Math 112 - Winter 2019
Exam 1
January 31, 2019

Name: ________________________

Section: ________________________

Student ID Number: ________________________

PAGE 1	12	
PAGE 2	11	
PAGE 3	12	
PAGE 4	15	
Total	50	

- After this cover page, there are 4 pages of questions in addition to this cover page . Please make sure your exam contains all of this material.
- You are allowed to use a Ti-30x IIS Calculator model ONLY (**no other calculators allowed**). And you are allowed one **hand-written** 8.5 by 11 inch page of notes (front and back).
- You must show your work on all problems. The correct answer with no supporting work may result in no credit.
- If you use a guess-and-check, or calculator, method when an algebraic method is available, you may not receive full credit.
- If you need more room, use the backs of the pages and indicate to the grader that you have done so.
- Raise your hand if you have a question.
- There are **multiple versions** of the exam so if you copy off a neighbor and put down the answers from another version we will know you cheated. Any student found engaging in academic misconduct will receive a score of 0 on this exam. All suspicious behavior will be reported to the academic misconduct board. Sit far away from your study partners and keep your eyes down, don't risk a zero on this exam!
- You have 50 minutes to complete the exam. Budget your time wisely.
SPEND NO MORE THAN 10 MINUTES PER PAGE!

GOOD LUCK!

1. (12 points)

   (a) For the two derivative questions below, you do NOT have to simplify your final answer. *Put a box around your final answers.*

      i. Find $f'(x)$, if $f(x) = 5\left(\frac{4}{x^2} + \frac{x^2}{3}\right)^4$.

      ii. Find $\frac{dy}{dx}$, if $y = \frac{3x}{8} + \sqrt[3]{x}\sqrt{x^7 - 4x^3}$.

   (b) Write the *equation of the tangent line* to the graph of $y = \frac{3x^5 - 3x - 9}{4 - x^2}$ at $x = 1$. Simplify your final answer into the form $y = mx + b$.

ANSWER: $y =$ ____________________

2. (11 pts) **Parts (a) and (b) below are NOT related.**

(a) Let $f(x) = 3x - 2x^2$.
Write out, expand and *completely simplify* the following: $\dfrac{f(x+h) - f(x)}{h}$.
Then **also** give $f'(x)$. (Feel free to check your work!)

ANSWERS: $\frac{f(x+h)-f(x)}{h}$ = ____________________

$f'(x)$ = ____________________

(b) For a different function, $g(x)$, you are told that $g(x+h) - g(x) = 2h^3 + 6h^2x + 6hx^2 - h$ for all values of x and h (you are NOT given $g(x)$). Answer the following questions:

i. Give the value of $g(3) - g(2)$.

ANSWER: $g(3) - g(2)$ = ____________________

ii. Give the value of $g'(5)$.

ANSWER: $g'(5)$ = ____________________

3. (12 pts) You sell Items. If you sell q hundred Items, you are given:

demand curve (*i.e.* price):	$p = 81 - 2q$	dollars/Item
total cost:	$TC(q) = q^3 - 20q^2 + 141q + 2$	hundred dollars

***Note*: Pay attention to units.**

(a) Find the quantity and price that correspond to maximum **total revenue** (round to the nearest Item and dollar/Item)

ANSWER: Quantity: ____________ Items

Price: __________ dollars/Item

(b) Find the longest interval on which marginal revenue exceeds marginal cost.

ANSWER: From q = ____________ to q = ____________ hundred Items

(c) What is the maximum value of **profit** to the nearest dollar?

ANSWER: max profit = ____________ dollars

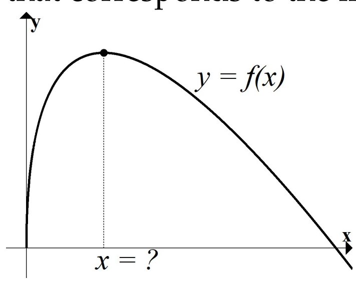
4. (15 pts) **Parts (a) and (b) below are NOT related.**

(a) Let $f(x) = 3\sqrt{x} - 4x$.

i. Find the second derivative of $f(x)$.

ANSWER: $f''(x)$ = ____________________

ii. The graph of $f(x) = 3\sqrt{x} - 4x$ is below. Use a derivative to find the x-coordinate that corresponds to the maximum point shown on the graph (shown below).

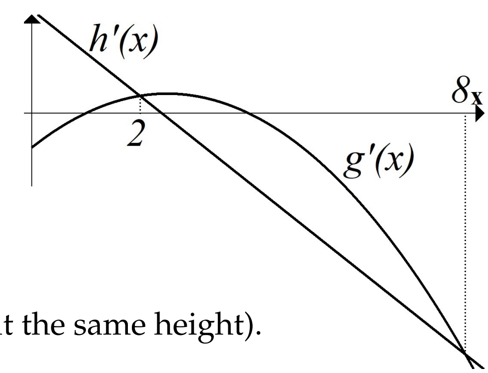


ANSWER: x = ____________________

(b) . Two functions $g(x)$ and $h(x)$ have derivatives

$$g'(x) = -x^2 + 5x - 4 \text{ and } h'(x) = -5x + 12.$$

The *derivative* graphs are shown, including the locations where they intersect each other (2 and 8). Note that the formulas for $g(x)$ and $h(x)$ are not given.



i. Assume $g(0) = h(0)$ (*i.e.* original functions start at the same height). For each part, circle the true statement:

A. Circle one: $g(2) > h(2)$ or $g(2) = h(2)$ or $g(2) < h(2)$.

B. Circle one: $h(1) > h(0)$ or $h(1) = h(0)$ or $h(1) < h(0)$.

ii. Name the longest interval over which $g(x)$ is increasing and $h(x)$ is decreasing.

ANSWER: from $x =$ ______________ to $x =$ ______________