

Complete Trigonometry Formula Notes (Class 9, 10, 11, 12 & College Level)

1. Basic Trigonometric Ratios

- $\sin \theta = \text{Perpendicular} / \text{Hypotenuse}$
 - $\cos \theta = \text{Base} / \text{Hypotenuse}$
 - $\tan \theta = \text{Perpendicular} / \text{Base}$
 - $\cot \theta = \text{Base} / \text{Perpendicular}$
 - $\sec \theta = \text{Hypotenuse} / \text{Base}$
 - $\text{cosec } \theta = \text{Hypotenuse} / \text{Perpendicular}$
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2. Reciprocal Identities

- $\sin \theta \times \text{cosec } \theta = 1$
 - $\cos \theta \times \sec \theta = 1$
 - $\tan \theta \times \cot \theta = 1$
 - $\text{cosec } \theta = 1/\sin \theta$
 - $\sec \theta = 1/\cos \theta$
 - $\cot \theta = 1/\tan \theta$
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3. Quotient Identities

- $\tan \theta = \sin \theta / \cos \theta$
 - $\cot \theta = \cos \theta / \sin \theta$
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4. Pythagorean Identities

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

- $1 + \tan^2\theta = \sec^2\theta$
 - $1 + \cot^2\theta = \operatorname{cosec}^2\theta$
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5. Complementary Angle Formulas

- $\sin(90^\circ - \theta) = \cos \theta$
 - $\cos(90^\circ - \theta) = \sin \theta$
 - $\tan(90^\circ - \theta) = \cot \theta$
 - $\cot(90^\circ - \theta) = \tan \theta$
 - $\sec(90^\circ - \theta) = \operatorname{cosec} \theta$
 - $\operatorname{cosec}(90^\circ - \theta) = \sec \theta$
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6. Compound Angle Formulas

- $\sin(A + B) = \sin A \cos B + \cos A \sin B$
 - $\sin(A - B) = \sin A \cos B - \cos A \sin B$
 - $\cos(A + B) = \cos A \cos B - \sin A \sin B$
 - $\cos(A - B) = \cos A \cos B + \sin A \sin B$
 - $\tan(A + B) = (\tan A + \tan B)/(1 - \tan A \tan B)$
 - $\tan(A - B) = (\tan A - \tan B)/(1 + \tan A \tan B)$
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7. Double Angle Formulas

- $\sin 2A = 2\sin A \cos A$
 - $\cos 2A = \cos^2 A - \sin^2 A$
 - $\cos 2A = 1 - 2\sin^2 A$
 - $\cos 2A = 2\cos^2 A - 1$
 - $\tan 2A = 2\tan A / (1 - \tan^2 A)$
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8. Triple Angle Formulas

- $\sin 3A = 3\sin A - 4\sin^3 A$
 - $\cos 3A = 4\cos^3 A - 3\cos A$
 - $\tan 3A = (3\tan A - \tan^3 A)/(1 - 3\tan^2 A)$
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9. Half Angle Formulas

- $\sin(A/2) = \pm\sqrt{[(1 - \cos A)/2]}$
 - $\cos(A/2) = \pm\sqrt{[(1 + \cos A)/2]}$
 - $\tan(A/2) = \pm\sqrt{[(1 - \cos A)/(1 + \cos A)]}$
 - $\tan(A/2) = \sin A / (1 + \cos A)$
 - $\tan(A/2) = (1 - \cos A)/\sin A$
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10. Product to Sum Formulas

- $\sin A \sin B = \frac{1}{2}[\cos(A-B) - \cos(A+B)]$
 - $\cos A \cos B = \frac{1}{2}[\cos(A-B) + \cos(A+B)]$
 - $\sin A \cos B = \frac{1}{2}[\sin(A+B) + \sin(A-B)]$
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11. Sum to Product Formulas

- $\sin A + \sin B = 2\sin[(A+B)/2] \cos[(A-B)/2]$
 - $\sin A - \sin B = 2\cos[(A+B)/2] \sin[(A-B)/2]$
 - $\cos A + \cos B = 2\cos[(A+B)/2] \cos[(A-B)/2]$
 - $\cos A - \cos B = -2\sin[(A+B)/2] \sin[(A-B)/2]$
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12. Standard Trigonometric Values

- $\sin 0^\circ = 0$
- $\sin 30^\circ = 1/2$
- $\sin 45^\circ = 1/\sqrt{2}$

- $\sin 60^\circ = \sqrt{3}/2$
 - $\sin 90^\circ = 1$
 - $\cos 0^\circ = 1$
 - $\cos 30^\circ = \sqrt{3}/2$
 - $\cos 45^\circ = 1/\sqrt{2}$
 - $\cos 60^\circ = 1/2$
 - $\cos 90^\circ = 0$
 - $\tan 0^\circ = 0$
 - $\tan 30^\circ = 1/\sqrt{3}$
 - $\tan 45^\circ = 1$
 - $\tan 60^\circ = \sqrt{3}$
 - $\tan 90^\circ = \text{Undefined}$
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13. Radian Conversion

- $180^\circ = \pi \text{ radians}$
 - $1 \text{ radian} = 180^\circ/\pi$
 - Degree to Radian = Degree $\times \pi/180$
 - Radian to Degree = Radian $\times 180/\pi$
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14. Trigonometric Graph Properties

- Range of $\sin x = [-1, 1]$
 - Range of $\cos x = [-1, 1]$
 - Range of $\tan x = (-\infty, +\infty)$
 - Period of $\sin x = 2\pi$
 - Period of $\cos x = 2\pi$
 - Period of $\tan x = \pi$
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15. Inverse Trigonometric Formulas

- $\sin^{-1}x + \cos^{-1}x = \pi/2$
 - $\tan^{-1}x + \cot^{-1}x = \pi/2$
 - $\sec^{-1}x + \operatorname{cosec}^{-1}x = \pi/2$
 - $\sin(\sin^{-1}x) = x$
 - $\cos(\cos^{-1}x) = x$
 - $\tan(\tan^{-1}x) = x$
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16. Important College-Level Formulas

- $e^{ix} = \cos x + i \sin x$
- De Moivre's Theorem: $[\cos x + i \sin x]^n = \cos(nx) + i \sin(nx)$
- $\sin x \approx x$ (for very small x)
- $\tan x \approx x$ (for very small x)
- $\cos x \approx 1 - x^2/2$