

SIMON FRASER UNIVERSITY  
DEPARTMENT OF MATHEMATICS

Math 151 – Calculus I  
Instructor: Bruce Kadonoff

Midterm 2 – Version A  
6 July 2005

Name: \_\_\_\_\_

Student Number: \_\_\_\_\_

Question	1	2	3	4	5	Total
Marks	/8	/8	/6	/10	/8	/40

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**Instructions:**

1. Do not open this test booklet until instructed to do so.
2. You have 50 minutes for this exam.
3. There are a total of five (5) questions and 40 marks. Ensure you allot your time effectively.
4. You are allowed to use a basic scientific calculator (that is, no graphing or programming functions).
5. Answers may be written in pen or pencil. Errors or changed answers must be clearly erased or crossed out. Only work shown on this test paper will be marked.
6. You are not allowed any reference material including dictionaries. If you are caught with reference material, you will receive a zero on the exam and may face additional disciplinary action by the school administration.
7. Copying from or communicating with a neighbour will result in both students receiving a zero and may result in further disciplinary action by the school administration.
8. If you finish early, hand in your test and leave the room immediately.
9. Cellphones OFF, please.

1. [8 marks] Two sides of a triangle have lengths of 12 cm and 15 cm. The angle between them is increasing at a rate of  $2^\circ$  per minute. How fast is the third side increasing when the angle between the two sides of fixed length is  $60^\circ$ ?

2. [8 marks]

a) Find a linear approximation to estimate  $\sqrt{85}$ .

b) Use Newton's method to estimate  $\sqrt{85}$  to three decimal places.

3. [6 marks] Sketch a graph of a function that meets all the following criteria:

$$f(0) = 0$$

$$f'(0) = 1, \quad f'(2) = 0$$

$$f''(x) > 0 \text{ for all } x \neq 1$$

$$\lim_{x \rightarrow 1^-} f(x) = \infty = \lim_{x \rightarrow 1^+} f(x) \text{ and}$$

$$\lim_{x \rightarrow \pm\infty} [f(x) - (x-1)] = 0$$

4. [10 marks] Let  $y = \frac{\ln(x)}{x^2}$ .  $y' = \frac{1-2\ln(x)}{x^3}$ ,  $y'' = -\frac{5-6\ln(x)}{x^4}$

a) Find the domain and intercepts.

b) Find all the asymptotes.

c) Find the intervals where the function is increasing or decreasing.

d) Find the intervals where the function is concave up or concave down.

e) Sketch the graph of the function.

5. [8 marks] Find the limits:

a)  $\lim_{x \rightarrow \infty} [\sqrt{x+1} - \sqrt{x}]$

b)  $\lim_{x \rightarrow 1^+} [(x-1)^{\ln x}]$