

Name _____ Differential Equations Mike Huff Project 1

Consider the following very simple model of blood cholesterol levels based on the fact that cholesterol is manufactured by the body for use in the construction of cell walls and is absorbed from foods containing cholesterol: Let $C(t)$ be the amount (in milligrams per deciliter) of cholesterol in the blood of a particular person at time t (in days). Then

$$\frac{dC}{dt} = k_1(C_0 - C) + k_2E$$

where

C_0 = the person's natural cholesterol level

k_1 = production parameter

E = daily rate at which cholesterol is eaten

k_2 = absorption parameter

- Suppose $C_0 = 200$, $k_1 = 0.1$, $k_2 = 0.1$, $E = 400$, and $C(0) = 150$. What will the person's cholesterol level be after 2 days on this diet?
- With the initial conditions as above, what will the person's cholesterol level be after 5 days on this diet?
- What will the person's cholesterol level be after a long time on this diet?
- High levels of cholesterol in the blood are known to be a risk factor for heart disease. Suppose that, after a long time on the high cholesterol diet described above, the person goes on a very low cholesterol diet, so E changes to $E = 100$. (Note: The initial cholesterol level at the starting time of this diet is the result of part c). What will the person's cholesterol level be after 1 day on the new diet, after 5 days on the new diet, and after a very long time?
- Suppose the person stays on the high cholesterol diet but takes drugs that block some of the intake of cholesterol from food, so k_2 changes to $k_2 = 0.075$. With the cholesterol level from part c, what will the person's cholesterol level be after 1 day, after 5 days, and after a very long time?