$$(a+b)^2 = a^2 + 2ab + b^2$$

$$(a-b)^2 = a^2 - 2ab + b^2$$

$$a^2 - b^2 = (a+b)(a-b)$$

$$a^2 + b^2 = (a+b)^2 - 2ab = (a-b)^2 + 2ab$$

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3 = a^3 + b^3 + 3ab(a+b)$$

$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3 = a^3 - b^3 - 3ab(a-b)$$

$$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$$

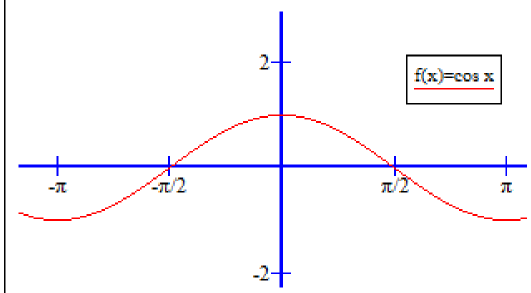
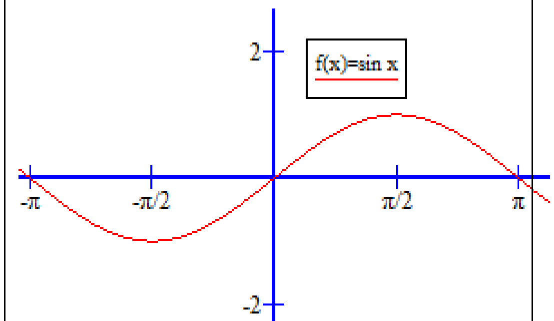
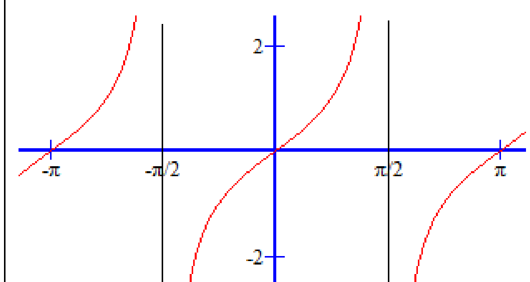
$$(a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca) = a^3 + b^3 + c^3 - 3abc$$

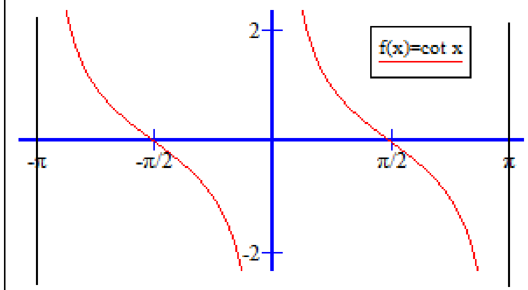
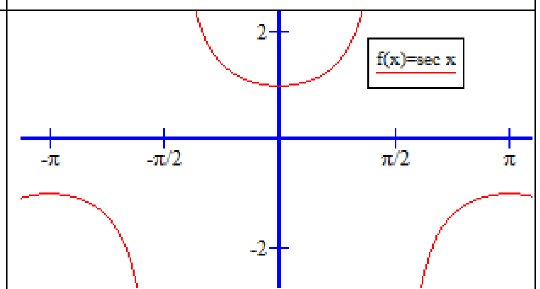
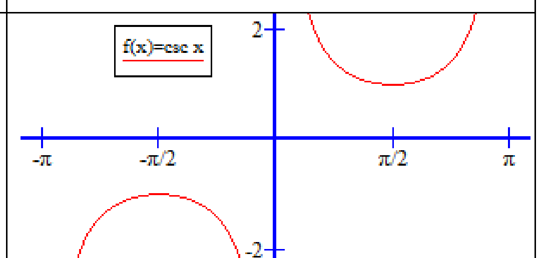
$$a + b + c = 0 \text{ then } a^3 + b^3 + c^3 = 3abc$$

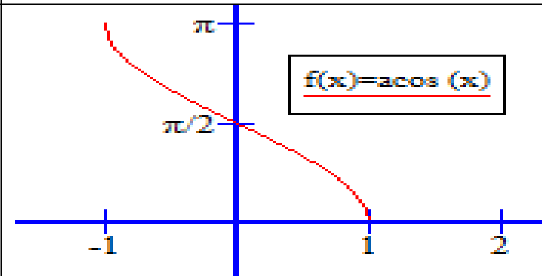
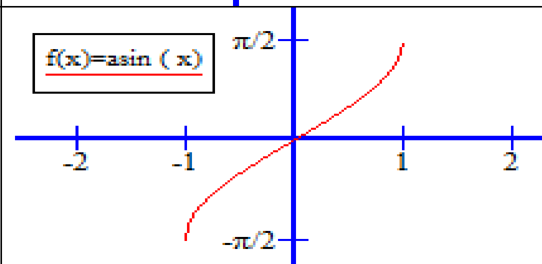
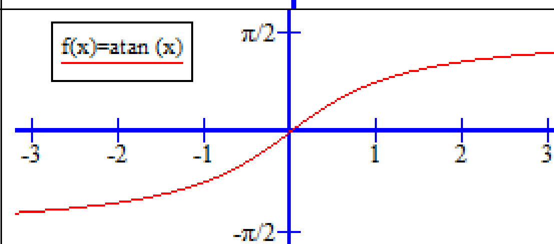
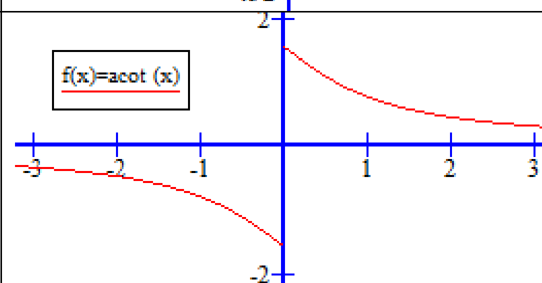
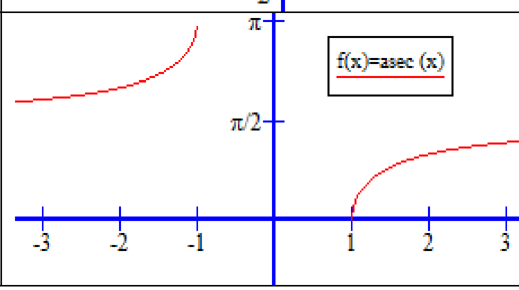
$$\text{Last term} = \frac{(\text{middle term})^2}{4 \text{ X First term}}$$

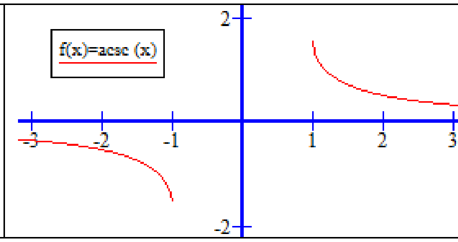
$$\text{Frist term} = \frac{(\text{middle term})^2}{4 \text{ X last term}}$$

$$\text{middle term} = \pm 2\sqrt{(\text{Frist term})\text{X}(\text{last term})}$$

