Math 126B **Calculus With Analytic Geometry III** **Spring 1995**

THE PROFICIENCY QUIZ IN DIFFERENTIATION TECHNIQUE

On the Proficiency Quiz you will be asked to take partial derivatives (Sec. 14 of the Lecture Notes) and to use the chain rule (Sec. 15). The quiz tests for reliability in formula work. It is given three times. If you pass it, you do not have to take it again, and nothing happens. If you have not passed after three tries, your course grade will be lowered by three decimal points (.3).

Dates and times: The first try is given in your quiz section of Thursday, May 4. The second try is given on Thursday, May 18 at the Math Study Center, B014 Communications, precisely at the times the quiz sections meet (those who pass the quiz the first time go to section as usual on May 18 & 25): Sections BA and BB at 10:30, Sections BC and BD at 11:30. The third try is given on Thursday May 25 at the Math Study Center at the same times.

The questions of the quiz: There will be four questions, one each of the following kinds:

1. *Straight partial derivatives of first or second order.* Example: $f(x,y) = xy^3 + 2xe^y$. Find f_y. Answer: $f_y = 3xy^2 + 2xe^y$.
2. *Using the chain rule of elementary calculus.* Example: $a(t)$ is a function of one variable whose formula we do not know. We define a new function $g(x,y,z) = a(4x+xz+y^2z)$. Find g_x. The answer is $g_x = a'(4x+xz+y^2z)\cdot(4+z)$.
3. *Chain rule of Sec. 15, one variable.* Example: $g(x,y) = x^2+y^2$, and $b(t)$ is a function of one variable whose formula we do not know. Find $\dfrac{dg(t^3,b(t))}{dt}$. Answer: $2t^3\cdot 3t^2 + 2b(t)\cdot b'(t)$
4. *Chain rule of Sec. 15, two variables.* Example: $f(x,y) = xy$. Find $\dfrac{\partial f(uv, u+v)}{\partial v}$. Answer: $(u+v)\cdot u + uv\cdot 1$.

Correct form of answers: If the formula of a function is given, you have to use it in your answer. If the formula of the function $a(t)$ of one variable is not given, write $a'(t)$ for the derivative of $a(t)$. If the formula of $f(x,y)$ is not given, write f_x, f_y, etc. for the partial derivatives. If an answer contains the derivative of a function whose formula is not given, you have to show where the derivative has to be evaluated.

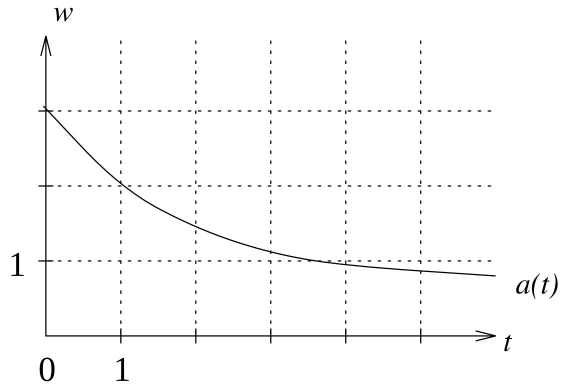
In a question such as the example in (3) above, the answer has to be a formula in t as much as this is possible. Similarly, in a question such as the example in (4) above, the answer has to be a formula in u, v as much as this is possible.

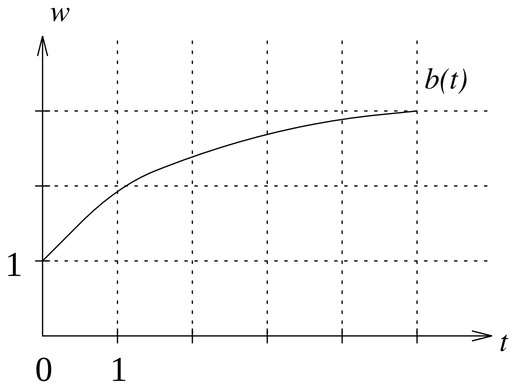
How the quiz is graded: You must get three correct answers to pass. There is no partial credit. Any error, even if it is minor, disqualifies the answer. If more than one answer disqualifies, you do not pass. You have to use commonly accepted notation. For example if you mean "$(a+b)\,c$", you cannot write "$a+b\cdot c$" and say "by $a+b\cdot c$ I really mean $(a+b)\,c$".

Selection of practice problems from the Math 126 Lecture Notes

14.15, 14.18, 14.20, 14.24, 14.26, 15.6, 15.8, 15.17, 15.18, 15.20

(over)





PROFICIENCY QUIZ – SAMPLE 1

1.1 $f(x, y, z) = xy^2z^3$. Find $f_{yz}(2, 2, 2)$, that is, the partial derivative f_{yz} evaluated at $(2, 2, 2)$.

1.2 The function $a(t)$ is given by its graph shown above left. We define a new function $g(x, y)$ by $g(x, y) = a(\frac{1}{2}x^2 + \frac{1}{2}y^2)$. Find $g_y(1, 2)$, that is, the partial derivative g_y evaluated for $(x, y) = (1, 2)$.

1.3 $h(x, y, z) = xyz$. Find $\dfrac{dh(t + 1, t^2 + 2, t^3 + 3)}{dt}$.

1.4 We do not know the formula of $p(x, y)$. Find $\dfrac{\partial p(2u + 3v, u^2)}{\partial u}$.

PROFICIENCY QUIZ – SAMPLE 2

2.1 $f(x, y) = x^2y^2$. Find f_{xy}.

2.2 The function $m(t)$ is given by $m(t) = e^t$. We define a new function $g(x, y)$ by $g(x, y) = m(\sin x \cos y)$. Find g_y.

2.3 $h(x, y) = xy$, and $a(t)$, $b(t)$ are the functions whose graphs are shown above. Evaluate the derivative $\dfrac{dh(a(t), b(t))}{dt}$ for $t = 2$.

2.4 $g(x, y) = \sin x \sin y$. $p(u, v)$ is a function whose formula we do not know. Find $\dfrac{\partial g(p(u, v), p(u, v))}{\partial u}$.

Answers to sample quizzes: 1.1. 96 **1.2.** $a'(2.5) \cdot 2 = -0.68$ **1.3.** $(t^2 + 2)(t^3 + 3) \cdot 1 + (t + 1)(t^3 + 3) \cdot 2t + (t + 1)(t^2 + 2) \cdot 3t^2$ **1.4.** $p_x(2u + 3v, u^2) \cdot 2 + p_y(2u + 3v, u^2) \cdot 2u$ reak **2.1.** $4xy$ **2.2.** $e^{\sin x \cos y}(\sin x(-\sin y))$ [*Note this answer was printed incorrectly in the version handed out in section.*] **2.3.** $b(2)a'(2) + a(2)b'(2) = 2.4(-\frac{2.1}{5}) + 1.5(\frac{1}{2.7})$
2.4. $2 \sin(p(u, v)) \cdot \cos(p(u, v)) \cdot p_u(u, v)$