Simon Fraser University

MATH 154 – MIDTERM 1

Instructor: D.Kent

October 5, 2005

Last Name______________________________

Given Name(s)__________________________

Student ID______________________________

Signature___________________________

INSTRUCTIONS

1. Do not open this booklet until instructed to do so. The booklet contains 8 pages including the cover page.

2. **Print** your name and student ID in the space provided above.

3. For each question you must **show all your work** unless stated otherwise.

4. No book, paper, or device other than the usual writing instruments, this booklet, and scientific calculators are allowed. **In particular, no graphing/programmable calculators are allowed.**

5. During this examination, speaking to, communicating with, or exposing written papers to the view of other students is forbidden.

6. You may use the back of the previous page for a rough work or if you run out of space.

7. Stop writing when you are instructed to do so. Failure to follow instructions may result in penalties.

Question	Maximum	Mark
1	5	
2	6	
3	4	
4	4	
5	9	
6	4	
7	4	
8	4	
Total	40	

1. [5 marks total] Indicate whether the statement is True (**T**) or False (**F**). No explanations necessary.

#	**Statement**	**T**	**F**
1	The function $f(x) = x\sin x$ is an odd function.		
2	If $g(x)$ is one-to-one function given by $g(x) = 3 + x + e^x$, then $g^{-1}(4) = 0$.		
3	Function $f(x)$ is one-to-one if it successfully passes the horizontal line test.		
4	The derivative of a function $f(x)$ is given by $f'(x) = \dfrac{f(x+h) - f(x)}{h}$.		
5	A rational function is continuous on its domain.		

2. [6 marks total] Find the following:

a) [1] The domain of $f(x) = \tan 2x$.

b) [1] The range of $f(x) = -x^2 - 2x + 2$.

c) [2] The domain of $(g \circ f)(x)$ where $f(x) = x^2$ and $g(x) = \dfrac{1}{\sqrt{16 - x}}$.

d) [2] The inverse of $g(x) = \sqrt{2x+1}$ and the domain of $g^{-1}(x)$.

3. [4 marks] Draw a sketch of $y = 3 \cdot 10^{-2x}$ on a semilog plot and indicate the values of intercepts.

4. [4 marks total] The Monod growth function $r(N)$ describes growth as a function of nutrient concentration *N*:

$$r(N) = \frac{5N}{1+N}, \quad N \geq 0.$$

a) [2] Find the saturation level of this model.

b) [2] Find when the half-saturation is reached.

5. [9 marks total] Find the following limits if they exist:

a) [2] $\lim_{x \to 0} \frac{\sqrt{x^2+9}-3}{x^2}$

b) [2] $\lim_{x \to -\infty} \frac{x^2-3x+1}{4-x}$

c) [3] $\lim_{x \to 0} \frac{\tan 4x}{\tan 5x}$

d) [2] $\lim_{x \to 1} \frac{x^2 - 1}{|1 - x|}$

6. [4 marks] Use the definition of continuous function to show that the function

$$f(x) = \begin{cases} \dfrac{1}{x+5}, & x \neq -5 \\ 0, & x = -5 \end{cases}$$

Is discontinuous at $x = -5$ and identify the type of discontinuity. Sketch the graph of the function.

7. [4 marks] State the Intermediate Value Theorem and use it to show that the equation $x^2 - 2x - 3 = 0$ has a solution in the interval (-3, 1).

8. [4 marks] Apply the definition of the derivative to find $f'(x)$ if $f(x) = 3 - 2x^2$.