

FINAL EXAM-MATH 1300
FALL TERM, 2009

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Name(Print LEGIBLY)_____

I.D. Number_____

Instructions-This final examination consists of 10 multiple choice questions worth 3 points each. Your answers to the multiple choice questions must be clearly marked in the squares below. There are also 5 long answer questions worth a total of 70 points. For the long answer questions, you must show your work **on the exam itself** and clearly display your answers. **Do not unstaple these pages.**

NO CALCULATORS. NO NOTES OR BOOKS.

Multiple Choice Answers:

#1

#2

#3

#4

#5

#6

#7

#8

#9

#10

Question 1- What are the horizontal and vertical asymptotes of the function $y = \frac{2x^3 - 2}{x^3 - x^2}$?

- A) H.A. at $y = 0$, V.A. at $x = 1$
- B) H.A. at $y = 0$, V.A. at $x = 0$
- C) H.A. at $y = 2$, V.A. at $x = 1$
- D) H.A. at $y = 2$, V.A. at $x = 0$
- E) H.A. at $y = 2$, V.A. at $x = 0$ and at $x = 1$.

Question 2- Which are the inflection points of $f(x) = x^4 - \frac{2}{3}x^3 + 1$?

- A) $x = 0$ is the only inflection point.
- B) $x = \frac{1}{3}$ is the only inflection point.
- C) $x = \frac{1}{2}$ is the only inflection point.
- D) $x = 0$ and $x = \frac{1}{2}$ are the inflection points.
- E) $x = 0$ and $x = \frac{1}{3}$ are the inflection points.

Question 3- Find the equation of the tangent line to the graph of $y = \frac{1}{2}e^{2x}$ when $x = \ln(2)$.

A) $y = 4x + 2 - 4 \ln(2)$ **B)** $y = \frac{1}{2}x + \frac{1}{2} \ln(2)$ **C)** $y = 4x - 2$ **D)** $y = \frac{1}{2}x + \ln(2)$

E) $y = 4x - 2 \ln(2)$

Question 4- What are the critical points of the function $f(x) = \sqrt[3]{2x} - \frac{2}{3}x + 2$?

A) f has no critical points **B)** $x = 0$ **C)** $x = 0, x = \frac{1}{2}$ **D)** $x = \frac{1}{2}$ **E)** $x = \frac{1}{4}, x = \frac{1}{2}$

Question 5- Calculate:

$$\int_1^e \ln(x) dx$$

- A) 0 B) 1 C) e D) $e - 1$ E) $1 - e$

Question 6- Evaluate:

$$\int_1^{\infty} \frac{3}{x^2} dx$$

- A) 1 B) -1 C) 3 D) -3 E) divergent

Question 7- A company has determined that its marginal profit function is given as $P'(x) = 3\sqrt{x} - 3$. Currently the company is producing 4 units and is breaking even. How much profit will the company make when production is increased to 9 units?

- A) \$0 B) -\$12 C) \$27 D) \$23 E) -\$27

Question 8- If the demand function is $D(x) = -x^2 + x + 10$ and the supply function is $S(x) = x + 1$, find the producer surplus.

- A) 4 B) $\frac{11}{2}$ C) $\frac{9}{2}$ D) 3 E) $\frac{4}{3}$

Question 9- If $f(x, y) = \sqrt{xy^2}$, what is the domain of f ?

A) $\{(x, y) | x \geq 0\}$ **B)** $\{(x, y) | x \geq 0, y \geq 0\}$ **C)** $\{(x, y) | x \geq 0, y \neq 0\}$

D) $\{(x, y) | x \neq 0, y > 0\}$ **E)** $\{(x, y) | x < 0, y \neq 0\}$

Question 10- If $f(x, y) = e^{x^2} + 2xy - 2y$, what is the critical point of $f(x, y)$?

A) $(0, 0)$ **B)** $(1, -e)$ **C)** $(-1, 1)$ **D)** $(0, e)$ **E)** $(1, 1)$

Long Answer Question 1 (14 points)

A girl is flying a kite. Initially the kite is directly above her at a height of 80 feet. The kite is moving horizontally away from her at a rate of 5 feet per second. At what rate is the string being let out when the distance from the girl to the kite is 100 feet? You may assume the string is on a straight line from the girl to the kite.

Question 2 (14 points)

Calculate the following two indefinite integrals:

$$\int x^2 e^{3x^3} dx$$

$$\int x^7 \ln(3x) dx$$

Question 3 (14 points)

A manufacturer can produce T-shirts at a cost of 2 dollars each. They have been selling the shirts at 5 dollars each. At this price they sell 4,000 shirts per month. The manufacturer is planning on raising the price and estimates that for each 1 dollar increase in price, 400 fewer shirts will be sold.

