## Свойства степеней и корней

$(abc)^n = a^n b^n c^n$

$\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$

$a^m a^n = a^{m+n}$

$\dfrac{a^m}{a^n} = a^{m-n}$

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

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

$\sqrt[m]{abc...} = \sqrt[m]{a} \cdot \sqrt[m]{b} \cdot \sqrt[m]{c}...$

$\sqrt[m]{\dfrac{a}{b}} = \dfrac{\sqrt[m]{a}}{\sqrt[m]{b}}$

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

## Свойства логарифмов

$\log_a 1 = 0$

$\log_a (x_1 \cdot x_2) = \log_a |x_1| + \log_a |x_2|$

$\log_a \dfrac{x_1}{x_2} = \log_a |x_1| - \log_a |x_2|$

$\log_a x^p = p \log_a x$

$\log_a x = \dfrac{\log_b x}{\log_b a}$

$\log_{a^q} x = \dfrac{1}{q} \log_a x$

$\lg 10^n = n$

$\ln e^n = n$

## Производные

$(x^a)' = a x^{a-1}$

$(a^x)' = a^x \ln a; a > 0$

$(e^x)' = e^x$

$(\log_a x)' = \dfrac{1}{x \ln a}$

$(\ln x)' = \dfrac{1}{x}$

$(\sin x)' = \cos x$

$(\cos x)' = -\sin x$

$(tgx)' = \dfrac{1}{\cos^2 x}$

$(ctgx)' = -\dfrac{1}{\sin^2 x}$

$(\arcsin x)' = \dfrac{1}{\sqrt{1-x^2}}$

$(\arccos x)' = -\dfrac{1}{\sqrt{1-x^2}}$

$(arctgx)' = \dfrac{1}{1+x^2}$

$(arcctgx)' = -\dfrac{1}{1+x^2}$

## Свойства интегралов

$\int k \cdot f(x)dx = k \int f(x)$

$\int (f(x) + g(x))dx = \int f(x)dx + \int g(x)dx$

$\int_a^b f(x)dx = F(b) - F(a) = F(x)\Big|_a^b$

$\int_a^a f(x)dx = 0$

$\int_a^b f(x)dx = -\int_b^a f(x)dx$

$\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$

$\int_a^b k \cdot f(x)dx = k \cdot \int_a^b f(x)dx$

## Таблица интегралов

$\int x^n dx = \dfrac{x^{n+1}}{n+1} + C; n \neq -1$

$\int \dfrac{dx}{x} = \ln|x| + C$

$\int a^x dx = \dfrac{a^x}{\ln a} + C; (a > 0); \int e^x dx = e^x + C$

$\int \sin x dx = -\cos x + C$

$\int \cos x dx = \sin x + C$

$\int \dfrac{dx}{x^2 + a^2} = \dfrac{1}{a} arctg \dfrac{x}{a} + C; (a \neq 0)$

$\int \dfrac{dx}{x^2 - a^2} = \dfrac{1}{2a} \ln\left|\dfrac{x-a}{x+a}\right| + C; (a \neq 0)$

$\int \dfrac{dx}{a^2 - x^2} = \dfrac{1}{2a} \ln\left|\dfrac{a+x}{a-x}\right| + C; (a \neq 0)$

$\int \dfrac{dx}{\sqrt{a^2 - x^2}} = \arcsin \dfrac{x}{a} + C =$

$= -\arccos \dfrac{x}{a} + C; (a > 0)$

$\int \dfrac{dx}{\sqrt{x^2 + a}} = \ln\left|x + \sqrt{x^2 + a}\right| + C; (a \neq 0)$

$\int \dfrac{dx}{\cos^2 x} = tgx + C$

$\int \dfrac{dx}{\sin x} = \ln\left|tg \dfrac{x}{2}\right| + C = \ln|\cos ecx - ctgx| + C$

$\int \dfrac{dx}{\sin^2 x} = -ctgx + C$

$\int \dfrac{dx}{\cos x} = \ln\left|tg\left(\dfrac{x}{2} + \dfrac{\pi}{4}\right)\right| + C =$

