Simon Fraser University
Department of Mathematics
Burnaby Campus

MATH 151-3, Spring 2005
Midterm 1
February 9th, 2005, 8:30 – 9:20 am

Last Name (please print): _____

First Name (please print): _____

Student Number: _____

Instructions:

1. DO NOT OPEN THIS BOOKLET UNTIL TOLD TO DO SO.
2. Fill in the above box.
3. This exam contains 8 pages with a total of 7 questions. Once the exam begins please check to make sure your exam is complete.
4. SHOW ALL YOUR WORK!
5. If you run out of space in a problem, use the space on the back of the previous page and clearly indicate where the solution continues.
6. **Only** scientific calculators are allowed.
7. No book, paper, or device, other than the usual writing instruments, this booklet and a scientific calculator, shall be within reach of a student during the examination.
8. During the examination, speaking to, communicating with, or deliberately exposing written papers to the view of other examinees is forbidden.
9. Try your best!

Do not write in this table!	
Question	**Marks**
1	**/7**
2	**/9**
3	**/4**
4	**/4**
5	**/4**
6	**/5**
7	**/7**
Total	**/40**

1. Evaluate the following limits (if they exist). Show all steps in your working.

a) [2 marks] $\lim_{x\to 1}\left(3x^2-2x+1\right)^4$

b) [2 marks] $\lim_{x\to 14}\dfrac{\sqrt{x+2}-4}{x-14}$

c) [3 marks] $\lim_{u \to 3} \frac{|u-3|}{u-3}$

2. Evaluate the following. DO NOT simplify your answers.

a) [3 marks] $D_u\left(1+u^2\right)^3$

b) [3 marks] $f\,'(y)$, where $f(y)=\csc 3y \sin y$

c) [3 marks] $\frac{d}{dx}\left(\frac{e^{-x}}{\cos x}\right)$

3. [4 marks] The distance x (in metres) of a particle from the origin at time t (in seconds) is given by $x(t) = t^3 - 6t^2 + 9t$. When is the particle at rest?

4. [4 marks] A cube has sides of length x (cm), and x is increasing at a rate of 2 cm/s. What is the volume of the cube at the moment when the volume is increasing at a rate of 36 cm^3/s?

5. (a) [2 marks] State the Squeeze Law, clearly identifying any hypotheses and the conclusion.

(b) [2 marks] Show that $\lim_{x\to 0} x^2 \cos\frac{1}{x} = 0$, explaining your reasoning.

6. [5 marks] Using only the definition of the derivative (i.e. from first principles), find $f'(x)$ for $f(x) = \sqrt{x}$.

7. (a) [3 marks] Suppose that f is a continuous function on the closed interval $[a, b]$. List all possible conditions (involving c) for f to have a global minimum at $x = c$. (If your answer includes any concepts not mentioned in this question, explain their meaning.)

(b) [4 marks] Find the minimum value attained by the function $f(x) = 2x^2 - 4x + 7$ on the closed interval [0, 2].