

DIFFERENTIATION FORMULAS

(In the following formulas, $D = d/dx$)

1. $D(x^r) = rx^{r-1}$
2. $D(e^x) = e^x$
3. $D(\ln|x|) = \frac{1}{x}$
4. $D(\sin x) = \cos x$
5. $D(\cos x) = -\sin x$
6. $D(\tan x) = \sec^2 x$
7. $D(\sec x) = \sec x \tan x$
8. $D(\cot x) = -\csc^2 x$
9. $D(\csc x) = -\csc x \cot x$
10. $D(a^x) = a^x \ln a, a > 0$
11. $D(\sinh x) = \cosh x$
12. $D(\cosh x) = \sinh x$
13. $D(\tanh x) = \operatorname{sech}^2 x$
14. $D(\operatorname{sech} x) = -\operatorname{sech} x \tanh x$
15. $D(\operatorname{coth} x) = -\operatorname{csch}^2 x$
16. $D(\operatorname{csch} x) = -\operatorname{csch} x \operatorname{coth} x$
17. $D(\arcsin x) = \frac{1}{\sqrt{1-x^2}}$
18. $D(\arccos x) = -\frac{1}{\sqrt{1-x^2}}$
19. $D(\arctan x) = \frac{1}{1+x^2}$
20. $D(\operatorname{arcsec} x) = \frac{1}{|x| \sqrt{x^2-1}}$
21. $D(\operatorname{arcsinh} x) = \frac{1}{\sqrt{x^2+1}}$
22. $D(\operatorname{arccosh} x) = \frac{1}{\sqrt{x^2-1}}$
23. $D(\operatorname{arctanh} x) = \frac{1}{1-x^2}$
24. $D(\operatorname{arcsech} x) = -\frac{1}{x \sqrt{1-x^2}}$

TRIGONOMETRIC IDENTITIES

1. $\sin^2 x + \cos^2 x = 1$
 2. $\cos(-x) = \cos x$
 3. $\sin(-x) = -\sin x$
 4. $\sin(x \pm y) = \sin x \cos y \pm \cos x \sin y$
 5. $\cos(x \pm y) = \cos x \cos y \mp \sin x \sin y$
 6. $\sin 2x = 2 \sin x \cos x$
 7. $\cos 2x = \cos^2 x - \sin^2 x$
 8. $\sin^2 x = \frac{1 - \cos 2x}{2}$
 9. $\cos^2 x = \frac{1 + \cos 2x}{2}$
 10. $\sin x \sin y = \frac{[\cos(x-y) - \cos(x+y)]}{2}$
 11. $\cos x \cos y = \frac{[\cos(x-y) + \cos(x+y)]}{2}$
 12. $\sin x \cos y = \frac{[\sin(x-y) + \sin(x+y)]}{2}$
 13. $\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y}$
 14. $1 + \tan^2 x = \sec^2 x$
 15. $1 + \cot^2 x = \csc^2 x$
- In any plane triangle with sides a, b, c opposite angles A, B, C :
16. $a^2 = b^2 + c^2 - 2bc \cos A$
 17. Area of triangle = $\frac{bc(\sin A)}{2}$
 $= \sqrt{s(s-a)(s-b)(s-c)},$
where $2s = a + b + c$

INFINITE SERIES

$$1. \frac{1}{-x} = 1 + x + x^2 + \dots + x^n + \dots, \quad -1 < x < 1$$

$$2. e^x = 1 + x + \frac{x^2}{2!} + \dots + \frac{x^n}{n!} + \dots, \quad -\infty < x < \infty$$

$$3. \sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots + \frac{(-1)^n x^{2n+1}}{(2n+1)!} + \dots, \quad -\infty < x < \infty$$

$$4. \cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \dots + \frac{(-1)^n x^{2n}}{(2n)!} + \dots, \quad -\infty < x < \infty$$

$$5. \ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \dots + \frac{(-1)^{n+1} x^n}{n} + \dots, \quad -1 < x \leq 1$$

$$6. \arctan x = x - \frac{x^3}{3} + \frac{x^5}{5} - \dots + \frac{(-1)^n x^{2n+1}}{2n+1} + \dots, \quad -1 \leq x \leq 1$$

$$7. (1+x)^r = 1 + rx + \frac{r(r-1)}{2!} x^2 + \dots + \frac{r(r-1)\dots(r-n+1)}{n!} x^n + \dots, \quad -1 < x < 1$$

$$8. \cosh x = 1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \dots + \frac{x^{2n}}{(2n)!} + \dots, \quad -\infty < x < \infty$$

$$9. \sinh x = x + \frac{x^3}{3!} + \frac{x^5}{5!} + \dots + \frac{x^{2n+1}}{(2n+1)!} + \dots, \quad -\infty < x < \infty$$

$$10. \arcsin x = x + \frac{1}{2} \frac{x^3}{3} + \frac{1 \cdot 3}{2 \cdot 4} \frac{x^5}{5} + \dots + \frac{1 \cdot 3 \dots (2n-1)}{2 \cdot 4 \dots (2n)} \frac{x^{2n+1}}{2n+1} + \dots, \quad -1 < x < 1$$

HYPERBOLIC FUNCTIONS

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

$$2. \cosh(-x) = \cosh x$$

$$3. \sinh(-x) = -\sinh x$$

$$4. \sinh(x \pm y) = \sinh x \cosh y \pm \cosh x \sinh y$$

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