Math 10250 Name:_____

Exam 3 Instructor:_____

November 16, 2006 Section:_____

Calculators are allowed. Do not remove this answer page – you will return the whole exam. You will be allowed 1 hour and 15 minutes to do the test. You may leave earlier if you are finished.

Part I consists of 10 multiple choice questions worth 5 points each. Record your answers by placing an $\times$ through one letter for each problem on **this** answer sheet.

Part II consists of 5 pages of partial credit problems worth a total of 50 points. Write your answer and show **all** your work on the page on which the question appears.

You are taking this exam under the honor code.

GOOD LUCK

1.	a	b	c	d	e	6.	a	b	c	d	e
2.	a	b	c	d	e	7.	a	b	c	d	e
3.	a	b	c	d	e	8.	a	b	c	d	e
4.	a	b	c	d	e	9.	a	b	c	d	e
5.	a	b	c	d	e	10.	a	b	c	d	e

For grading use:

Q1- Q10	
Pg. 6	
Pg. 7	
Pg. 8	
Pg. 9	
Pg. 10	
Total	

Part I: Multiple Choice Questions (5 Points Each)

1. A restaurant owner estimates that the demand for an octopus dish each night is given by $p = \dfrac{72}{q+2}$, where p is the price in dollars for each dish and $q \geq 0$ is the number of dishes. Which of the following statements is **not** true for the revenue function $R(q)$?

   (a) The domain of $R(q)$ is $[0, +\infty)$.

   (b) The function $R(q)$ is increasing.

   (c) The graph of $R(q)$ is concave up.

   (d) $R(q)$ has a horizontal asymptote.

   (e) $R(0) = 0$.

2. A restaurant owner estimates that the demand for an octopus dish each night is given by $p = \dfrac{72}{q+2}$, where p is the price in dollars for each dish and $q \geq 0$ is the number of dishes. Suppose each appetizer costs the restaurant \$4 to make. Which of the following statements **is** true for the profit function $P(q)$?

   (a) The maximum profit is \$32.

   (b) The minimum profit is \$32.

   (c) The maximum profit is \$48.

   (d) The minimum profit is \$48.

   (e) There is no maximum profit.

3. Imagine that you have started driving on a straight highway and that during the first minute you are **accelerating** (keep increasing your velocity). Which of the following statements is **not** true about your position function $s(t)$, where t is measured in minutes?

   (a) The domain of $s(t)$ is $[0, 1]$.

   (b) $s(t)$ is increasing.

   (c) $s(t)$ has a maximum value at $t = 1$.

   (d) $s(t)$ has no minimum value.

   (e) The graph of $s(t)$ is concave up

4. The graph of the **derivative** of $f(x)$ is shown in Figure 1. Which of the following statements is **not** true?

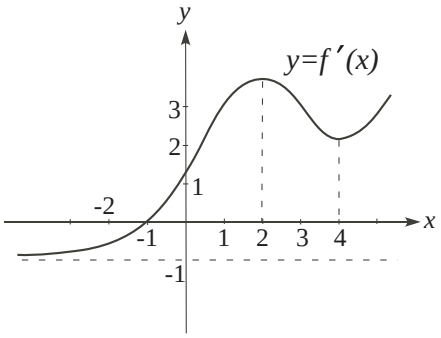


Figure 1

   (a) The only critical point of $f(x)$ is at $x = -1$.

   (b) $f(x)$ is increasing on $(-\infty, -1)$ and decreasing on $(-1, +\infty)$.

   (c) The graph of $f(x)$ is concave down on $(2, 4)$.

   (d) The graph of $f(x)$ is concave up on $(-\infty, 2) \cup (4, +\infty)$.

   (e) The graph of $f(x)$ has an inflection point at $x = 2$ and $x = 4$.

5. If $f(x)$ is a function whose **derivative** is $f'(x) = e^{x^3+x}$, then which of the following statements is **not** true? (Hint: You don't need an explicit formula for $f(x)$.)

   (a) $f(x)$ increasing

   (b) The graph of $f(x)$ is concave down.

   (c) $f(x)$ has no inflection points.

   (d) $f(x)$ has no maximum value on $(-\infty, +\infty)$.

   (e) $f(x)$ has no minimum value on $(-\infty, +\infty)$.

6. The revenue function from selling x units of a certain item is $R(x) = -0.01x^2+12x$ and the cost function is $C(x) = 2x + 1000$, where both $R(x)$ and $C(x)$ represent dollar amounts. Find the maximum profit when production is in the interval [100, 600].

