Linear Algebra~~

For Discriminant (D) of Quadratic Eqⁿ, the formula is:

$D = b^2 - 4ac$

If α & β are the roots then:

$\alpha + \beta = -\frac{b}{a}$ or $\alpha . \beta = \frac{c}{a}$

If they are roots then $(X-\alpha)(X-\beta) = 0$
or $x^2 - (\alpha+\beta)x + \alpha\beta = 0$

Nature of Roots: Considering $ax^2+bx+c=0$ with α & β as roots.

$D = b^2 - 4a.c$

$D = 0$ then roots are equal $\alpha = \beta = \frac{-b}{2a}$

$D \neq 0$ then roots not equal

$D > 0$
Real roots

$D < 0$
Imaginary Roots

D is perfect square then roots are rational

D is not Perfect Square Roots are irrational