Math 112 - Winter 2018

Exam 2

February 15, 2018

Name: ______________________________

Section: ______________________________

Student ID Number: ______________________________

1	13	
2	12	
3	12	
4	13	
Total	50	

- After this cover page, there are 4 problems spanning 4 pages. 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. (13 pts) Put a box around your final answer. You do not have to simplify.

   (a) Find y' for $y = \left(\ln(t^3+1)\right)^{10}$

   (b) Find $f'(x)$ for $f(x) = \frac{1}{2} + 3x + \frac{5}{6e^{\sqrt{x}}}$

   (c) Find the general anti-derivative: $\int \frac{\sqrt{x}}{5} - 3e^{2x}\,dx$

   (d) Evaluate $\int_1^2 x\left(\frac{12}{x^3} + \frac{3}{x}\right)\,dx$

2. (12 pts) Two balloons are at the same height at $t = 0$. Time, t, is measured in minutes and height is measured in feet. You are given:

$$A'(t) = 15 - \frac{5t}{2} \qquad \text{feet/min} \quad = \text{'RATE of ascent for balloon A'}$$

$$B(t) = \tfrac{1}{3}t^3 - 5t^2 + 24t + 30 \quad \text{feet} \qquad = \text{'HEIGHT for balloon B'}$$

(a) Use the fact that $A(0) = B(0)$ to find the formula for $A(t)$ without any undetermined constants.

$A(t) =$ ______________________

(b) Give an interval over which the graph of the height of Balloon B is concave down.

$t =$ ________________ to $t =$ ________________

(c) Find all times at which Balloon B changes from falling to rising.

$t =$ ________________ min

(d) Find the lowest and highest altitudes reached by Balloon A from $t = 0$ to $t = 10$.

'lowest altitude' = ________________ feet
'highest altitude' = ________________ feet

3. (12 pts) You sell items. The functions for marginal revenue and marginal cost (in dollars/item) are given by

$$MR(q) = 7e^{0.02q} \quad \text{and} \quad MC(q) = q^2 - 12q + 124,$$

where q is in thousands of items. You are also told that Fixed Costs are given $FC = 15$ thousand dollars (so $TC(0) = 15$).

(a) Give the functions for Total Revenue and Total Cost (solve for the constants of integration).

$TR(q) =$ ______________________

$TC(q) =$ ______________________

(b) Find the largest and smallest values of Marginal Cost on the interval $q = 0$ to $q = 10$.

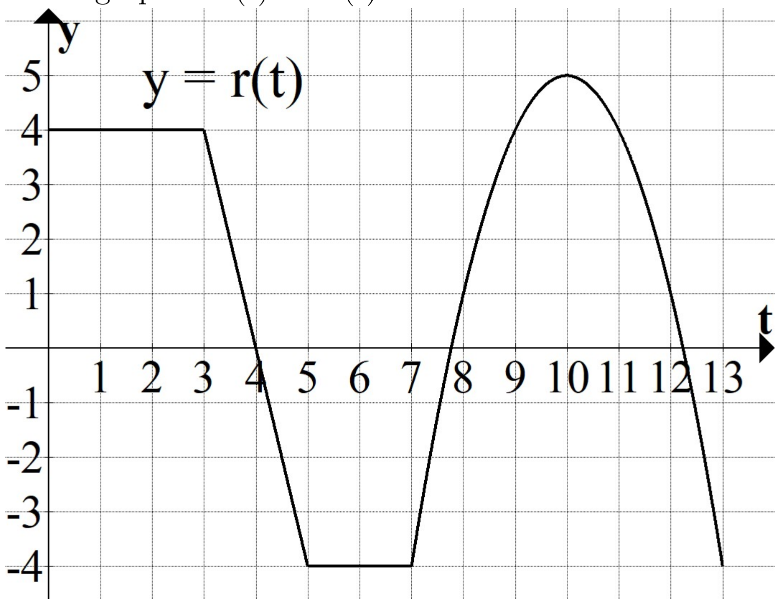
'smallest value of MC' = ________________ dollars/item

'largest values of MC' = ________________ dollars/item

(c) Recall: $AC(q) = \frac{TC(q)}{q}$.
Determine if $AC(q)$ is concave up, concave down, or neither at $q = 1$ thousand items. (You must show appropriate derivatives and make correct conclusions to get full credit).

ANSWER: (Circle one) CONCAVE UP CONCAVE DOWN NEITHER

4. (13 pts) The graph below shows the **rate of ascent**, $r(t)$, at time t for a hot-air balloon. Let $A(t)$ be the function for the height (in feet) of the hot-air balloon at time t minutes. As a reminder, the picture below is the graph of $r(t) = A'(t)$ which is the **derivative** of the altitude function!!



Use the picture to estimate the answers to the questions below as accurately as possible.

(a) Estimate the following:

i. $\int_0^4 r(t)\,dt =$

ii. $\int_3^7 r(t)\,dt =$

iii. $A''(4) =$

(b) Find *all* critical values of $A(t)$ (estimate from the picture).

$t =$ ____________________ min

(c) Give the longest interval of time over which the graph of $A(t)$ is concave up (*remember* the picture above is $A'(t)$).

$t =$ ____________________ min to $t =$ ____________________ min

(d) At time $t = 0$, assume the balloon is 20 feet high. Give the time and the corresponding altitude at which the balloon is highest in the first 7 minutes.

$t =$ ____________________ min

max height = ____________________ feet