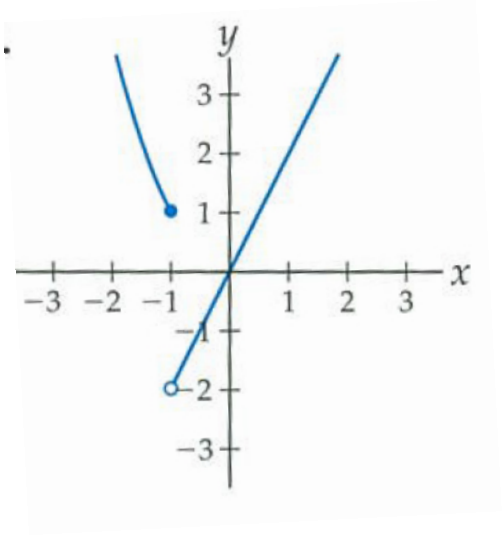
Name:_____

Exam 1 - Math 105

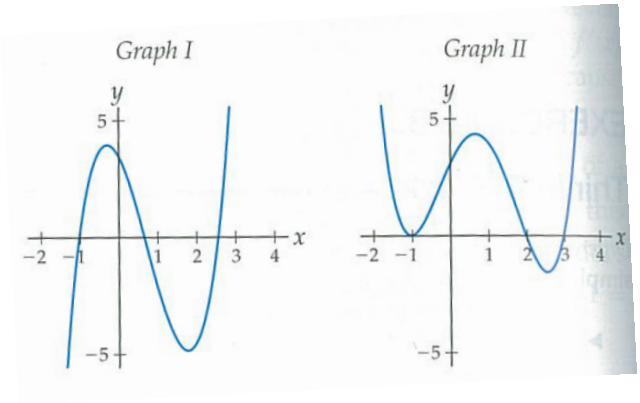
Show all your work to receive full credit for a problem. There are a total of 72 points on this test. Good luck!

1. (4 points) The graph of a function f is given below. Use the graph to determine the values of x at which f is not continuous. Justify your answers with limit statements (that is, I don't want you to just make references to the picture).



2. (6 points) Use the limit definition of the derivative to find $p'(-2)$ for $p(x) = 3x^2$.

3. (5 points) One of the graphs shown below is a function h and the other is its derivative h'. Which one is which, and why?



4. (6 points each, 12 points total.) The following table lists the consumption of gasoline in billions of gallons in the United States from 1994 to 2000:

Year	1994	1995	1996	1997	1998	1999	2000
Gas	109	111	113	117	118	121	122

(a) Compute the average rate of change in gasoline consumption in the United States for each year from 1994 to 2000.

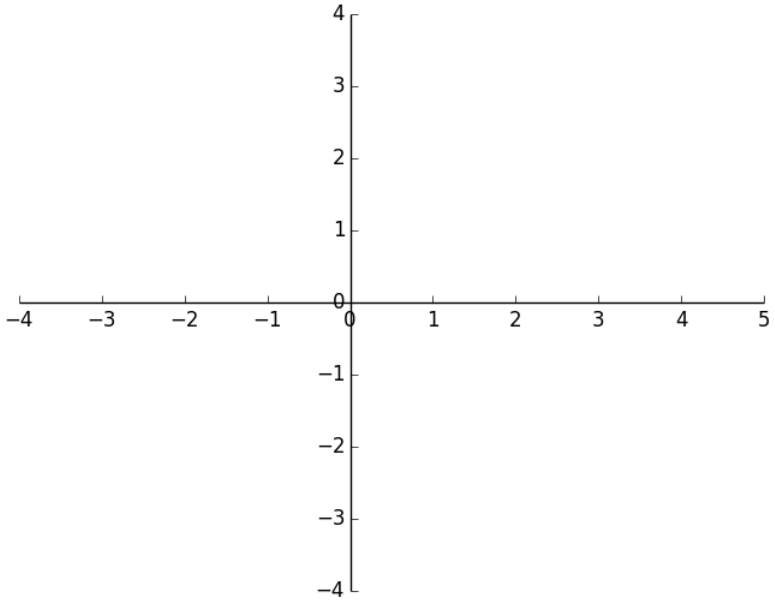
(b) During which year was gasoline consumption increasing most rapidly? Least rapidly?

5. Suppose you throw a ball straight up into the air at a velocity of $v_0 = 42$ feet per second, initially releasing the ball at a height of 4 feet. Acceleration due to gravity is constantly $a(t) = -32$ feet per second squared (negative since it pulls downward).

   (a) (3 points) Calculate a formula for the velocity $v(t)$ of the ball after t seconds.

   (b) (3 points) Calculate a formula for the position $s(t)$ of the ball after t seconds.

   (c) (6 points) Draw graphs for $a(t)$, $v(t)$ and $s(t)$ in the axes provided.



6. (3 points each, 15 points total.) Construct examples of the thing(s) described in the following.

   (a) The graph of a function f for which $f(2)$ does not exist but $\lim_{x \to 2} f(x)$ does exist.

   (b) The graph of a function that is continuous, but not differentiable, at $x = 2$.

   (c) A function that is always positive and always decreasing, on all of $\mathbb{R}$.

   (d) The graph of a function f for which $f(3) = 0$, $f'(3) = 0$, and $f''(3) = 0$.

   (e) Two antiderivatives of $t(x) = 7x^2 + 8x^{11} - 18$.

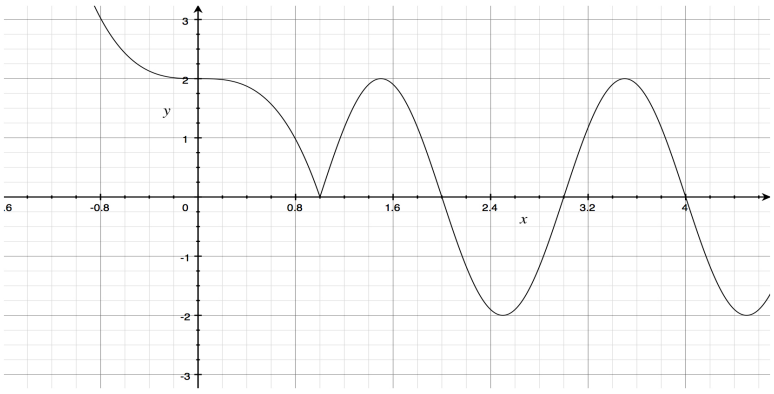


Figure 1: Graph of $g(x)$

7. (3 pts each, 18 pts total.) Let $G(x)$ be an antiderivative of $g(x)$, the function shown in Figure 1. Answer the following questions about G. (You may use estimates if you're not sure of the exact values.)

   (a) What is $G'(1)$? What is $G''(1)$?

   (b) Where are the maximum and minimum points of G?

   (c) On what intervals is G increasing? On what intervals is G decreasing?

   (d) What are the inflection points of G?

   (e) On what intervals is G concave up? On what intervals is G concave down?

   (f) Suppose $G(0) = 15$. Is it possible that $G(2) = 10$? Justify your answer.

8. (1 point extra credit) Tell me about something in this class that you understand really well, and what has helped you understand it.

9. (1 point extra credit) Tell me about something you wish you understood better, and why.