

Trigonometric Equations

1. $\sin^2 q + \cos^2 q = 1$
 $\sec^2 q = 1 + \tan^2 q$
 $\operatorname{cosec}^2 q = 1 + \cot^2 q$

2. $\sin(-q) = -\sin q$
 $\cos(-q) = \cos q$
 $\tan(-q) = -\tan q$

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

4. $2 \sin A \cos B = \sin(A + B) + \sin(A - B)$
 $2 \cos A \sin B = \sin(A + B) - \sin(A - B)$
 $2 \cos A \cos B = \cos(A + B) + \cos(A - B)$
 $2 \sin A \sin B = \cos(A - B) - \cos(A + B)$

5. $\sin C + \sin D = 2 \sin\left(\frac{C+D}{2}\right) \cos\left(\frac{C-D}{2}\right)$
 $\sin C - \sin D = 2 \cos\left(\frac{C+D}{2}\right) \sin\left(\frac{C-D}{2}\right)$
 $\cos C + \cos D = 2 \cos\left(\frac{C+D}{2}\right) \cos\left(\frac{C-D}{2}\right)$
 $\cos C - \cos D = 2 \sin\left(\frac{C+D}{2}\right) \sin\left(\frac{D-C}{2}\right)$

6. $\sin 2A = 2 \sin A \cos A$
 $\cos 2A = \cos^2 A - \sin^2 A = 2 \cos^2 A - 1 = 1 - 2 \sin^2 A$
 $1 + \cos 2A = 2 \cos^2 A \qquad 1 - \cos 2A = 2 \sin^2 A$
 $\tan 2A = \frac{2 \tan A}{1 - \tan^2 A} \qquad \sin 2A = \frac{2 \tan A}{1 + \tan^2 A}$

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

7. $\sin 3A = 3 \sin A - 4 \sin^3 A$
 $\cos 3A = 4 \cos^3 A - 3 \cos A$
 $\tan 3A = \frac{3 \tan A - \tan^3 A}{1 - 3 \tan^2 A}$

Hyperbolic Equations

1. $\cos x = \frac{1}{2}(e^{ix} + e^{-ix})$

$$\sin x = \frac{1}{2i}(e^{ix} - e^{-ix})$$

2. $\cosh x = \frac{1}{2}(e^x + e^{-x})$

$$\sinh x = \frac{1}{2}(e^x - e^{-x})$$

3. $\cos ix = \cosh x$

$$\sin ix = i \sinh x$$

$$\cosh ix = \cos x$$

$$\sinh ix = i \sin x$$

4. $\cosh^2 x - \sinh^2 x = 1$

$$1 - \tanh^2 x = \operatorname{sech}^2 x$$

$$\operatorname{coth}^2 x - 1 = \operatorname{cosech}^2 x$$

5. $\sinh(x + y) = \sinh x \cosh y + \cosh x \sinh y$

$$\cosh(x + y) = \cosh x \cosh y + \sinh x \sinh y$$

6. $\sinh 2x = 2 \sinh x \cosh x$

$$\cosh 2x = \cosh^2 x + \sinh^2 x$$

7. $\sinh(-x) = -\sinh x$

$$\cosh(-x) = \cosh x$$

Differentiation

$$1. \quad \frac{d}{dx} \sin x = \cos x$$

$$2. \quad \frac{d}{dx} \cos x = -\sin x$$

$$3. \quad \frac{d}{dx} \tan x = \sec^2 x$$

$$4. \quad \frac{d}{dx} \cot x = -\operatorname{cosec}^2 x$$

$$5. \quad \frac{d}{dx} \sec x = \sec x \tan x$$

$$6. \quad \frac{d}{dx} \operatorname{cosec} x = -\operatorname{cosec} x \cot x$$

$$7. \quad \frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$$

$$8. \quad \frac{d}{dx} \cos^{-1} x = -\frac{1}{\sqrt{1-x^2}}$$

$$9. \quad \frac{d}{dx} \tan^{-1} x = \frac{1}{1+x^2}$$

$$10. \quad \frac{d}{dx} \sinh x = \cosh x$$

$$11. \quad \frac{d}{dx} \cosh x = \sinh x$$

$$12. \quad \frac{d}{dx} \tanh x = \operatorname{sech}^2 x$$

$$13. \quad \frac{d}{dx} \sinh^{-1} x = \frac{1}{\sqrt{1+x^2}}$$

$$14. \quad \frac{d}{dx} \cosh^{-1} x = \frac{1}{\sqrt{x^2-1}}$$

$$15. \quad \frac{d}{dx} \tanh^{-1} x = \frac{1}{x^2-1}$$

Integration

$$1. \int a^x dx = \frac{a^x}{\log a} + C$$

$$2. \int \tan x dx = \log \sec x + C$$

$$3. \int \cot x dx = \log \sin x + C$$

$$4. \int \sec x dx = \log \tan \left(\frac{x}{2} + \frac{\pi}{4} \right) + C$$

$$5. \int \operatorname{cosec} x dx = \log \tan \left(\frac{x}{2} \right) + C$$

$$6. \int \frac{dx}{x^2 + a^2} = \frac{1}{a} \tan^{-1} \frac{x}{a} + C$$

$$7. \int \frac{dx}{x^2 - a^2} = \frac{1}{2} \log \frac{x-a}{x+a} + C$$

$$8. \int \frac{dx}{a^2 - x^2} = \frac{1}{2} \log \frac{a+x}{a-x} + C$$

$$9. \int \frac{dx}{\sqrt{x^2 + a^2}} = \log \left(x + \sqrt{x^2 + a^2} \right) + C$$

$$10. \int \frac{dx}{\sqrt{x^2 - a^2}} = \log \left(x + \sqrt{x^2 - a^2} \right) + C$$

$$11. \int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \frac{x}{a} + C$$

$$12. \int \sqrt{x^2 + a^2} dx = \frac{1}{2} \left[x\sqrt{x^2 + a^2} + a^2 \log \left(x + \sqrt{x^2 + a^2} \right) \right] + C$$

$$13. \int \sqrt{x^2 - a^2} dx = \frac{1}{2} \left[x\sqrt{x^2 - a^2} - a^2 \log \left(x + \sqrt{x^2 - a^2} \right) \right] + C$$

$$14. \int \sqrt{a^2 - x^2} dx = \frac{1}{2} \left[x\sqrt{a^2 - x^2} + a^2 \sin^{-1} \frac{x}{a} \right] + C$$