BRIGHT CAREER SCIENCE ACADEMY (BCSA), NAROWAL

TRIGONOMETRIC & ALGEBRAIC FORMULAS

$l = r\theta \;,\; A = \frac{1}{2}r^2\theta$

Where θ is measure in radian

Trignometric Ratios

$\sin\theta = \frac{p}{h} \Leftrightarrow \operatorname{cosec}\theta = \frac{h}{p}$

$\cos\theta = \frac{b}{h} \Leftrightarrow \sec\theta = \frac{h}{b}$

$\tan\theta = \frac{p}{b} \Leftrightarrow \cot\theta = \frac{b}{p}$

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

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

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

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

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

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

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

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

$\sin\frac{\alpha}{2} = \sqrt{\frac{(s-b)(s-c)}{bc}}$

$\sin\frac{\beta}{2} = \sqrt{\frac{(s-c)(s-a)}{ca}}$

$\sin\frac{\gamma}{2} = \sqrt{\frac{(s-a)(s-b)}{ab}}$

$\cos\frac{\alpha}{2} = \sqrt{\frac{s(s-a)}{bc}}$

$\cos\frac{\beta}{2} = \sqrt{\frac{s(s-b)}{ca}}$

$\cos\frac{\gamma}{2} = \sqrt{\frac{s(s-c)}{ab}}$

$\tan\frac{\alpha}{2} = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$

$\tan\frac{\beta}{2} = \sqrt{\frac{(s-c)(s-a)}{s(s-b)}}$

$\tan\frac{\gamma}{2} = \sqrt{\frac{(s-a)(s-b)}{s(s-c)}}$

Fundamental Law Of Trignometry

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

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

$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$

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

$\tan(\alpha+\beta) = \frac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta}$

$\tan(\alpha-\beta) = \frac{\tan\alpha-\tan\beta}{1+\tan\alpha\tan\beta}$

Law of Cosines

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

$b^2 = c^2 + a^2 - 2ca\cos\beta$

$c^2 = a^2 + b^2 - 2ab\cos\gamma$

Law of sine

$\frac{a}{\sin\alpha} = \frac{b}{\sin\beta} = \frac{c}{\sin\gamma}$

$\sin^{-1}A + \sin^{-1}B = \sin^{-1}\left(A\sqrt{1-B^2} + B\sqrt{1-A^2}\right)$

$\sin^{-1}A - \sin^{-1}B = \sin^{-1}\left(A\sqrt{1-B^2} - B\sqrt{1-A^2}\right)$

$\cos^{-1}A + \cos^{-1}B = \cos^{-1}\left(AB - \sqrt{(1-A^2)(1-B^2)}\right)$

$\cos^{-1}A - \cos^{-1}B = \cos^{-1}\left(AB + \sqrt{(1-A^2)(1-B^2)}\right)$

$\tan^{-1}A + \tan^{-1}B = \tan^{-1}\left(\frac{A+B}{1-AB}\right)$

$\tan^{-1}A - \tan^{-1}B = \tan^{-1}\left(\frac{A-B}{1+AB}\right)$

$2\tan^{-1}A = \tan^{-1}\left(\frac{2A}{1-A^2}\right)$

Algebric Formulas

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

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

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

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

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

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

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

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

$a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

$a^3 + b^3 + c^3 - 3abc =$

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

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

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

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

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

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

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

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

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

Hero's Formula

$\Delta = \sqrt{s(s-a)(s-b)(s-c)}$

$\textit{where } s = \frac{a+b+c}{2}$

Law of Tangents

$\frac{a-b}{a+b} = \frac{\tan\left(\frac{\alpha-\beta}{2}\right)}{\tan\left(\frac{\alpha+\beta}{2}\right)}$

$\frac{b-c}{b+c} = \frac{\tan\left(\frac{\beta-\gamma}{2}\right)}{\tan\left(\frac{\beta+\gamma}{2}\right)}$

$\frac{c-a}{c+a} = \frac{\tan\left(\frac{\gamma-\alpha}{2}\right)}{\tan\left(\frac{\gamma+\alpha}{2}\right)}$

$\Delta = \frac{a^2\sin\beta\sin\gamma}{2\sin\alpha}$

$\Delta = \frac{b^2\sin\gamma\sin\alpha}{2\sin\beta}$

$\Delta = \frac{c^2\sin\alpha\sin\beta}{2\sin\gamma}$

$\Delta = \frac{1}{2}bc\sin\alpha$

$\Delta = \frac{1}{2}ca\sin\beta$

$\Delta = \frac{1}{2}ab\sin\gamma$

$R = \frac{abc}{4\Delta}$

$R = \frac{a}{2\sin\alpha}$

$R = \frac{b}{2\sin\beta}$

$R = \frac{c}{2\sin\gamma}$

$r = \frac{\Delta}{s}$

$r_1 = \frac{\Delta}{s-a}$

$r_2 = \frac{\Delta}{s-b}$

$r_3 = \frac{\Delta}{s-c}$

Where

R=Circum Radius

r = In Radius

r_1, r_2, r_3 = Escribed Radius

Δ = Area of Triangle

Pythagorean Identities

$h^2 = p^2 + b^2$

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

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

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

Half Angle Identities

$\sin\theta = 2\sin\frac{\theta}{2}\cos\frac{\theta}{2}$

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

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

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

Double Angle Identities

$\sin 2\theta = 2\sin\theta\cos\theta$

$\cos 2\theta = \cos^2\theta - \sin^2\theta$

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

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

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

Triple Angle Identities

$\sin 3\theta = 3\sin\theta - 4\sin^3\theta$

$\cos 3\theta = 4\cos^3\theta - 3\cos\theta$

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

1 radian $\approx 57.296^\circ$

$1^\circ \approx 0.0175$ radian

Function	*Domian*	*Range*	*Period*
y=sinx	$-\infty < x < +\infty$	$-1 \le y \le 1$	2π
y=cosx	$-\infty < x < +\infty$	$-1 \le y \le 1$	2π
y=tanx	$-\infty < x < +\infty,\ x \ne (2n+1)\frac{\pi}{2}$	$-\infty < y < +\infty$	π
y=secx	$-\infty < x < +\infty,\ x \ne (2n+1)\frac{\pi}{2}$	$y \ge 1$ or $y \le -1$	2π
y=cosecx	$-\infty < x < +\infty,\ x \ne n\pi$	$y \ge 1$ or $y \le -1$	2π
$y = \cot x$	$-\infty < x < +\infty,\ x \ne n\pi$	$-\infty < y < +\infty$	π

Acute Angle: $0<\theta<90^\circ$	Right Angle: $\theta=90^\circ$
Obtuse Angle: $90^\circ<\theta<180^\circ$	Straight Angle: $\theta=180^\circ$
Reflex Angle: $180^\circ<\theta<360^\circ$	1 Rotation: $\theta=360^\circ$

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