MATH 111 A
Exam I
Autumn 2018

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:_____

- Check that your exam contains **three** problems.
- You are allowed to use a TI-30XIIS calculator, a ruler, and a 3-inch-by-5-inch note card containing hand-written notes. 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 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.
- **Do not write within 1 centimeter of the edge!** Your exam will be scanned for grading.
- If you run out of room, write on the back of the last page and **indicate that you have done so**. If you still need more room, ask your TA for an extra page to staple to your exam.
- There are multiple versions of the exam, you have signed an honor statement, and cheating is a hassle for everyone involved. DO NOT CHEAT.

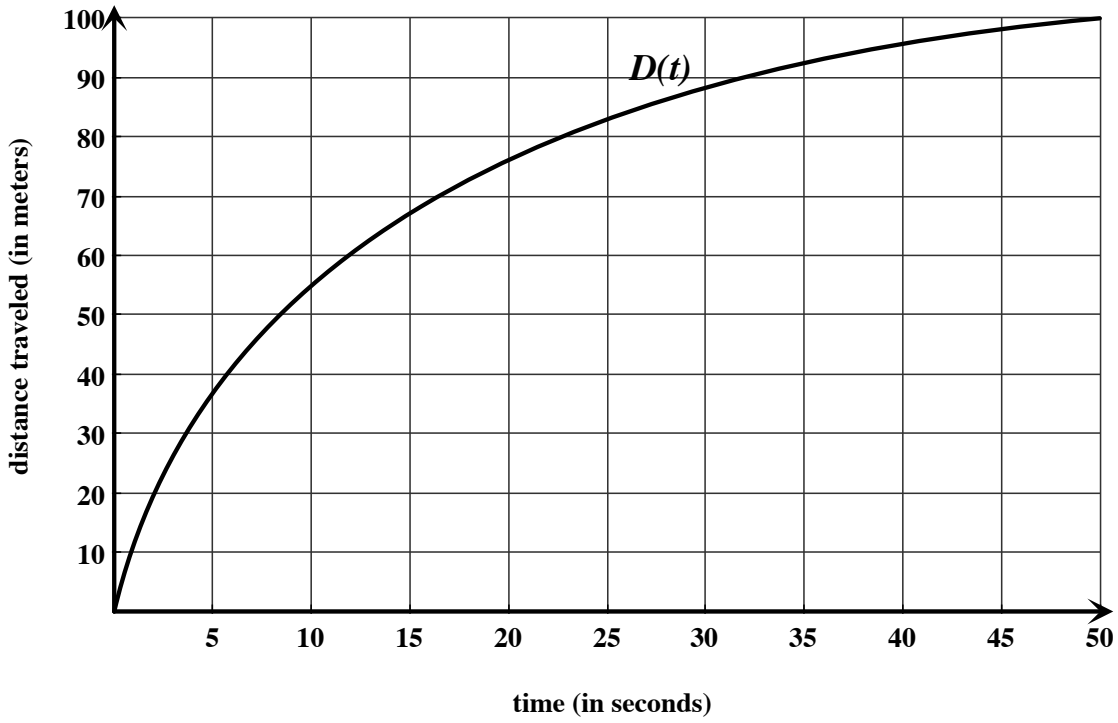
GOOD LUCK!

Suppose you produce and sell Things. The following table summarizes the terms we've learned so far relating to revenue and cost. Assume you are given a graph of total cost $TC(q)$ and total revenue $TR(q)$ for producing and selling q Things.

Term	**Definition**	**Related equations and formulas**	**Graphical Interpretation**
total cost $TC(q)$	the total amount you spend to produce q Things	$TC(q) = VC(q) + FC$	—
variable cost $VC(q)$	the money you spend to produce q Things without including fixed costs	$VC(q) = TC(q) - FC$	the graph of VC has the same shape as TC and goes through the origin
fixed cost FC	the money you must spend even if you produce 0 Things; also known as *overhead*	$FC = TC(q) - VC(q)$ $FC = TC(0)$	the vertical distance between the TC and VC graphs OR the "y"-intercept of the TC graph
average cost $AC(q)$	total cost averaged over the number of Things produced	$AC(q) = \frac{TC(q)}{q}$	the slope of the diagonal line through the TC graph at q
average variable cost $AVC(q)$	variable cost averaged over the number of Things produced	$AVC(q) = \frac{VC(q)}{q}$	the slope of the diagonal line through the VC graph at q
breakeven price BEP	the smallest value of average cost	—	the slope of the least steep diagonal line that intersects the TC graph
shutdown price SDP	the smallest value of average variable cost	—	the slope of the least steep diagonal line that intersects the VC graph
marginal cost $MC(q)$ (see footnote)	the incremental rate of change in TC from q to $q+1$ Things	$MC(q) = \frac{TC(q+1)-TC(q)}{1}$	the slope of the secant line through TC (or VC) at q and $q+1$
total revenue $TR(q)$	the total amount you receive when you sell q Things	—	—
average revenue $AR(q)$	total revenue averaged over the number of Things sold; also known as *price per Thing*	$AR(q) = \frac{TR(q)}{q}$	the slope of the diagonal line through the TR graph at q
marginal revenue $MR(q)$ (see footnote)	the incremental rate of change in TR from q to $q+1$ Things	$MR(q) = \frac{TR(q+1)-TR(q)}{1}$	the slope of the secant line through the TR graph at q and $q+1$
profit $P(q)$	the money you are left with after subtracting total cost from total revenue	$P(q) = TR(q) - TC(q)$	the vertical distance between TR and TC (when $TR > TC$)

NOTE: If q is measured in hundreds or thousands of Things, the definitions, formulas, and graphical interpretations of marginal revenue and marginal cost must be adjusted appropriately.

