table of laplace transforms

$f(t)\quad t \ge 0$	$\mathcal{L}(s)$		$f(t)\quad t \ge 0$		$\mathcal{L}(s)$	
1	$\frac{1}{s}$	$s>0$	e^{at}		$\frac{1}{s-a}$	$s>a$
t	$\frac{1}{s^2}$	$s>0$	te^{at}		$\frac{1}{(s-a)^2}$	$s>a$
$t^n \quad n=1,2,\dots$	$\frac{n!}{s^{n+1}}$	$s>0$	$t^n e^{at}$		$\frac{n!}{(s-a)^{n+1}}$	$s>a$
$t^a \quad a>-1$	$\frac{\Gamma(a+1)}{s^{a+1}}$	$s>0$	$(1-at)e^{-at}$		$\frac{s}{(s+a)^2}$	
$\sin at$	$\frac{a}{s^2+a^2}$	$s>0$	$u(t-a)=\begin{cases}0 & t<a\\ 1 & t\ge a\end{cases}$	$a>0$	$\frac{e^{-as}}{s}$	$s>0$
$\cos at$	$\frac{s}{s^2+a^2}$	$s>0$	$\delta(t)$		1	
			$\delta(t-a)$	$a \ge 0$	e^{-as}	$s>0$
$t\sin at$	$\frac{2as}{(s^2+a^2)^2}$	$s>0$	$J_0(at)$		$\frac{1}{\sqrt{s^2+a^2}}$	$s>0$
$t\cos at$	$\frac{s^2-a^2}{(s^2+a^2)^2}$	$s>0$	$J_0(a\sqrt{t})$		$\frac{e^{-\frac{a^2}{4s}}}{s}$	$s>0$
$e^{at}\sin bt$	$\frac{b}{(s-a)^2+b^2}$	$s>a$	$J_n(at)$	$n=0,1,2,..$	$\frac{\left(\sqrt{s^2+a^2}-s\right)^n}{a^n\sqrt{s^2+a^2}}$	
$e^{at}\cos bt$	$\frac{s-a}{(s-a)^2+b^2}$	$s>a$	$t^p J_p(at)$	$p>-\frac{1}{2}$	$\frac{2^p a^p \Gamma\left(p+\frac{1}{2}\right)}{\sqrt{\pi}\left(s^2+a^2\right)^{p+\frac{1}{2}}}$	$s>0$
$\sinh at$	$\frac{a}{s^2-a^2}$	$s>\lvert a\rvert$	$\frac{\sqrt{\pi}}{\Gamma(k)}\left(\frac{t}{2a}\right)^{k-\frac{1}{2}}J_{k-\frac{1}{2}}(at)$	$k>0$	$\frac{1}{(s^2+a^2)^k}$	$s>0$
$\cosh at$	$\frac{s}{s^2-a^2}$	$s>\lvert a\rvert$	$\frac{\sqrt{\pi}}{\Gamma(k)}a\left(\frac{t}{2a}\right)^{k-\frac{1}{2}}J_{k-\frac{3}{2}}(at)$	$k>\frac{1}{2}$	$\frac{s}{(s^2+a^2)^k}$	$s>0$
$t\sinh at$	$\frac{2bs}{(s^2-a^2)^2}$	$s>\lvert a\rvert$	$\operatorname{erf}(at)$	$a>0$	$\frac{1}{s}e^{\frac{s^2}{4a^2}}\operatorname{erfc}\left(\frac{s}{2a}\right)$	$s>0$
$t\cosh at$	$\frac{s^2+b^2}{(s^2-a^2)^2}$	$s>\lvert a\rvert$	$\operatorname{erf}(a\sqrt{t})$	$a\ge 0$	$\frac{a}{s\sqrt{s+a^2}}$	$s>0$
$e^{at}\sinh bt$	$\frac{b}{(s-a)^2-b^2}$	$s>a+\lvert b\rvert$	$\operatorname{erfc}\left(\frac{a}{2\sqrt{t}}\right)$	$a\ge 0$	$\frac{1}{s}e^{-a\sqrt{s}}$	$s>0$
$e^{at}\cosh bt$	$\frac{s-a}{(s-a)^2-b^2}$	$s>a+\lvert b\rvert$	$e^{-a^2t^2}$	$a>0$	$\frac{\sqrt{\pi}}{2a}e^{\frac{s^2}{4a^2}}\operatorname{erfc}\left(\frac{s}{2a}\right)$	$s>0$

maple

For calcualtaion of Laplace transform or inverse Laplace transform the package with integral transforms has to be downloaded:

```
> with(inttrans);
    [fourier,laplace,invlaplace,...]
```

Laplace transform is calculated with the command laplace (f(t),t,s):

f(t) denotes the function to be transformed, t is the independent variable of the function, s is the variable of the transformed function

Example 1:

```
> laplace(t^2,t,s);
```

$$\frac{2}{s^3}$$

Example 2:

```
> f(t):=t^2*sin(5*t);
```

$$f(t) := t^2 \sin(5t)$$

```
> laplace(f(t),t,s);
```

$$\frac{10\left(3s^2-25\right)}{\left(s^2+25\right)^3}$$

Inverse Laplace transform is calculated with the command invlaplace (ϕ(s),s,t):

ϕ(s) denotes the function to be transformed, s is the independent variable of the function, t is the variable of the transformed function

Example 3:

```
> phi(s):=exp(-4*s)/s;
```

$$\phi(s) := \frac{e^{(-4s)}}{s}$$

```
> laplace( φ(s),s,t);
```

$$\mathrm{Heaviside}(t-4)$$

Example 4:

```
> phi(s):=exp(-3*sqrt(s));
```

$$\phi(s) := e^{(-3\sqrt{s})}$$

```
> laplace( φ(s),s,t);
```

$$\frac{3e^{\left(-\frac{9}{4t}\right)}}{2\sqrt{\pi}\,t^{(3/2)}}$$