Department of Mathematics, Bennett University

EMAT102L, Tutorial Sheet 10

Laplace Transforms

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1. Find the Laplace transform of the following functions.
   (a) $t^2 + at + b$ (b) $3\sin 5t - 2\cos 3t$ (c) te^{5t} (d) $t^2 e^{-at}\sin bt$
   (e) $te^{2t}\sin 4t$ (f) $\cos(\omega t + \theta)$ (g) $t^n e^{at}$

2. Find a function $f(t)$ such that $F(s) = \dfrac{4}{(s-1)^3}$.

3. Find the inverse Laplace transform of the following functions.
   (a) $\dfrac{1}{s(s+1)}$ (b) $\dfrac{s-5}{s^2 - 10s + 61}$ (c) $\dfrac{(s+1)(s+3)}{s(s+2)(s+8)}$

4. Solve the following initial value problems using Laplace transforms.
   (a) $y' + 4y = e^t, \quad y(0) = 2.$
   (b) $y'' - 2y' - 3y = 10\sinh 2t, \quad y(0) = 0, \quad y'(0) = 4.$

5. Solve the following system of differential equations using Laplace transforms.
   (a) $y_1' + y_2 = 2\cos x, \quad y_1 + y_2' = 0, \;\; y_1(0) = 0, \quad y_2(0) = 1.$
   (b) $x' - 6x + 3y = 8e^t, \;\; y' - 2x - y = 4e^t, \;\; x(0) = -1, \;\; y(0) = 0.$