

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

فرمول های کاربردی ریاضیات تجربی

مشتق ✓

هم ارزی ✓

مثلثات ✓

انتگرال ✓

اتحادها ✓

مای درس

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مشتق

تابع	مشتق	تابع	مشتق	تابع	مشتق
C	0	Arctan x	$\frac{1}{1+x^2}$	\sqrt{u}	$\frac{u'}{2\sqrt{u}}$
x^n	nx^{n-1}	Arccos x	$-\frac{1}{\sqrt{1-x^2}}$	$\sqrt[m]{u}$	$\frac{u'}{m\sqrt[m]{u}^{m-1}}$
$\ln x $	$\frac{1}{x}$	Arctan x	$\frac{1}{1+x^2}$	$\frac{au+b}{cu+d}$	$\frac{ad-bc}{(cu+d)^2} u'$
e^x	e^x	Arccot x	$-\frac{1}{1+x^2}$	Arctan u	$\frac{u'}{1+u^2}$
$\sin x$	$\cos x$	u^n	$nu'u^{n-1}$	Arccos u	$-\frac{u'}{\sqrt{1-u^2}}$
$\cos x$	$-\sin x$	e^u	$u'e^u$	Arctan u	$\frac{u'}{1+u^2}$
$\tan x$	$1+\tan^2 x$	$\ln u $	$\frac{u'}{u}$	Arccot u	$-\frac{u'}{1+u^2}$
$\cot x$	$-(1+\cot^2 x)$	$\sin u$	$u' \cos u$	$\sin^m u$	$mu' \cos u \sin^{m-1} u$
\sqrt{x}	$\frac{1}{2\sqrt{x}}$	$\cos u$	$-u' \sin u$	$\cos^m u$	$-mu' \sin u \cos^{m-1} u$
$\sqrt[m]{x}$	$\frac{1}{m\sqrt[m]{x}^{m-1}}$	$\tan u$	$u'(1+\tan^2 u)$	$\tan^m u$	$mu'(1+\tan^2 u)\tan^{m-1} u$
$\frac{ax+b}{cx+d}$	$\frac{ad-bc}{(cx+d)^2}$	$\cot u$	$-u'(1+\cot^2 u)$	$\cot^m u$	$-mu'(1+\cot^2 u)\cot^{m-1} u$

هم ارزی

$$u \rightarrow 0: \sin u \sim u, \quad \tan u \sim u, \quad (1+u)^n \sim 1+nu$$

$$u \rightarrow 0: \ln(1+u) \sim u, \quad e^u - 1 \sim u, \quad \sqrt[n]{1+u} \sim 1 + \frac{u}{n}$$

$$u \rightarrow 0: 1 - \cos^m u \sim m \frac{u^2}{2}, \quad u - \sin u \sim \frac{u^3}{6}, \quad u - \tan u \sim -\frac{u^3}{3}$$

جمله‌ی کم توان - عبارت جبری: $x \rightarrow 0$

جمله‌ی پرتوان - عبارت جبری: $x \rightarrow \pm\infty$

$$x \rightarrow \pm\infty: \sqrt[n]{ax^n + bx^{n-1} + \dots} \sim \sqrt[n]{a} \left| x + \frac{b}{na} \right|$$

اگر n فرد باشد نیازی به قدر مطلق نیست.

$$n \rightarrow \infty: 1 < |a| < |b| \Rightarrow a^n \pm b^n \sim \pm b^n$$

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$$n \rightarrow \infty: \sqrt[n]{n!} \sim \frac{n}{e}$$

$$n \rightarrow \infty: 1^k + 2^k + 3^k + \dots + n^k \sim \frac{n^{k+1}}{k+1}$$

$$u \rightarrow \pm\infty: [u] \sim u$$

مثلات

$$\tan x = \frac{\sin x}{\cos x}, \quad \cot x = \frac{\cos x}{\sin x}, \quad \cot x = \frac{1}{\tan x}$$

$$\sin^2 x + \cos^2 x = 1, \quad 1 + \tan^2 x = \frac{1}{\cos^2 x}, \quad 1 + \cot^2 x = \frac{1}{\sin^2 x}$$

$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta, \quad \sin 2\alpha = 2 \sin \alpha \cos \alpha$$

$$\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta, \quad \cos 2\alpha = \cos^2 \alpha - \sin^2 \alpha$$

$$\cos 2\alpha = 2 \cos^2 \alpha - 1 = 1 - 2 \sin^2 \alpha, \quad 1 - \cos 2\alpha = 2 \sin^2 \alpha, \quad 1 + \cos 2\alpha = 2 \cos^2 \alpha$$

$$(\sin \alpha \pm \cos \alpha)^2 = 1 \pm \sin 2\alpha, \quad \tan \alpha + \cot \alpha = \frac{2}{\sin 2\alpha}, \quad \cot \alpha - \tan \alpha = 2 \cot 2\alpha$$

$$\sin(\alpha + \beta) \sin(\alpha - \beta) = \sin^2 \alpha - \sin^2 \beta, \quad \sin 2\alpha = \frac{2 \tan \alpha}{1 + \tan^2 \alpha}$$

$$\cos(\alpha + \beta) \cos(\alpha - \beta) = \cos^2 \alpha - \sin^2 \beta, \quad \cos 2\alpha = \frac{1 - \tan^2 \alpha}{1 + \tan^2 \alpha}$$

