APMA 0350 – PROGRAMMING ASSIGNMENT 2

Instructions: In the problems below, please take a screenshot of your code and your result/plot, and include it in your assignment.

Problem 1: (4 points) Use the dsolve command in Python to solve

$$2y'' + 4y' + y = 0$$

Problem 2: (4 points) Use the dsolve command in Python to solve and plot for $-20 \leq t \leq 1$

$$\begin{cases} y'' + 4y = 2e^{3t} + 2t + 6\cos(t) \\ y(0) = 1 \\ y'(0) = 1 \end{cases}$$

Problem 3: (4 points) Use Python to find the Laplace transform of

$$e^{2t} + 4t^3$$

Problem 4: (4 points) Use Python to find a function whose Laplace transform is

$$\frac{2(s-1)e^{-3s}}{s^2 - 2s + 2}$$

Problem 5: (4 points) Use the dsolve command in Python to solve and plot for $0 \leq t \leq 10$

$$\begin{cases} y'' + 9y = u_3(t) - 2(t-5)u_5(t) \\ y(0) = 0 \\ y'(0) = 0 \end{cases}$$

Note: Python uses Heaviside$(t-3)$ instead of $u_3(t)$. You might see a θ as part of your answer. This means Heaviside as well.

Here you can find some sample code that helps you solve the problems:

Sample Code 1:

The following code finds and plots the solution of the following ODE for $0 \leq t \leq 10$

$$\begin{cases} y'' - 5y' + 6y = 0 \\ y(0) = 1 \\ y'(0) = -3 \end{cases}$$

```
from sympy import *
from matplotlib import pyplot as plt

t=symbols('t')
y=Function('y')
ysoln=dsolve(diff(y(t),t,2)-5*diff(y(t),t)+6*y(t),y(t),
ics={y(0):1,diff(y(t),t).subs(t,0):-3})
print(ysoln)

yoft=ysoln.rhs
plot(yoft,(t,0,10))
```

Sample Code 2:

The following code finds the Laplace transform of $\cos(3t) + 5t^2$

```
from sympy import *
```

```
s,t=symbols('s t',positive="True")
f=cos(3*t)+5*t**2
laplace_transform(f,t,s)[0]
```

Sample Code 3:

The following code finds a function whose Laplace transform is $\frac{1-e^{-2s}}{s^2}$

```
from sympy import *

s,t=symbols('s t',positive=True)
F=(1-exp(-2*s))/s**2
inverse_laplace_transform(F,s,t)
```