MATH 215 HW #6

PROBLEM 1 FIND THE GENERAL SOLUTION TO EACH OF THE FOLLOWING GIVEN THAT YOU HAVE ONE SOLUTION TO THE HOMOGENEOUS PROBLEM y_1.

(i) $x^2 y'' + x y' - y = x \ln x$, $\quad y_1 = x$

(ii) $x^2 y'' + 7x y' + 5y = x$, $\quad y_1 = 1/x$

PROBLEM 2 CONSIDER $y'' + y' + 2y = F_0 \cos(\omega t)$, F_0 = CONSTANT.

PLOT THE AMPLITUDE OF THE STEADY-STATE RESPONSE AS A FUNCTION OF ω. AT WHICH VALUE OF ω IS A MAXIMUM OF THIS AMPLITUDE OBTAINED?

PROBLEM 3 FIND THE GENERAL SOLUTION TO THE FOLLOWING ODE'S OF FOURTH ORDER FOR $y(t)$:

(i) $y'''' - 4y = 0$

(ii) $y'''' - 4y'' + 3y = t^2$

PROBLEM 4 THE FOLLOWING PROBLEM ARISES IN TUNING AN ELECTRONIC CIRCUIT WITH CAPACITANCE $C > 0$:

$$y'' + \frac{1}{10} y' + \frac{1}{C} y = \sin t + 4 \sin(5t) \qquad y = \text{CURRENT through circuit.}$$

(i) FIND THE STEADY-STATE RESPONSE AS A SUM OF TWO DISTINCT

(ii) TERMS OF THE FORM $R_j \sin(\omega_j t - \phi_j)$ FOR SOME $R_j, \phi_j, \omega_j, j = 1, 2$.

(iii) GIVEN $C = 1/81$, $C = 1$, OR $C = 1/25$, WHICH OF THE TWO TERMS IN THE STEADY-STATE RESPONSE IS MOST PROMINENT?

EXPLAIN YOUR REASONING HERE.

PROBLEM 5 DO PAGE 189 SECTION 3.6 # 13

PROBLEM 6 DO PAGE 190 SECTION 3.6 # 23a)

PROBLEM 7 FOR THE FIRST ORDER PROBLEM RELATED TO NEWTON'S LAW OF COOLING,

$y' + y = T_0 + T_1 \cos(wt)$, WITH T_0 AND T_1 CONSTANTS,

FIND THE SOLUTION TO THE HOMOGENEOUS PROBLEM, THE PARTICULAR SOLUTION, AND THE GENERAL SOLUTION BY FOLLOWING SAME PROCEDURE AS USED FOR SECOND ORDER DIFFERENTIAL EQUATIONS.