KHAN GLOBAL STUDIES

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Defence (Mathematics)

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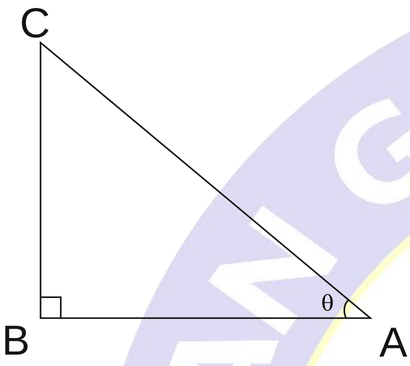
Trigonometry formula



$\sin\theta = \frac{BC}{AC}, \cos\theta = \frac{AB}{AC},$

$\tan\theta = \frac{BC}{AB}\ , \cot\theta = \frac{AB}{BC}$

$\sec\theta = \frac{AC}{AB}, cosec\ \theta = \frac{AC}{BC}$

$\angle A$	0°	30°	45°	60°	90°
$\sin A$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos A$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan A$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞
$\cot A$	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0
$\sec A$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞
$cosec\ A$	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1

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

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

$cosec^2\theta - cot^2\theta = 1 \Rightarrow cosec^2\theta = 1 + cot^2\theta$

$\sec x = \frac{1}{\cos x}, x \neq (2n+1)\frac{\pi}{2},$

Where n is any integer

$\tan x = \frac{\sin x}{\cos x}, x \neq (2n+1)\frac{\pi}{2},$

where n is any integer

$\cot x = \frac{\cos x}{\sin x}, x \neq n\pi,$

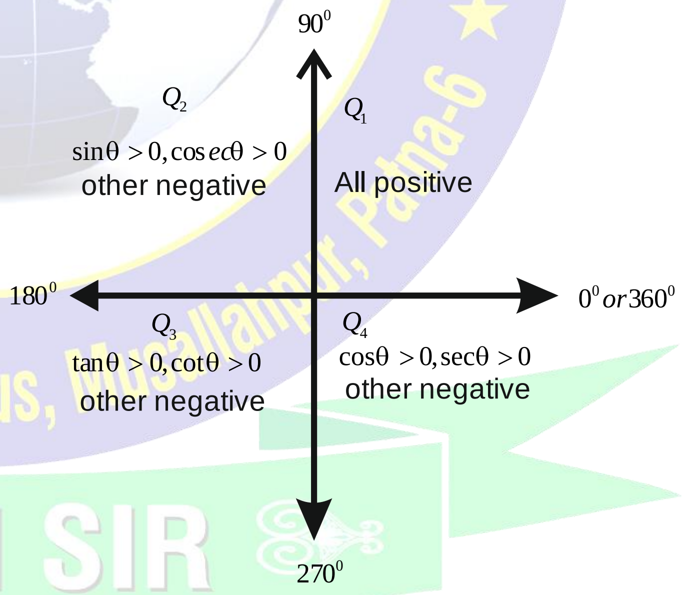
Where n is any integer

Note :

1. If $\theta \neq (2n+1)\frac{\pi}{2}$, $n\epsilon Z$, then

$$sec^2\theta - tan^2\theta = 1 \Rightarrow$$
$$(\sec\theta + \tan\theta)(\sec\theta - \tan\theta) = 1$$
$$\Rightarrow \sec\theta + \tan\theta = \frac{1}{\sec\theta - \tan\theta}$$

2. If $\theta \neq n\pi$, $n\epsilon Z$ then $cosec\ \theta - \cot\theta = \frac{1}{cosec\ \theta + \cot\theta}$



i. $\sin n\pi = \tan n\pi = \cos(2n+1)\frac{\pi}{2} = 0, \forall n\epsilon Z$

ii. $\sin(2n+1)\frac{\pi}{2} = (-1)^n$ and $\cos n\pi = (-1)^n$, $\forall n\epsilon Z$

➢. $\sin(A+B) = \sin A\cos B + \cos A\sin B$

➢. $\sin(A-B) = \sin A\cos B - \cos A\sin B$

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

- $\cos(A-B) = \cos A\cos B + \sin A\sin B$
- $\tan(A+B) = \frac{\tan A+\tan B}{1-\tan A\tan B}$
- $\tan(A-B) = \frac{\tan A-\tan B}{1+\tan A\tan B}$
- $\cot(A+B) = \frac{\cot A\cot B-1}{\cot B+\cot A}$
- $\cot(A-B) = \frac{\cot A\cot B+1}{\cot B-\cot A}$
- $sin^2A - sin^2B = cos^2B - cos^2A = \sin(A+B).\sin(A-B)$
- $cos^2A - sin^2B = cos^2B - sin^2A = \cos(A+B).\cos(A-B)$
- $\tan(A+B+C) = \frac{\tan A+\tan B+\tan C-\tan A\tan B\tan C}{1-\tan A\tan B-\tan B\tan C-\tan C\tan A}$
- $\sin 2A = 2\sin A\cos A$; $\sin\theta = 2\sin\frac{\theta}{2}\cos\frac{\theta}{2}$
- $\cos 2A = cos^2A - sin^2A = 2cos^2A - 1 = 1 - 2sin^2A$;