$= \ln|tgx + \sec x| + C$

$\int shdx = chx + C$

$\int chxdx = shx + C$

$\int \dfrac{dx}{ch^2 x} = thx + C$

$\int \dfrac{dx}{sh^2 x} = -cthx + C$

## Тригонометр. тождества

$\sin^2 a + \cos^2 a = 1$

$tga = \dfrac{\sin a}{\cos a}$

$ctga = \dfrac{\cos a}{\sin a}$

$tga \cdot ctga = 1$

$tg^2 a + 1 = \dfrac{1}{\cos^2 a}$

$ctg^2 a + 1 = \dfrac{1}{\sin^2 a}$

## Формулы сложения тригон. ф-ий.

$\cos(a-b) = \cos a \cdot \cos b + \sin a \cdot \sin b$

$\cos(a+b) = \cos a \cdot \cos b - \sin a \cdot \sin b$

$\sin(a-b) = \sin a \cdot \cos b - \cos a \cdot \sin b$

$\sin(a+b) = \sin a \cdot \cos b + \cos a \cdot \sin b$

$tg(a+b) = \dfrac{tga + tgb}{1 - tga \cdot tgb}$

$tg(a-b) = \dfrac{tga - tgb}{1 + tga \cdot tgb}$

## Сумма триг. ф-ий

$\sin a + \sin b = 2\sin\dfrac{a+b}{2} \cdot \cos\dfrac{a-b}{2}$

$\sin a - \sin b = 2\sin\dfrac{a-b}{2} \cdot \cos\dfrac{a+b}{2}$

$\cos a + \cos b = 2\cos\dfrac{a+b}{2} \cdot \cos\dfrac{a-b}{2}$

$\cos a - \cos b = -2\sin\dfrac{a-b}{2} \cdot \sin\dfrac{a+b}{2}$

## Ф-ии кратных углов

$\sin 2a = 2\sin a \cdot \cos a$

$\cos 2a = \cos^2 a - \sin^2 a$

$\cos 2a = 1 - 2\sin^2 a$

$\cos 2a = 2\cos^2 a - 1$

$tg 2a = \dfrac{2tga}{1 - tg^2 a}$

## Уравнение касательной

$y = f(x_0) + f'(x_0)(x - x_0)$

## Геометрическая прогрессия

$b_n = b_1 \cdot q^{n-1}$

$\dfrac{b_n}{b_{n-1}} = \dfrac{b_{n+1}}{b_n}$

$b_n^2 = b_{n-1} \cdot b_{n+1}$

$S_n = \dfrac{b_1(1-q^n)}{1-q}$

## Алгебраическая прогрессия

$a_n = a_{n-1} + d = a_1 + (n-1)d$

$a_n - a_{n-1} = a_{n+1} - a_n$

$a_n = \dfrac{a_{n-1} + a_{n+1}}{2}$

$S_n = \dfrac{a_1 + a_n}{2} n = \dfrac{2a_1 + d(n-1)}{2} n$

$a^2 - b^2 = (a-b)(a+b)$

$(a+b)^2 = a^2 + 2ab + b^2$

$(a-b)^2 = a^2 - 2ab + b^2$

$(a+b)^3 = a^3 + 3a^2 b + 3ab^2 + b^3$

$(a-b)^3 = a^3 - 3a^2 b + 3ab^2 - b^3$

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

## Ур-е корней и т. Виета

$ax^2 + bx + c = 0$

$x_{1,2} = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

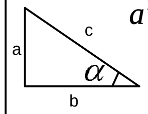
$\begin{cases} x_1 - x_2 = -\dfrac{b}{a} \\ x_1 \cdot x_2 = \dfrac{c}{a} \end{cases}$

## Координаты вершины параболы

$ax^2 + bx + c$

$x_0 = -\dfrac{b}{2a}$

$y_0 = a x_0^2 + b x_0 + c = \dfrac{4ac - b^2}{4a}$




$a^2 + b^2 = c^2$

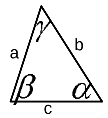
$a = c\sin\alpha$

$b = c\cos\alpha$

$a = b \cdot tg\alpha$

$\dfrac{\sin\alpha}{a} = \dfrac{\sin\beta}{b} = \dfrac{\sin\gamma}{c}$

$a^2 = b^2 + c^2 - 2bc\cos\alpha$




$S = \dfrac{1}{2} ab\sin\gamma$

$p = \dfrac{1}{2}(a+b+c)$

$S = \sqrt{p(p-a)(p-b)(p-c)}$

$S = \dfrac{1}{2} hc$

$V = SH$ призма

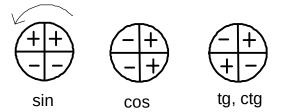
$V = \dfrac{1}{3} SH$ пирамида

$\begin{cases} S_{бок} = 2\pi RH \\ V = \pi R^2 H \end{cases}$ цилиндр

$\begin{cases} S_{бок} = 2\pi Rl \\ V = \dfrac{1}{3}\pi R^2 H \end{cases}$ конус

$\begin{cases} S = 4\pi R^2 \\ V = \dfrac{4}{3}\pi R^3 \end{cases}$ шар

$\begin{cases} S = 2\pi RH \\ V = \pi H^2\left(R - \dfrac{H}{3}\right) \end{cases}$ сегмент шара




