Math 3280 Worksheet 39: 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	$\dfrac{1}{s}$
t	$\dfrac{1}{s^2}$
t^n (n is a non-negative integer)	$\dfrac{n!}{s^{n+1}}$
t^a $(a > -1)$	$\dfrac{\Gamma(a+1)}{s^{a+1}}$
e^{kt}	$\dfrac{1}{s-k}$
$\cos(kt)$	$\dfrac{s}{s^2+k^2}$
$\sin(kt)$	$\dfrac{k}{s^2+k^2}$
$-tf(t)$	$F'(s)$
$\int_0^t f(\tau)d\tau$	$F(s)/s$
$f'(t)$	$sF(s) - f(0)$
$f''(t)$	$s^2 F(s) - sf(0) - f'(0)$

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