Name: ______________________________ **Exam 2**

Math 341 Differential Equations – Crawford **17 April 2019**

- Books and notes (in any form) are not allowed.
- You may use calculators and the provided integral table.
- ***Put all of your work and answers on other sheets of paper.*** Include this sheet as a cover sheet.
- ***Show all your work.*** Partial credit may be given for written work.

Score

1	/6
2	/14
3	/24
4	/14
5	/14
6	/14
7	/16
Total	/100

Formulas that may or may not be helpful.

$R = \sqrt{C_1^2 + C_2^2} \qquad \tan\delta = \frac{C_2}{C_1}$

$$\cos(A) + \cos(B) = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$\cos(A) - \cos(B) = -2\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)$$

Good Luck!

1. (6 pts). Determine the longest interval in which the given initial value problem is guaranteed to have a unique solution. [Do not attempt to find the solution.]

$(t-3)y'' + \ln|t|y' = t\,, \qquad y(1) = 1, y'(1) = -4$

2. (14 pts). Determine the ***form only*** of a particular solution y_p. Do **NOT** evaluate the constants.

$D(D-2)^2(D^2+1)[y] = t^2 + te^{2t} + e^t\sin t$

3. (24 pts). Find the general solution for the following differential equations.

(a). $y'' - 4y' + 7y = 0$

(b). $x^2y'' - 5xy' + 9y = 0$

4. (14 pts). Solve the following initial value problem.

$y'' + y' - 6y = 3t + 10e^{-3t} \qquad y(0) = 0, y'(0) = 1$

5. (14 pts). Given the initial value problem

$y'' + 4y' + 4y = 0 \quad y(0) = 1, y'(0) = b$

(a). Find the solution in terms of b.

(b). Determine the time t_M (in terms of b) at which a maximum in the graph occurs.

6. (14 pts). Given that $y_1(t) = \cos(3t)$ and $y_2(t) = \sin(3t)$ are solutions to the corresponding linear homogeneous equation, ***use variation of parameters*** to find the particular solution for the following differential equation. Then write the general solution.

$y'' + 9y = \sec(3t)$

7. (16 pts). A mass of 12 g stretches a spring 4 cm. The mass is attached to a viscous damper with a damping constant of 360 dyn·s/cm. The mass is compressed 2 cm from equilibrium position and then released. [Note: The units are all consistent and $g = 980$ cm/s^2.]

(a). Set up, but do not solve, the initial value problem for this mass-spring system.

(b). Solve for the ***general solution*** only, but do ***not*** solve for the constants using the initial conditions.

(c). Determine the quasi-period.