Carleton University

Dept. of Systems and Computer Engineering

Systems and Simulations—SYSC 3600

Homework #1

Dr. Ramy Gohary

- 1. Find the Laplace transform of $e^{-\alpha t} \sin(\omega_0 t + \theta)$ and $e^{-\alpha t} \cos(\omega_0 t + \theta)$. What is the abscissa of convergence in each case?
- 2. Show that $\mathcal{L}{tf(t)} = -\frac{d}{ds}F(s)$. Repeat for $\mathcal{L}{t^2f(t)}$.
- 3. Given

$$F(s) = \frac{5(s+4)}{s(s+1)(s+2)}$$

- (a) Determine $f(\infty)$ without finding the inverse transform.
- (b) What is f(0)?
- 4. It is known that $\mathcal{L}\{e^{-t^2/2}\} = \sqrt{2\pi}e^{s^2/2}Q(-s)$, where $Q(\cdot)$ is the standard Q-function defined as $Q(x) = \frac{1}{\sqrt{2\pi}} \int_x^\infty e^{-r^2/2} dr$.
 - (a) What is the abscissa of convergence in this case?
 - (b) Use the time-differentiation property to find the Laplace transform of $te^{-t^2/2}$. What is the abscissa of convergence in this case?

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