$$\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}, \quad \tan 2\alpha = \frac{2 \tan \alpha}{1 - \tan^2 \alpha}$$

$$\cot(\alpha \pm \beta) = \frac{\cot \alpha \cot \beta \mp 1}{\cot \alpha \pm \cot \beta}, \quad \cot 2\alpha = \frac{\cot^2 \alpha - 1}{2 \cot \alpha}$$

$$\tan(\alpha + \beta) + \tan(\alpha - \beta) = \frac{\sin 2\alpha}{\cos^2 \alpha - \sin^2 \beta}$$

$$\sqrt{r} \sin\left(\alpha \pm \frac{\pi}{f}\right) = \sin \alpha \pm \cos \alpha \quad , \quad \sqrt{r} \cos\left(\alpha \pm \frac{\pi}{f}\right) = \cos \alpha \mp \sin \alpha \quad , \quad \tan\left(\frac{\pi}{f} + \alpha\right) = \frac{1 + \tan \alpha}{1 - \tan \alpha}$$

$$\sin^f \alpha + \cos^f \alpha = 1 - r \sin^r \alpha \cos^r \alpha = 1 - \frac{1}{f} \sin^r r \alpha$$

$$\sin^f \alpha + \cos^f \alpha = 1 - r \sin^r \alpha \cos^r \alpha = 1 - \frac{r}{f} \sin^r r \alpha$$

$$\sin r \alpha = r \sin \alpha - r \sin^r \alpha \quad , \quad \cos r \alpha = r \cos^r \alpha - r \cos \alpha$$

$$\tan r \alpha = \frac{r \tan \alpha - \tan^r \alpha}{1 - r \tan^r \alpha} \quad , \quad \cot r \alpha = \frac{r \cot \alpha - \cot^r \alpha}{1 - r \cot^r \alpha}$$

$$f \sin \alpha \sin\left(\frac{\pi}{f} - \alpha\right) \sin\left(\frac{\pi}{f} + \alpha\right) = \sin r \alpha$$

$$f \cos \alpha \cos\left(\frac{\pi}{f} - \alpha\right) \cos\left(\frac{\pi}{f} + \alpha\right) = \cos r \alpha$$

$$\tan \alpha \tan\left(\frac{\pi}{f} - \alpha\right) \tan\left(\frac{\pi}{f} + \alpha\right) = \tan r \alpha$$

$$\cot \alpha \cot\left(\frac{\pi}{f} - \alpha\right) \cot\left(\frac{\pi}{f} + \alpha\right) = \cot r \alpha$$

$$\alpha + \beta + \gamma = k\pi + \frac{\pi}{f} \Rightarrow \tan \alpha \tan \beta + \tan \alpha \tan \gamma + \tan \beta \tan \gamma = 1$$

$$\alpha + \beta + \gamma = k\pi \Rightarrow \tan(\alpha + \beta + \gamma) = 0 \Rightarrow \tan \alpha + \tan \beta + \tan \gamma = \tan \alpha \tan \beta \tan \gamma$$

انتگرال

$$\int 1 dx = \int dx = x + C$$

$$\int (1 + \tan^2 x) dx = \int \frac{1}{\cos^2 x} dx = \tan x + C$$

$$\int \frac{1}{x^r} dx = \frac{-1}{x} + C$$

$$\int (1 + \cot^2 x) dx = \int \frac{1}{\sin^2 x} dx = -\cot x + C$$

$$\int x^r dx = \frac{x^{r+1}}{r+1} + C \quad (r \in \mathbb{Q}, r \neq -1)$$

$$\int u^n u' dx = \int u^n du = \frac{u^{n+1}}{n+1} + C$$

$$\int \frac{1}{\sqrt{x}} dx = 2\sqrt{x} + C$$

$$\int u' \sin u dx = \int \sin u du = -\cos u + C$$

$$\int e^x dx = e^x + C$$

$$\int u' \cos u dx = \int \cos u du = \sin u + C$$

$$\int \frac{1}{x} dx = \ln|x| + C = \ln|C'x|$$

$$\int \frac{u'}{u} dx = \ln|u| + C$$

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

$$\int u' e^u dx = e^u + C$$

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

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$$\int \tan x dx = -\ln|\cos x| + C$$

$$\int \sqrt{x} dx = \frac{2}{3} x\sqrt{x} + C$$

$$\int \cot x dx = \ln|\sin x| + C$$

اتحادها

$$(a+b)^r = a^r + r ab + b^r \quad , \quad (a-b)^r = a^r - r ab + b^r$$

$$(a+b)^r + (a-b)^r = r a^r + r b^r \quad , \quad (a+b)^r - (a-b)^r = r ab$$

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

$$(a-b)^r = a^r - r a^r b + r ab^r - b^r \quad , \quad (a+b)^r = a^r + r a^r b + r ab^r + b^r$$

$$(x+a)(x+b) = x^r + (a+b)x + ab$$

$$a^r - b^r = (a-b)(a^r + ab + b^r) \quad , \quad a^r + b^r = (a+b)(a^r - ab + b^r)$$

$$(a+b+c)^r = a^r + b^r + c^r + r ab + r ac + r bc$$

$$a^r + b^r + c^r - r abc = (a+b+c)(a^r + b^r + c^r - ab - ac - bc) = \frac{1}{r} (a+b+c)[(a-b)^r + (a-c)^r + (b-c)^r]$$