Name: _____ **Exam 1**

Math 342 Applied Analysis – Crawford **11 March 2016**

- Books and notes (in any form) are not allowed. You may use the formula sheet, an integration table, and a calculator.
- Clearly indicate your answers.
- ***Show all your work*** – partial credit may be given for written work.
- Good Luck!

	Score
1	/12
2	/12
3	/14
4	/14
5	/14
6	/18
7	/18
Total	/100

1. (12 pts). Determine whether the following boundary value problem has no solution, exactly one solution, or an infinite number of solutions. [Show all your work.]

$$\frac{d^2u}{dx^2} + u = 1, \quad u(0) = 0, \quad u'\left(\frac{\pi}{2}\right) = 0$$

2. (12 pts). Find the general solution to the following differential equation.

$$\frac{d}{dx}\left[(h + kx)\frac{dv}{dx}\right] = 0 \qquad h, k \text{ are constants.}$$

3. (14 pts). Given the equation $x^2(4-x)u'' + (x-1)u' - 3xu = 0$

(a). Identify all of the singular points.

(b). Classify each singular point as regular or irregular. [Show all your work.]

4. (14 pts). Given $t^2\dfrac{d^2u}{dt^2} + t\dfrac{du}{dt} - u = -5t^3$

(a). Use variation of parameters to find a particular solution given that $u_1(t) = t$ and $u_2(t) = \dfrac{1}{t}$ are solutions to the associated homogeneous equation.

(b). Write the general solution.

5. (14 pts). Clearly state and solve the steady-state problem for the heat equation problem below. [r is a constant representing heat generation.]

PDE: $\dfrac{1}{k}\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2} + r \qquad 0 < x < L,\ t > 0$

BC: $\quad u(0,t) = 0 \qquad \dfrac{du}{dx}(L,t) = S_0 \qquad t > 0$

IC: $\quad u(x,0) = f(x) \qquad 0 < x < L$

6. (18 pts). Use $n = 4$ to set up the replacement equations for

$$\frac{d^2u}{dx^2} - 4x\frac{du}{dx} = 0, \quad 0 < x < 1$$

$$u(0) = 0, \quad u(1) = 3$$

[Substitute any known values and simplify the equations, but do **not** solve.]

7. (18 pts). Take-Home Problem – see separate sheet. Due Monday, March 14, 2016 by 8am.