   (a) \$1200

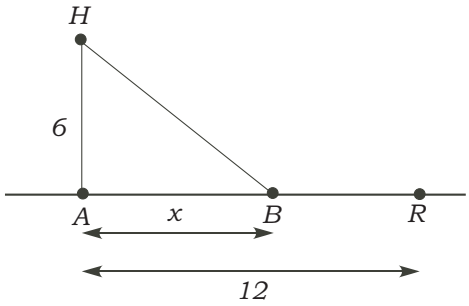
   (b) \$1300

   (c) \$1400

   (d) \$1500

   (e) \$1600

7. A house H is located in the woods, 6 miles from the nearest point, A, on a straight road. A restaurant, R, is located 12 miles down the road from A. Jack can ride his bike 2 miles per hour in the woods and 10 miles per hour along the road. He decides to ride the bike through the woods to some intermediate point B, x miles from A, and then ride along the road to R. Since he is starving, he wants to minimize his time. Which of the following is the function to be minimized?



(a) $\dfrac{\sqrt{36+x^2}}{2}+\dfrac{12-x}{10}$

(b) $2\sqrt{36+x^2}+10(12-x)$

(c) $3+\dfrac{x}{10}$

(d) $12+10x$

(e) $\dfrac{\sqrt{36+x^2}}{2}+\dfrac{x}{10}$

8. Two factories are located 10 miles apart at points A and B on a straight road. Both emit smoke, but the intensity coming from A is twice that of B, as measured by the particulate count. A contractor wants to build a house along that stretch of road at a point where the total intensity is minimal. Assume that wherever he puts the house, the total intensity is the sum of the intensity from point A and the intensity from point B. Also assume that at a point x miles from A the intensity from A is given by the formula $I_A=\dfrac{0.4}{x}$. What is the function that should be minimized? **Do not solve the rest of the problem!**

(a) $\dfrac{0.4}{x}+\dfrac{0.8}{10-x}$

(b) $\dfrac{0.4}{10-x}+\dfrac{0.2}{x}$

(c) $\dfrac{0.4}{x}+\dfrac{0.2}{10-x}$

(d) $\dfrac{0.8}{x}+\dfrac{0.4}{10-x}$

(e) $\dfrac{0.4}{x}+\dfrac{0.2}{x}$

9. If $y(t)$ is the solution to the initial value problem: $\dfrac{dy}{dt} = e^{0.5t} + 2t$, $y(0) = 5$, then find $y(2)$.

(a) $e + 7$

(b) $2e + 7$

(c) $4e + 7$

(d) $10e + 7$

(e) $0.5e + 7$

10. The marginal profit MP of a company after the year 2000 is given by $20te^{-t^2}$ in millions of dollars per year. The company's profit in 2001 was 4 million dollars. What will the company's profit be in the year 2008?

(a) $-10e^{-64} + 4 + \dfrac{10}{e}$

(b) $-10e^{-64} + \dfrac{10}{e}$

(c) $10e^{-64} + 4 + \dfrac{10}{e}$

(d) $10e^{-64} + \dfrac{10}{e}$

(e) $20e^{-64} + \dfrac{20}{e}$

Part II: Partial Credit Problems (10 Points per Page)

Show all work and put your final answer in the space provided. **No credit** will be given for a correct answer without showing how it was obtained. You will receive no credit if the answer is not in the space provided.

11. **(a)** Let $f(x) = 3x^5 - 5x^4$. $f(x)$ has critical points at $x = 0$ and $x = \frac{4}{3}$. (You don't have to check this.) What can be said about the critical points using the second derivative test *alone*? Do not apply any test other than the second derivative test. Be sure to show all your work!

Answer: _____

(b) Find the function whose tangent has slope $2x + e^{2x}$ for each value of x and whose graph passes through the point $(0, 0)$.

Answer: _____

12. A book publisher is designing a book whose pages have 2 inch margins along each side and 1 inch margins at the top and the bottom. The publisher wants the total page area to be 200 square inches. Find the dimensions of the page that will maximize the printed area.

Answer: _____

13. Compute the following indefinite integrals:

(a) $\int (e^x + e^{-x})dx.$

Answer: _____

(b) $\int \frac{2x}{(x^2+1)}dx$

Answer: _____

14. Suppose that the cost of producing x units of a certain product is given by the function

$$C(x) = 10x + \frac{6250}{x+1} + 259.$$

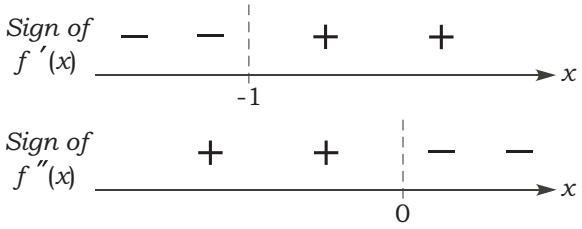
How many units should be produced to minimize the cost?

Answer: _____

15. Draw a graph of a *continuous* function $y = f(x)$ with the following properties. Be sure that it is clear how your graph satisfies all of these conditions. Draw your answer on the axes provided.

$f(-1) = -1, \quad f(0) = 0, \quad f(1) = 1$

$f'(-1) = 0$



Answer: