# Math 112
## Exam 1
### April 20, 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. (13 points)

   (a) Find the instantaneous rate of change for $f(x) = \dfrac{5x^2}{2} - \dfrac{6}{x} + 12x^4\sqrt{x^2 + 8}$ at $x = 1$.

<div align="right">ANSWER: $f'(1) = $ _____</div>

   (b) Let $g(x) = 3x^2 - 4$.

      i. Write out and *completely simplify* the formula, in terms of $h$, for

$$\frac{g(x+h) - g(x)}{h}.$$
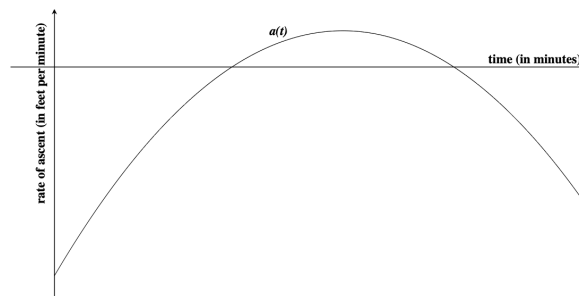
      AND give the derivative of $g(x)$.

ANSWER: $\dfrac{g(x+h) - g(x)}{h} = $ _____    $g'(x) = $ _____

      ii. Find the equation for the tangent line to $g(x)$ at $x = 2$.

<div align="center">ANSWER: _____</div>

2. (13 pts) At $t = 0$, Balloon A is 250 feet above the ground. Its **rate of ascent** (in feet per minute) at $t$ minutes is

$$a(t) = -0.5t^2 + 6.5t - 18.$$



Recall, $a(t)$ is the **derivative** of the height function, so if $A(t)$ is the height of Balloon A, then $A'(t) = a(t)$.

(a) Give the longest interval over which the Balloon A is rising.

ANSWER: $t =$ _____ to $t =$ _____

(b) Give the time when Balloon A is rising the fastest?

ANSWER: $t =$ _____

(c) The **height** (in feet) of a second balloon, Balloon B at $t$ minutes is given by

$$B(t) = -1.5t^2 + 24t + 250.$$

How fast is Balloon A moving when Balloon B is at its highest altitude?

ANSWER: Balloon A Speed = _____ ft/min

3. (14 pts) You sell Items. For sell and producing $x$ **hundred** Items, you are given:
   Demand Curve (*i.e.* price):   $p = 10 - x$                         dollars/Item
   Total Cost:                   $TC(x) = \frac{x^3}{12} + x^2 + x + 1$   hundred dollars.

   (a) Recall:  Average cost is defined by $AC(x) = \frac{TC(x)}{x}$.  Find and simplify the formula for $AC(x)$ and the formula for the derivative of average cost $AC'(x)$.

   ANSWER: $AC(x) = $ _____

   ANSWER: $AC'(x) = $ _____

   (b) Approximate the change in Total Revenue from 200 Items to 201 Items. (*You can use either Math 111 or Math 112 tools, but it is much faster to use the new tools*).

   ANSWER: _____ dollars

   (c) Give the longest interval over which $TR(x)$ is increasing.

   ANSWER: $x = $ _____ to $x = $ _____ hundred items

   (d) At what quantity and selling price is profit maximum?
       (Round final answer to two digits after the decimal)

   ANSWER: quantity = _____ hundred items

   price = _____ dollars/Item

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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