$\qquad$

# THOMPSON RIVERS UNIVERSITY 

MATH 115<br>Calculus for the Biological Sciences

Instructor: Richard Taylor

## MIDTERM EXAM \#2

17 November 2005 14:30-15:20

## Instructions:

1. Read all instructions carefully.
2. Read the whole exam before beginning.
3. Make sure you have all 6 pages.
4. Organize and write your solutions neatly.
5. You may use the backs of pages for calculations.
6. You must clearly show your work to receive full credit.
7. You may use a calculator.

| PROBLEM | GRADE | OUT OF |
| :---: | :---: | :---: |
| 1 |  | 8 |
| 2 |  | 6 |
| 3 |  | 5 |
| 4 |  | 5 |
| 5 |  | 6 |
| TOTAL: |  | 30 |

Problem 1: For the function $f(x)=3 x^{5}-5 x^{3}+3$,
(a) find the intervals of increase or decrease, and identify the local maxima and minima;
(b) find the intervals of concavity, and identify the inflection points;
(c) use the information from parts (a)-(b) to sketch the graph of $y=f(x)$.

Problem 2: Evaluate the following limits, using L'Hôpital's Rule where appropriate (or, if the limit does not exist, say so).
(a) $\lim _{x \rightarrow 1} \frac{\ln x}{\sin (\pi x)}$
(b) $\lim _{x \rightarrow \infty} x^{3} e^{-x}$

Problem 3: Use Newton's method to find one solution of the equation

$$
x^{4}=1+x
$$

correct to two decimal places.

Problem 4: (a) Find the linear approximation of the function $f(x)=\sqrt[4]{x}$, based at $a=16$.
(b) Use your result from part (a) to find the approximate value of $\sqrt[4]{15}$.

Problem 5: If $1200 \mathrm{~cm}^{2}$ of material is available to make a box with a square base and an open top, what should be the box's dimensions in order to maximize its volume?

