

AAAAAAAAAAAAHHHHHHHHHHHHHHHHHHHH!!!!!!!

Math 121C
Fall 2009
Instructor: Shawn Rafalski

Applied Calculus I
Exam 2

Write your name on this exam right now. Your work on this exam is to be your work alone. No calculators allowed. You have one hour to finish. Explain your answers clearly, and *show your work*. This exam has 9 pages, and the questions are worth a total of 100 points (not including bonus points). Only work on the bonus questions **after** you have tried to do all the regular questions. Don't forget to breathe regularly, and good luck!!

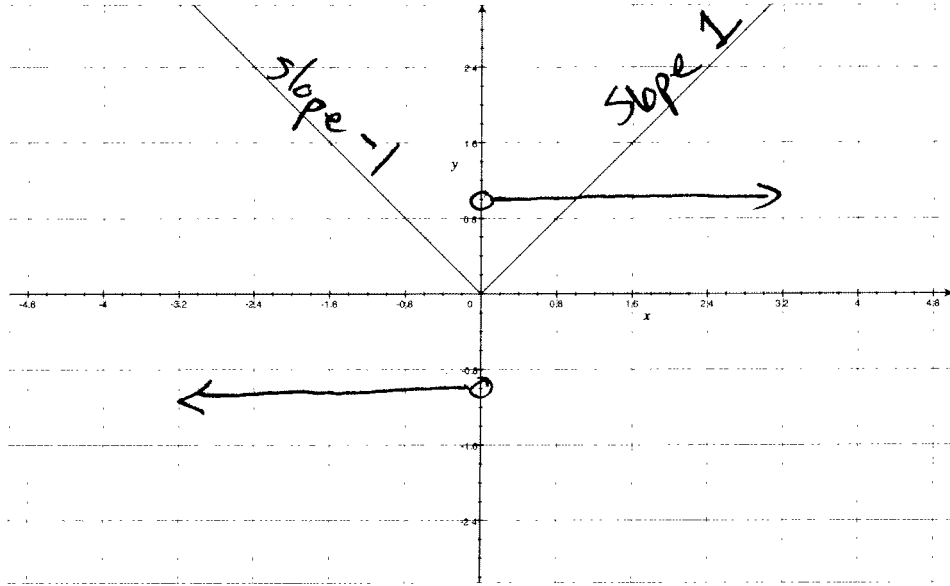
Begin working on the next page...

(b) (7 points) $h(x) = (x^7 - 3x^2)(x^2 + 4x + 17)$

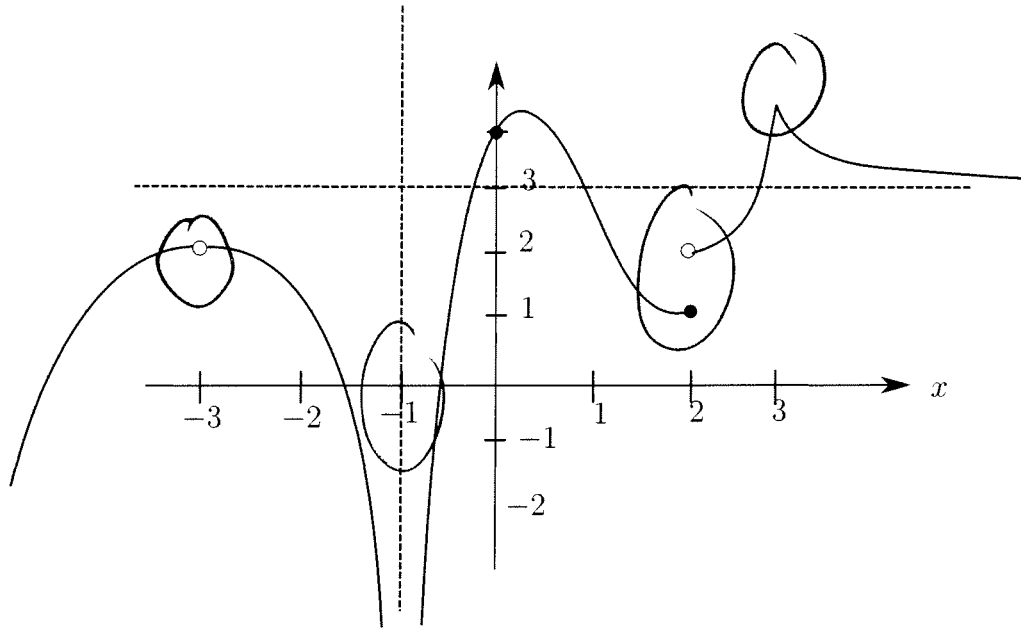
$$\frac{dh}{dx} = (7x^6 - 6x)(x^2 + 4x + 17) + (x^7 - 3x^2)(2x + 4)$$

(c) (8 points) $F(x) = \frac{x^3}{(\sqrt{x} + 3x)}$

$$F'(x) = \frac{3x^2(\sqrt{x} + 3x) - x^3\left(\frac{1}{2}x^{-1/2} + 3\right)}{(\sqrt{x} + 3x)^2}$$



3. (10 points) Pictured above is the graph of a function $F(x)$. Draw the graph of $F'(x)$.



4. (10 points) The graph of the function $g(x)$ is pictured above. Identify the x values for which the derivative of $g(x)$ is not defined, and explain your answers.

$x = -3, -1$ b/c g is not defined at these points

$x = 2$ b/c there is a jump discontinuity

$x = 3$ b/c there is a sharp turn

5. You run a business that produces blanks (just fill in the “blanks” with your favorite product). Let $C(x)$ be the cost in hundreds of dollars to make x blanks.

