Ableitungen:

$$f(t) \circ\!\!-\!\!\bullet F(s)$$

$$f'(t) \circ\!\!-\!\!\bullet \int_{-\infty}^{+\infty} \underbrace{f'(t)}_{u'} \underbrace{e^{-st}}_{v} dt$$

$$= \underbrace{\underbrace{f(t)}_{u} \underbrace{e^{-st}}_{v} \Big|_{-\infty}^{+\infty}}_{\overset{!}{=} 0} - \int_{-\infty}^{+\infty} \underbrace{f(t)}_{u} \underbrace{e^{-st} \cdot (-s)}_{v'}$$

$$= s \underbrace{\int_{-\infty}^{+\infty} f(t) e^{-st} dt}_{F(s)}$$

$$\boxed{\begin{array}{l} f'(t) \circ\!\!-\!\!\bullet s \cdot F(s) \\ \text{analog} \quad f''(t) \circ\!\!-\!\!\bullet s^2 F(s) \\ \qquad f^{(n)}(t) \circ\!\!-\!\!\bullet s^n F(s) \end{array}}$$

$$\boxed{f'(t) \cdot u(t)} \circ\!\!-\!\!\bullet \underbrace{\int_{-\infty}^{+\infty} f'(t) u(t) e^{-st} dt}_{\text{zweiseitige LT vom } f'(t) \cdot u(t)} = \underbrace{\int_{0}^{+\infty} \underbrace{f'(t)}_{u'} \underbrace{e^{-st}}_{v} dt}_{\text{einseitige LT vom } f'(t)}$$

$$= f(t) e^{-st} \Big|_{0}^{+\infty} - \int_0^{\infty} f(t) e^{-st} (-s)\, dt$$

$$= \underbrace{\lim_{R \to +\infty} f(R) e^{-sR}}_{\overset{!}{=} 0 \;\leadsto\; \text{ROC}} - f(0) \underbrace{e^{-0}}_{1} + s \underbrace{\int_0^{\infty} f(t) e^{-st} dt}_{F(s)}$$

$$\boxed{= s F(s) - f(0)}$$

$$\boxed{f''(t) \cdot u(t)} \circ\!\!-\!\!\bullet \int_0^{\infty} \underbrace{f''(t)}_{u'} \underbrace{e^{-st}}_{v} dt = \underbrace{f'(t)}_{u} \underbrace{e^{-st}}_{v} \Big|_0^{\infty} - \int_0^{\infty} \underbrace{f'(t)}_{u} \underbrace{e^{-st} (-s)}_{v'} dt$$

$$= \underbrace{\lim_{R \to \infty} f'(R) e^{-sR}}_{\overset{!}{=} 0 \;\leadsto\; \text{ROC}} - f'(0) e^{-0} + s \underbrace{\int_0^{\infty} f'(t) e^{-st} dt}_{\text{LT von } f'(t) \cdot u(t)}$$