MATH 191, Section 2
Calculus I
Spring 2009

# *Practice Exam 3*

This practice exam is similar in length, content, and format to the actual exam. This is not to say that the problems given here represent *all* of the concepts you will encounter on the actual exam, since it's difficult to "cover" all possible subjects in such a short exam! However, if you feel confident on your performance on this practice exam and you've gone over all homeworks and quizzes, you should feel confident about your upcoming performance on the actual exam.

In order to save paper, I have not included space for you to work out your solutions. (The actual exam will provide such space.) Rather, please complete solutions to the below problems on your own paper. The practice exam is worth a total of 100 points; the point value of each question is provided with that question.

1. (18 points total; 6 points each) Evaluate each of the following limits.
   (a) $\lim_{x\to\infty} \frac{3x^4+3x-1}{7x^4-3x^3+x^2-x}$
   (b) $\lim_{x\to\pi} \frac{x-\pi}{\cos(x)}$
   (c) $\lim_{t\to\infty} \frac{\ln(t)}{\sqrt{t}}$
2. (14 points) Two berserker guinea pigs begin running from the same point at the same time. One runs due west at 1 km/hr, and the other runs due south at 2 km/hr. How fast is the distance between the two guinea pigs changing 1 hour after the time at which they began running?
3. (15 points total) Let $f(x) = 3x + x^2 - x^3$.
   (a) (5 points) Explain carefully why the Mean Value Theorem applies to the function $f$ on the interval $[-1, 2]$.
   (b) (10 points) Find all values $c$ making the Mean Value Theorem true for $f$ on the interval $[-1, 2]$.
4. (21 points total; 7 points each) Find the derivative of each function given below.
   (a) $f(t) = \sin^{-1}(e^t)$
   (b) $g(x) = e^{\sin(x)}$
   (c) $h(x) = \ln(x\sin(x))$
5. (10 points) Find the equation of the tangent line to the graph of the relation $x^2y^3 - x - 1 = y$ at the point $(2, 1)$.
6. (12 points total; 6 points each) Let $f(x) = x^3$.
   (a) Draw a graph which illustrates carefully how to use 4 rectangles to approximate the area under the graph of $f$ between $x = 0$ and $x = 1$.
   (b) Find the approximation to the area under $f$ given by the 4 rectangles you drew in (a).
7. (10 points) Show how to find the derivative of $y = \sin^{-1}(x)$ using implicit differentiation.