

MTH 204  
Quiz 2  
23 Jan 2009

Name: Key

Section: C or F (circle one)

Read the directions carefully.

Write neatly in pencil and **show all your work**  
**(you will only get credit for what you put on paper).**

**You may use your homework solutions.**

**If you get stuck, free feel to ask me for help.**

**LEAD: Thursdays, 5:00 - 7:00 PM**  
**CSF G5D**

Consider the DE  $xy \frac{dy}{dx} = \frac{e^{-3y}}{4-x}$

a. Give the order of the DE. Determine if the DE is (non)linear, (non)autonomous, and (non)separable. State why.

1st order. nonlinear - nonlinear function of  $y$ .

nonautonomous -  $x$  is in the equation

separable - can be rewritten as  $\frac{dy}{dx} = g(x)h(y)$ .

b. What method(s) can you use to solve this DE?

{ SoV - separable  
~~IR~~ - nonlinear

c. Solve the DE.

SoV  $\Rightarrow \int ye^{3y} dy = \int \frac{dx}{x(4-x)}$

LHS:  $u=y$      $dv=e^{3y}dy \Rightarrow \int ye^{3y}dy = \frac{1}{3}ye^{3y} - \frac{1}{3}\int e^{3y}dy$   
 $du=dy$      $v=\frac{1}{3}e^{3y}$      $= \frac{1}{3}ye^{3y} - \frac{1}{9}e^{3y}$

RHS:  $\frac{1}{x(4-x)} = \frac{A}{x} + \frac{B}{4-x} \Rightarrow 1 = (4-x)A + Bx$

$x=0 \Rightarrow 4A=1 \Rightarrow A=\frac{1}{4}$

$x=4 \Rightarrow 4B=1 \Rightarrow B=\frac{1}{4}$

$\Rightarrow \frac{1}{4} \int \left( \frac{1}{x} + \frac{1}{4-x} \right) dx = \frac{1}{4} (\ln|x| - \ln|4-x|) + C = \frac{1}{4} \ln \left| \frac{x}{4-x} \right| + C$

So  $\frac{1}{3}e^{3y} \left( y - \frac{1}{3} \right) = \frac{1}{4} \ln \left| \frac{x}{4-x} \right| + C$