FUNCTION	RIGHT ANGLED TRIANGLE	UNIT CIRCLE	RANGE	SET OF ZEROES	PRINCIPAL PERIOD	TYPE OF FUNCTION	GRAPH
cosine	$\frac{\text{Adjecent Side}}{\text{Hypotenuse}}$	cos:R→R, cosθ=(gof)(θ) =g(f(x)) =g(x,y) =x	[-1, 1]	$\{(2K\pm1)\frac{\pi}{2}/k\in Z\}$	2π	many-one, on to, even	
sine	$\frac{\text{Opposite Side}}{\text{Hypotenuse}}$	sin:R→R, sinθ=(gof)(θ) =g(f(x)) =g(x.y) =y	[-1, 1]	{kπ/k∈ Z}	2π	many-one, on to, odd	
tan	$\frac{\text{Opposite Side}}{\text{Adjecent Side}}$	tan:R-$\{(2K\pm1)\frac{\pi}{2}/k\in Z\}$ →R, $\tan\theta = \frac{\sin\theta}{\cos\theta}$	R	{kπ/k∈ Z}	π	many-one, on to, odd	

FUNCTION	RIGHT ANGLED TRIANGLE	UNIT CIRCLE	RANGE	SET OF ZEROES	PRINCIPAL PERIOD	TYPE OF FUNCTION	GRAPH
cot	$\frac{\text{Adjecent Side}}{\text{Opposite Side}}$	tan:R-{kπ/k∈Z}, $\cot\theta = \frac{\cos\theta}{\sin\theta}$	R	{(2K±1) $\frac{\pi}{2}$/k∈Z}	π	many-one, on to, odd	
sec= $\frac{1}{\cos}$	$\frac{\text{Hypotenuse}}{\text{Adjecent Side}}$	tan:R-{(2K±1) $\frac{\pi}{2}$ /k∈Z} →R, $\tan\theta = \frac{\sin\theta}{\cos\theta}$	R-(-1, 1)	∅	2π	many-one, on to, even	
cosec= $\frac{1}{\sin}$	$\frac{\text{Hypotenuse}}{\text{Opposite Side}}$	tan:R-{kπ/k∈Z}, $\cot\theta = \frac{\cos\theta}{\sin\theta}$	R-(-1, 1)	∅	2π	many-one, on to, odd	

INVERSE FUNCTION	DOMAIN	RANGE	TYPE OF FUNCTION	GRAPH
$\cos^{-1} = \{(y, x)/y = \cos x, x \in [0,\pi], y \in [-1, 1]\}$	[-1, 1]	$[0, \pi]$	one-one, on to	
$\sin^{-1} = \{(y, x)/y = \sin x, x \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right], y \in [-1, 1]\}$	[-1, 1]	$\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$	one-one, on to	
$\tan^{-1} = \{(y, x)/y = \tan x, x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right), y \in R\}$	R	$\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$	one-one, on to	
$\cot^{-1} = \{(y, x)/y = \cot x, x \in (0,\pi), y \in R\}$	R	$(0,\pi)$	one-one, on to	
$\sec^{-1} = \{(y, x)\ y = \sec x, x \in [0,\pi] - \left(\frac{\pi}{2}\right), y \in (-1,1)\}$	R- (-1, 1)	$[0,\pi] - \left(\frac{\pi}{2}\right)$	one-one, on to	

$cosec^{-1}$ = {(y, x)/ y = cosec x, x∈$\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ - {0} ,y∈R- (-1, 1)}	R- (-1, 1)	$\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$ -{0}	one-one, on to	

1. $\sin^{-1} x \neq (\sin x)^{-1} = \frac{1}{\sin x}$
2. $\forall\theta\in\left[-\frac{\pi}{2},\frac{\pi}{2}\right]$, $\sin^{-1}(\sin\theta) = \theta$ and $\forall$ x$\in$ [-1.1], $\sin^{-1}(\sin x) = x$.
   same as cos, tan, cot, sec, cosec.
3. codomain of sin, cos, tan, cot, sec & cosec function is R.
4. Range of $\sin^2$ and $\cos^2$ function are [0, 1].
5. Range of $\tan^2$ and $\cot^2$ function are $[0, \infty)$.
6. Range of cosec^2 and $\sec^2$ function are $[1,\infty)$.
7. All S T C.
8. Increasing function is ↑ and decreasing function is ↓.

	First Quadrant	Second Quadrant	Third Quadrant	Fourth Quadrant
sin	↑	↓	↓	↑
cos	↓	↓	↑	↑
cosec	↓	↑	↑	↓
sec	↑	↑	↓	↓

We assume that tan is ↑ and cot is ↓ in all quadrant.

Degrees	0°	15°	18°	22.5°	30°	36°	45°	54°	60°	67.5°	72°	75°	90°
Radian	0	$\frac{\pi}{12}$	$\frac{\pi}{10}$	$\frac{\pi}{8}$	$\frac{\pi}{6}$	$\frac{\pi}{5}$	$\frac{\pi}{4}$	$\frac{3\pi}{10}$	$\frac{\pi}{3}$	$\frac{3\pi}{8}$	$\frac{2\pi}{5}$	$\frac{5\pi}{12}$	$\frac{\pi}{2}$
sin	0	$\frac{\sqrt{6}-\sqrt{2}}{4}$	$\frac{\sqrt{5}-1}{4}$	$\frac{\sqrt{2-\sqrt{2}}}{2}$	$\frac{1}{2}$	$\frac{\sqrt{10-2\sqrt{5}}}{4}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{6}-\sqrt{2}}{4}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2+\sqrt{2}}}{2}$	$\frac{\sqrt{10+2\sqrt{5}}}{4}$	$\frac{\sqrt{6}+\sqrt{2}}{4}$	1
cos	1	$\frac{\sqrt{6}+\sqrt{2}}{4}$	$\frac{\sqrt{10+2\sqrt{5}}}{4}$	$\frac{\sqrt{2+\sqrt{2}}}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{5}+1}{4}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{6}-\sqrt{2}}{4}$	$\frac{1}{2}$	$\frac{\sqrt{2-\sqrt{2}}}{2}$	$\frac{\sqrt{5}-1}{4}$	$\frac{\sqrt{6}-\sqrt{2}}{4}$	0
tan	0	$2-\sqrt{3}$	$\frac{\sqrt{25-10\sqrt{5}}}{4}$	$\sqrt{2}-1$	$\frac{1}{\sqrt{3}}$	$\sqrt{5-2\sqrt{5}}$	1	$\frac{\sqrt{25-10\sqrt{5}}}{4}$	$\sqrt{3}$	$\sqrt{2}+1$	$\sqrt{5+2\sqrt{5}}$	$2+\sqrt{3}$	∞

$\cos^2\theta + \sin^2\theta = 1$	$\cos^2\theta = 1 - \sin^2\theta$	$\sin^2\theta = 1 - \cos^2\theta$	$\theta \in R$
$\sec^2\theta - \tan^2\theta = 1$	$1 + \tan^2\theta = \sec^2\theta$	$\sec^2\theta - 1 = \tan^2\theta$	$\theta \neq (2k+1)\frac{\pi}{2}, k \in Z$
$\mathrm{cosec}^2\theta - \cot^2\theta = 1$	$1 + \cot^2\theta = \mathrm{cosec}^2\theta$	$\mathrm{cosec}^2\theta - 1 = \cot^2\theta$	$\theta \neq k\pi, k \in Z$

