Department of Mathematical Sciences

IUPUI

May 2, 2015

Calculus for Life Sciences I (Math 23100)

FINAL EXAMINATION

Professors: Sen, Worth

Last Name:

First Name:

Last four digits of your student ID:

Books, notes, and other paper and electronic (e.g., laptops, cell phones etc) materials and devices are not allowed.

***** Calculators are NOT allowed *****

You must show your work to receive any credit. Correct answers not accompanied by the solution steps will be given no credit.

Math 23100 **Final Examination** **Spring 2015**

Total: 100 points

1. (5 points each) Calculate $\frac{dy}{dx}$ for each of the following functions.

(a) $y = x \ln(\frac{x^2}{x^2+1})$

(b) $y = \frac{e^x \cos x}{2x}$

(c) $y = \sqrt{x} \tan(e^{2x})$

(d) $y = \frac{x^3}{x + 4 \sin x}$

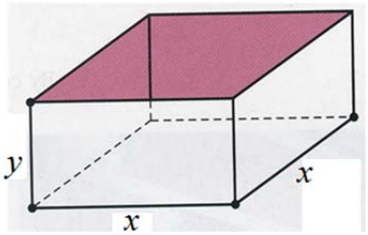
2. (10 points each) Evaluate the following integrals.

$(a)\ \int x^4 \ln x\, dx$

(b) $\int x^3 (6x^4 + 9)^6 dx$

(c) $\int \frac{x}{\sqrt{x+4}}\, dx$

3. (10 points) An open-top box with a square base is to be constructed from a metal sheet. The volume of the box is to be 108 cubic inches. Find the dimensions of the box with the smallest total surface area.



4. (10 points) Calculate the area of the region enclosed by the graphs of the functions: $y = 5x - x^2$ and $y = 2x$ in the xy-plane.

5. (10 points) Consider the region bounded by the graph of $y = \sqrt{x}$ and the x-axis from $x = 0$ to $x = 4$. Find the volume of the solid of revolution generated by rotating this region from about the x-axis.

6. (5 points) Find the linearization of the function: $f(x) = x^2 \ln x$ at $x = 1$.

7. (15 points) Consider the function: $y = 3 + 6x - 2x^3$.

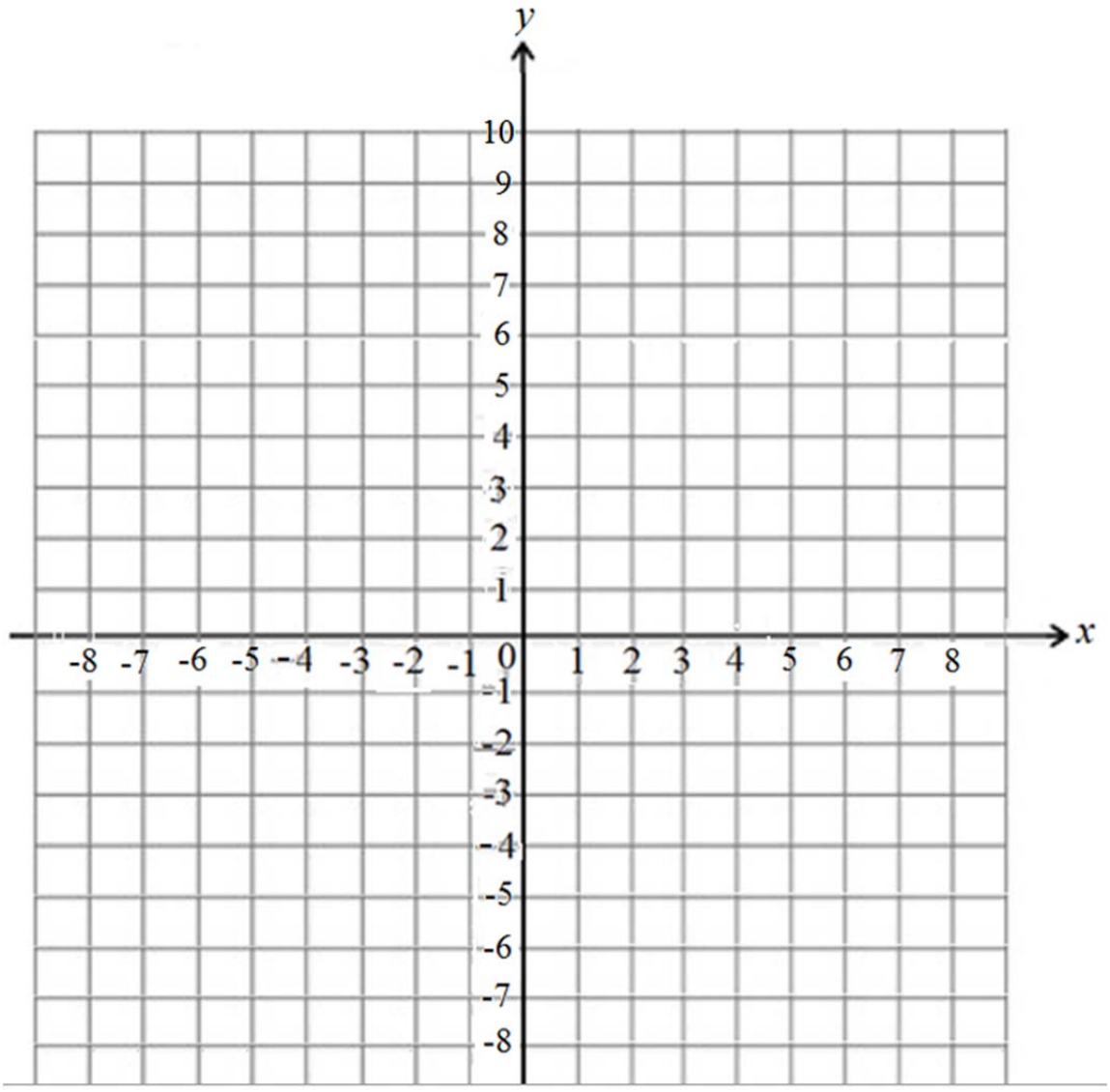
(a) Find the critical points (both x and y values) of this function and determine if these points are points of relative maxima or relative minima.

(b) Find the intervals where the graph of this function is increasing and decreasing,

(c) Find the inflection points of this function.

(d) Find the intervals where the graph of this function is concave up and concave down.

(e) Sketch the graph of this function marking clearly the critical points, inflection points, and the intervals where the graph is concave up and concave down. **Use the graph sheet on the next page.**



Graph sheet for Problem 7

Grading

1	
2	
3	
4	
5	
6	
7	

Total