- (a) (7 points) Suppose that the average rate of change of cost from $x = 2$ to $x = 7$ is 17. What are the units of “17,” and what is the meaning of this quantity?

17 $\frac{100\text{s of } \$}{\text{blank}}$. This means that, on average, the cost to produce blanks is increasing by about \$1,700/blank between 2 and 7 blanks.

- (b) (5 points) Define the *marginal cost function*. What relationship does the marginal cost at $x = 2$ have to the graph of $C(x)$?

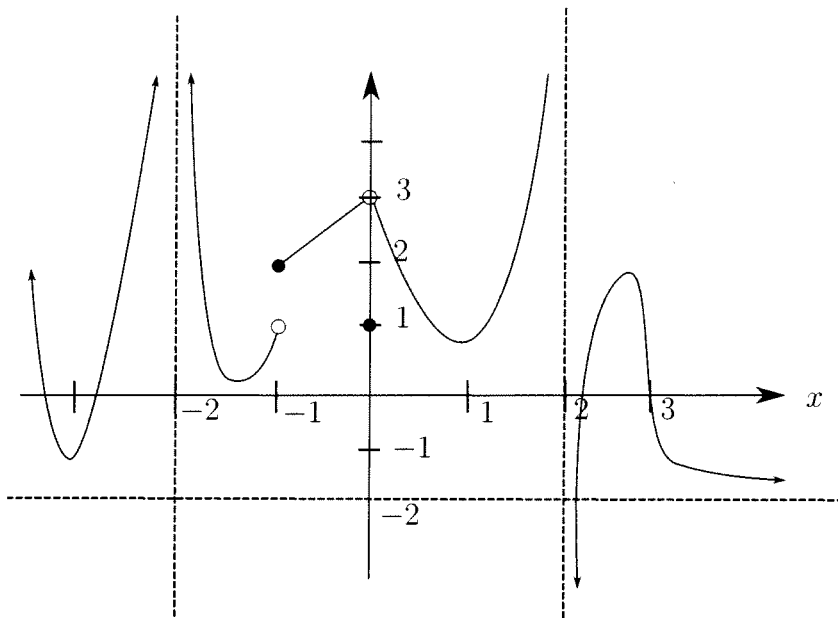
m.c. = $C'(x)$. $C'(2)$ is the slope of the tangent line to the graph of $C(x)$ at the point $(2, C(2))$.

- (c) (8 points) Suppose you know that the marginal cost at $x = 7$ is 4. Explain everything you can about what this tells you about the cost function?

$C'(7) = 4$. This tells us that it should cost about \$400 more to make 8 blanks than it cost to make 7 blanks.

- (d) (5 points) Define the *average cost function*.

$$\bar{C}(x) = \frac{C(x)}{x}$$



6. (3 points each) The above figure shows the graph of the function $f(x)$. Determine the following:

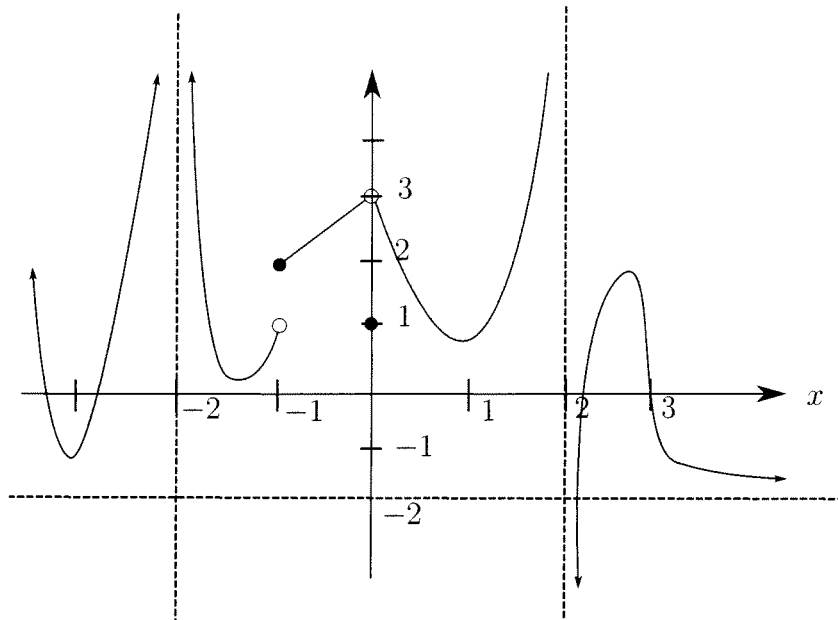
(a) $\lim_{x \rightarrow 2} f(x) = \text{dne.}$

(b) $\lim_{x \rightarrow -1^+} f(x) = 2$

(c) $\lim_{x \rightarrow 3} f(x) = 0$

(d) $\lim_{x \rightarrow \infty} f(x) = -2$

(e) $f(0) = 1$



7. (10 points) Pictured above is the graph of the function $f(x)$ (this is the same function as in the previous question). Identify each value of x at which f is discontinuous, and explain your answer for each value.

$x = -2, 2$ b/c f is not defined at these values

$x = -1$ b/c $\lim_{x \rightarrow -1} f$ dne

$x = 0$ b/c $f(0) \neq \lim_{x \rightarrow 0} f$

8. (**Bonus 3 points!**) Compute 435×2.31 and 2.31 divided by 435 . Both must be correct for you to receive the bonus. Compute the division correctly to 5 decimal places.