Addition Formula:- $\alpha, \beta \in R$

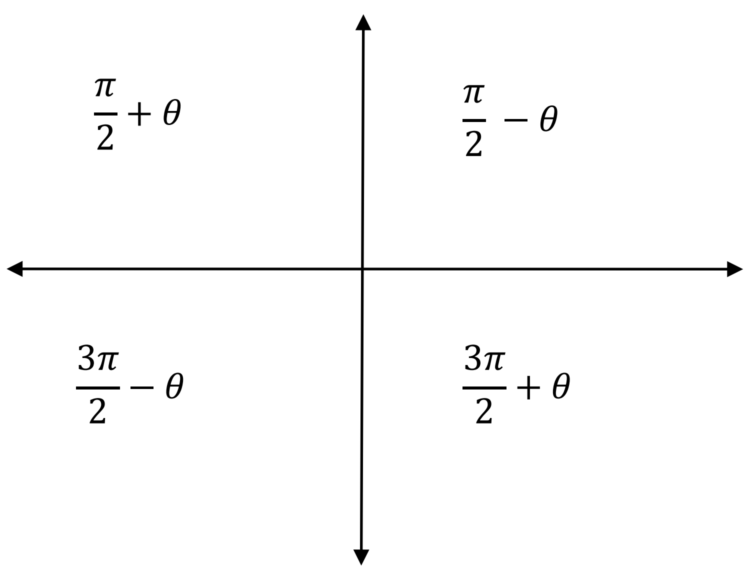
- $\cos(\alpha \pm \beta) = \cos\alpha \cos\beta \mp \sin\alpha \sin\beta$
- $\sin(\alpha \pm \beta) = \sin\alpha \cos\beta \pm \cos\alpha \sin\beta$

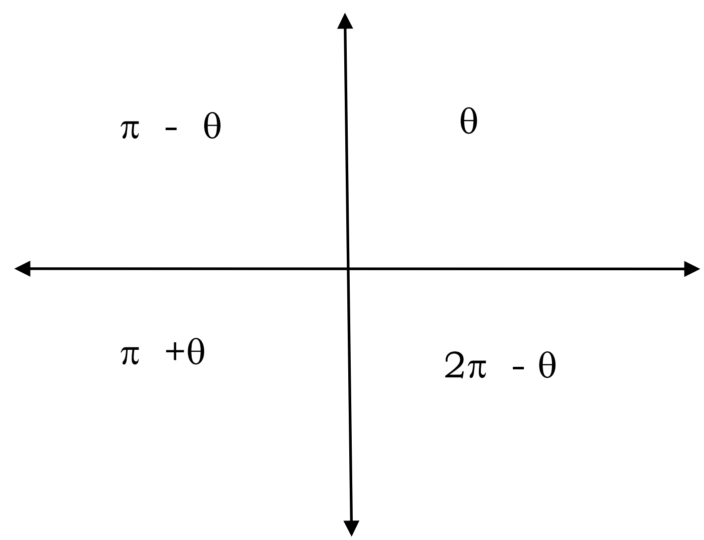
If $k\pi \pm \theta$, $k \in Z$ is given then the function remains same.

sin ↔ sin	cos ↔ cos
tan ↔ tan	cot ↔ cot
sec ↔ sec	cosec ↔ coses

If $\frac{k\pi}{2} \pm \theta$, $k \in Z$,k is odd integer is given then the function remains change.

sin ↔ cos
tan ↔ cot
sec ↔ cosec





$\sin(\alpha + \beta) \cdot \sin(\alpha + \beta) = \sin 2\alpha - \sin 2\beta = \cos 2\alpha - \cos 2\beta$

$\cos(\alpha + \beta) \cdot \cos(\alpha + \beta) = \cos 2\alpha - \sin 2\beta = \cos 2\beta - \cos 2\alpha$

The range of $f(\alpha) = a\cos\alpha + b\sin\alpha$, $\alpha \in R$; $a,b \in R$, $a2 + b2 \neq 0$ is $[-\sqrt{a^2+b^2}, \sqrt{a^2+b^2}]$

OR $-r \leq r\cos(\theta - \alpha) \leq r$, $\therefore$ The range is $[-r, r]$.

$2\sin\alpha \cos\beta = \sin(\alpha + \beta) + \sin(\alpha - \beta) \rightarrow 1$

$2\cos\alpha \sin\beta = \sin(\alpha + \beta) - \sin(\alpha - \beta) \rightarrow 2$

$2\cos\alpha \cos\beta = \cos(\alpha + \beta) + \cos(\alpha - \beta) \rightarrow 3$

$2\sin\alpha \sin\beta = -\cos(\alpha + \beta) + \cos(\alpha - \beta) \rightarrow 4$

Expression of sum or difference as product:

let in 1 to 4 $\alpha + \beta = C$ and $\alpha - \beta = D$, $\therefore \alpha = \frac{C+D}{2}$ and $\beta = \frac{C-D}{2}$

$$\sin C + \sin D = 2\sin\frac{C+D}{2}\cos\frac{C-D}{2}$$

$$\sin C - \sin D = 2\cos\frac{C+D}{2}\sin\frac{C-D}{2}$$

$$\cos C + \cos D = 2\cos\frac{C+D}{2}\cos\frac{C-D}{2}$$

$$\cos C - \cos D = -2\sin\frac{C+D}{2}\sin\frac{C-D}{2}$$

$$\sin\alpha = 2\sin\frac{\alpha}{2}\cos\frac{\alpha}{2} = \sqrt{\frac{1-\cos 2\alpha}{2}} = \frac{2\tan\frac{\alpha}{2}}{1-\tan^2\frac{\alpha}{2}} = \frac{2t}{1+t^2} \quad \left(\text{take } \tan\frac{\alpha}{2} = t\right)$$

$$\cos\alpha = \cos^2\frac{\alpha}{2} - \sin^2\frac{\alpha}{2} = 2\cos^2\frac{\alpha}{2} - 1 = 1 - 2\sin^2\frac{\alpha}{2} = \sqrt{\frac{1+\cos 2\alpha}{2}} = \frac{1-\tan^2\frac{\alpha}{2}}{1+\tan^2\frac{\alpha}{2}} \; \frac{1-t^2}{1+t^2}$$

$$\tan\alpha = \frac{2\tan\frac{\alpha}{2}}{1-\tan^2\frac{\alpha}{2}}$$

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

$$\sin^2\alpha = \frac{1-\cos2\alpha}{2}$$

$$\sin2\alpha = 2\sin\alpha\cos\alpha = \frac{2\tan\alpha}{1-\tan^2\alpha}$$

$$\cos2\alpha = \cos^2\alpha - \sin^2\alpha = 2\cos^2\alpha - 1 = 1 - 2\sin^2\alpha = \frac{1-\tan^2\alpha}{1+\tan^2\alpha}$$

