Hwmk 2

Math 528 Summer Session 1

Due 5/24 (Monday at 11:59 pm)

1 Hot Pockets

Newtons law of cooling states that:

$$\frac{dT(t)}{dt} = k(T(t) - T_s)$$

where T is the temperature of an object as a function of time, k is an empirically measured value for the rate of heat entering or leaving the body, and T_s is the surrounding environment's temperature.

(a) [2 points] Solve this differential equation for $T(t)$ using separation of variables.

(b) [2 points] Now suppose we have some scorching hot bagel bites at 400F, fresh out of the oven. I then place them in a vat of liquid nitrogen (which is -320F) to rapidly cool them off. If from a home experiment, I found k to be -0.22. How long will it take the bagel bites to reach a safe and delicious temperature of 115F? Note that the units of time (t) are in minutes. Fun fact: your mouth's threshold for being burned is just above this temperature.

(c) [1 point] If you double the initial temperature of the bagel bites, by what percentage will the time required to reach 115F increase?

2 Big Mistake

(a) [1 point] Solve $y' = y - e^{-9x}$ with the condition that $y(0) = \frac{1}{10}$ analytically using integrating factors.

(b) [4 points] Using Euler and Improved Euler's Method method with a step size of 0.5, fill in the table below and find the relative percent error at $x = 1$. Note that the relative percent error is the error divided by the exact value converted to a percentage. Round your values from Euler method to four decimals after each step in x, and round the percent error to the nearest integer.

Method	@$x = 0.5$	@$x = 1$	Relative Percent Error @$x = 1$
Euler's Method			
Improved Euler's Method			