Hwmk 4

Math 528 Summer Session 1

Due 5/26 (Wednesday at 11:59 pm)

1 Chchch Cherry Bob

Suppose you see a can of Cheerwine Soda (made near my hometown!) floating in water. You push it down and then release it (with zero initial velocity) and notice that it begins to oscillate with a period of 0.5 seconds. Modeling an object's buoyancy is possible with a simple force balance equation. In particular, with the ODE:

$$mx'' = -\rho_w g A_c x$$

where $x(t)$ is the position in time, ρ_w is the density of water, g is gravity, A_c is the cross sectional area perpendicular to gravity (πr^2) in cm^2, and m is the mass in grams.

(a) $\boxed{\text{5 points}}$ Solve the general problem (note that you only have one initial condition $x'(0) = 0$)

(b) $\boxed{\text{2 points}}$ Use the values $\rho_w = 1\frac{gram}{cm^3}$, $r = 8cm$ and $g = 981\frac{cm}{s^2}$ to calculate the mass given the period stated in the problem description

(c) $\boxed{\text{1 point}}$ As mass increases or decreases what happens to the oscillations?

(d) $\boxed{\text{2 points}}$ How does the period change if I release at different depths ($x(0) = d$ versus $x(0) = 2d$)?