

Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use arrows and equal signs when appropriate. Always simplify expressions. BOX final short answers. LABEL parts of problem. Keep answers EXACT (but give decimal approximations for interpretation). Indicate where technology is used and what type (Maple, GC): only for antiderivatives, finding a root, or checking.

1.  $y' = 2x e^{-y}, \quad y(0) = 0$

- a) Find the general solution of this differential equation by hand.
- b) Find the solution which satisfies the initial condition.
- c) Check by backsubstitution that your solution of this initial value problem satisfies the differential equation.

2.  $y' = 2y e^{-x}, \quad y(0) = 1$

- a) Find the general solution of this differential equation by hand.
- b) Find the solution which satisfies the initial condition. Combine the exponential factors in your formula into a single exponential.
- c) Check that your solution agrees with Maple. If not write down Maple's solution and look for your error.

3)  $\frac{dT}{dt} = -k(T - 350), \quad T(0) = 40, \quad T(4) = 180.$

- a) Bob pulls a turkey from the refrigerator at 40 degrees and puts it into a 350 degree oven. After 4 hours the instant read thermometer jabbed into the turkey thigh reaches the recommended final temperature of 180 degrees. If this turkey thigh obeys Newton's law of cooling/heating, what temperature would bob have read off the instant read thermometer at 1 hour (to the nearest degree!)?
- b) What is the numerical value of  $k$  to 6 decimal places? What is the corresponding characteristic time  $\tau$  to 3 significant digits?

Make a rough hand sketch of your solution for  $t = 0 \dots \tau$ , labeling on your sketch the initial and final data points given above, and indicating the value of  $\tau$  on the time axis.

- c) **Optional.** Is your solution of the DE correct according to Maple? Explain.

## ► solution

### ▼ pledge

When you have completed the exam, please read and sign the dr bob integrity pledge and hand this test sheet in on top of your answer sheets as a cover page, with the first test page facing up:  
 "During this examination, all work has been my own. I give my word that I have not resorted to any ethically questionable means of improving my grade or anyone else's on this examination and that I have not discussed this exam with anyone other than my instructor, nor will I until after the exam period is terminated for all participants."

Signature:

Date: