

Math 241 Homework 7: §14.6, 14.7

1. For the following surfaces, find the tangent plane and the normal line to the surface at the given point.
 - (a) $x^2 - 2y^2 - z^2 = 1$ at the point $(2, -1, 1)$.
 - (b) $x^2 + xy - y^2 - z^2 = 4$ at the point $(2, 1, 1)$.
 - (c) $x^3 - y^2 + z^4 = 1$ at the point $(1, 1, 1)$.
 - (d) $2(x - 2)^2 + (y - 1)^2 + (z - 3)^2 = 10$ at the point $(3, 3, 5)$.
 - (e) $x^2 + 3xy - 2y^2 + z^2 = 0$ at the point $(1, -1, 2)$.
2. Find all local extrema and saddle points of the following functions. Give the z -coordinate as well as the x and y coordinates (you can use a calculator for arithmetic if you like).
 - (a) $f(x, y) = x^3 + 3y^2 - 6xy$
 - (b) $f(x, y) = 2x^2 + y^2 + 2xy^2$
 - (c) $f(x, y) = 2x^2y - 8xy + y^2 + 5$
3. Find the global maximum and minimum of the following functions in the region indicated. Give the z -coordinate as well as the x and y coordinates (you can use a calculator for arithmetic if you like).
 - (a) $f(x, y) = 18x^2 - 6x + 3 - 24xy + 16y^2$ in the triangle bounded by $y = 0$, $x = 1$ and $y = x$.
 - (b) $f(x, y) = 3x^2 + 6y^2 - 2x$ within the circle $x^2 + y^2 \leq 1$.
 - (c) $f(x, y) = 2x^3 + 5x^2 + 4xy^2$ within the rectangle $\{(x, y) | 0 \leq x \leq 2, -1 \leq y \leq 1\}$.