$$\tan2\alpha = \frac{2\tan\alpha}{1-\tan^2\alpha}$$

sin3α = 3sinα - 4sin3α

cos3α = 4cos3α - 3cosα

$$\tan3\alpha = \frac{3\tan\alpha - \tan^3\alpha}{1-3\tan^2\alpha}$$

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

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

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

INVERSE TRIGONOMETRIC FORMULA : -

$\sin^{-1}(-x) = -\sin^{-1}x, \quad |x| \leq 1$

$\cos^{-1}(-x) = \pi - \cos^{-1}x, \quad |x| \leq 1$

$\tan^{-1}(-x) = -\tan^{-1}x, \quad x \in R$

$\cot^{-1}(-x) = \pi - \cot^{-1}x, \quad x \in R$

$$\mathrm{cosec}^{-1}(-x) = \sin^{-1}\frac{1}{x}, |x| \geq 1$$

$$\sec^{-1}(-x) = \cos^{-1}\frac{1}{x}, |x| \geq 1$$

$$\cot^{-1}x = \tan^{-1}\frac{1}{x}, x \geq 1$$

$\cot^{-1} x = \tan^{-1}\frac{1}{x} + \pi, x < 1$

Value of inverse functions for complementary numbers :→

$\sin^{-1} x + \cos^{-1} x = \frac{\pi}{2}, \quad |x| \leq 1$

$\operatorname{cosec}^{-1} x + \sec^{-1} x = \frac{\pi}{2}, \quad |x| \geq 1$

$\tan^{-1} x + \cot^{-1} x = \frac{\pi}{2}, \quad x \in R$

Values for Addition and Subtraction :→

$\tan^{-1} x + \tan^{-1} y = \tan^{-1}\frac{x+y}{1-xy}, xy < 1$

$\tan^{-1} x + \tan^{-1} y = \pi + \tan^{-1}\frac{x+y}{1-xy}, xy > 1$

$\tan^{-1} x + \tan^{-1} y = \frac{\pi}{2}, xy = 1$

$\tan^{-1} x - \tan^{-1} y = \tan^{-1}\frac{x-y}{1+xy}$

Inter-relations of inverse trigonometric function :→

$\sin^{-1} x = \cos^{-1}\sqrt{1-x^2} = \tan^{-1}\frac{x}{\sqrt{1-x^2}}, 0 < x < 1$

$\cos^{-1} x = \sin^{-1}\sqrt{1-x^2} = \tan^{-1}\frac{\sqrt{1-x^2}}{x}, 0 < x < 1$

$\tan^{-1} x = \cos^{-1}\frac{1}{\sqrt{1+x^2}} = \sin^{-1}\frac{x}{\sqrt{1+x^2}}, x > 0$

Trigonometric Equations :→

The general solution of cosx = a , $|a| \leq 1 \Rightarrow x = 2k\pi \pm \cos^{-1} a, k \in Z$

$\therefore \cos x = \cos\theta \Rightarrow x = 2k\pi \pm \theta, k \in Z$

The general solution of sinx = a , $|a| \leq 1 \Rightarrow x = k\pi + (-1)^k \sin^{-1} a, k \in Z$

$\therefore \sin x = \sin\theta \Rightarrow x = k\pi + (-1)k\,\theta, k \in Z$

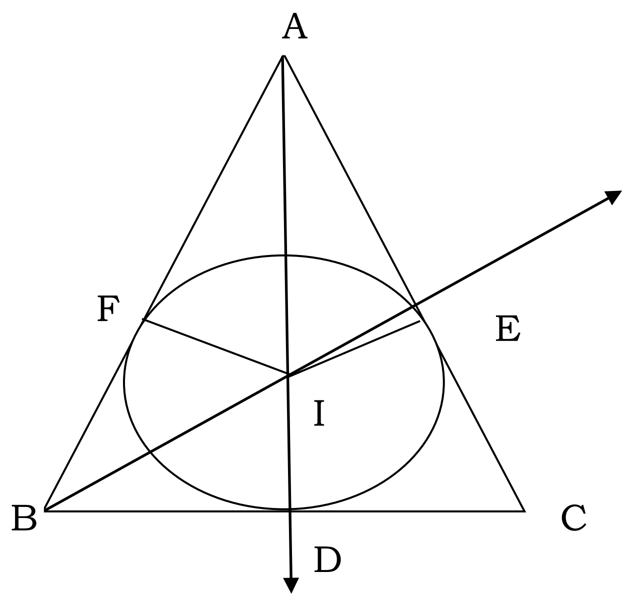
The general solution of tanx = a , $a \in R \Rightarrow x = k\pi + \tan^{-1} a, k \in Z$

$\therefore \tan x = \tan\theta \Rightarrow x = k\pi + \theta, k \in Z$

The solution set of a cosx + b sinx = c , a2 + b2 ≠ 0

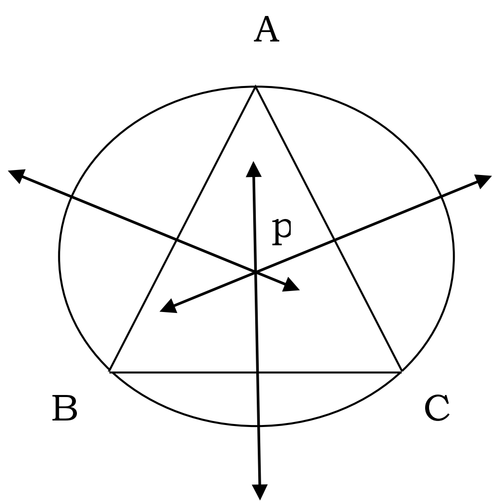
$$\Leftrightarrow x = 2k\pi + \alpha \pm \cos^{-1}\frac{c}{r}, k\epsilon Z, \alpha\epsilon[0,2\pi), \cos\alpha = \frac{a}{r}, \sin\alpha = \frac{b}{r}$$

Properties of triangles :→



In Center : I
In radius : ID = IE = IF
It is INCIRCLE OR DISCIBED CIRCLE

Circumcircle:-



Circumcenter is P,
Circuumradius: PA=PB=PC=R

SINE RULE:→

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$$

COSINE RULE :→

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}, \quad \cos B = \frac{c^2 + a^2 - b^2}{2ca}, \quad \cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

PROJECTION FORMULA :→

a=b cosC +c cosB, b=a cosC +c cosA, c= a cos B + b cosA

NAPIER'S FORMUULA (TANGENT FORMULA) : →

$$\tan\left(\frac{B-C}{2}\right) = \frac{b-c}{b+c}\cot\frac{A}{2}$$
$$\tan\left(\frac{C-A}{2}\right) = \frac{c-b}{c+b}\cot\frac{B}{2}$$
$$\tan\left(\frac{A-B}{2}\right) = \frac{a-b}{a+b}\cot\frac{C}{2}$$

FORMULAE OF SEMI-ANGLES (HALF-ANGLES FORMLE) : →

A,B,C are angles of a triangle ⇒ 0 < A,B,C < π ⇒ $0 < \frac{A}{2}, \frac{B}{2}, \frac{C}{2} < \frac{\pi}{2}$

$$\sin\frac{A}{2} = \sqrt{\frac{(s-b)(s-c)}{bc}}, \quad \sin\frac{B}{2} = \sqrt{\frac{(s-c)(s-a)}{ca}}, \quad \sin\frac{C}{2} = \sqrt{\frac{(s-a)(s-b)}{2}}$$

$$\cos\frac{A}{2} = \sqrt{\frac{s(s-a)}{bc}}, \quad \cos\frac{B}{2} = \sqrt{\frac{s(s-b)}{ac}}, \quad \cos\frac{C}{2} = \sqrt{\frac{s(s-c)}{ab}}$$

$$\tan\frac{A}{2}=\sqrt{\frac{(s-b)(s-c)}{s(s-a)}}\,,\qquad \tan\frac{B}{2}=\sqrt{\frac{(s-a)(s-c)}{s(s-b)}}\,,\qquad \tan\frac{C}{2}=\sqrt{\frac{(s-a)(s-b)}{s(s-c)}}$$

