

# Homework 9: Basic Laplace Transforms

## Introduction

The problems for this week focus on basic Laplace Transforms. You should do these by hand and not in Maple. Tables 15.1 and 15.2 are exceedingly helpful. Also, in addition to the MOAT:

$$x(t) = e^{-at} (A \cos(\omega t) + B \sin(\omega t))$$

$$X(s) = \frac{A(s+a) + B(\omega)}{(s+a)^2 + \omega^2}$$

there is a hyperbolic trig version I call the “MOATH”:

$$x(t) = e^{-at} (A \cosh(kt) + B \sinh(kt))$$

$$x(t) = e^{-at} \left( A \frac{e^{kt} + e^{-kt}}{2} + B \frac{e^{kt} - e^{-kt}}{2} \right)$$

$$x(t) = \frac{A}{2} (e^{-(a-k)t} + e^{-(a+k)t}) + \frac{B}{2} (e^{-(a-k)t} - e^{-(a+k)t})$$

$$X(s) = \frac{A}{2} \left( \frac{1}{s+a-k} + \frac{1}{s+a+k} \right) + \frac{B}{2} \left( \frac{1}{s+a-k} - \frac{1}{s+a+k} \right)$$

$$X(s) = \frac{A}{2} \frac{s+a+k+s+a-k}{((s+a)-k)((s+a)+k)} + \frac{B}{2} \frac{s+a+k-s-a+k}{((s+a)-k)((s+a)+k)}$$

$$X(s) = \frac{A(s+a) + B(k)}{(s+a)^2 - k^2}$$

## Problems

### Connect

- (1) A&S 15.2
- (2) A&S 15.3
- (3) A&S 15.7
- (4) A&S 15.9
- (5) A&S 15.14
- (6) A&S 15.15
- (7) A&S 15.18
- (8) A&S 15.27
- (9) A&S 15.29
- (10) A&S 15.34
- (11) A&S 15.35

### Sakai

None for this assignment.