1. (16 points) The graph below shows **distance vs. time** for a moving object.



(a) Find the object's **average speed** from $t = 5$ to $t = 50$.

ANSWER: _____meters per second

(b) Find the object's **average trip speed** at $t = 40$.

ANSWER: _____meters per second

(c) Give the interval during which the object's **average trip speed** changes from 5 meters per second to 3 meters per second.

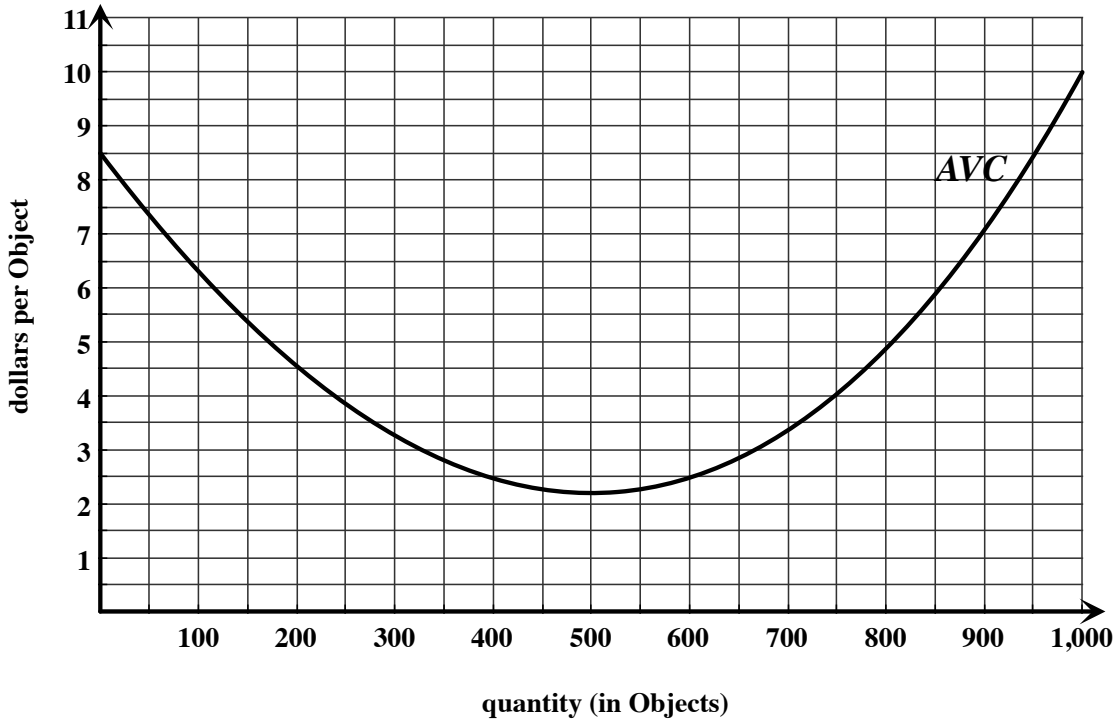
ANSWER: from $t =$_____to $t =$_____seconds

(d) Let $D(t)$ represent distance traveled at time t.

i. Translate into **functional notation**: *the object's average speed during the* 3*-second interval beginning at time* t

ii. Translate into **English**: $D(50) - D(10) = 45$.

2. (17 points) The following is the graph of **average variable cost** for producing Objects.



(a) What is the **average variable cost** to produce 300 Objects.

ANSWER: _____dollars per Object

(b) What is the **shutdown price**?

ANSWER: _____dollars per Object

(c) What is the **change in variable cost** if quantity increases from $q = 200$ to $q = 750$ Objects.

ANSWER: _____dollars

(d) Suppose fixed costs are \$1200. What is the total cost to produce 600 Objects?

ANSWER: _____dollars

(e) Again, suppose fixed costs are \$1200 and that Objects sell for \$8 each. What is the profit for selling 600 Objects?

ANSWER: _____dollars

3. (17 points) You sell Things.
   The total revenue and total cost functions for selling Things are both **linear**.
   If you sell 20 Things, your total revenue is \$640.
   If you produce 20 Things, your total cost is \$960. If you produce 60 Things, your total cost is \$1440.

   (a) Find the formula for $R(x)$, the **total revenue** (in dollars) for selling x Things.

   ANSWER: $R(x) =$_____

   (b) Find the formula for $C(x)$, the **total cost** (in dollars) to produce x Things.

   ANSWER: $C(x) =$_____

   (c) What is the **variable cost** to produce 50 Things?

   ANSWER: _____dollars

   (d) How much does your **profit** change if production level increases by *one Thing*?

   ANSWER: _____dollars

   (e) Find the smallest quantity at which you do not take a loss.

   ANSWER: _____Things