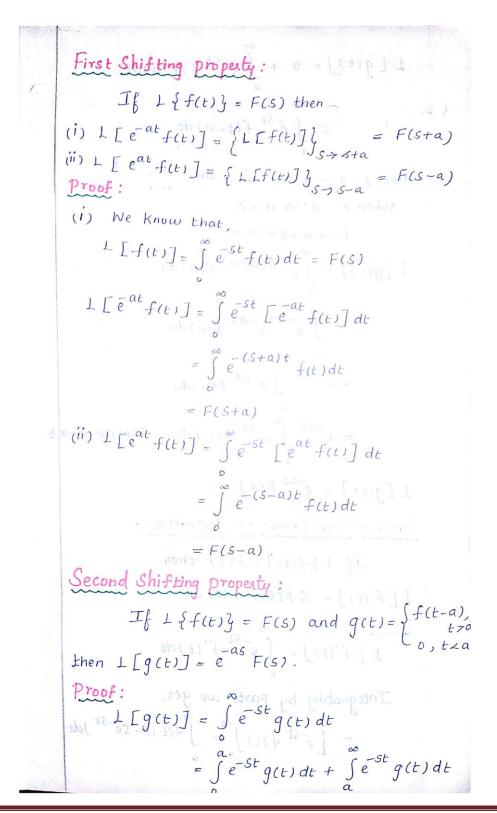




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$$L[g(t)] = 0 + \int_{a}^{\infty} e^{-st} f(t-a)dt$$

$$= \int_{a}^{e-st} f(t-a)dt$$

$$= \int_{a}^{e-st} f(t-a)dt$$

$$= \int_{a}^{e-st} e^{-st} f(t-a)dt$$

$$= \int_{a}^{e-st} e^{-st} f(u)du$$

$$= \int_{a}^{e-st} e^{-st} f(u)du$$

$$= \int_{a}^{e-st} e^{-as} f(u)du$$

$$= \int_{a}^{e-st} e^{-as} f(u)du$$

$$= \int_{a}^{e-st} e^{-st} f(t)dt \text{ Replace } u \to t$$

$$L[g(t)] = \int_{a}^{e-st} f(t) dt \text{ Replace } u \to t$$

$$L[f(t)] = \int_{a}^{e-st} f(t) dt \text{ Replace } u \to t$$

$$L[f'(t)] = \int_{a}^{e-st} f'(t) dt$$

$$L[f'(t)] = \int_{a}^{e-st} f'(t) dt$$

$$L[f'(t)] = \int_{a}^{e-st} e^{-st} f'(t) dt$$





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Let
$$f''(t) = s^2 f(s) - f'(s) + s \int_0^{\infty} e^{-st} f(t) dt$$

$$= s f(s) - f(s) .$$

Let $f''(t) = s^2 f(s) - s f(s) - f'(s)$

Let $L [g'(t)] = s f(s) - g(s) .$

We know that,

$$L [f'(t)] = s L [f(t)] - f(s) .$$

Replace $f(t) \rightarrow f'(t) & f'(t) \rightarrow f''(t) & f''(t) \rightarrow$





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$$\Rightarrow L \left[\int_{S}^{L} f(t) dt \right] = \int_{S}^{L} L \left[f(t) \right]$$

$$\Rightarrow L \left[\int_{S}^{L} f(t) dt \right] = \frac{F(s)}{s}$$

Desivative of Laplace Transform (or) Laplace

transform of $L f(t)$:

$$L \left[L \left[f(t) \right] \right] = F(s) \text{ then }$$

$$L \left[L \left[f(t) \right] \right] = -\frac{d}{ds} F(s)$$

Proof:

We know that,
$$L \left[f(t) \right] = F(s) = \int_{S}^{L} e^{-st} f(t) dt$$

$$\frac{d}{ds} F(s) = \frac{d}{ds} \int_{S}^{L} e^{-st} f(t) dt$$

$$= \int_{S}^{L} \int_{S}^{L} (e^{-st}) f(t) dt$$

$$= \int_{S}^{L} \int_{S}^{L} e^{-st} f(t) dt$$

$$= -L \left[L \int_{S}^{L} f(t) \right] = -L \left[L \int_{S}^{L} f(t) \right]$$

In general,
$$L \left[L \int_{S}^{L} f(t) \right] = (-1)^{n} \frac{d}{ds}^{n} \left[F(s) \right]$$





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