Honors 125, Test 2, Fall 2009

Questions from old tests

1. The amount of cough suppressant A, in mg, remaining in the body t hours after consuming one dose is modeled by the function $A = 10(0.82)^t$.
   a) How much cough suppressant is in the initial dose?

   b) What percent of the cough suppressant leaves the body every hour?

   c) What is the continuous rate at which the cough suppressant leaves the body?

   d) Find the half-life of cough suppressant in the body.

2. The projected population of Japan t years after 2000 is modeled by the function $P(t) = 128e^{-.0020t}$, in millions.
   a) What was the population of Japan in the year 2000?

   b) Is the population of Japan expected to grow or decrease?

   c) What is the expected annual rate of change of the population of Japan?

   d) What is the expected population in 2030?

   e) When would the population of Japan be expected to reach 110 million?

3. Solve for x:
   a) $350 = 280 + 4e^{-x}$

   b) $90 = 15 \cdot 7^{2x}$ (you may leave your answer either in exact form or a decimal approximation.)

4. Find each of the following limits, if the limit exists. If it does not exist, write DNE and briefly explain your answer.
   a) $\lim_{x \to 2} \frac{x^2 - 3x + 2}{x + 2}$

   b) $\lim_{x \to 1} \frac{x + 1}{x^2 + 5x - 6}$

   c) $\lim_{x \to 1} \frac{x - 1}{x^2 + 5x - 6}$

d) $\lim_{x \to \infty} \frac{x-1}{x^2+5x-6}$

5. Problem 29, page 194 (limits from a graph).

6. True or False. Indicate whether each statement is true or false. If the statement is true, explain how you know. If it is false, give a counterexample.

   a) ________ If a function is not continuous at a point, then it is not defined at that point.

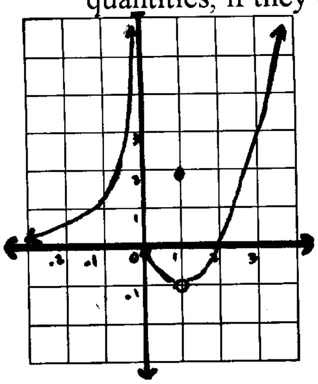
   b) ________ If $\lim_{x \to 1^+} f(x) = \lim_{x \to 1^-} f(x) = 2$, then $\lim_{x \to 1} f(x) = 2$.

   c) ________ If $\lim_{x \to 1^+} f(x) = \lim_{x \to 1^-} f(x) = 2$, then $f(1) = 2$.

7. Find all points of discontinuity of the function $f(x) = \begin{cases} \frac{1}{x}, & if\ x < 0 \\ 2x+1, & if\ 0 \le x \le 2 \\ x^2+1, & if\ x > 2 \end{cases}$.

   (NOTE: Be sure to look at similar problems in section 3.3, # 43-50).

8. The graph of the function f is given below. Use the graph to compute the following quantities, if they exist. If they do not exist, write DNE and explain why.



   a) $\lim_{x \to 0^+} f(x)$ ________

   b) $\lim_{x \to 0^-} f(x)$ ________

   c) $\lim_{x \to 0} f(x)$ ________

   d) $\lim_{x \to 1} f(x)$ ________

   e) $f(1)$ ________

   f) What value, if any, should be assigned to $f(1)$ to make $f(x)$ continuous at $x = 1$?

   g) What value, if any, should be assigned to $f(0)$ to make $f(x)$ continuous at $x = 0$?

9. Consider the function $f(x)=\begin{cases} 2x-1, & if\ x>-1 \\ x^2-4, & if\ x<-1 \\ 0, & if\ x=-1 \end{cases}$

a) Showing all work, find each of the following, if it exists. Otherwise write DNE and briefly explain your answer.

i) $\lim_{x\to -1^+} f(x)$ ___________

ii) $\lim_{x\to -1^-} f(x)$ ___________

iii) $\lim_{x\to -1} f(x)$ ___________

iv) $f(-1)$ ___________

b) Is f continuous at $x=-1$? ___________ Why or why not?

c) Find $\lim_{x\to 3} f(x)$, if it exists. ___________

d) Is f continuous at $x=3$? ___________ Why or why not?

10. Consider the function $f(x)=\begin{cases} 2x-1, & if\ x>1 \\ 5x^2-2, & if\ x<1 \\ 4, & if\ x=1 \end{cases}$ Showing all work, do the following:

a) Find $\lim_{x\to 1^+} f(x)$, if it exists. ___________

b) Find $\lim_{x\to 1^-} f(x)$, if it exists. ___________

c) Find $\lim_{x\to 1} f(x)$, if it exists. ___________

d) Find $f(1)$, if it exists. ___________

e) Is f continuous at $x=1$? ___________ Why or why not?

f) Find $\lim_{x\to 4} f(x)$, if it exists. ___________

g) Is f continuous at $x=4$? ___________ Why or why not?

2. Let $f(x)=\dfrac{2x-6}{x^2-9}$.

a) Determine what value, if any, to assign to $f(3)$ to make f continuous at $x=3$. If there is none, briefly explain why.

b) Determine what value, if any, to assign to $f(-3)$ to make f continuous at $x=-3$. If there is none, briefly explain why.