

### Tabelle von Laplace-Transformationen

Nr.	Originalfunktion $f(t)$	Bildfunktion $L[f(t)] = L(p)$
1	$1, h(t)$	$\frac{1}{p}$
2	$t$	$\frac{1}{p^2}$
3	$t^n, n \in \mathbb{N}$	$\frac{n!}{p^{n+1}}$
4	$e^{\pm at}$	$\frac{1}{p \mp a}$
5	$te^{at}$	$\frac{1}{(p-a)^2}$
6	$t^n e^{at}$	$\frac{n!}{(p-a)^{n+1}}$
7	$\sin at$	$\frac{a}{p^2 + a^2}$
8	$\cos at$	$\frac{p}{p^2 + a^2}$
9	$t \sin at$	$\frac{2ap}{(p^2 + a^2)^2}$
10	$t \cos at$	$\frac{p^2 - a^2}{(p^2 + a^2)^2}$
11	$t^n \sin at, n \in \mathbb{N}$	$\frac{in!}{2} \left( \frac{1}{(p+ia)^{n+1}} - \frac{1}{(p-ia)^{n+1}} \right)$
12	$t^n \cos at, n \in \mathbb{N}$	$\frac{n!}{2} \left( \frac{1}{(p+ia)^{n+1}} + \frac{1}{(p-ia)^{n+1}} \right)$
13	$\sinh at$	$\frac{a}{p^2 - a^2}$
14	$\cosh at$	$\frac{p}{p^2 - a^2}$
15	$t \sinh at$	$\frac{2ap}{(p^2 - a^2)^2}$
16	$t \cosh at$	$\frac{p^2 + a^2}{(p^2 - a^2)^2}$
17	$t^n \sinh at, n \in \mathbb{N}$	$\frac{n!}{2} \left( \frac{1}{(p-a)^{n+1}} - \frac{1}{(p+a)^{n+1}} \right)$

Nr.	Originalfunktion $f(t)$	Bildfunktion $L[f(t)] = L(p)$
18	$t^n \cosh at, \quad n \in \mathbb{N}$	$\frac{n!}{2} \left( \frac{1}{(p-a)^{n+1}} + \frac{1}{(p+a)^{n+1}} \right)$
19	$e^{at} \sin bt$	$\frac{b}{(p-a)^2 + b^2}$
20	$e^{at} \cos bt$	$\frac{p-a}{(p-a)^2 + b^2}$
21	$e^{at} \sinh bt$	$\frac{b}{(p-a)^2 - b^2}$
22	$e^{at} \cosh bt$	$\frac{p-a}{(p-a)^2 - b^2}$
23	$\sin^2 at$	$\frac{2a^2}{p(p^2 + 4a^2)}$
24	$\cos^2 at$	$\frac{p^2 + 2a^2}{p(p^2 + 4a^2)}$
25	$\sinh^2 at$	$\frac{2a^2}{p(p^2 - 4a^2)}$
26	$\cosh^2 at$	$\frac{p^2 - 2a^2}{p(p^2 - 4a^2)}$
27	$\sin(at + b)$	$\frac{p \sin b + a \cos b}{p^2 + a^2}$
28	$\cos(at + b)$	$\frac{p \cos b - a \sin b}{p^2 + a^2}$
29	$\sinh(at + b)$	$\frac{p \sinh b + a \cosh b}{p^2 - a^2}$
30	$\cosh(at + b)$	$\frac{p \cosh b + a \sinh b}{p^2 - a^2}$
31	$\sin at \sin bt$	$\frac{2abp}{(p^2 + (a+b)^2)(p^2 + (a-b)^2)}$
32	$\cos at \cos bt$	$\frac{p(p^2 + a^2 + b^2)}{(p^2 + (a+b)^2)(p^2 + (a-b)^2)}$
33	$\sin at \cos bt$	$\frac{a(p^2 + a^2 - b^2)}{(p^2 + (a+b)^2)(p^2 + (a-b)^2)}$
34	$\frac{1}{a} e^{-t/a}$	$\frac{1}{ap + 1}$
35	$\frac{1}{a} (e^{at} - 1)$	$\frac{1}{p(p-a)}$