THE AREA OF A TRIANGLE: →

$$\Delta=\frac{1}{2}bc\sin A\,,\qquad \Delta=\frac{1}{2}ac\sin B\,,\qquad \Delta=\frac{1}{2}ab\sin C$$

$$\Delta=\frac{abc}{4R}\,,\qquad \Delta=\sqrt{s(s-a)(s-b)(s-c)}$$

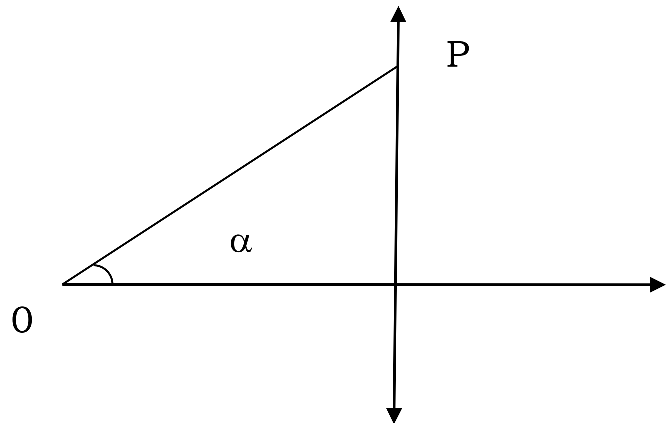
$$\cot A=\frac{b^2+c^2-a^2}{4\Delta}\,,\qquad \cot B=\frac{a^2+c^2-b^2}{4\Delta}\,,\qquad \cot C=\frac{a^2+b^2-c^2}{4\Delta}$$

IN RADIUS : →

$$r=\frac{\Delta}{s}\,,\qquad r=4R\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2}$$

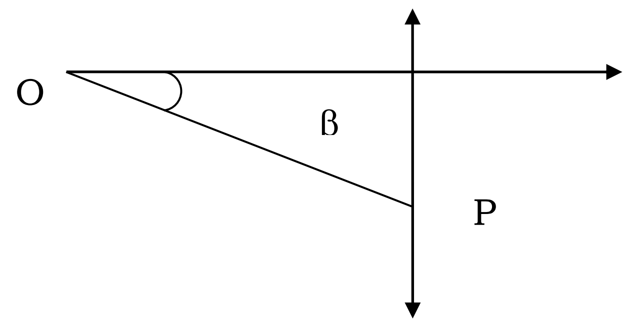
$$r=(s-a)\tan\frac{A}{2}\,,\qquad r=(s-b)\tan\frac{B}{2}\,,\qquad r=(s-c)\tan\frac{C}{2}$$

ANGLE OF ELEVATION :→



α is the angle of elevation of P from O.

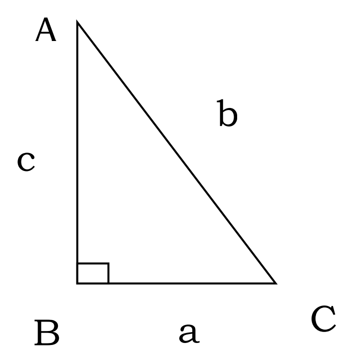
ANGLE OF DEPRESSION:→



β is the angle of depression of P from O.

In ΔABC, m∠B=90° using Pythagoras : $b = \sqrt{c^2 + a^2}$

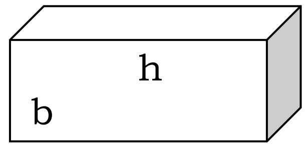
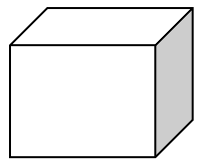
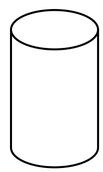
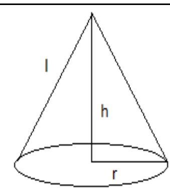
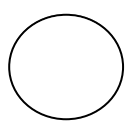
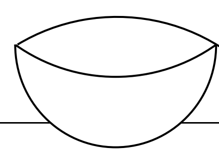
$\therefore By\ sine - rule : \dfrac{a}{\sin A} = \dfrac{b}{1} = \dfrac{c}{\sin C}$

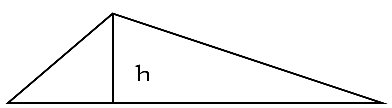
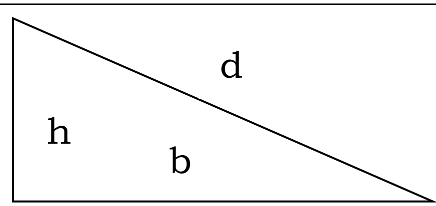


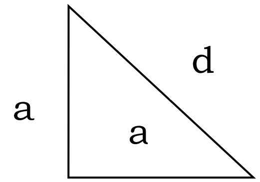
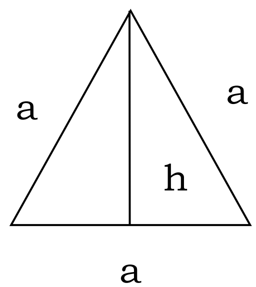
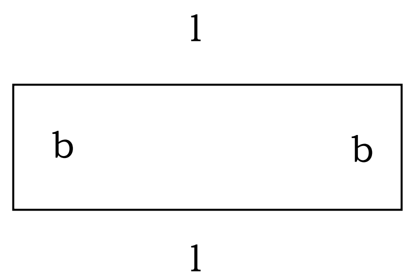
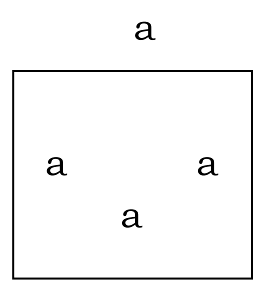
SEQUENCE AND SERIES : →

