

Math 3280 Worksheet 36: Solving initial value problems with Laplace transforms

Group members (2 to 4): \_\_\_\_\_

- (1) Solve the initial value problem  $x'' + x' - 2x = t$ ,  $x(0) = x'(0) = 0$  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)	$\frac{n!}{s^{n+1}}$
$t^a$ ( $a > -1$ )	$\frac{\Gamma(a+1)}{s^{a+1}}$
$e^{kt}$	$\frac{1}{s-k}$
$\cos(kt)$	$\frac{s}{s^2+k^2}$
$\sin(kt)$	$\frac{k}{s^2+k^2}$
$-tf(t)$	$F'(s)$
$\int_0^t f(\tau)d\tau$	$F(s)/s$
$f'(t)$	$sF(s) - f(0)$
$f''(t)$	$s^2F(s) - sf(0) - f'(0)$

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