

Example 7.15 (Time-domain differentiation property). Find the Laplace transform X of the function

$$x(t) = \frac{d}{dt} \delta(t).$$

LT table



Solution. From Table 7.2, we have that

$$\delta(t) \xleftrightarrow{\text{LT}} 1 \text{ for all } s.$$

Using the time-domain differentiation property, we can deduce

differentiate ↓

$$x(t) = \frac{d}{dt} \delta(t) \xleftrightarrow{\text{LT}} X(s) = s(1) \text{ for all } s.$$

multiply by s

ROC contains original ROC

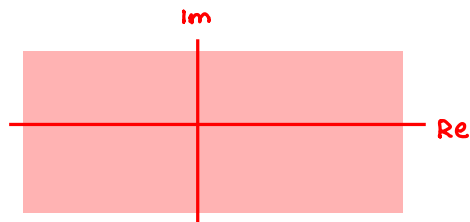
s

Therefore, we have

$$X(s) = s \text{ for all } s.$$



obviously, ROC cannot be larger



Sanity check:

are the stated algebraic expression and stated ROC self consistent?

yes, since no poles, ROC fills entire plane