

Simon Fraser University  
Department of Mathematics  
Burnaby Campus

**MATH 151**, Summer 2006  
Midterm 1  
June 7<sup>th</sup>, 2006, 8:30 – 9:20

Last Name (please print): \_\_\_\_\_  
First Name (please print): \_\_\_\_\_  
Student ID: \_\_\_\_\_  
Instructor: Keshav Mukunda

**Instructions:**

1. DO NOT OPEN THIS BOOKLET UNTIL TOLD TO DO SO.
2. Fill in the above box.
3. This exam contains 8 pages (not including this cover page) with a total of 5 questions. Once the exam begins please check to make sure your exam is complete.
4. SHOW ALL YOUR WORK! No credit will be given for just writing down the answer.
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, non-programmable calculators with no differentiation and integration capabilities are allowed.
7. No book, paper, or device, other than the usual writing instruments, this booklet and an acceptable 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.

Do not write in this table!	
Question	Marks
1	/6
2	/6
3	/5
4	/5
5	/6
<b>Total</b>	<b>/28</b>

Q1.

Evaluate the following limits, if they exist. You must provide reasoning which **cannot** be simply “this is what the calculator says.”

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(a) [2 marks]  $\lim_{x \rightarrow -3^+} \frac{|x+3|}{x^2-9} =$

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(b) [2 marks]  $\lim_{\theta \rightarrow 0} \frac{\tan \theta}{\theta} =$

Q1. (continued)

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(c) [2 marks]  $\lim_{x \rightarrow \infty} \frac{5x^2 + 26 - 3x}{42 + 10x^2} =$

Q2.

(a) [1 mark] State the definition of continuity for a function  $F(x)$  at a number  $a$ .

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Suppose that

$$g(x) = \begin{cases} x - 2 & \text{if } x < 1; \\ x^2 + 1 & \text{if } 1 \leq x < 3; \\ k/x & \text{if } 3 \leq x, \end{cases}$$

where  $k$  is some constant.

(b) [2 marks] Is the function  $g$  continuous at  $x = 1$  ? Justify your answer.

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Q2 continues on the next page.

Q2. (continued)

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(c) [1 mark] True or false? Since  $g(0) = -2$  and  $g(1) = 2$ , by the Intermediate Value Theorem the function  $g(x)$  must have a root in the interval  $(0, 1)$ . Justify your answer.

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(d) [2 marks] Find the constant  $k$  that makes the above function  $g(x)$  continuous at  $x = 3$ . Then show that  $g$  is continuous at  $x = 3$ .

Q3.

(a) [1 mark] Give the definition of the derivative of a function  $f$ .

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(b) [4 marks] Using the definition from part (a), evaluate  $f'(3)$  for the function

$$f(x) = \sqrt{x+1}$$

Q4.

A particle is moving in a straight line. It's position function at time  $t$  seconds is given by

$$s(t) = \frac{1}{4}t^4 - 4.5t^2 + 2, \text{ where } t \geq 0.$$

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(a) [3 marks] Using any method you like, find an expression for the velocity of the particle at time  $t$ .

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(b) [2 marks] Find the times  $t$  at which the particle is not moving.

Q5.

Evaluate the following.

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(a) [2 marks]  $y'$ , if  $y = 4x^{1/2} - 7 \cos x$

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(b) [2 marks]  $\frac{df}{dx}$ , if  $f(x) = \sin(x^3 + 2)$



Q5. (continued)

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(c) [2 marks]  $\frac{d}{dt} \left( \sqrt[3]{t} e^t \right) =$