Nr.	Originalfunktion $f(t)$	Bildfunktion $L[f(t)] = L(p)$
36	$\frac{1}{a^2}(e^{at} - at - 1)$	$\frac{1}{p^2(p-a)}$
37	$\frac{1}{a^2}[1 + (at - 1)e^{at}]$	$\frac{1}{p(p-a)^2}$
38	$1 - e^{-t/a}$	$\frac{1}{p(ap+1)}$
39	$\frac{1}{ab}\left(1 + \frac{be^{at} - ae^{bt}}{a-b}\right)$	$\frac{1}{p(p-a)(p-b)}$
40	$1 + \frac{ae^{-t/a} - be^{-t/b}}{b-a}$	$\frac{1}{p(ap+1)(bp+1)}$
41	$ae^{-t/a} + t - a$	$\frac{1}{p^2(ap+1)}$
42	$1 - \cos at$	$\frac{a^2}{p(p^2 + a^2)}$
43	$t - \frac{1}{a} \sin at$	$\frac{a^2}{p^2(p^2 + a^2)}$
44	$1 - \cos at - \frac{at}{2} \sin at$	$\frac{a^4}{p(p^2 + a^2)^2}$
45	$\frac{1}{a^2}te^{-t/a}$	$\frac{1}{(1+ap)^2}$
46	$\frac{1}{2a^3}t^2e^{-t/a}$	$\frac{1}{(ap+1)^3}$
47	$1 - \frac{a+t}{a}e^{-t/a}$	$\frac{1}{p(ap+1)^2}$
48	$\frac{e^{at} - e^{bt}}{a-b}$	$\frac{1}{(p-a)(p-b)}$
49	$\frac{e^{-t/a} - e^{-t/b}}{a-b}$	$\frac{1}{(ap+1)(bp+1)}$
50	$\frac{e^{-(\alpha/2)t}}{\gamma_1} \sinh \gamma_1 t$ mit $\gamma_1 = \sqrt{\frac{\alpha^2}{4} - \beta}$	$\frac{1}{p^2 + \alpha p + \beta}$ mit $\frac{\alpha^2}{4} - \beta > 0$
51	$\frac{e^{-(\alpha/2)t}}{\gamma_2} \sin \gamma_2 t$ mit $\gamma_2 = \sqrt{\beta - \frac{\alpha^2}{4}}$	$\frac{1}{p^2 + \alpha p + \beta}$ mit $\frac{\alpha^2}{4} - \beta < 0$

Nr.	Originalfunktion $f(t)$	Bildfunktion $L[f(t)] = L(p)$
52	$b \cos at + \frac{c}{a} \sin at$	$\frac{bp + c}{p^2 + a^2}$
53	$-\frac{c}{a} + \left(b + \frac{c}{a}\right)e^{at}$	$\frac{bp + c}{p(p - a)}$
54	$(1 + at)e^{at}$	$\frac{p}{(p - a)^2}$
55	$\left(t + \frac{1}{2}at^2\right)e^{at}$	$\frac{p}{(p - a)^3}$
56	$[b + (ab + c)t]e^{at}$	$\frac{bp + c}{(p - a)^2}$
57	$\frac{ae^{at} - be^{bt}}{a - b}$	$\frac{p}{(p - a)(p - b)}$
58	$\frac{e^{-(\alpha/2)t}}{\gamma_1} \left[ \left(-\frac{\alpha}{2}\right) \sinh \gamma_1 t + \gamma_1 \cosh \gamma_1 t \right]$ mit $\gamma_1 = \sqrt{\frac{\alpha^2}{4} - \beta}$	$\frac{p}{p^2 + \alpha p + \beta}$ mit $\frac{\alpha^2}{4} - \beta > 0$
59	$\frac{e^{-(\alpha/2)t}}{\gamma_2} \left[ \left(-\frac{\alpha}{2}\right) \sin \gamma_2 t + \gamma_2 \cos \gamma_2 t \right]$ mit $\gamma_2 = \sqrt{\beta - \frac{\alpha^2}{4}}$	$\frac{p}{p^2 + \alpha p + \beta}$ mit $\frac{\alpha^2}{4} - \beta < 0$
60	$\frac{(b - c)e^{at} + (c - a)e^{bt} + (a - b)e^{ct}}{(a - b)(a - c)(b - c)}$	$\frac{1}{(p - a)(p - b)(p - c)}$
61	$\frac{a(b - c)e^{-t/a} + b(c - a)e^{-t/b} + c(a - b)e^{-t/c}}{(a - b)(a - c)(b - c)}$	$\frac{1}{(ap + 1)(bp + 1)(cp + 1)}$
62	$\frac{1}{\beta} \left[ 1 - \frac{e^{-(\alpha/2)t}}{\gamma_1} \left( \frac{\alpha}{2} \sinh \gamma_1 t + \gamma_1 \cosh \gamma_1 t \right) \right]$ mit $\gamma_1 = \sqrt{\frac{\alpha^2}{4} - \beta}$	$\frac{1}{p(p^2 + \alpha p + \beta)}$ mit $\frac{\alpha^2}{4} - \beta > 0$
63	$\frac{1}{\beta} \left[ 1 - \frac{e^{-(\alpha/2)t}}{\gamma_2} \left( \frac{\alpha}{2} \sin \gamma_2 t + \gamma_2 \cos \gamma_2 t \right) \right]$ mit $\gamma_2 = \sqrt{\beta - \frac{\alpha^2}{4}}$	$\frac{1}{p(p^2 + \alpha p + \beta)}$ mit $\frac{\alpha^2}{4} - \beta < 0$
64	$\frac{a(b - c)e^{at} + b(c - a)e^{bt} + c(a - b)e^{ct}}{(a - b)(a - c)(b - c)}$	$\frac{p}{(p - a)(p - b)(p - c)}$
65	$\frac{(c - b)e^{-t/a} + (a - c)e^{-t/b} + (b - a)e^{-t/c}}{(a - b)(a - c)(b - c)}$	$\frac{p}{(ap + 1)(bp + 1)(cp + 1)}$

