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	Laplace Transform
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}	$\frac{1}{s-k}$
$\cos(kt)$	$\frac{s}{s^2+k^2}$
$\sin(kt)$	$\frac{k}{s^2+k^2}$
$-tx(t)$	$X'(s)$
$\int_0^t x(\tau)d\tau$	$X(s)/s$
$x'(t)$	$sX(s) - x(0)$
$x''(t)$	$s^2X(s) - sx(0) - x'(0)$

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