

MATH 112  
Exam II  
Spring 2016

Name \_\_\_\_\_

Student ID # \_\_\_\_\_

Section \_\_\_\_\_

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: \_\_\_\_\_

1	6	
2	12	
3	16	
4	16	
Total	50	

- Check that your exam contains 4 problems.
- You are allowed to use a TI30-XIIS calculator, a ruler, and one sheet of hand-written notes. All other sources are forbidden.
- Do not use scratch paper. If you need more room, use the back of the page and indicate to the grader you have done so.
- 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 label lines and points that you are using and show all calculations. The correct answer with no supporting work may result in no credit.
- If you use a guess-and-check method when an algebraic method is available, you may not receive full credit.
- When rounding is necessary, you may round your final answer to two digits after the decimal.
- There are multiple versions of the exam, you have signed an honor statement, and cheating is a hassle for everyone involved. DO NOT CHEAT.
- Put your name on your sheet of notes and turn it in with the exam.

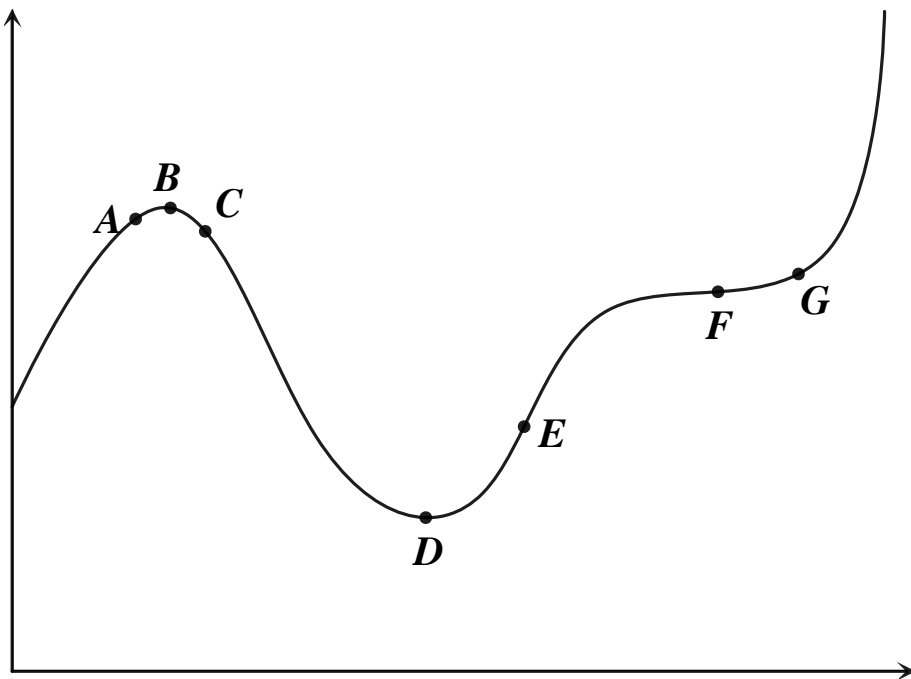
GOOD LUCK!

1. (6 points) Compute the indefinite integral. Put a box around your answer.

(a)  $\int \frac{3x + 10}{x^6} + \frac{4}{\sqrt[3]{x}} dx$

(b)  $\int \left(\frac{1}{x} + 3\right)(x^2 - 1) dx$

2. (12 points) Below is the graph of a function  $f(x)$ .



From among the points labeled  $A$  through  $G$ , circle **all points** at which each of the following criteria are satisfied. (Points may be circled more than once.)

$f(x)$ has a local minimum	$A$	$B$	$C$	$D$	$E$	$F$	$G$
$f(x)$ is concave down	$A$	$B$	$C$	$D$	$E$	$F$	$G$
$f(x)$ has a horizontal point of inflection	$A$	$B$	$C$	$D$	$E$	$F$	$G$
$f'(x) > 0$ and $f''(x) < 0$	$A$	$B$	$C$	$D$	$E$	$F$	$G$
$f'(x) > 0$ and $f''(x) = 0$	$A$	$B$	$C$	$D$	$E$	$F$	$G$
$f''(x) > 0$	$A$	$B$	$C$	$D$	$E$	$F$	$G$

3. (16 points) You produce Items. Your average cost to produce  $q$  Items is given by a function  $AC(q)$ . The **derivative** of average cost, in dollars per Item, is

$$AC'(q) = \frac{1}{25} - \frac{36}{q^2}.$$

- (a) Find the positive value of  $q$  at which the graph of **average cost** has a horizontal tangent line.

ANSWER:  $q =$  \_\_\_\_\_

- (b) Apply the Second Derivative Test to determine whether your answer to part (a) gives a local maximum or a local minimum of **average cost**.

ANSWER: (circle one) local maximum local minimum

- (c) From experience, you know that, when you produce 3 Items, your **average cost** is \$62.78 per Item. Find the formula for  $AC(q)$ .

ANSWER:  $AC(q) =$  \_\_\_\_\_

- (d) Recall that  $AC(q) = \frac{TC(q)}{q}$ . Find the largest value of **marginal cost** on the interval from  $q = 0$  to  $q = 50$  Items.

ANSWER: \_\_\_\_\_ dollars per Item

4. (16 points) Water flows into Vat  $A$  with an instantaneous rate of flow given by

$$a(t) = 4e^{0.01t}$$

where  $t$  is in hours after midnight and the rate,  $a(t)$ , is in gallons per hour.

- (a) Compute  $\int_1^5 a(t) dt$ .

ANSWER:  $\int_1^5 a(t) dt =$  \_\_\_\_\_

- (b) Describe, in terms of the water in the vat, what your answer to part (a) represents.

- (c) The amount in Vat  $B$ , in gallons, is given by

$$B(t) = (3t + 4) \ln(t^2 + 1) + \frac{50}{t + 2}.$$

Find a formula for the instantaneous rate of flow into Vat  $B$  at time  $t$ . You do not need to simplify. Put a box around your answer.

- (d) Let  $A(t)$  represent the amount, in gallons, in Vat  $A$  after  $t$  hours.  
At  $t = 0$ , Vat  $A$  and Vat  $B$  contain the same amount of water.  
How much water is in Vat  $A$  at  $t = 10$ ?

ANSWER: \_\_\_\_\_ gallons