NAME: ________________________________ Student ID #: _________________

QUIZ SECTION:______

Math 111 D
Midterm I -- Solutions

October 19th, 2006

Problem 1	6	
Problem 2	10	
Problem 3	14	
Problem 4	20	
Total:	**50**	

- You are allowed to use a calculator, a ruler, and one sheet of notes.
- Your exam should contain 4 pages in total and 4 problems. Please check that your test is complete!
- You **must explain how you get your answers**. Correct (or incorrect) answers with no supporting work may result in little or no credit. On problems in which you use a graph, draw lines, label them, and mark points clearly.
- Write your **final answer in the indicated spaces**. Unless otherwise noted, round your answer to two decimal digits.
- If you need more room, use the backs of pages and indicate to the reader that you have done so.
- Raise your hand if you have a question.

GOOD LUCK!

Do you want me to post your grade so far next week on the class website under the last 4 digits of your student ID?

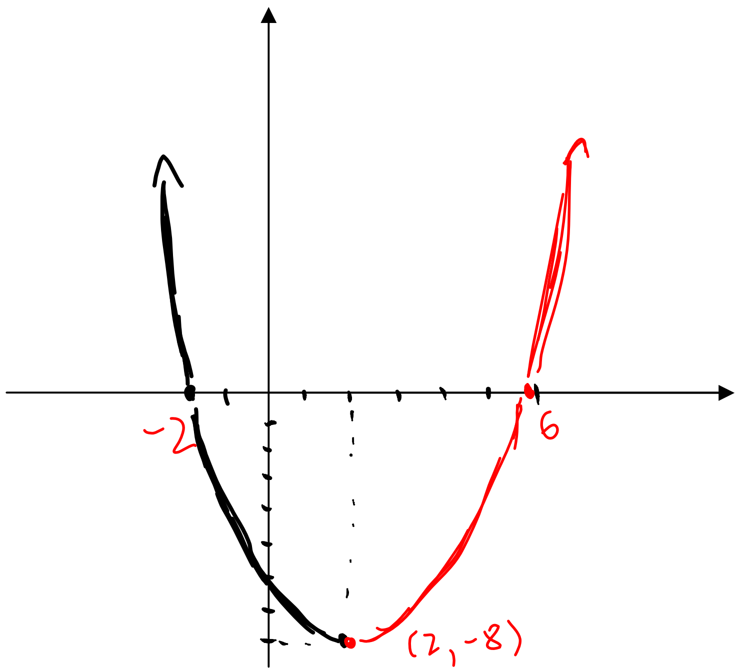
☐ *Yes, please post my grade. Sign to give permission:* ________________________________

☐ *No, please don't post my grade so far.*

1 (6 points) Graph the following quadratic function: $f(x)=\frac{1}{2}x^2-2x-6$.

Label both coordinates of its vertex. Also, label its intersection points with the x-axis.

(Show work and indicate which formulas you used – using a graphing calculator will not get much credit)



Shape: concave up parabola

Vertex:

x-coordinate via vertex formula:

$$\frac{-b}{2a}=\frac{-(-2)}{2\left(\frac{1}{2}\right)}=\frac{2}{1}=2$$

& y-coord: f(2)=-8

x-intercepts via quadratic formula:

$$\frac{-b\pm\sqrt{b^2-4ac}}{2a}=\frac{2\pm\sqrt{(-2)^2-4(1/2)(-6)}}{2(1/2)}$$

$$=\frac{2\pm\sqrt{16}}{1}=-2\ \&\ 6$$

2 (10 points: 3+3+4) The following table indicates the (incremental) average rate of water usage from a reservoir, over successive 5 minute time intervals.

Time interval (in min.)	0 →5	5 →10	10→15	15→20	20→25	25→30	30→35	35→40	40→45
Rate of Usage (in gallons per min)	3.5	1.7	2	2.8	3.3	4.4	10	2.9	5

a) How much water was used during the first 5 minutes?

Work: (*3.5 gal/min)x(5 min)=17.5 gal*

Answer: __*17.5*______ gallons.

b) How much water was used from t=15 to t=30 minutes?

Work: *compute the amount used over each 5 minute interval, then add up the amounts*
2.8x5+3.3x5+4.4x5=52.5
Note: It is not OK to add up the rates first, then multiply by 15 minutes! You'd get a different (and incorrect answer)

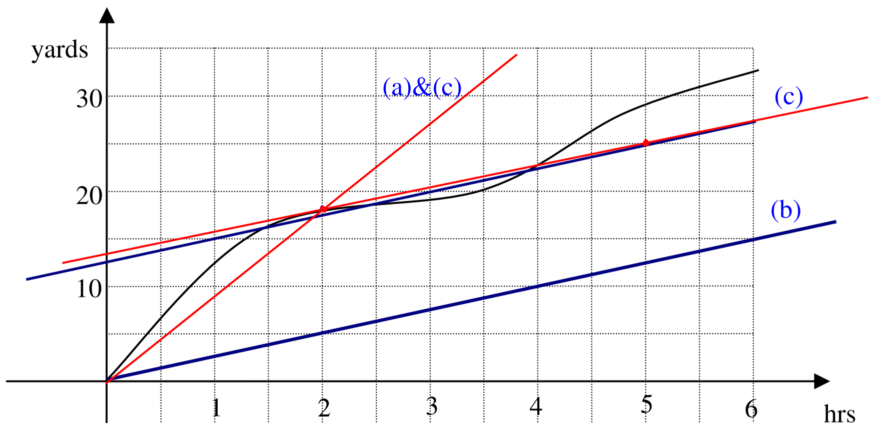
Answer: ____*52.5*_____ gallons.

c) What was the overall average rate of water usage, over the entire 45 minutes?

