# Math 112, Winter 2015, Midterm I 

January 29, 2015

Name
TA/Section

## Instructions.

- There are 4 questions. The exam is out of 50 points.
- You are allowed to use one page of notes written only on one side of the sheet in your own handwriting. It has to be the original and not a photocopy. Hand in your notes with your exam paper.
- You may use a calculator which does not graph and which is cannot do calculus.
- Show your work. If I cannot read or follow your work, I cannot grade it. You may not get full credit for a right answer if your answer is not justified by your work. Please BOX your final answer.

Copying from someone elses paper, using notes (unless expressly allowed by the teacher), altering an exam for re-grading, getting an advance copy of the examination, or hiring a surrogate test-taker are all flagrant violations of University policy.
Source: Student Academic Responsibility, University of Washington

| Question | points |
| :---: | :---: |
| 1 |  |
| 2 |  |
| 3 |  |
| 4 |  |
| Total |  |

1. (10 points) You do not have to simplify your answers but make sure they are clearly written with properly used parentheses where necessary.
(a) Find $f^{\prime}(x)$ if $f(x)=\frac{(5 x-7)^{2}}{x^{3}+5}$.
(b) Compute $\frac{d}{d x}\left(\left(3 x^{3}-5 x+8\right)\left(2 x^{3 / 2}+1\right)\right)$
(c) Find the second derivative $y^{\prime \prime}$ if $y=0.25 x^{4}-\sqrt{x}+\frac{2}{x^{3}}$
2. (14 points) Two toy cars, a Gray one and a Black one, are on a two lane straight track. At $t=0$, they are both at the point of reference shown by the vertical line. The distance is measured positive to the right. The distance function of the Gray Car is

$$
\mathbf{G}(t)=-1.25 t^{2}+20 t
$$

where $\mathbf{G}$ is in centimeters and the time $t$ is in seconds. The velocity of the Black Car is

$$
\mathbf{b}(t)=-0.25 t^{2}+5 t-16
$$

which is in centimeters per second. Everything happens in $0 \leq t \leq 12$. Answer the following questions.
(a) The following are two snapshots. Put arrows to show which direction each car was traveling when the picture was taken. Show your computations under the pictures. The Gray Car is in the top lane, in case the colors came too close in your copy.

(b) At what time is the Gray Car farthest to the right?
(c) At what time is the Black Car momentarily at rest?

The distance function of the Gray Car is $\mathbf{G}(t)=-1.25 t^{2}+20 t$ and the velocity of the Black Car is $\mathbf{b}(t)=-0.25 t^{2}+5 t-16$.
(d) At what time is the distance between the two cars greatest?
(e) The following are possible graphs for the distance functions $\mathbf{G}(t)$ and $\mathbf{B}(t)$. Circle the correct one.

(f) The following are possible graphs for the velocity functions $\mathbf{g}(t)$ and $\mathbf{b}(t)$. Circle the correct one.

3. (14 points) The Total Cost and Total Revenue for producing and selling Bonjouks are given by

$$
\mathbf{T C}(q)=0.013 q^{3}-1.7 q^{2}+73.4 q+650 \quad \mathbf{T R}(q)=-q^{2}+140 q
$$

where $q$ is the number of boxes of Bonjouks and the Total Revuenue and Total Cost are in dollars.
(a) What is the maximum profit?
(b) Give the longest interval where Total Revenue and Marginal Cost are both increasing.
(c) Below are graphs of Total Cost and Total Revenue. Mark the graphs as TC and TR. Show Maximum Profit, Marginal Revenue and Marginal Cost on the graph at the quantity where profit is maximized (from your answer in part (a)).

4. (12 points) A function $f$ has the property that

$$
f(A+B)-f(A)=20 A B+10 B^{2}-7 B
$$

(a) If $f(0)=-12$, what is $f(2)$ ?
(b) What is $f^{\prime}(x)$ ?
(c) Which one is more: The average rate of change of $f$ from $x=1$ to $x=5$ or the instantaneous rate of change of $f$ at $x=2$ ?
(d) For which value(s) of $x$ is the tangent line to the graph of $y=f(x)$ horizontal?

