MAP 2302 - Quiz #1 **Name:** Key

For full credit, you must show all work and circle your final answer.

1 *(2.5 points)* Solve the linear differential equation for the given initial conditions.

$$x\frac{dy}{dx} + 3y + 2x = 3x^2, \quad y(1) = 1.$$

Assume $x > 0$

$$x\frac{dy}{dx} + 3y + 2x = 3x^2$$

$$\frac{dy}{dx} + \left(\frac{3}{x}\right)y = 3x - 2$$

$P(x) = 3/x$

$e^{\int P(x)dx} = e^{\int 3/x\,dx} = e^{3\ln x} = x^3$

$$x^3\frac{dy}{dx} + 3x^2 y = 3x^4 - 2x^3$$

$$\frac{d}{dx}[x^3 y] = 3x^4 - 2x^3$$

$$x^3 y = \int 3x^4 - 2x^3\,dx$$

$$x^3 y = \frac{3}{5}x^5 - \frac{1}{2}x^4 + C$$

$$y = \frac{3}{5}x^2 - \frac{1}{2}x + Cx^{-3}$$

initial cond: $1 = y(1) = \frac{3}{5} - \frac{1}{2} + C$

$$1 = \frac{6}{10} - \frac{5}{10} + C$$

$$\frac{9}{10} = C$$

Solution: $y = \frac{3}{5}x^2 - \frac{1}{2}x + \frac{9}{10}x^{-3}$

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2 *(2.5 points)* Solve the following equation.

$$(e^x y + xe^x y)\,dx + (xe^x + 2)dy = 0$$

$M(x,y) = (e^x y + xe^x y)$ $\quad N(x,y) = (xe^x + 2)$

$\frac{\partial M}{\partial y} = e^x + xe^x \overset{\checkmark}{=} \frac{\partial N}{\partial x} = xe^x + e^x$

$F(x,y) = \int xe^x + 2\,dy + h(x)$

$\Rightarrow F(x,y) = xe^x y + 2y + h(x)$

if $M = \frac{\partial F}{\partial x}$ then,

$e^x y + xe^x y = xe^x y + e^x y + h'(x)$

so $h'(x) = 0$ and thus $h(x) = C$

$F(x,y) = xe^x y + 2y + C$ ← Solution

or $xe^x y + 2y = C$

University of Florida Honor Code:

On my honor, I have neither given nor received unauthorized aid in doing this assignment.

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Signature