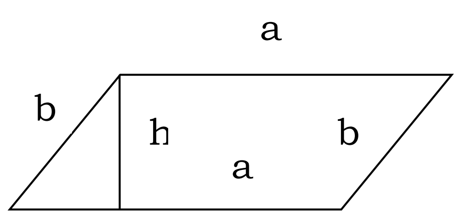
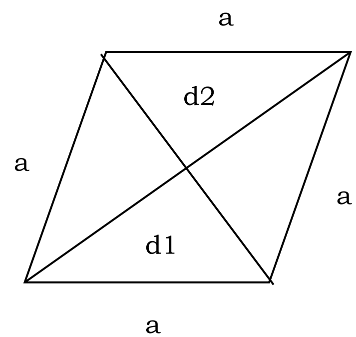
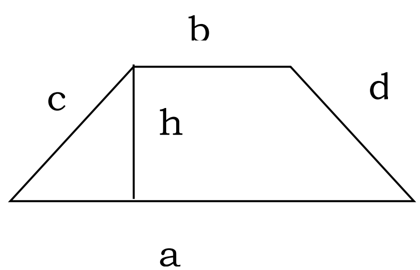
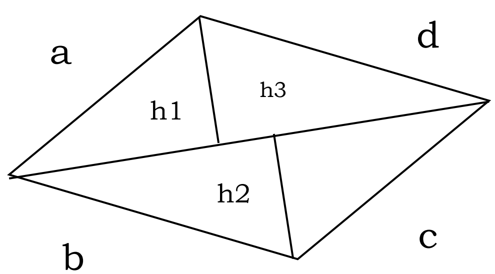
	SEQUENCE	SERIES	t_n or a_n term	mean between a and b	nth mean between a and b
Gernal	$a_1, a_2, \dots, a_n$	$S_1 = a_1$ $s_2 = a_1 + a_2$ $s_3 = a_1 + a_2 + a_3$ … $s_n = a_1 + a_2 + a_3 + \dots + a_n$	$a_n = S_n - S_{n-1}$	----	----
Arithmetic Progression	a,a+d,a+2d,…, a+(n-1)d a=First term l = last term = a + (n-1)d	Sn= a+(a+d)+ (a+2d)+…+ (a+(n-1)d) $= \frac{n}{2}[2a+(n-1)d]$ $= \frac{n}{2}[a+l]$	$t_n = a + (n-1)d$	$A = \frac{a+b}{2}$	$a, A_1, A_2, \dots, A_n, b$ $d = \frac{b-a}{n+1}$
Geometric Progression	$a, ar, ar^2, \dots, ar^{n-1}$ a=First term	$S_n = a + ar + ar^2 + \dots + ar^{n-1}$ $= \frac{a(r^n-1)}{r-1}, r \neq 1$ if r=1 then $S_n = na$	$t_n = ar^{n-1}$	$G = \sqrt{ab}$	$a, G_1, G_2, \dots, G_n.b$ $r = \left(\frac{b}{a}\right)^{\frac{1}{n+1}}$
	SEQUENCE	SERIES	t_n or a_n term	mean between a and b	nth mean between a and b
Harmonic Progression	$\frac{1}{a}, \frac{1}{a+d}, \frac{1}{a+2d}, \dots, \frac{1}{a+(n-1)d}$	---	$t_n = \frac{1}{a+(n-1)d}$	$H = \frac{2ab}{a+b}$	$\frac{1}{a}, H_1, H_2, \dots, H_n, \frac{1}{b}$

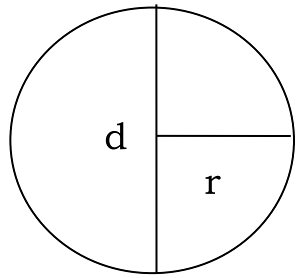
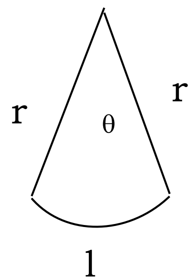
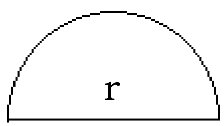
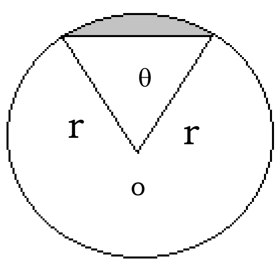
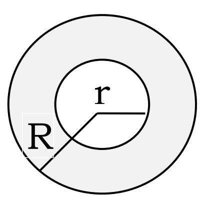
Arithmetic and Geometric Progression	a,(a+d)r,(a+2d)r^2 ,…,(a+(n-1)d)r^n	$Sn = \frac{a}{r-1} + \frac{dr(1-r^n)}{(1-r)^2} - \frac{[a+(n-1)d]r^n}{1-r}$	$t_n = \frac{1}{[a+(n-1)d]r^{n-1}}$	----	----
Relation between A.P.,G.P., and H.P. : (1) AH=G^2 (2) A > G > H					

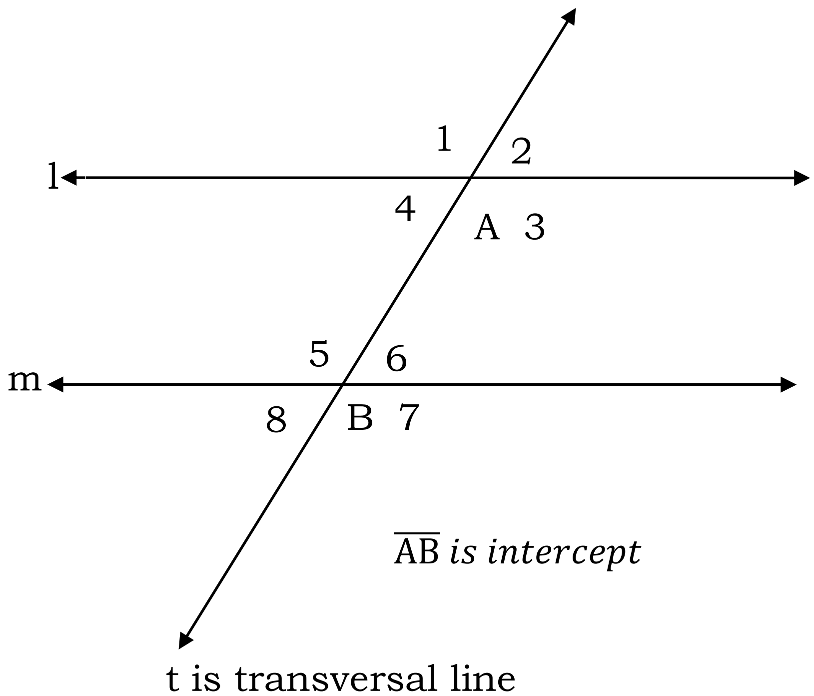
NAME OF THE SOLID	Figure	LATERAL/ CURVED SRFACE AREA	TOTAL SURFACE AREA	VOLUME	
CUBOID		$2h\ (l + b)$	$2(lb+bh+hl)$	lbh	
CUBE		$4a^2$	$6a^2$	a^2	
RIGHT CIRCULAR CYLINDER		$2\pi rh$	$2\pi r(r+h)$	$\pi r^2 h$	
RIGHT CIRCULAR CONE		πrl	$\pi r(l+r)$	$\frac{1}{3}\pi r^2 h$	
SPHERE		$4\pi r^2$	$4\pi r^2$	$\frac{4}{3}\pi r^2$	
HIMESPHERE		$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^2$	

Sr. No.	Name	Figure	Perimeter in units of length	Area of Square units	Remark
1	Triangle		a + b + c = 2s	$\frac{1}{2}ch$ or $\sqrt{s(s-a)(s-b)(s-c)}$	
2	Right Triangle		h+b+d	$\frac{1}{2}bh$	$d = \sqrt{b^2 + h^2}$

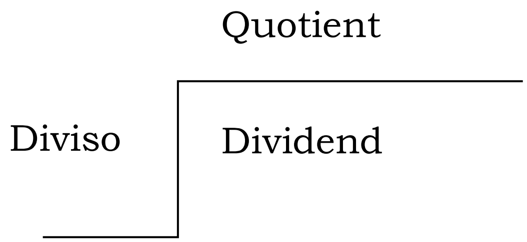
a 3	Isosceles Right Triangle		2a+d	$\frac{1}{2}a^2$	$d = a\sqrt{2}$
4	Equilateral Triangle		3a	$\frac{1}{2}ah \quad OR \quad \frac{\sqrt{3}}{4}a^2$	$h = \frac{\sqrt{3}}{2}a$
5	Rectangle		2(l +b)	lb	l is length, b is breadth. All angles 90°. Diagonals = & bisect
6	Square		4a	a^2	a is side. All side = AND 1x90° angle. Diagonals = & bisect @ 90°.

