לוח נגזרות

$(x^n)' = nx^{n-1}$ $\quad (c)' = 0$ $\quad (x)' = 1$

$$\left(\frac{1}{x}\right)' = -\frac{1}{x^2}$$

$$\sqrt{x} = \frac{1}{2\sqrt{x}}$$

$(a^x)' = a^x \ln a$ $\quad (e^x)' = e^x$

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

$(\sin x)' = \cos x$ $\quad (\tan x)' = \frac{1}{\cos^2 x}$

$(\cos x)' = -\sin x$ $\quad (\cot anx)' = -\frac{1}{\sin^2 x}$

$(\arcsin x)' = \frac{1}{\sqrt{1-x^2}}$ $\quad (\arctan x)' = \frac{1}{1+x^2}$

$(\arccos x)' = -\frac{1}{\sqrt{1-x^2}}$ $\quad (\arctan x)' = -\frac{1}{1+x^2}$

1. $(u + v)' = u' + v'$
2. $(u - v)' = u' - v'$
3. $(u \cdot v)' = u'v + uv'$
4. $\left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}$

טבלת אינטגרלים

$$\int x^n dx = \frac{x^{n+1}}{n+1} + c \qquad (n \neq -1)$$

$$\int \frac{dx}{x} = \ln|x| + c$$

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

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

$$\int \frac{dx}{\cos^2 x} = \tan x + c$$

$$\int \frac{dx}{\sin^2 x} = -\cot anx + c$$

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

$$\int \cot anx dx = \ln|\sin x| + c$$

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

$$\int a^x dx = \frac{a^x}{\ln a} + c$$

$$\int \frac{dx}{1+x^2} = \arctan x + c$$

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a}\arctan \frac{x}{a} + c$$

$$\int \frac{dx}{a^2 - x^2} = \frac{1}{2a}\ln\left|\frac{a+x}{a-x}\right| + c$$

$$\int \frac{dx}{\sqrt{1-x^2}} = \arcsin x + c$$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \arcsin \frac{x}{a} + c$$

$$\int \frac{dx}{\sqrt{x^2 \pm a^2}} = \ln\left|x + \sqrt{x^2 \pm a^2}\right| + c$$

1. הצבה טריגונומטרית אוניברסלית

$$Tan\left[\frac{x}{2}\right]=t \quad \Rightarrow \quad x=2Arc\tan[t] \quad \Rightarrow \quad dx=\frac{2dt}{1+t^2}$$

$$Cos[x]=\frac{1-t^2}{1+t^2} \qquad Sin[x]=\frac{2t}{1+t^2}$$

2. אינטגרלים

$$\int e^{ax}Sin[bx]dx=e^{ax}\frac{-bCos[bx]+aSin[bx]}{a^2+b^2}+c$$

$$\int e^{ax}Cos[bx]dx=e^{ax}\frac{aCos[bx]+bSin[bx]}{a^2+b^2}+c$$

טריגונומטריה

זהויות

הזהויות היסודיות

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

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

סכום והפרש זויות

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

$$\tan(\alpha+\beta)=\frac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta} \qquad \tan(\alpha-\beta)=\frac{\tan\alpha-\tan\beta}{1+\tan\alpha\tan\beta}$$

זוית כפולה וחצי זוית

$$\sin2\alpha=2\sin\alpha\cos\alpha$$

$$\cos2\alpha=\cos^2\alpha-\sin^2\alpha$$

$$\tan2\alpha=\frac{2\tan\alpha}{1-\tan^2\alpha} \qquad \cot2\alpha=\frac{\cot^2\alpha-1}{2\cot\alpha}$$

$$\sin^2\alpha=\frac{1-\cos2\alpha}{2} \qquad \cos^2\alpha=\frac{1+\cos2\alpha}{2}$$

$$\sin\frac{\alpha}{2}=\pm\sqrt{\frac{1-\cos\alpha}{2}} \qquad \cos\frac{\alpha}{2}=\pm\sqrt{\frac{1+\cos\alpha}{2}}$$

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

סכום והפרש פונקציות

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

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

מכפלת פונקציות

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

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

N4

TABLE 6.1 Elementary Laplace Transforms

$f(t) = \mathscr{L}^{-1}\{F(s)\}$	$F(s) = \mathscr{L}\{f(t)\}$
1	$\dfrac{1}{s}, \quad s > 0$
e^{at}	$\dfrac{1}{s-a}, \quad s > a$
$\sin at$	$\dfrac{a}{s^2+a^2}, \quad s > 0$
t^n, $n =$ positive integer	$\dfrac{n!}{s^{n+1}}, \quad s > 0$
t^p, $p > -1$	$\dfrac{\Gamma(p+1)}{s^{p+1}}, \quad s > 0$
$\cos at$	$\dfrac{s}{s^2+a^2}, \quad s > 0$
$\sinh at$	$\dfrac{a}{s^2-a^2}, \quad s > \lvert a\rvert$
$\cosh at$	$\dfrac{s}{s^2-a^2}, \quad s > \lvert a\rvert$
$e^{at}\sin bt$	$\dfrac{b}{(s-a)^2+b^2}, \quad s > a$
$e^{at}\cos bt$	$\dfrac{s-a}{(s-a)^2+b^2}, \quad s > a$
$t^n e^{at}$, $n =$ positive integer	$\dfrac{n!}{(s-a)^{n+1}}, \quad s > a$
$u_c(t)$	$\dfrac{e^{-cs}}{s}, \quad s > 0$
$u_c(t)f(t-c)$	$e^{-cs}F(s)$
$e^{ct}f(t)$	$F(s-c)$
$f(ct)$	$\dfrac{1}{c}F\left(\dfrac{s}{c}\right), \quad c > 0$
$\displaystyle\int_0^t f(t-\tau)g(\tau)\,d\tau$	$F(s)G(s)$
$\delta(t-c)$	e^{-cs}
$f^{(n)}(t)$	$s^nF(s) - s^{n-1}f(0) - \cdots - f^{(n-1)}(0)$
$(-t)^n f(t)$	$F^{(n)}(s)$