Nr.	Originalfunktion $f(t)$	Bildfunktion $L[f(t)] = L(p)$
66	$\left(1 + 2at + \frac{a^2 t^2}{2}\right) e^{at}$	$\frac{p^2}{(p-a)^3}$
67	$1 + 4ate^{at}$	$\frac{(p+a)^2}{p(p-a)^2}$
68	$1 + 2 \sin at$	$\frac{(p+a)^2}{p(p^2+a^2)}$
69	$\frac{1}{2}(\sin at + at \cos at)$	$\frac{ap^2}{(p^2+a^2)^2}$
70	$\cos at + \frac{at}{2} \sin at$	$\frac{p^3}{(p^2+a^2)^2}$
71	$\frac{1}{a^2+b^2} \left( e^{-at} - \cos bt + \frac{a}{b} \sin bt \right)$	$\frac{1}{(p+a)(p^2+b^2)}$
72	$\frac{a}{a^2+b^2} \left( -e^{-at} + \cos bt + \frac{b}{a} \sin bt \right)$	$\frac{p}{(p+a)(p^2+b^2)}$
73	$\frac{\cos bt - \cos at}{a^2-b^2}$	$\frac{p}{(p^2+a^2)(p^2+b^2)}$
74	$\frac{a \sin bt - b \sin at}{(a^2-b^2)}$	$\frac{ab}{(p^2+a^2)(p^2+b^2)}$
75	$\frac{a \sin at - b \sin bt}{a^2-b^2}$	$\frac{p^2}{(p^2+a^2)(p^2+b^2)}$
76	$\frac{a \cos bt - b \cos at}{a^2-b^2}$	$\frac{p(p^2+a^2+b^2+ab)}{(p^2+a^2)(p^2+b^2)(a+b)}$
77	$\frac{a \cos at - b \cos bt}{a^2-b^2}$	$\frac{p(p^2-ab)}{(p^2+a^2)(p^2+b^2)(a+b)}$
78	$\sqrt{t}$	$\frac{\sqrt{\pi}}{2} \frac{1}{p\sqrt{p}}$
79	$\frac{1}{\sqrt{t}}$	$\sqrt{\frac{\pi}{p}}$
80	$\frac{t^n}{\sqrt{t}}, \quad n \in \mathbb{N}$	$\frac{(2n)!\sqrt{\pi}}{n!4^n} \frac{1}{p^n\sqrt{p}}$
81	$\sqrt{t} e^{at}$	$\frac{\sqrt{\pi}}{2(p-a)\sqrt{p-a}}$
82	$\frac{1}{\sqrt{t}} e^{at}$	$\frac{\sqrt{\pi}}{\sqrt{p-a}}$
83	$\frac{t^n}{\sqrt{t}} e^{at}, \quad n \in \mathbb{N}$	$\frac{(2n)!\sqrt{\pi}}{n!4^n} \frac{1}{(p-a)^n\sqrt{p-a}}$

Nr.	Originalfunktion $f(t)$	Bildfunktion $L[f(t)] = L(p)$
84	$\frac{e^{bt} - e^{at}}{t}$	$\ln \frac{p-a}{p-b}$
85	$\frac{1 - e^{at}}{t}$	$\ln \frac{p-a}{p}$
86	$\frac{1 - \cos at}{t}$	$\frac{1}{2} \ln \frac{p^2 + a^2}{p^2}$
87	$\frac{\sin at \sin bt}{t}$	$\frac{1}{4} \ln \frac{p^2 + (a+b)^2}{p^2 - (a-b)^2}$
88	$\frac{\cos at - \cos bt}{t}$	$\frac{1}{2} \ln \frac{p^2 + b^2}{p^2 + a^2}$
89	$\frac{\sinh at}{t}$	$\frac{1}{2} \ln \frac{p+a}{p-a}$
90	$\frac{\sin at}{t}$	$\arctan \frac{a}{p}$
91	$\frac{1}{\sqrt{t}} \sin \frac{a}{2t}$	$\sqrt{\frac{\pi}{p}} e^{-\sqrt{ap}} \sin \sqrt{ap}$
92	$\frac{1}{\sqrt{t}} \cos \frac{a}{2t}$	$\sqrt{\frac{\pi}{p}} e^{-\sqrt{ap}} \cos \sqrt{ap}$