

**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  $\{(x, y) | 0 \leq x \leq 2, -1 \leq y \leq 1\}$ .