

MATH 209 QUIZ 1 - Version A

Name: ANSWERS

Instructions: Use your own scrap paper. Write your answers in the space provided. Simplify your answers!

1. Differentiate:

(a)  $\frac{d}{dx} e^{1/x} = -\frac{1}{x^2} e^{1/x}$  (b)  $\frac{d}{dx} \ln(e^{x^3} - x) = \frac{3x^2 e^{x^3} - 1}{e^{x^3} - x}$

(c)  $\frac{d}{dx} \frac{1}{3 + xe^x} = \frac{-(e^x + xe^x)(3 + xe^x)^{-2}}{1}$  (d)  $\frac{d}{dx} \frac{3x^2 + x + x^2 e^x}{x^2} = -\frac{1}{x^2} + e^x$

2. Solve for y:

(a)  $2e^{1/y} = 4x^2 - 8x + C \Rightarrow y = \frac{1}{\ln(2x^2 - 4x + C)}$

\* (b)  $\ln\left(\frac{2}{y}\right) = e^x + C \Rightarrow y = \frac{2}{Ce^{e^x}}$  or  $\frac{2}{e^{e^x + C}}$

3. Integrate:

\* (a)  $\int \frac{(x^2 + 1)^2}{x} dx = \frac{x^4}{4} + x^2 + \ln|x| + C$  (b)  $\int \frac{1}{\sqrt{x+1}} dx = 2\sqrt{x+1} + C$

(c)  $\int \frac{4e^{3x}}{e^{3x} + 7} dx = \frac{4}{3} \ln|e^{3x} + 7| + C$  (d)  $\int e^{7/2 x} dx = \frac{2}{7} e^{7/2 x} + C$

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

(a)  $\frac{dy}{dx} = e^x + y$ : N (b)  $\frac{dy}{dx} = xy + x$ : Y (c)  $\frac{dy}{dx} = \frac{y+1}{x-5}$ : Y

(d)  $\frac{dy}{dx} = y(y+3)$ : Y (e)  $\frac{dy}{dx} = x + 2y$ : N (f)  $\frac{dy}{dx} = \frac{x-1}{y}$ : Y

5. Separate the variables. (Do not solve the equation!)

(a)  $\frac{dy}{dx} = \frac{2xy}{1+x}$ :  $\frac{1}{y} dy = \frac{2x}{1+x} dx$  (b)  $\frac{dy}{dx} = \frac{3+y^2}{4+x^2}$ :  $\frac{1}{3+y^2} dy = \frac{1}{4+x^2} dx$

(c)  $\frac{dy}{dx} = \frac{3(x+1)e^x}{4xy^2}$ :  $y^2 dy = \frac{3(x+1)e^x}{4x} dx$

6. Solve the ODE:

\* (a)  $\frac{dy}{dx} = 3y + 1, y(1) = 3$ :  $y = \frac{10e^{3x-3} - 1}{3}$  (b)  $\frac{dy}{dx} = \frac{2y}{x+1}$ :  $y = C(x+1)^2$

**Bonus:** (~~points total~~) A quantity  $P$  grows exponentially with a relative growth rate  $r$ . Using  $t$  for time and  $P_0$  for the initial amount of  $P$ , describe the quantity as:

(a) An ODE:  $P' = rP$  (b) A formula:  $P = P_0 e^{rt}$