Math 112
Exam 1
May 18, 2023

Name _____

Student ID #_____

HONOR STATEMENT

"I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam."

SIGNATURE:_____

- This exam consists of a cover, three pages of questions, and two blank scratch sheets, if you put work on the scratch sheets which you want graded, you MUST tell note in the problem to "see scratch sheet".
- You will have 50 minutes.
- You are allowed to use a non-graphing scientific calculator, a ruler, and one 8.5 by 11 inch sheet of handwritten notes (front and back). All other sources are forbidden.
- Turn your cell phone OFF and put it away for the duration of the exam. You may not listen to headphones or earbuds during the exam.
- **You must show your work.** Clearly show your work and calculations. The correct answer with no supporting work may result in no credit.
- Unless otherwise indicated, when rounding is necessary, you may round your final answer to two digits after the decimal.
- **Do not write within 1 centimeter of the edge!** Your exam will be scanned for grading.
- There are multiple versions, you have signed an honor statement, and cheating is a hassle for everyone involved. If we find that you give an answer that is only appropriate for the other version of the exam and there is no work to support your answer, then you will get a zero on the entire exam and your work will be submitted to the academic misconduct board. JUST DO NOT CHEAT.

GOOD LUCK!

1. (12 points)

(a) Find the derivative of $f(x) = \dfrac{6}{\sqrt{x^3}} + 10\ln(x^4+1)$ at $x = 1$.

$f'(1) =$ _____

(b) Evaluate the integral: $\displaystyle\int 3e^{5x} - \frac{x^4}{2} + \frac{5}{7x}\,dx$

Answer = _____

(c) Evaluate the integral: $\displaystyle\int_1^2 4x(x^2+1)\,dx$

Answer = _____

2. (15 points)

(a) (5 pts) Find and classify all critical values for the function $f(x) = \frac{1}{3}x^3 + x^2 - 8x + 30$. (*Clearly, label if each critical value is a local max, local min or horizontal point of inflection*).

(List Critical values) $x =$ _____

(b) Water is flowing into and out of two vats, Vat A and Vat B. You are given

- Vat A rate of flow: $A'(t) = 8 - 4t$ in gallons/hour.
- Vat B amount: $B(t) = -t^3 + 12t + 39$ in gallons.

Also, both vats have the same amount of water at time $t = 1$ hour (*i.e.* $A(1) = B(1)$).

i. (3 pts) Find the formula, $A(t)$, for the amount of water in the vat A at time t. (Remember to solve for "$+C$")

$A(t) =$ _____ gallons.

ii. (3 pts) The function $B(t) = -t^3 + 12t + 39$ has one point of inflection. Find this point of inflection and determine the interval on which the function $B(t)$ is concave down.

point of inflection: (x, y) = _____

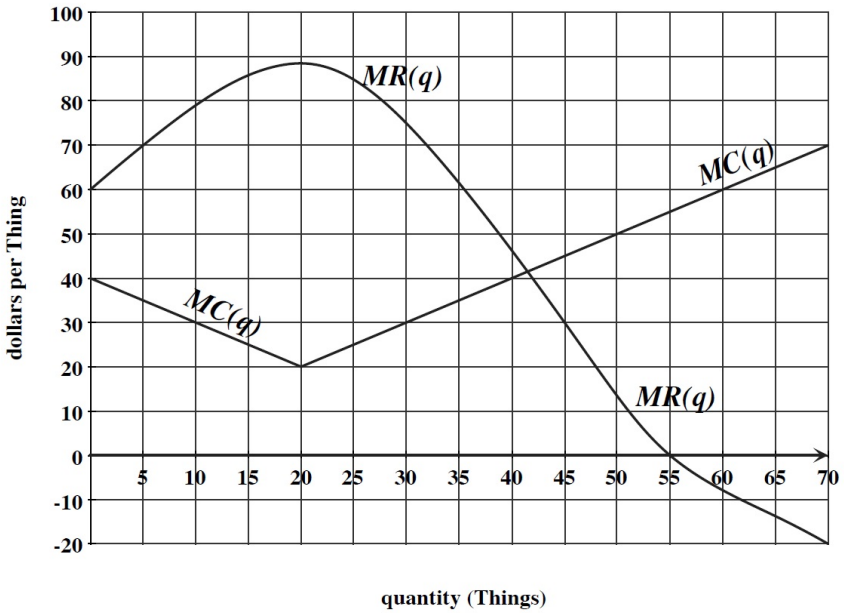
interval when concave down: _____ $< x <$ _____

iii. (4 pts) What is the largest and smallest amount of water (in gallons) in **Vat B** in the first 4 hours?

global max = _____ gallons

global min = _____ gallons

3. (13 pts) Below are the graphs of marginal revenue and marginal cost for selling Things:



Also assume that fixed cost is $FC = TC(0) = 25$ dollars.

(a) (6 pts) Estimate as accurately as possible from the graph:

i. $TC(10)$ = _____

ii. $TC'(10)$ = _____

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iii. $TC''(10)$ = _____

(b) (3 pts) Give the quantity at which each of the following occur (estimate from the graph):

i. The graph of MR has a local maximum at $q =$ _____

ii. The graph of Profit has a local maximum at $q =$ _____

iii. The graph of TR has a local maximum at $q =$ _____

(c) (4 pts) Estimate the maximum profit (in dollars).
(It is okay to use the "counting boxes" method, we will acceptable a range of answers, but please show your work in how you got your answer)

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max profit = _____ dollars

You may use this page for scratch-work or extra room.
All work on this page will be ignored unless you write and circle "see scratch pages" on the problem and you label your work.

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