

**MATH 3334**  
**HOMEWORK #5 DUE OCTOBER 23**

PROFESSOR DAVID WAGNER

- (1) Find all the critical points of the following functions. Tell whether each critical point is a local maximum, local minimum, or saddle point.
  - (a)  $f(x, y) = 3x^4 + 4x^3 - 12x^2 + y^2$ .
  - (b)  $f(x, y) = x^3 - 6x + y^4 - 2y^2$ .
- (2) Given  $f(x, y) = 3x^2 - y + y^2 - 2xy$  and the square  $D = \{(x, y) : 0 \leq x \leq 1, 0 \leq y \leq 1\}$ . Find all critical points and find the maximum and minimum on  $D$ .
- (3) If  $H(x, y) = x^2y^4 + x^4y^2 + 3x^2y^2 + 1$ , show that  $H(x, y) \geq 0$  for all  $(x, y)$ . *Hint:* find the minimum value of  $H$ .
- (4) Let  $f(x, y) = (y - x^2)(y - 2x^2)$ . Show that the origin is a critical point for  $f$  which is a saddle point, even though on any line through the origin,  $f$  has a local minimum at  $(0, 0)$ .