

Simon Fraser University
MATH 154 – MIDTERM 2
Instructor: D.Kent

November 9, 2005

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|--------------------|
| 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 | 15 | |
| 2 | 3 | |
| 3 | 4 | |
| 4 | 3 | |
| 5 | 5 | |
| 6 | 4 | |
| 7 | 2 | |
| 8 | 4 | |
| Total | 40 | |

1. [15 marks total] Find y' for given function $y = f(x)$ (**DO NOT SIMPLIFY**):

a) [3 marks] $y = 2x^3 - \frac{5}{\sqrt{x}} + \frac{3}{(x^2 - 4)^3 + 7}$

b) [4 marks] $y = (\sqrt{1 - x^2} + 2^{3-x})^2$

c) [4 marks] $y = (1 - x)(2 + \tan 3x)e^{2-x}$

d) [4 marks] $y = (\sin x)^{\cos x}$

2. [3 marks] Suppose $f(x)$ and $g(x)$ are two differentiable functions that satisfy:

$$g(3) = 4, \quad g'(3) = -1, \quad f'(4) = 2.$$

Let $F(x) = (f \circ g)(x)$. Find $F'(3)$.

3. [4 marks] Find the equation of two straight lines of slope $m = -2$ that are tangent to the curve $y = 1/x$.

4. [3 marks] A spherical air balloon is being inflated at a constant rate $k \text{ (cm}^3/\text{s)}$. At what rate is the radius of the balloon increasing when it is $L \text{ (cm)}$ long.

5. [5 marks] Find the second derivative $\frac{d^2y}{dx^2}$ of a function $y(x)$ that is defined implicitly by the equation

$$x^2 - xy + y^2 = 9$$

6. [4 marks] Use linear approximation to evaluate $(0.98)^{25}$.

7. [2 marks] Let $f(x) = |1 - x^2|$, $-2 < x < 3$. Find the global extrema and briefly justify your answer.

8. [4 marks] Suppose $W(t)$ denotes the amount of a radioactive material left after time t . Assume that $W(0) = 4$ and that $\frac{dW}{dt} = -7W(t)$. How much material is left at time $t = 3$? What is the half-life of this material? You may leave your reply in the calculator-ready form.