Name:___________________________________ Lecturer _________________________

Lecture Section: ___________

Ma 221 **Exam IB** **15S**

You may not use a calculator, cell phone, or computer while taking this exam. All work must be shown to obtain full credit. Credit will not be given for work not reasonably supported. When you finish, be sure to sign the pledge.

Score on Problem #1 ________

#2 ________

#3 ________

#4 ________

Total Score ________

I pledge my honor that I have abided by the Stevens Honor System.

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1 [20 **pts**.] Solve the initial value problem

$$\frac{dy}{dx} = \frac{3y}{x} + x^3 \cos x \qquad y(\pi) = 2\pi^3.$$

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2 [20 **pts**.] Solve the initial value problem

$$2x^3 y dy - \left(1 - y^2\right) dx = 0 \qquad y(1) = 0.$$

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3 [35 **points**] Consider the differential equation

$$\left(3y^3 + 3\right)dx + \left(3xy^2\right)dy = 0$$

a. Show that the differential equation is not exact.

b. Find a value of n, such that multplying the equation by x^n results in an exact differential equation.

c. The differential equation

$$\left(2xy^3 + 3x^2\right)dx + \left(3x^2y^2 + 2y\right)dy = 0$$

is exact. Find a solution.

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4 [25 **pts**.] Solve

$$\frac{dy}{dt} + 3y = y^3$$

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Table of Integrals

$\int \sec^2 t\,dt = \tan t + C$
$\int \frac{\sec^2 t}{\tan t}dt = \ln(\tan t) + C$
$\int \tan t\,dt = \ln(\sec t) + C$
$\int te^{at}dt = \frac{1}{a^2}e^{at}(at-1) + C$
$\int t^2e^{at}dt = \frac{1}{a^3}e^{at}\left(a^2t^2 - 2at + 2\right) + C$
$\int \cos^2 t\,dt = \frac{1}{2}t + \frac{1}{4}\sin 2t + C$
$\int \cos^3 t\,dt = \frac{1}{3}\cos^2 t\sin t + \frac{2}{3}\sin t + C$
$\int \sin^2 t\,dt = \frac{1}{2}t - \frac{1}{4}\pi - \frac{1}{4}\sin 2t + C$
$\int \sin^3 t\,dt = \frac{1}{12}\cos 3t - \frac{3}{4}\cos t + C$
$\int t\cos t\,dt = \cos t + t\sin t + C$
$\int t^2\cos t\,dt = t^2\sin t - 2\sin t + 2t\cos t + C$
$\int t^3\cos t\,dt = 3t^2\cos t - 6\cos t + t^3\sin t - 6t\sin t + C$