7	Parallelogram		2(a +b)	ah	Both opp. angles =. Both opp. sides =. Both opp. Sides ||. Diagonals bisect.
8	Rhombus		4a	$\frac{1}{2}d_1d_2$	d_1d_2 are the diagonal. All sides=. Diagonals bisect @ 90°and ≠.
9	Trapezium		a+b+c+d	$\frac{1}{2}(a+b)h$	
10	Quadrilateral		a+b+c+d	$\frac{1}{2}(h_1+h_2)h_3$	

11	Circle		2πr OR πd	πr^2	r is radius, d is diameter
12	Sector of circle		$2\pi r\left(\frac{\theta}{360}\right)+2r$ ***OR*** l+2r	$\pi r^2\left(\frac{\theta}{360}\right)$ **OR** $\frac{1}{2}$lr	l is length of sector
13	Semi-circle		πr + 2r	$\frac{1}{2}\pi r^2$	
14	Segment of a Circle (Shaded portion)		$\left[2\pi r\left(\frac{\theta}{360}\right) + 2r sin\frac{\theta}{2}\right]$	$\left[\pi r^2\left(\frac{\theta}{360}\right)-\frac{1}{2}r^2 sin\theta\right]$	
15	Ring (Shaded region)		-	$\pi(R^2-r^2)$	R is Outer radius, r is inner radius



Alternate Angles	Corresponding Angles	Interior Angles
∠3 ≅ ∠5	∠1 ≅ ∠5	m∠4+m∠5=180°
∠4 ≅ ∠6	∠2 ≅ ∠6	m∠3+m∠6=180°
	∠3 ≅ ∠7	
	∠4 ≅ ∠8	



$$\frac{Numerator}{Denominator}$$

Co-ordinate system in R^1:

Set : { P(x) / x $\in$ R }

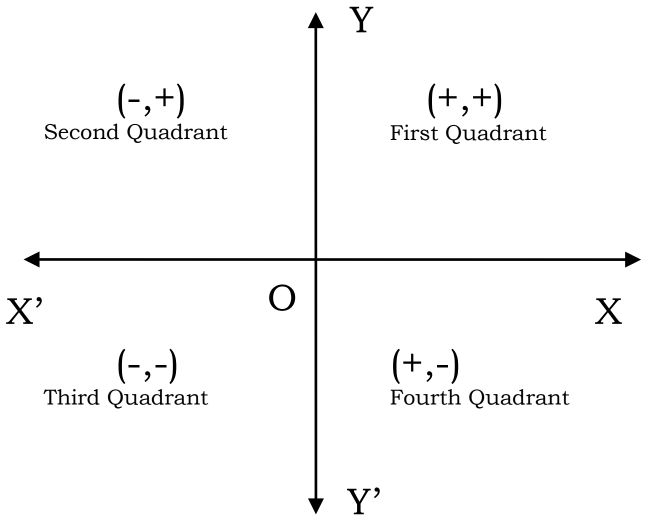
Distance Function in R^1: P(x),Q(y) $\in R^1$,The Function d:$R^1 \times R^1 \rightarrow R^+ \cup \{0\}$, d(P,Q) = $|x - y|$

Co-ordinate system in R^2:

Set : { P(x, y) / x $\in$ R, y $\in$ R }

Distance Function in R^2:

$P(x_1, y_1), Q(x_2, y_2) \in R^2$,The Function $d: R^2 \times R^2 \to R^+ \cup \{0\}$, $d(P,Q) = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$



The line $\overleftrightarrow{X'X}$ is called X-axis → Horizontal line X-axis = { P (x, 0)/ x ∈ R }
The line $\overleftrightarrow{Y'Y}$ is called Y-axis → Vertical line Y-axis = { P (0, y)/ y ∈ R }
The point O is called the Origin.
The First Quadrant = { P (x, y)/ x > 0, y > 0 }
The Second Quadrant = { P (x, y)/ x < 0, y > 0 }
The Third Quadrant = { P (x, y)/ x < 0, y < 0 }
The Fourth Quadrant = { P (x, y)/ x > 0, y < 0 }
If P is P (a, 0), $a \in R^+$ then the +ve direction of X-axis is dir $\overrightarrow{OP}$.
If Q is Q (0, b), $b \in R^+$ then the +ve direction of Y-axis is dir $\overrightarrow{OQ}$.
The two axes are perpendicular to each other, this co-ordinate system is called the Rectangular Co-ordinate System.

Distance Function in R2 & R1 Properties:

$\forall$ P, Q, T $\in$ R2 & R1

(1) d(P, Q) >= 0

(2) d(P, Q) = 0 $\Leftrightarrow$ P = Q

(3) d(P, Q) = d(Q, P)

(4) d(P, Q) $\leq$ d(P, T) + d(T, Q) (Triangular inequality)

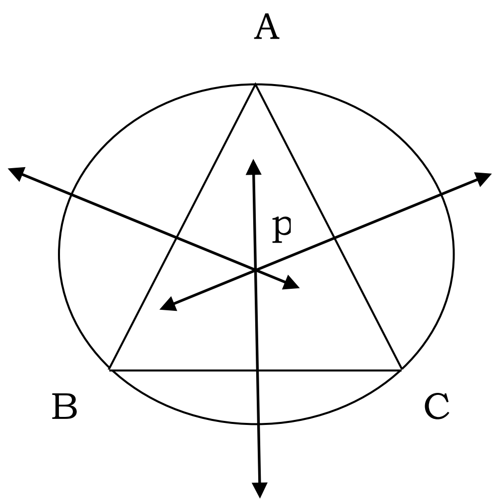
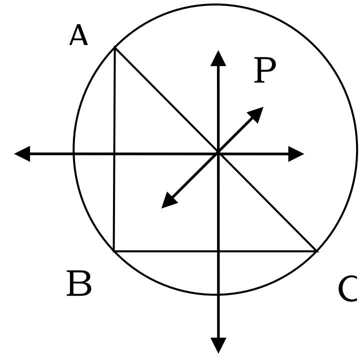
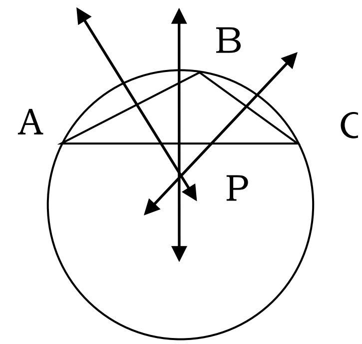
Identification of Geometrical Figures & Properties:

Type of triangles:

Sr.No.	Side	angle
1	Isosceles : any two sides =	Equiangular: all angles=
2	Equilateral : all sides =	Acute angled: any one angle < 90°
3	Scalene: all sides $\neq$	Right angled: any one angle = 90°
4		Obtuse angled: any one angle > 90°

Circumcentre(P): The perpendicular bisector of three side of a triangle is concurrent. The point of concurrency is called circumcentre of a triangle.

Circumcircle(P) :-In ΔABC, co-ordinate of A(x_1,y_1), co-ordinate of B(x_2,y_2), co-ordinate of A(x_3,y_3) and co-ordinate of P(x, y), **PA = PB = PC = radius of circle** , P is circumcentre.