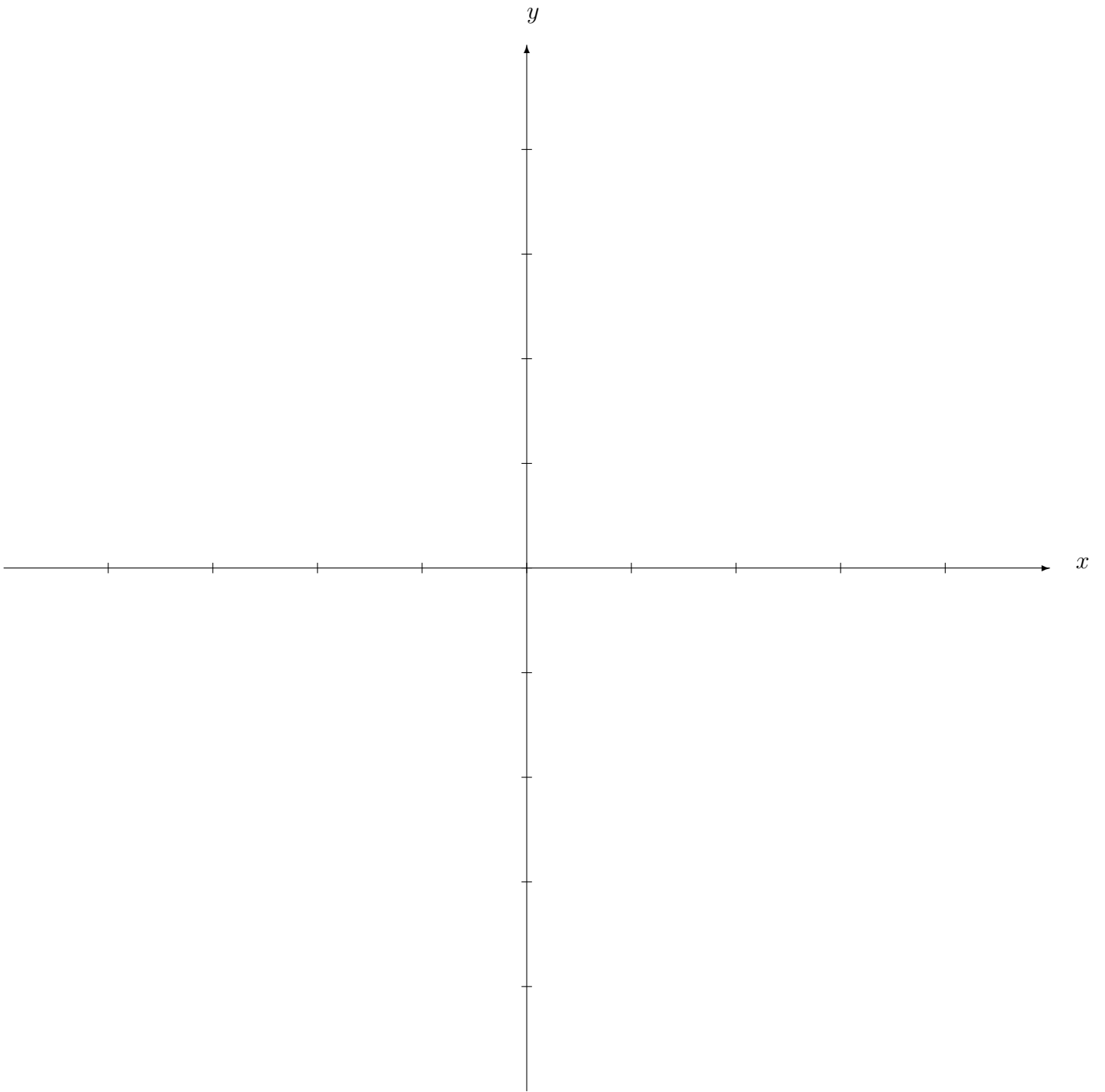
- (a) **(3 points)** Find the demand function.
- (b) **(3 points)** Find the profit function.
- (c) **(5 points)** How many shirts should be produced in order to maximize profit?
- (d) **(3 points)** Explain why your answer in (c) is an absolute maximum.

Question 4 (16 points)

Consider the two functions:

$$f(x) = x^2 - 2x \text{ and } g(x) = x$$

- (a) **(4 points)** Find the intersection points of the graphs of the two functions.
- (b) **(6 points)** On the next page, graph these functions, and shade the region bounded by $f(x), g(x), x = 0$ and $x = 4$.
- (c) **(6 points)** Find the area of the shaded region.



Question 5 (12 points)

Consider the function of two variables $f(x, y) = 2x^3 + y^2 + 3x^2 - 8y - 12x + 4$.

- (a) **(3 points)** Calculate the first-order partial derivatives.
- (b) **(3 points)** Find all critical points.
- (c) **(6 points)** Identify what type of critical points they are (local max, local min or saddle point).

Extra page for additional work