

## Homework Assignment 13 in Differential Equations, MATH308-Fall 2015

This homework is a **bonus assignment**. You can get extra points to your total numerical grade if you submit it.

Anyway, it is highly recommended to solve all problems in it because the material of it is in the final test

Please submit it on Wednesday, December 7.

Topics covered : *step function, Laplace transform of discontinuous functions and differential equations with discontinuous forcing function (corresponds to sections 6.3, 6.4).*

1. Find the Laplace transform of the function

$$f(t) = \begin{cases} 2t - 1 & t < 3, \\ t^3 - 2t + 3 & 3 \leq t < 4, \\ 1 - 2t & 4 \leq t. \end{cases}$$

2. Find the inverse Laplace transform of the function  $\frac{e^{-\frac{3\pi}{2}s}(s^2 + 3s + 4)}{(s + 1)^2(s^2 + 6s + 25)}$ .

3. Find the solution of the initial value problem  $y'' + 10y' + 29y = g(t)$ ;  $y(0) = -2$ ,  $y'(0) = 1$ , where

$$g(t) = \begin{cases} 4 \cos 3t, & 0 \leq t < \frac{5\pi}{2} \\ 2 + 5 \sin 3t, & t \geq \frac{5\pi}{2}. \end{cases}$$