

## HW 5

**Exercise 1.** Find the terms up to order 2 in the Taylor formula of the following functions (taking  $P = (0,0)$ ).

- $\sin(xy)$
- $\sin(x) \cos(y)$

**Exercise 2.** Find the terms up to order 2 in the Taylor formula of  $\cos(x^2 + y)$  at  $P = (0, \pi)$ .

**Exercise 3.** Show that  $f(x, y) = ax^2 + bxy + cy^2$  has the origin  $(0, 0)$  as a critical point.

**Exercise 4.** Determine whether the following quadratic forms have a maximum, minimum, or saddle at the origin.

- $3x^2 - 4xy + y^2$
- $x^2 + 3xy + 4y^2$
- $-x^2 + 2xy - y^2$

**Exercise 5.** Find the critical points of  $f(x, y) = ye^{-(x^2+y^2)}$  and for each one, determine whether the point is a local min, max, or saddle.

**Exercise 6.** Use the single variable power series

$$\sin(x) = x - x^3/3! + \dots$$

and

$$e^x = 1 + x + x^2/2 + \dots$$

to find the terms up to order 2 in the Taylor formula at  $P = (0, 0)$  of

- $\sin(xy)$
- $e^{x+y}$