

University of Delaware
Department of Mathematical Sciences

MATH-243 – Analytical Geometry and Calculus C
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Fall 2012

Homework 8

Due date: October 23, 2012

Problems

Based on Sections 14.3, 14.4 and 14.5 of the book *Calculus: Early Transcendentals* 7th edition by J. Stewart.

1. You are hired as a consultant and your first task is to help a university increase its matriculation. You ask information about the relationship between the number of applicants, N , tuition fees, t , and room and board charges, b , and they tell you that according to their analysis $\frac{\partial N}{\partial b} < 0$ and $\frac{\partial N}{\partial t} > 0$. Does this information make sense? Explain.
2. Find the equation of the tangent plane to $z = e^{x^2-y^2}$ at the point $(1, -1, 1)$.
3. 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.
4. Linearize $\sqrt{y + \cos^2 x}$ at $(0, 0)$.
5. 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.
6. Find the linear approximation of the function $f(x, y) = x^4y^2 + 3x^2 - 2y$ at $(1, 1)$ and use it to approximate $f(0.98, 1.05)$.
7. If $u = x^2y^3 + z^4$, where $x = p + 3p^2$, $y = pe^p$, and $z = p \sin p$, use the Chain Rule to find $\frac{du}{dp}$.
8. Suppose $z = f(x, y)$, where $x = g(s, t)$, $y = h(s, t)$, $g(1, 2) = 3$, $g_s(1, 2) = -1$, $g_t(1, 2) = 4$, $h(1, 2) = 6$, $h_s(1, 2) = -5$, $h_t(1, 2) = 10$, $f_x(3, 6) = 7$, and $f_y(3, 6) = 8$. Find $\frac{\partial z}{\partial s}$ and $\frac{\partial z}{\partial t}$ when $s = 1$ and $t = 2$.

9. The radius of a right circular cone is increasing at a rate of 1.8 in/s while its height is increasing at a rate of 2.5 in/s. At what rate is the volume of the cone changing when the radius is 120 in. and the height is 140 in.?
10. Find the directional derivative of $f(x, y) = 2\sqrt{x} - y^2$ at (1,5) in the direction toward (4,1)