AMS 361: Applied Calculus IV

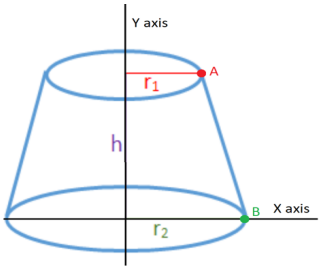
Homework 4

Assignment Date: When available in Brightspace
Due Date: See Brightspace
Submission to: Brightspace (1 PDF)
Grades: See individual problems

Ch2: Math Models (a total of 4 problems including one in HW3).

Problem 4.1 (10 points): In a hot summer day at a constant temperature $A = 90F$, my car overheated to $T_0 = 250F$. I pulled over and waited for 15 minutes and read the temperature again: it's $T_{15} = 180F$. The car can function, properly, only at (or below) $T_x = 125F$. How much longer should I wait? Of course, when I drive again, it will heat up again. Never mind of that.

Problem 4.2 (10 points): The radii of the two end-discs of a container (as shown) are r_1 and r_2 and its height is h. Two identical holes are made at the centers of the 2 end-discs to enable a draining constant k. We define T_1 *as* the time needed to empty the fully filled container when it is placed as shown and T_2 as the time to empty the fully filled (same liquid) container after it's turned upside down. Derive the formulas for T_1 and T_2. In addition, if $r_1 = 0$, derive the formulas again.



Problem 4.3 (10 points): *Please do a hypothetical problem:* A particular animal is diagnosed to have contracted P_0 a particular virus at time $t = 0$ and these viruses "multiply" subsequently according $P' = -\alpha P(M - P)$ where $P(t)$ is #viruses at time t while $\alpha > 0$ and $M > 0$ are constants. The animal will die when $P(t) \to \infty$. If $P_0 > M$, the animal's prognosis, i.e., the time T_P it has left to live, is short. Derive a formula for T_P and for given $P_0 = 1000, M = 100, \alpha = 0.001$. Compute the value of T_P.