$$\varphi(p) = \int_0^\infty e^{-pt} f(t)\, dt$$

$$\mathcal{L}\{f(t)\} = \varphi(p)$$

$$\left.\begin{array}{l} \mathcal{L}(f+g) = \mathcal{L}(f) + \mathcal{L}(g) \\ \cancel{cf}\ \mathcal{L}(cf) = c\mathcal{L}f \end{array}\right\}$$ Linear

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$$\mathcal{L} f'(t) = \int_0^\infty e^{-pt} f'(t)\, dt =$$

$$= e^{-pt} f(t) \Big|_0^\infty + p \int_0^\infty e^{-pt} f(t)\, dt =$$

$$= -f(0) + p\,\mathcal{L} f(t)$$

$$\mathcal{L} f''(t) = p^2 \mathcal{L}(f_t) - p f_0 - f'(0)$$

$$\int_0^t f(t)\, dt = F(t)$$

$$\mathcal{L} f(t) = p\,\mathcal{L} F(t) = p\,\mathcal{L} \int_0^t f(t)\, dt$$

$$\mathcal{L} \int_0^t f(t)\, dt = \frac{1}{p} \mathcal{L} f(t)$$