  $2cos^2\frac{\theta}{2} = 1+\cos\theta$; $2sin^2\frac{\theta}{2} = 1-\cos\theta$
- $\tan 2A = \frac{2\tan A}{1-tan^2A}$; $\tan\theta = \frac{2\tan\frac{\theta}{2}}{1-tan^2\frac{\theta}{2}}$
- $\sin 2A = \frac{2\tan A}{1+tan^2A}$; $\cos 2A = \frac{1-tan^2A}{1+tan^2A}$
- $\sin 3A = 3\sin A - 4sin^3A$
- $\cos 3A = 4cos^3A - 3\cos A$
- $\tan 3A = \frac{3\tan A-tan^3A}{1-3tan^2A}$
- $sin\,A.sin(60^0-A)\,sin(60^0+A) = \frac{1}{4}sin\,3A$
- $cos\,A.cos(60^0-A)\,cos(60^0+A) = \frac{1}{4}cos\,3A$
- $tan\,A.tan(60^0-A)\,tan(60^0+A) = tan\,3A$
- $cos\,\theta.cos\,2\theta.cos2^2\theta.cos2^3\theta\ldots cos2^{n-1}\theta = \frac{sin2^n\theta}{2^n\sin\theta}$
- $2\sin A\cos B = \sin(A+B)+\sin(A-B)$
- $2\,cos\,A\,sin\,B = sin(A+B) - sin(A-B)$
- $2\,cos\,A\,cos\,B = cos(A+B) + cos(A-B)$
- $2\,sin\,A\,sin\,B = cos(A-B) - cos(A+B)$
- $sin\,C + sin\,D = 2\,sin\frac{C+D}{2}cos\frac{C-D}{2}$
- $sin\,C - sin\,D = 2\,cos\frac{C+D}{2}sin\,\frac{C-D}{2}$
- $cos\,C + cos\,D = 2\,cos\frac{C+D}{2}cos\frac{C-D}{2}$
- $cos\,C - cos\,D = -2\,sin\frac{C+D}{2}sin\frac{C-D}{2}$
- $\sin n\pi = 0$; $\cos n\pi = (-1)^n$; $\tan n\pi = 0$ where $n\epsilon Z$
- $sin\,15^0 or\,sin\frac{\pi}{12} = \frac{\sqrt{3}-1}{2\sqrt{2}} = cos\,75^0 or\,cos\frac{5\pi}{12}$;

  $cos\,15^0 or\,cos\frac{\pi}{12} = \frac{\sqrt{3}+1}{2\sqrt{2}} = sin\,75^0 or\,sin\frac{5\pi}{12}$;

  $tan\,15^0 = \frac{\sqrt{3}-1}{\sqrt{3}+1} = 2-\sqrt{3} = cot\,75^0$;

  $tan\,75^0 = \frac{\sqrt{3}+1}{\sqrt{3}-1} = 2+\sqrt{3} = cot\,15^0$;
- $sin\frac{\pi}{10} or\,sin\,18^0 = \frac{\sqrt{5}-1}{4}$ &

  $cos\,36^0 or\,cos\frac{\pi}{5} = \frac{\sqrt{5}+1}{4}$
- $\sin\alpha + \sin(\alpha+\beta) + \sin(\alpha+2\beta) + \cdots + \sin(\alpha+\overline{n-1}\beta)$

  $= \frac{\sin\frac{n\beta}{2}}{\sin\frac{\beta}{2}}\sin\left(\alpha+\frac{n-1}{2}\beta\right)$
- $\cos\alpha + \cos(\alpha+\beta) + \cos(\alpha+2\beta) + \cdots + \cos(\alpha+\overline{n-1}\beta)$

  $= \frac{\sin\frac{n\beta}{2}}{\sin\frac{\beta}{2}}\cos\left(\alpha+\frac{n-1}{2}\beta\right)$
- $\sin(-\theta) = -\sin\theta$

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

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

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

  $cosec\,(-\theta) = -cosec\,\theta$

  $\sec(-\theta) = \sec\theta$
- If $a\cos\theta + b\sin\theta = c$ and then $a\sin\theta - b\cos\theta = K$ then $a^2+b^2 = c^2+k^2$
- If $a\sec\theta + b\tan\theta = c$ and $a\tan\theta + b\sec\theta = k$ then $a^2-b^2 = c^2-k^2$
- If $a\,cosec\,\theta + b\cot\theta = c$ and $a\cot\theta + b\,cosec\,\theta = k$ then $a^2-b^2 = c^2-k^2$
- If $8\cos\theta + 6\sin\theta = 5$ then $8\sin\theta - 6\cos\theta =$
- If $a>0$, $b>0$ and $f(x)>0$ then

  $a\,f(x) + \frac{b}{f(x)} \geq 2\sqrt{ab}$