Work: *total water/ total time*= $\frac{3.5x5+1.7x5+...+5x5}{45}=\frac{178}{45}=3.96$

Answer: ____*3.96*______ gallons per minute.

3 (14 points: 4+4+6) The graph below represents the distance D(t) (in yards) traveled by the Mars Rover vehicle at time t (in hours), starting at noon.



NOTE: In all questions below we accepted a range of values as correct, as long as correct work was shown and the lines/measurements used were not too far off.

a) What was the average trip speed of the Rover two hours into the trip? (include units)

Draw a diagonal line to the point on the graph above t=2. Measure the slope.
OR: use ATS(2)=D(2)/2=18/2=9

Answer:______9____Units*: yards per hour*

b) Find a one hour time interval over which the Rover traveled 2.5 yards.

Draw a reference line of slope 2.5 (diagonal through point (2,5)). Keep your ruler parallel to this and roll it until it intersects the graph at two points which are 1 hr (2 horizontal tickmarks) apart. There are two possible answers: about 1.4 to 2.4 and about 2.7 to 3.7. We accepted a range around these values.

Answer: from t = _1.4__ to t = ___2.4____ hours.

c) Consider the following statement in functional notation: $\frac{D(2+3)-D(2)}{3} > \frac{D(2)}{2}$.

i) Translate it into English:

Answer:
The car's average speed over a 3-hour interval starting at t=2 (or: from 2hrs to 5 hrs) was greater than the car's average trip speed after 2 hrs.

ii) Translate it into graph language:

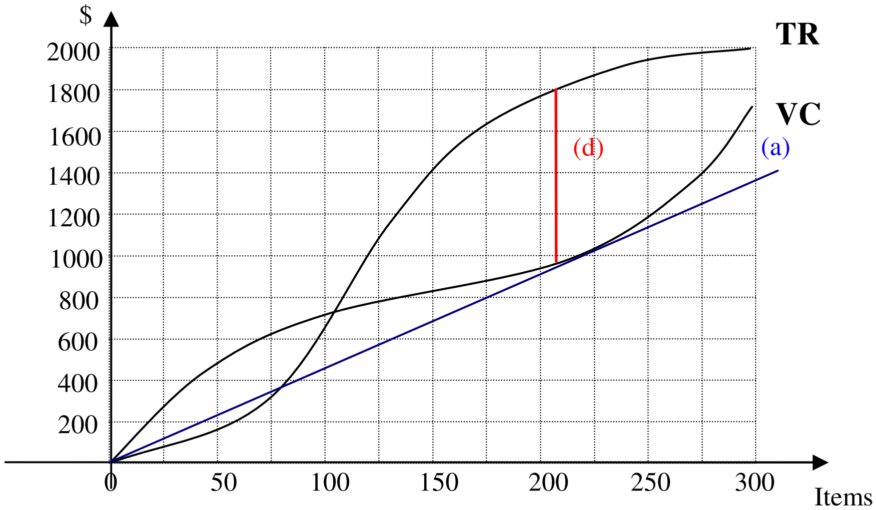
Answer:
The slope of the secant line through the distance graph at t=2 and t=5 is greater than the slope of the diagonal line through the distance graph at t=2.

iii) Use the graph to determine if the statement true or false.

See the red lines

Answer (circle one): True or False

4 (20 points) The following are the graphs of the the total revenue (**TR**) and the variable cost (**VC**), in dollars, for producing and selling Items.



a) For this VC curve, what is the shutdown price in a market price situation?

Work:
Draw the lowest slope diagonal line which intersects the graph of VC. It passes thru (175, 800).
SDP=Slopeof this line=800/175=4.57

Answer: SDP = ___4.57______ $ per Item.

b) What is the Average Revenue from selling 50 Items?

Work:
AR(50)=TR(50)/50≈175/50=3.5
OR: slope of diag line to TR at q=50.

Answer: AR(50) = __3.5______$ per Item.

c) Give an interval of quantities q over which the marginal revenue MR is decreasing.

Work:
Looking for a range of quantities so that the tangents to TR become less steep with larger q.
This happens for all q larger than about 125, so pick an interval above that value..

Answer: from q = __150__ Items to q = _300___ Items

d) Suppose the fixed cost is $250. Find the maximum profit, and at what quantity q it occurs.

Work:
Keep ruler vertical and roll it looking for the largest vertical distance between TR (top) and VC (bottom).
This occurs at about q=210 items (range: 205 to 245).
The distance is about 4 vertical tickmarks, so about $800.
So the max TR-VC=$800
Profit=TR-TC=TR-VC-FC. Max profit is $800-$250=$550

Answer: Maximum profit is $__550____ for q = __210____ Items