

Your Name _____

Your Partner's Name _____

Emphasis – pattern matching to a given pattern, time constants, steady state/transient, is a solution valid?, application of initial conditions.

I have censored the below a bit.

This year there is no internet usage – only calculator, books, and notes. Each partner solves a different exam. Those working alone can pick and choose.

1) (30 points: 6 points each – 3 for linear, 3 for separable) Identify whether the following differential equations are separable, linear, neither or both. To receive full credit you must put the differential equation in the *standard form* for separable and/or linear differential equations, when appropriate. **If separable, please identify $A(x)$ and $B(x)$ or just write it in separable form. If linear, please identify $p(x)$ and $q(x)$.** If not linear or not separable, tell me how you know.

Do **not** solve the equation; just put it in the appropriate form(s). **There will not be so many this year – probably two instead of five.**

ID	Exam A	Exam B
a)	$\frac{dy}{dx} = \frac{2x^2}{y} + \frac{y}{x^3}$	$\frac{1}{x} \frac{dy}{dx} + x^2 \csc(x) = 2xy \cot(x)$
b)	$\frac{1}{x} \frac{dy}{dx} = y^2(1+x)$	$x \frac{dy}{dx} = \frac{y^2}{1+x}$
c)	$x^2 \frac{dy}{dx} + 3y = \frac{y}{x}$	$\frac{dy}{dx} = \frac{3y}{x^2} + \frac{y^2}{x^3}$
d)	$\frac{dy}{dx} - y \tan(x) = \frac{5y \ln(x)}{x}$	$yx \frac{dy}{dx} - 2y = x^2 y^2$
e)	$x^2 \frac{dy}{dx} - x = xy$	$x^2 \frac{dy}{dx} = xy + x$

2 & 3) For problems 2 and 3 (20 points each), choose from the following list of eight differential equations. One equation must be solved using separable techniques and another, by using the formalism for solving linear differential equations. You may solve the same equation by two different methods, if appropriate. You may not solve the same problem using the same method as your partner.

a) $\frac{dy}{dx} + x = x(y+1)$	e) $\frac{dy}{dx} = \frac{1+x^2}{y^2}$
b) $x\frac{dy}{dx} - 2x^2y = x^2$	f) $\frac{dy}{dx} = 3x^2e^{-y}$
c) $\frac{dy}{dx} - \frac{3}{x}y = \frac{4}{x}$	g) $\frac{dy}{dx} = 2x(y^2 + 1)$
d) $\frac{dy}{dx} = 2e^{-(x+y)}$	h) $\frac{dy}{dx} = x^3 - 2xy$

4) (10 points) Evaluate C for **one** of your solutions in problems 2 and 3 using the condition that $y(1)=1$. Then write the full solution where C has been replaced by its value.

5) (10 points) Solve one of the following problems. Do **not** choose that same one as your partner.

Time constant problems. I give you a choice of three sets of values (e.g. $R=...$, $C=...$) leading to different time constants. Which set matches a given condition?

6) (10 points) Determine whether or not the given "solution" is a solution of the given differential equation. Be sure to show any intermediate steps. You may perform the algebra steps on your TI but you need to write down what you are doing.

	Solution?	D.E.
Exam A	$y = x^2 + \frac{1}{x}$	$x^2 \frac{dy}{dx} + 1 = 2x^3$
Exam B	$y = xe^{-x^2}$	$e^{x^2} \frac{dy}{dx} + 2x^2 = 1$

I will be adding a word problem (temperature, RL, RC). Identify transient and steady state (persistent).

Note that I will still have to be able to do the exam in 10 or so minutes in order for the class to be able to finish it.