

Math 215
Homework Set 3: §§14.2 – 15.4
Winter 2008

Most of the following problems are modified versions of homework problems from your text book
Multivariable Calculus by James Stewart.

- 14.2a. Sketch the curve described by the parametric equation $\mathbf{r}(t) = \langle 3 + e^t \sin(t), e^t \cos(t), e^t \rangle$. Find an equation which describes the tangent line to the curve at the point $(0, 1, 1)$. Sketch the tangent line.
- 14.2b. Problem 50 of §14.2 of Stewart's *Multivariable Calculus*. (Hint: Consider the function $f(t) = |\mathbf{r}(t)|^2$.)
- 15.1a. Problem 30 of §15.1 of Stewart's *Multivariable Calculus*.
- 15.1b. Problems 55–60 of §15.1 of Stewart's *Multivariable Calculus*.
- 15.1c. Describe the level surfaces of the function $f(x, y, z) = z^2 + x^2 - 2y^2$.
- 15.1d. Sketch the graph of the function $f(x, y) = 7 - 3x - 4y$.
- 15.1e. Sketch the graph of the function $f(x, y) = \sqrt{16 - 16x^2 - y^2}$
- 15.1f. Draw the circle of radius two centered at $(1, 1, 1)$ and lying on the plane $x + y + z = 3$. (Hint: Find two orthogonal unit vectors which are parallel to the plane. Use MAPLE to graph.)
- 15.1g. Sketch the graph of the function $f(x, y) = 2x + 3y$. Sketch the graph described by the equation $r - |z| = 0$. Sketch the graph of the intersection of these two surfaces. (HINT: Use MAPLE.)
- 15.1h. Draw a contour map of the function $f(x, y) = y/(x^2 + 2y^2)$ showing several level curves.
- 15.1i. Draw a contour map of the function $f(x, y) = 4x - y^2$ showing several level curves.
- 15.3a. Do parts (a) and (b) of Problem 4 of §15.3 of Stewart's *Multivariable Calculus*. Replace part (c) with the following problem: Estimate the values of $f_{vv}(40, 15)$, $f_{tt}(40, 15)$, $f_{vt}(40, 15)$, and $f_{tv}(40, 15)$. (WARNING: These calculations will require some thought - you may wish to consult with your teaching assistant; see also problem 69.)
- 15.3b. Suppose $f(x, y) = 25 - 3x^2 - 4y^2$. Calculate both $f_x(1, -1)$ and $f_y(1, -1)$. Sketch (by hand, or, better, using MAPLE) some level curves for the function f . Use these sketches to interpret your answers as slopes.
- 15.3c. The ellipsoid $3x^2 + y^2 + z^2 = 25$ intersects the plane $y = 3$ in an ellipse. Find parametric equations for the tangent line to this ellipse at the point $(2, 3, -2)$.
- 15.4a. Suppose a tin can is made from a sheet of tin which is .1cm thick. If the can is 13cm high and 5cm in diameter, use differentials to estimate the mass of the can. The density of tin is $7,310 \text{ kg/m}^3$.
- 15.4b. Use the answers you found in Problem 15.3a to find a linear approximation to the wave height function when v is near 40 knots and t is near 15 hours.