

MATH 209 QUIZ 1 - Version B

Name: ANSWERS

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

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

(c)  $\frac{d}{dx} \frac{1}{5 + xe^x} = \frac{-(e^x + xe^x)(5 + xe^x)^{-2}}{1}$  (d)  $\frac{d}{dx} \frac{7x^4 + x^2 + x^3 e^x}{x^3} = \frac{7 - \frac{1}{x^2} + e^x}{1}$

2. Solve for y:

\* (a)  $\ln\left(\frac{3}{y}\right) = e^x + C \Rightarrow y = \frac{3}{Ce^{e^x}} \text{ or } \frac{3}{e^{e^x + C}}$

(b)  $5e^{1/y} = 15x^2 - 10x + C \Rightarrow y = \frac{1}{\ln(3x^2 - 2x + C)}$

3. Integrate:

\* (a)  $\int \frac{(x^3 + 1)^2}{x} dx = \frac{x^6}{6} + \frac{2x^3}{3} + \ln|x| + C$  (b)  $\int \frac{1}{\sqrt{x+4}} dx = 2\sqrt{x+4} + C$

(c)  $\int \frac{3e^{2x}}{e^{2x} + 9} dx = \frac{3}{2} \ln|e^{2x} + 9| + C$  (d)  $\int e^{7/9x} dx = \frac{9}{7} e^{7/9x} + C$

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

(a)  $\frac{dy}{dx} = \frac{2x-5}{y}$  : Y (b)  $\frac{dy}{dx} = xy + y$  : Y (c)  $\frac{dy}{dx} = \frac{7-y}{x+5}$  : Y

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

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

(a)  $\frac{dy}{dx} = \frac{7-y^2}{2+x^2}$  :  $\frac{1}{1-y^2} dy = \frac{1}{2+x^2} dx$  (b)  $\frac{dy}{dx} = \frac{2xy}{1+x}$  :  $\frac{1}{y} dy = \frac{2x}{1+x} dx$

(c)  $\frac{dy}{dx} = \frac{4(x^2+1)e^x}{5x^2y}$  :  $y dy = \frac{4(x^2+1)e^x}{5x^2} dx$

6. Solve the ODE: (a)  $\frac{dy}{dx} = 3y + 1$  :  $y = \frac{Ce^{3x} - 1}{3}$  (b)  $\frac{dy}{dx} = \frac{2y}{x+1}, y(0) = 3$  :  $y = \frac{3(x+1)^2}{1}$

Bonus:  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:  $P = P_0 e^{rt}$