MAT2705-04/05 22S Test 1 Print Name (Last, First) _____|__

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 EQUAL SIGNS and arrows 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 use technology to CHECK hand calculations, not subsitute for them, unless specifically requested. [Make sure you check every solution using Maple!]

pledge

When you have completed the exam, please read and sign the dr bob integrity pledge and hand this test sheet on top of your answer sheets as a cover page:
"During this examination, all work has been my own. I have not accessed any of the class web pages or any other sites during the exam. 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:

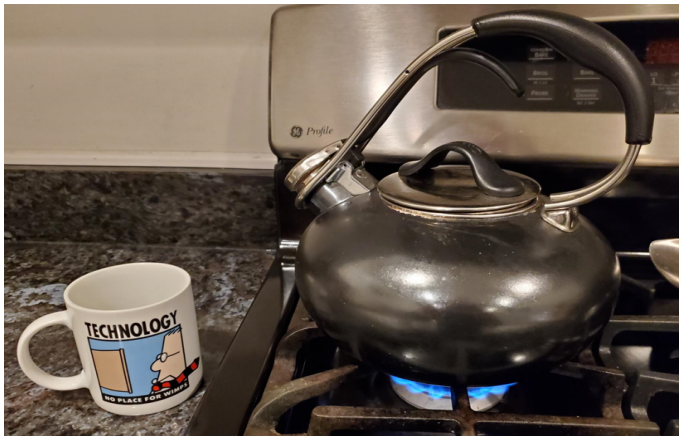
1. bob boils water in a teapot, pours it into a mug and uses an instant read thermometer to take Fahrenheit temperature data. Assume that the cooling down process is governed by the following IVP and bob reads off the value $T(20) = 107$ after exactly 20 minutes.

$\frac{dT}{dt} = -k \cdot (T - A)$, $T(0) = T_0$ where $A = 72$, $T_0 = 212$.

a) Plug in the numbers and solve this DE using separation of variables, showing EVERY individual step, boxing the general solution.
b) Impose the initial condition to find the solution of this IVP.
c) Use the secondary condition to determine the exact value of k, then backsubstitute this and simplify your solution of the IVP using rules of exponents.
d) Assuming the water obeys this model exactly, how long in minutes and seconds (to the nearest second) does bob and his stopwatch have to wait for the temperature to read 90 degrees?

2. Consider the IVP: $x\frac{dy}{dx} - 2y = 6x^3 \cos(2x)$, $y(1) = 3$, $x > 0$.

a) Find the general solution of this differential equation by hand, step by step.
b) Find the IVP solution by hand, step by step.
c) Verify your IVP solution by substitution into the original DE and simplifying each side independently.



Technology: No place for wimps.

Put all work on the lined paper please.

▶ **solution**