$$a^p * a^q = a^{p+q}$$

$$(a^p)^q = (a^q)^p = a^{pq}$$

$$a^{p^q} = a^{(p^q)} \neq a^{pq}$$

$$(ab)^p = a^p b^p$$

$$a^{-p} = \frac{1}{a^p}$$

$$\frac{a^p}{a^q} = a^{p-q} = \frac{1}{a^{q-p}}$$

$$\frac{a^p}{b^p} = \left(\frac{a}{b}\right)^p = \left(\frac{b}{a}\right)^{-p}$$

$$a^{\frac{m}{n}} = \left(a^{\frac{1}{n}}\right)^m = (a^m)^{\frac{1}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$$

$$a^{-\frac{m}{n}} = \frac{1}{\sqrt[n]{a^m}} = \frac{1}{\left(\sqrt[n]{a}\right)^m}, \qquad a \neq 0$$

$$\sqrt[n]{a}\sqrt[n]{b} = \sqrt[n]{ab}$$

$$\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}, \qquad b \neq 0$$

$$\sqrt[m]{\sqrt[n]{a}} = \sqrt[n]{\sqrt[m]{a}} = \sqrt[mn]{a}$$

$$\sqrt[nm]{a^m} = \sqrt[n]{a}$$

$$\log_c a = x \iff c^x = a, \quad a > 0$$

$$c^{\log_c a} = a \qquad \log_c xy = \log_c x + \log_c y \qquad \log_c d = \frac{1}{\log_d c}$$

$$\log_c c = 1 \qquad \log_c \frac{x}{y} = \log_c x - \log_c y \qquad \log_d x = \frac{\log_c x}{\log_c d}$$

$$\log_c c^p = p \qquad \log_{c^p} x = \frac{1}{p}\log_c x \qquad \log_c x^p = p \log_c x$$

$$\log_c 1 = 0 \qquad \log_c\left(\sqrt[n]{x}\right) = n \log_c x \qquad \log_c x = \log_{c^p} x^p$$

$$A(B \pm C) = AB \pm AC$$

$$(A \pm B)^2 = A^2 \pm 2AB + B^2$$

$$(A+B)^3 = A^3 + 3A^2B + 3AB^2 + B^3$$

$$(A-B)^3 = A^3 - 3A^2B + 3AB^2 - B^3$$

$$(A+B)^2(A-B)^2 = A^4 - 2A^2B^2 + B^4$$

$$A^2 - B^2 = (A-B)(A+B)$$

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

$$A^3 \pm B^3 = (A \pm B)(A^2 \mp AB + B^2)$$

$$x_{1/2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad x_1 + x_2 = -\frac{b}{a}, \qquad x_1 * x_2 = \frac{c}{a}$$

$$ax^2 + bx + c = a(x - x_1)(x - x_2)$$

$$\sin^2\alpha + \cos^2\alpha = 1 \qquad \tan\alpha * \cot\alpha = 1 \qquad \tan\alpha = \frac{\sin\alpha}{\cos\alpha} \qquad \cot\alpha = \frac{\cos\alpha}{\sin\alpha}$$

$$\cos^2\alpha = \frac{\cot^2\alpha}{1+\cot^2\alpha} \qquad \cos^2\alpha = \frac{1}{1+\tan^2\alpha} \qquad \sin^2\alpha = \frac{1}{1+\cot^2\alpha} \qquad \sin^2\alpha = \frac{\tan^2\alpha}{1+\tan^2\alpha}$$

$$\sin(\alpha \pm \beta) = \sin\alpha * \cos\beta \pm \cos\alpha * \sin\beta \qquad \cos(\alpha \pm \beta) = \cos\alpha * \cos\beta \mp \sin\alpha * \sin\beta$$

$$\tan(\alpha \pm \beta)\frac{\tan\alpha \pm \tan\beta}{1 \mp \tan\alpha * \tan\beta} \qquad \cot(\alpha \pm \beta)\frac{\cot\alpha * \cot\beta \mp 1}{\cot\beta \pm \cot\alpha}$$

$$\sin\alpha \pm \sin\beta = 2\sin\frac{\alpha \pm \beta}{2} * \cos\frac{\alpha \mp \beta}{2} \qquad \cos\alpha + \cos\beta = 2\cos\frac{\alpha+\beta}{2} * \cos\frac{\alpha-\beta}{2}$$

$$\cos\alpha - \cos\beta = -2\sin\frac{\alpha+\beta}{2} * \sin\frac{\alpha-\beta}{2} \qquad \sin\alpha * \sin\beta = \frac{1}{2}[\cos(\alpha-\beta) - \cos(\alpha+\beta)]$$

$$\sin\alpha * \cos\beta = \frac{1}{2}[\sin(\alpha+\beta) + \sin(\alpha-\beta)] \qquad \cos\alpha * \cos\beta = \frac{1}{2}[\cos(\alpha+\beta) + \cos(\alpha-\beta)]$$

$$\sin 2\alpha = 2\sin\alpha * \cos\alpha \qquad \sin 3\alpha = 3\cos^2\alpha * \sin\alpha - \sin^3\alpha$$

$$\cos 2\alpha = \cos^2\alpha - \sin^2\alpha \qquad \cos 3\alpha = \cos^3\alpha - 3\cos\alpha * \sin^2\alpha$$

α	0°	30°	45°	60°	90°	180°	270°	360°°
$\sin\alpha$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
$\cos\alpha$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0	-1	0	1
$\tan\alpha$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	$\pm\infty$	0	$\pm\infty$	0
$\cot\alpha$	$\pm\infty$	$\sqrt{3}$	1	$\frac{\sqrt{3}}{3}$	0	$\pm\infty$	0	$\pm\infty$
α	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$	π	$3\pi/2$	2π