Math 391 Quiz 1

June 9, 2020

Name: ____

Instructions: No calculators! Answer <u>all</u> problems in the space provided.

1. Separable or not? ("Y" or "N"):

$\frac{dy}{dx} = \frac{y+1}{x-5}$: _____ $\frac{dy}{dx} = xy + x$: _____ $\frac{dy}{dx} = e^x + y$: _____ $\frac{dy}{dx} = y(y+3)$: _____ $\frac{dy}{dx} = \frac{x-1}{y}$: _____

$\frac{dy}{dx} = x + 2y$: _____ $tdt + ye^{-t}dy = 0$: _____ $y^2(1-x)^{\frac{1}{2}}dy = \arccos x\, dx$: _____

2. Linear or not? ("Y" or "N"):

$(1+y^2)\frac{d^2y}{dt^2} + t\frac{dy}{dt} + y = e^t$: _____ $y'' + \sin(t+y) = \sin t$: _____ $x^2y'' + xy' + 2y = \cos x$: _____

3. What is the standard form of a first order linear ODE? : ______________________________

4. For the ODE above, what is the formula for its integrating factor? ____________________(equation)

5. Separate the variables. (Do not solve the ODEs!):

$\frac{dr}{d\theta} = \frac{r^2}{2\theta}$: ______________ $y' = \frac{2x}{y+x^2y}$: ______________ $\frac{dy}{dt} = \frac{ty(3-y)}{1+t}$: ______________

$\frac{dy}{dt} = tye^{3t+y^2}$: ______________ $dy = (x^2y^2 + x^2 - y^2 - 1)dx$: ______________

6. Solve the following ODEs:

(a) $\frac{dy}{dx} = 2y + 1$: $y =$ ______________ (b) $\frac{dy}{dx} = \frac{3y}{x-1}, y(0) = 3$: $y =$ ______________

7. If it is assumed that interest is compounded continuously, the Harvesting Model also describes the growth of money in an account. A man puts some money in a bank account earning 3% interest, compounded continuously, and makes withdrawals of \$600, every month. Suppose he puts P_0 dollars into the account initially. Assume the function $P(t)$ describes the current balance in the account. Describe $P(t)$ using:

An ODE ______________________________, the initial condition for the ODE______________

8. Solve the ODE above. Your answer should include the P_0: ______________________________

Bonus problems:

1. Solve the ODEs:

(a) $\frac{dy}{dx} = \frac{x^2+xy+y^2}{x^2}$: $y =$ ______________

(b) $2xy - x^2 + (2y + x^2 + 1)\frac{dy}{dx} = 0$ $\quad Soln$: ______________________________