

Math 3280 Worksheet 24: Solving initial value problems with Laplace transforms

Group members (2 to 4): _____

- (1) Solve the initial value problem $x'' + x' - 2x = t$, $x(0) = 1$, $x'(0) = -1$ using the Laplace transform. If you have time, check your work using other methods (characteristic equation and undetermined coefficients). A table of Laplace transforms is given on the back of this sheet.

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}	$\frac{1}{s-k}$
$e^{kt}f(t)$	$F(s-k)$
$\cos(kt)$	$\frac{s}{s^2+k^2}$
$\sin(kt)$	$\frac{k}{s^2+k^2}$
$-tf(t)$	$F'(s)$
$\int_0^t f(\tau)d\tau$	$F(s)/s$
$f'(t)$	$sF(s) - f(0)$
$f''(t)$	$s^2F(s) - sf(0) - f'(0)$

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