$\sin a \cdot \sin b = \dfrac{1}{2}(\cos(a-b) - \cos(a+b))$

$\cos a \cdot \cos b = \dfrac{1}{2}(\cos(a-b) + \cos(a+b))$

$\sin a \cdot \cos b = \dfrac{1}{2}(\sin(a-b) + \sin(a+b))$

## Ф-лы понижения степени

$\sin^2 a = \dfrac{1 - \cos 2a}{2}$ $\cos^2 a = \dfrac{1 + \cos 2a}{2}$

$tg^2 a = \dfrac{1 - \cos 2a}{1 + \cos 2a}$

$\sin^3 a = \dfrac{1}{4}(3\sin a - \sin 3a)$

$\cos^3 a = \dfrac{1}{4}(\cos 3a + 3\cos a)$

## Радиусы правильных многоугольников

$n = 3$ $R = \dfrac{a}{\sqrt{3}}$ $r = \dfrac{a}{2}$

$n = 4$ $R = \dfrac{a}{\sqrt{2}}$ $r = \dfrac{a}{2}$

$n = 6$ $R = a$ $r = \dfrac{a\sqrt{3}}{2}$

## Радиусы треугольников

$R = \dfrac{abc}{4S}$

$r = \dfrac{2S}{a+b+c}$

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| $x$ | $\pi + x$ | $\pi - x$ | $2\pi + x$ | $2\pi - x$ | $\frac{\pi}{2} + x$ | $\frac{\pi}{2} - x$ | $\frac{3\pi}{2} + x$ | $\frac{3\pi}{2} - x$ |
|---|---|---|---|---|---|---|---|---|
| $\sin x$ | $-\sin x$ | $\sin x$ | $\sin x$ | $-\sin x$ | $\cos x$ | $\cos x$ | $-\cos x$ | $-\cos x$ |
| $\cos x$ | $-\cos x$ | $-\cos x$ | $\cos x$ | $\cos x$ | $-\sin x$ | $\sin x$ | $\sin x$ | $-\sin x$ |
| $tgx$ | $tgx$ | $-tgx$ | $tgx$ | $-tgx$ | $-ctgx$ | $ctgx$ | $-ctgx$ | $ctgx$ |
| $ctgx$ | $ctgx$ | $-ctgx$ | $ctgx$ | $-ctgx$ | $-tgx$ | $tgx$ | $-tgx$ | $tgx$ |

| $\alpha$ | 0 | $\pi/6$ | $\pi/4$ | $\pi/3$ | $\pi/2$ | $2\pi/3$ | $3\pi/4$ | $5\pi/6$ | $\pi$ | $7\pi/6$ | $5\pi/4$ | $4\pi/3$ | $3\pi/2$ | $5\pi/3$ | $7\pi/4$ | $11\pi/6$ | $2\pi$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| sin | 0 | $1/2$ | $\sqrt{2}/2$ | $\sqrt{3}/2$ | 1 | $\sqrt{3}/2$ | $\sqrt{2}/2$ | $1/2$ | 0 | $-1/2$ | $-\sqrt{2}/2$ | $-\sqrt{3}/2$ | $-1$ | $-\sqrt{3}/2$ | $-\sqrt{2}/2$ | $-1/2$ | 0 |
| cos | 1 | $\sqrt{3}/2$ | $\sqrt{2}/2$ | $1/2$ | 0 | $-1/2$ | $-\sqrt{2}/2$ | $-\sqrt{3}/2$ | $-1$ | $-\sqrt{3}/2$ | $-\sqrt{2}/2$ | $-1/2$ | 0 | $1/2$ | $\sqrt{2}/2$ | $\sqrt{3}/2$ | 1 |
| tg | 0 | $1/\sqrt{3}$ | 1 | $\sqrt{3}$ | | $-\sqrt{3}$ | $-1$ | $-1/\sqrt{3}$ | 0 | $1/\sqrt{3}$ | 1 | $\sqrt{3}$ | | $-\sqrt{3}$ | $-1$ | $-1/\sqrt{3}$ | 0 |
| ctg | | $\sqrt{3}$ | 1 | $1/\sqrt{3}$ | 0 | $-1/\sqrt{3}$ | $-1$ | $-\sqrt{3}$ | | $\sqrt{3}$ | 1 | $1/\sqrt{3}$ | 0 | $-1/\sqrt{3}$ | $-1$ | $-\sqrt{3}$ | |