Basic Rules for Algebra

1. $(a+b)^2 = a^2 + 2ab + b^2$
2. $(a-b)^2 = a^2 - 2ab + b^2$
3. $(a+b)(a-b) = a^2 - b^2$
4. $a^0 = 1$
5. $a^{-n} = \dfrac{1}{a^n}$
6. $a^{\frac{1}{n}} = \sqrt[n]{a}$
7. $a^{\frac{m}{n}} = \sqrt[n]{a^m} = (\sqrt[n]{a})^m$
8. $a^{r+s} = a^r a^s$
9. $a^{r-s} = \dfrac{a^r}{a^s}$
10. $(a^r)^s = a^{rs}$
11. $(ab)^r = a^r b^r$
12. $\left(\dfrac{a}{b}\right)^r = \dfrac{a^r}{b^r}$

Basic Rules for Exponentials and Logarithms

1. $e^0 = 1$
2. $e^{x+y} = e^x e^y$
3. $e^{x-y} = \dfrac{e^x}{e^y}$
4. $e^{rx} = (e^x)^r$
5. $\ln 1 = 0$
6. $\ln(xy) = \ln x + \ln y$
7. $\ln\left(\dfrac{x}{y}\right) = \ln x - \ln y$
8. $\ln(x^r) = r \ln x$
9. $e^{\ln x} = x$ and $\ln(e^x) = x$
10. $\ln x = y$ if and only if $e^y = x$
11. $a^{\log_a x} = x$ and $\log_a(a^x) = x$
12. $\log_a x = y$ if and only if $a^y = x$

Basic Rules for Trigonometric Functions

1. $\tan x = \dfrac{\sin x}{\cos x}$
2. $\sec x = \dfrac{1}{\cos x}$
3. $\csc x = \dfrac{1}{\sin x}$
4. $\cot x = \dfrac{\cos x}{\sin x}$
5. $\sin^2 x + \cos^2 x = 1$
6. $\tan^2 x + 1 = \sec^2 x$
7. $\sin(-x) = -\sin x$
8. $\cos(-x) = \cos x$
9. $\sin(x + y) = \sin x \cos y + \cos x \sin y$
10. $\sin(x - y) = \sin x \cos y - \cos x \sin y$
11. $\cos(x + y) = \cos x \cos y - \sin x \sin y$
12. $\cos(x - y) = \cos x \cos y + \sin x \sin y$
13. $\sin(2x) = 2 \sin x \cos x$
14. $\cos(2x) = \cos^2 x - \sin^2 x$
15. $\sin^2 x = \dfrac{1 - \cos(2x)}{2}$
16. $\cos^2 x = \dfrac{1 + \cos(2x)}{2}$

Basic Rules for Inverse Trigonometric Functions

1. $\arcsin(\sin x) = x$ and $\sin(\arcsin x) = x$
2. $\arcsin x = y$ if and only if $\sin y = x$
3. $\arccos(\cos x) = x$ and $\cos(\arccos x) = x$
4. $\arccos x = y$ if and only if $\cos y = x$
5. $\arctan(\tan x) = x$ and $\tan(\arctan x) = x$
6. $\arctan x = y$ if and only if $\tan y = x$
7. $\operatorname{arcsec}(\sec x) = x$ and $\sec(\operatorname{arcsec} x) = x$
8. $\operatorname{arcsec} x = y$ if and only if $\sec y = x$
9. $\operatorname{arccsc}(\csc x) = x$ and $\csc(\operatorname{arccsc} x) = x$
10. $\operatorname{arccsc} x = y$ if and only if $\csc y = x$
11. $\operatorname{arccot}(\cot x) = x$ and $\cot(\operatorname{arccot} x) = x$
12. $\operatorname{arccot} x = y$ if and only if $\cot y = x$