

Homework Assignment 5

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Problem 3.23. Show that:

a. $\mathcal{L} \{t \cos ate^{-bt}\} = \frac{(s+b)^2 - a^2}{[(s+b)^2 + a^2]^2}.$

Solution. a. Let $f(t) = t \cos at$ and suppose that $\bar{f}(s) = \mathcal{L} \{f(t)\}.$

As shown previously, we know that

$$\bar{f}(s) = \mathcal{L} \{f(t)\} = \mathcal{L} \{t \cos at\} = \frac{s^2 - a^2}{(s^2 + a^2)^2}.$$

Therefore, by Heaviside's First Shifting Theorem,

$$\mathcal{L} \{t \cos ate^{-bt}\} = \mathcal{L} \{f(t)e^{-bt}\} = \bar{f}(s+b) = \frac{(s+b)^2 - a^2}{[(s+b)^2 + a^2]^2},$$

and we are done.

□

Problem 3.24.*Solution.*

Problem 3.27.*Solution.*

Problem 3.28.*Solution.*

Problem 3.29.*Solution.*

Problem 3.32.*Solution.*

Problem 3.34.*Solution.*

Problem 4.1.*Solution.*