Math 3280 Worksheet 23: Second order systems

Group members (2 to 4): _____

(1) Consider two blocks of mass $m_1 = m_2 = 1$ connected by springs to each other and to walls as shown below. The displacement of the masses from their equilibrium positions are denoted by x_1 and x_2. The stiffness of the three springs are $k_1 = 4$, $k_2 = 6$, and $k_3 = 4$ as shown. Compute the natural frequencies (assuming no damping) and describe the natural modes of oscillation.
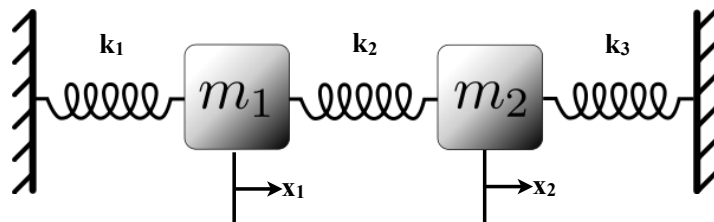
(2) Compute the Laplace transform of $f(t) = 2\sqrt{t} - 5e^{3t}$.

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 ($a > -1$)	$\dfrac{\Gamma(a+1)}{s^{a+1}}$, $\qquad \Gamma(1/2) = \sqrt{\pi}$
e^{kt}	$\dfrac{1}{s-k}$

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