

First Examination
Wednesday, February 8, 2006

Instructions: This exam should be done on your own paper. The answers should be written carefully and in order. If in doubt, show intermediate steps: Full credit may not be given, even for correct answers, unless work is arranged clearly. This exam is closed book. You may leave after handing in your exam paper, but be sure to check your answers carefully. Each entire problem is worth 14 points, and 2 points are “free”.

- Figure 1 shows the amount of nicotine, $N = f(t)$, in milligrams, in a person’s bloodstream as a function of the time t in hours, since the person finished smoking a cigarette.
 - Estimate $f(3)$ and interpret it in terms of nicotine.
 - About how many hours have passed before the nicotine level is down to 0.1 milligrams?
 - What is the vertical intercept? What does it represent in terms of nicotine?
 - If this function had a horizontal intercept, what would it represent?

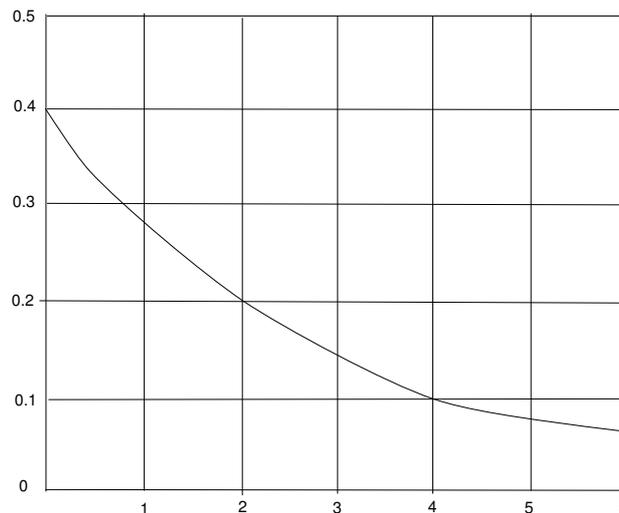


Figure 1: Nicotine concentration as a function of time (for Problem 1)

- Can the following table represent a linear function? State why or why not. If it can represent a linear function, then write down the equation of the corresponding line.

t	1.00	1.25	1.50	1.75	2.00
u	7.0	7.5	8.0	8.5	9.0

- Can the following table represent a linear function? State why or why not. If it can represent a linear function, then write down the equation of the corresponding line.

x	0.00	0.25	0.50	0.75	1.00
y	1.0000	1.0625	1.2500	1.5625	2.0000

4. Can the following table represent an exponential function? State why or why not. If it can represent an exponential function, then write down an expression for the corresponding function.

x	0.00	0.25	0.50	0.75	1.00
y	1	2	4	8	16

5. For each of the following functions, state whether
- the function is increasing or decreasing, neither, or we can't tell;
 - the function is concave up or concave down, neither, or we can't tell.

For each answer you give, explain your reasoning.

- the number R of rabbits on a large, grassy deserted island at time t after a pair of rabbits escapes from a ship onto the island;
 - the number of people P in a particular city who have heard of a certain news event, as a function of time t since the event occurred;
 - the amount of antibiotic in a patient's bloodstream as a function t of the time since the patient was administered the drug.
6. The demand and supply curves for a certain product are given in terms of price p as

$$2000 - 25p, \quad \text{and} \quad S(p) = 50p - 1000.$$

- Find the equilibrium price and quantity. Represent your answers on a graph.
 - If a specific tax of \$6 per unit is imposed on suppliers, find the new equilibrium price and quantity. Represent your answers on the graph.
 - How much of the \$6 tax is paid by consumers and how much by the producers?
 - What is the total tax revenue received by the government?
7. Compute the half-life of a substance the quantity of which decreases by 10% every four hours.