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# Simon Fraser University

Math 151 Section D1

Fall 2006

Midterm 2

Instructor: V. Jungic

Date: November 1, 2006

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

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

E-mail: \_\_\_\_\_

Signature: \_\_\_\_\_

## Instructions

1. Fill in the information above.
2. Please do not open the examination booklet until you are told to do so.
3. Do all your work in this test booklet. Show all your work.
4. Please no books, no notes, and no calculators.

1	2	3	4	5	6	Total
/3	/6	/4	/6	/5	/6	/30

1. **[3 marks]** Mark each statement **T** (True) or **F** (False):

**T F** If  $f$  is differentiable then  $\frac{d}{dx}f(\sqrt{x}) = \frac{f'(\sqrt{x})}{2\sqrt{x}}$ .

**T F**  $\frac{d}{dx}(\ln 10) = \frac{1}{10}$

**T F**  $\lim_{x \rightarrow 0} \frac{\sin 2x}{\sin 3x} = \frac{2}{3}$

**T F** The 99th derivative of  $y = \sinh x$  is  $y = \cosh x$ .

**T F** If  $f(x)$  has an inverse function,  $g(x)$ , then the derivative of  $g(x)$  is  $1/f'(x)$ .

**T F** If  $f'(c) = 0$ , then  $f$  has a local maximum or minimum at  $c$ .

2. (a) **[3]** Use implicit differentiation to find the slope of the tangent line to the curve  $\sin(xy) = y$  at the point  $(\pi/2, 1)$ .

- (b) **[3]** Find  $y''$  if  $y = x^{2x}$ ,  $x > 0$ .

3. [4] Show that  $\tanh^{-1} x = \frac{1}{2} \ln \left( \frac{1+x}{1-x} \right)$ ,  $-1 < x < 1$ .

4. [6] Two ships depart from the same small island at the same time. One ship, the *Queen Algebra*, is going east of the island and the other ship, the *Queen Geometry*, is going north of the island. At a certain time the *Queen Algebra* is sailing at 35 km/h and is 30 km from the island and the *Queen Geometry* is sailing at 45 km/h and is 40 km from the island. At what rate is the distance between them increasing at that time?

5. [5] **Happy Halloween!** When a murder is committed, the body, originally at  $37^{\circ}\text{C}$ , cools according to Newton's Law of Cooling. Suppose that after two hours the temperature is  $35^{\circ}\text{C}$ , and that the temperature of the surrounding air is constant at  $20^{\circ}\text{C}$ . Find the temperature,  $H$ , of the body as a function of  $t$ , the time in hours since the murder was committed.

**Note:** Leave your answer in the exact form, i.e., as an expression that contains logarithms.

6. (a) [2] State the Extreme Value Theorem.

(b) [4] Find the absolute maximum and minimum values of the function

$$f(x) = 5x^{2/3} - x^{5/3}$$

on the interval  $[-1, 1]$ .