

Math 3280 Worksheet 40: Solving systems of linear ODEs with Laplace transforms

Group members (2 to 4): _____

(1) Use the Laplace transform method to solve the initial value problem

$$\begin{aligned}x' &= x + 2y, \\y' &= x + e^t, \\x(0) &= 0, \quad y(0) = 0.\end{aligned}$$

Function $f(t)$	Transform $\mathcal{L}(f(t)) = F(s)$
1	$\frac{1}{s}$
t	$\frac{1}{s^2}$
t^n (n is a non-negative integer)	$\frac{n!}{s^{n+1}}$
t^a ($a > -1$)	$\frac{\Gamma(a+1)}{s^{a+1}}$
e^{kt}	$\frac{1}{s-k}$
$\cos(kt)$	$\frac{s}{s^2+k^2}$
$\sin(kt)$	$\frac{k}{s^2+k^2}$
$-tf(t)$	$F'(s)$
$e^{at}f(t)$	$F(s-a)$
$\int_0^t f(\tau)d\tau$	$F(s)/s$
$f'(t)$	$sF(s) - f(0)$
$f''(t)$	$s^2F(s) - sf(0) - f'(0)$

TABLE 1. Some Laplace transforms, $\mathcal{L}(f(t)) = F(s)$