MATH 112
Exam I
Spring 2015

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: _________________________________

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• Check that your exam contains 4 problems.
• You are allowed to use a scientific (non-graphing) 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. (12 points) Compute the derivative. DO NOT SIMPLIFY.

(a) \( s = \sqrt{t^5} \left( 4t^7 - \frac{1}{t^4} \right)^3 \)

(b) \( y = \frac{7}{3(2x^3 + x)^5} + \frac{8(2x^3 + x)^5}{11} \)

(c) \( z = \left( \frac{w^3 + 3w + 10}{w} \right)^{15} \)
2. (12 points) The graph below shows the function $y = f(x)$.

(a) Approximate $\frac{f(7 + h) - f(7)}{h}$ if $h = 0.001$.

\[
\text{ANSWER: } \frac{f(7 + h) - f(7)}{h} \approx __________
\]

(b) Find a value of $a$ (other than 15) at which $f'(a) = f'(15)$.

\[
\text{ANSWER: } a = __________
\]

(c) Give an interval of length 5 on which $f'(x)$ is \textit{negative}. If there is no such interval, circle NONE.

\[
\text{ANSWER: from } x = ________ \text{ to } x = ________ \text{ or } \text{NONE}
\]

(d) Give an interval on which the graph of $f'(x)$ looks like this:

If there is no such interval, circle NONE.

\[
\text{ANSWER: from } x = ________ \text{ to } x = ________ \text{ or } \text{NONE}
\]
3. (14 points) Two moving Objects, a Red Object and a Blue Object, begin from the same location at \( t = 0 \). After \( t \) minutes, the Red Object is \( R(t) \) feet from its starting location and the Blue Object is \( B(t) \) feet from its starting location, and these are given by the formulas:

\[
R(t) = 2t^2 + 6t \quad \text{and} \quad B(t) = -4t^2 + 159t.
\]

(a) Find a formula for the average speed of the Red Object from \( t = a \) to \( t = a + h \). Simplify your formula as much as possible. Place a box around your final answer.

(b) Find a time at which the Red Object’s instantaneous speed is the same as the average speed of the Blue Object from \( t = 3 \) to \( t = 7 \).

\[
\text{ANSWER: } t = \underline{} \text{ minutes}
\]

(c) During what interval of time is the Blue Object traveling faster than the Red Object?

\[
\text{ANSWER: from } t = \underline{} \text{ to } t = \underline{} \text{ minutes}
\]

(d) How far apart are the Objects and how fast are they traveling when they have the same instantaneous speed?

\[
\text{ANSWER: They are } \underline{} \text{ ft apart, traveling at a rate of } \underline{} \text{ ft per min.}
\]
4. (12 points)
You sell Things. The formulas for marginal revenue and marginal cost at $q$ hundred Things are given by:

$$MR(q) = -0.85q + 10.5$$
and

$$MC(q) = 0.25q^2 - 3.6q + 15.$$ 

Their graphs are given at right.

(a) Give the longest interval on which profit is increasing.

ANSWER: from $q =$ _______ to $q =$ _______ hundred Things

(b) Find the quantity at which total revenue is largest.

ANSWER: $q =$ _______ hundred Things

(c) Approximate the change in total cost if production increases from 900 to 901 Things. Include units.

ANSWER: _______ UNITS: ______________

(d) Find the quantity at which $TC''(q) = 0$.

ANSWER: $q =$ _______ hundred Things