

# Math 134

Quiz 8 Sample

April 15, 2011

You may use your calculator and table of integrals. Indicate any calculations you do with the calculator and show your algebra whenever calculations are done by hand.

1. The function  $y = y(x)$  satisfies the following differential equation:

$$\frac{dy}{dx} = y\sqrt{x}.$$

Find the particular solution to the equation subject to the condition  $y(1) = 1$ .

2. Consider the differential equation:

$$\frac{dP}{dt} = k(P - 2)(10 - P),$$

where  $k$  is a positive constant. Without solving the equation, for which values of  $P$  will the solutions be increasing functions of  $t$ ? For which values of  $P$  will the solutions be decreasing functions of  $t$ ?

3. A hot potato is taken out of a  $400^\circ\text{F}$  oven and placed on a plate in a room that remains a constant  $70^\circ\text{F}$ .
- (a) What is the differential equation that models the temperature  $T = T(t)$  of the potato after it is placed on the plate?
  - (b) Solve your equation for  $T$ . (Your answer will involve an unknown constant.)
  - (c) If the temperature of the potato decreases to  $300^\circ\text{F}$  in 5 minutes, find the unknown constant.
  - (d) How long will it take for the potato to reach  $100^\circ\text{F}$ ?

## Extra Credit Problem

1. (Hypothetical) A call-in radio show claims that 100 people call the instant the program starts and that on average a caller waits only 5 minutes for an operator to answer the call. (Their call might not make it to the show.)
  - (a) What probability density function can be used to model the number of calls that are answered by time  $t$ ?
  - (b) Find the mean of your density function from (a).
  - (c) Should all 100 people expect to have their calls answered by the end of the hour? Explain your answer.