Simon Fraser University
Department of Mathematics
Burnaby Campus

MATH 151-3, Spring 2005
Midterm 2
March 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 6 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 (basic math/stat functions + memory key).
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	**/8**
2	**/6**
3	**/5**
4	**/8**
5	**/7**
6	**/6**
Total	**/40**

1.

(a) [3 marks] Let $f(t) = \ln \dfrac{\sqrt{4t-7}}{3t-2}$. Apply laws of logarithms to simplify the function *f*(*t*) before finding $f'(t)$. Do NOT simplify your answer.

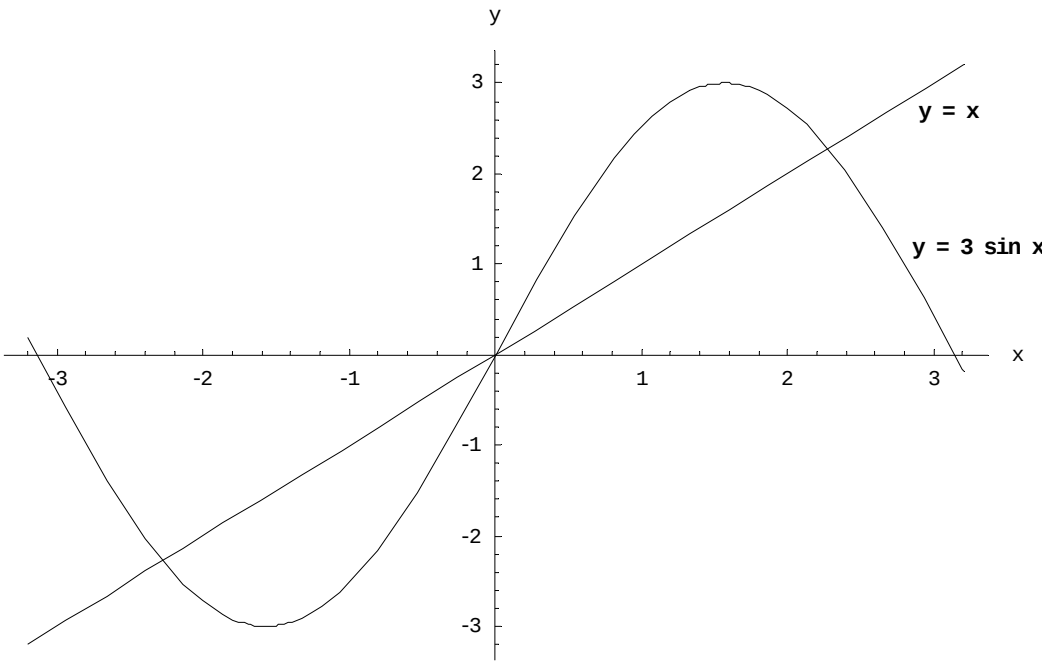
(b) [5 marks] Find $\dfrac{dy}{dx}$ in terms of *x* only, given that $y = (\ln x)^{\sin x}$. Do NOT simplify your answer.

2. [6 marks] Find the maximum possible area of a rectangle whose diagonals each have length $\sqrt{32}$ cm.

3. [5 marks] The radius r of a sphere and the edge length x of a cube are changing in such a way that their combined volume is decreasing at a rate of 18π cm^3/s and the edge length x is increasing at the rate of π cm/s. When $r = 3$ cm and $x = 3$ cm, is the radius r increasing or decreasing and at what rate? (The volume of the sphere is $\frac{4}{3}\pi r^3$.)

4.

(a) [2 marks] The figure below shows the graphs of $y = x$ and $y = 3 \sin x$. Mark on the x-axis the approximate location of each solution to the equation $x = 3 \sin x$, and write down an interval containing the largest solution.



(b) [5 marks] Use Newton's Method to approximate the largest solution of $x = 3 \sin x$ to two decimal places.

(c) [1 mark] If the value of the solution determined in part (c) is $x = a$, write down all the other solutions to $x = 3 \sin x$ without carrying out any further calculations.

5.

(a) [2 marks] What does it mean for a function $f(x)$ to be *increasing* on an open interval (a, b)?

(b) [5 marks] Find and classify the critical points (minimum or maximum, local or global, or not an extremum) of $f(x) = \sin x - x\cos x$ on the open interval $(-5,5)$.

6.

(a) [2 marks] Give an approximate expression for Δy (the change in y) when x changes by an amount Δx, where y is a function of x.

(b) [4 marks] A pendulum has length x cm and a period of oscillation T seconds, where $T = \frac{2\pi}{\sqrt{10}}\sqrt{x}$. Use your answer to part (a) to estimate to 3 decimal places the maximum error in the calculated value of T if x is measured to be 64 cm to within ± 0.5 cm.