

University of Delaware
Department of Mathematical Sciences

MATH-243 – Analytical Geometry and Calculus C
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Fall 2012

Homework 7

Due date: October 22, 2012

Problems

Based on Sections 14.3 and 14.4 of the book *Calculus: Early Transcendentals* 7th edition by J. Stewart.

1. Suppose that x is the average price of a new car and y is the average price of a gallon of gasoline. Then q_1 , the number of new cars bought in a year, depends on both x and y , so $q_1 = f(x, y)$. Similarly, if q_2 is the quantity of gas bought in a year, then $q_2 = g(x, y)$. What do you expect the signs of $\frac{\partial q_1}{\partial x}$, $\frac{\partial q_1}{\partial y}$, $\frac{\partial q_2}{\partial x}$, and $\frac{\partial q_2}{\partial y}$ to be? Explain.
2. Find a function $f(x, y)$ whose mixed-variables second order derivatives (f_{xy} and f_{yx}) do not satisfy Clairaut's Theorem.
3. Differentiate implicitly to find the first partial derivatives of z from the equation $x^2 + 2yz + z^2 = 1$.
4. Is there a function f which has the following partial derivatives? $f_x(x, y) = 4x^3y^2 - 3y^4$, $f_y(x, y) = 2x^4y - 12xy^3 + 3y^2$. If so, what is it?
5. Find the equation of the tangent plane to $z = e^{x^2 - y^2}$ at the point $(1, -1, 1)$.
6. Suppose you need to know the equation of the tangent plane to a surface S at the point $(2, 1, 3)$. You don't have the equation for S , but you know that the curves $\vec{r}(t) = \langle 2+3t, 1-t^2, 3-4t+t^2 \rangle$ and $\vec{p}(u) = \langle 1+u^2, 2u^3-1, 2u+1 \rangle$ both lie on S . Find an equation of the plane at the point of interest.
7. Find the points on the hyperboloid $x^2 + 4y^2 - z^2 = 4$ where the tangent plane is parallel to the plane $2x + 2y + z = 5$.
8. Using linear approximation at $(1, 1)$, estimate the value of $f(0.98, 1.05)$ if $f(x, y) = x^4y^2 + 3x^2 - 2y$.
9. Four positive numbers, each less than 50, are rounded to the first decimal place (for example, 5.23 turns into 5.2, and 5.27 turns into 5.3) and then multiplied together. Use differentials to estimate the maximum possible error in the computed product that might result from the rounding.

10. The radius and height of a right circular cylinder are measured with possible errors of 4% and 2%, respectively. Approximate the maximum possible percent error in measuring the volume.