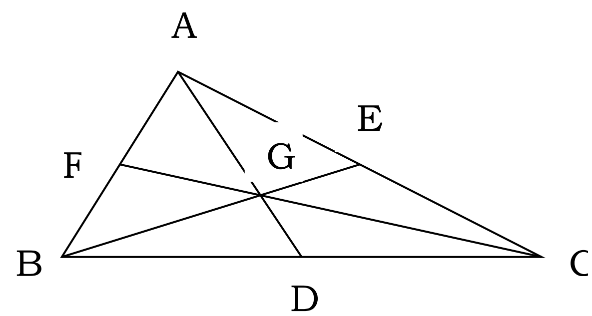
		
The Circumcentre(P) of an acute angled triangle is inside the triangle.	The Circumcentre(P) of a a right angled triangle is mid-point of the hypotenuse.	The Circumcentre(P) of an obtuse angled triangle is outside the triangle.

Centroid of a triangle (G): -

The point of concurrence of the three medians of a triangle is called centroid.

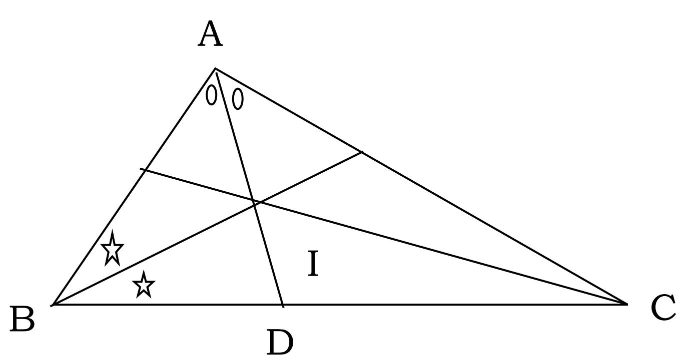
$$G = \left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3}\right)$$

$\overline{AD}, \overline{BE}, \overline{CF}$ *are mediun of triangle ABC*



The Incentre of triangle (I) : -

The point of concurance of the bisectors of the three angles of triangle is called incentre of triangle.



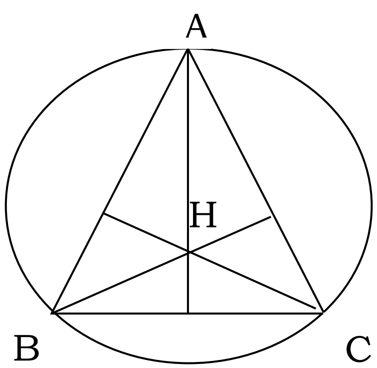
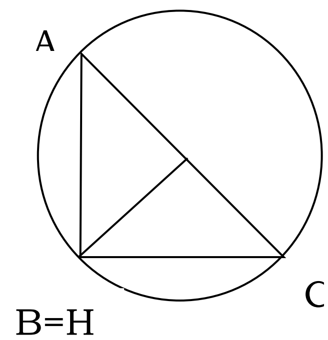
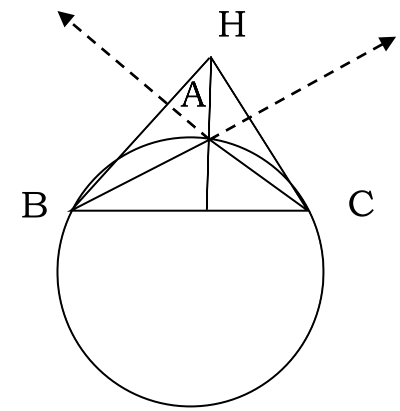
$$I = \left(\frac{ax_1 + bx_2 + cx_3}{a + b + c}, \quad \frac{ay_1 + by_2 + cy_3}{a + b + c}\right)$$

AB = c, BC = a, AC = b,

$$\frac{AB}{AC} = \frac{BD}{DC} = \frac{c}{b} = \lambda$$

Orthocentre of triangle (H) :-

The point of concurrence of the altitudes of a triangle is called its Orthocenter.

		
If triangle is an acute angled triangle then H in the interior of triangle.	If triangle is right angled triangle then the H is the vertex forming the right angle of the triangle.	If triangle is an obtuse angled triangle then H is in the exterior of triagle.

Short Cut Method : -

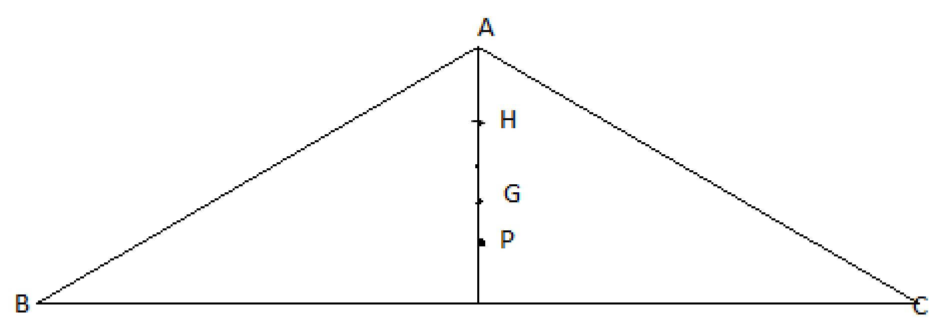
1. If (x_1, y_1), (x_2, y_2) are the ends of the hypotenuse of a right angled isosceles triangle, then the third vertex is given by $\left(\frac{x_1+x_2\pm(y_1-y_2)}{2}, \frac{y_1+y_2\mp(x_1-x_2)}{2}\right)$.
2. Given two vertices (x_1, y_1) and (x_2, y_2) of an equilateral triangle, then its third vertex is given by $\left(\frac{x_1+x_2\pm\sqrt{3}(y_1-y_2)}{2}, \frac{y_1+y_2\mp\sqrt{3}(x_1-x_2)}{2}\right)$.
3. Area of the triangle formed by (x_1, y_1), (x_2, y_2) and(x_3, y_3) is

$$\Delta = \left|\frac{1}{2}\begin{vmatrix} x_1 - x_3 & x_2 - x_3 \\ y_1 - y_3 & y_2 - y_3 \end{vmatrix}\right|.$$

4. Area of the quadrilateral formed by (x_1, y_1), (x_2, y_2), (x_3, y_3) and(x_4, y_4) is

$$\Delta = \left|\frac{1}{2}\begin{vmatrix} x_1 - x_3 & x_2 - x_4 \\ y_1 - y_3 & y_2 - y_4 \end{vmatrix}\right|.$$

5. If ABCD is a parallelogram, then D = A – B + C.
6. If D, E, F are the mid-point of the sides BC, CA, AB of ΔABC, then
   A = E + F – D, B = F + D – E, C = D + E – F.
7. If D, E, F are the mid-point of the sides BC, CA, AB of ΔABC, then
   The Centroid of ΔABC = Centroid of ΔDEF.
8. Orthocentre, Centroid, Circmcentre of triangle are collinear, Centroid divides the line joining Orthocentre and Circumcentre in the ratio 2:1.
9. In An Equilateral triangle Orthocentre, Centroid, Circmcentre, incentre coincide.
10. A triangle is isosceles of any two of its medians are equal.
11. In a triangle has integral co-ordinate then it will never be Equilateral.
12. In an Isosceles triangle Orthocentre, Centroid, Circmcentre lies on the same line.(median)



13. In Right Angled triangle if sum of the square of two sides is equal to the square of the square of hypotenuse.
14. In right angled triangle the middle point of the hypotenuse is circumcentre of triangle.
15. In an obtuse angled triangle orthocenter and circumcentre are always outside the triangle.