(local extremes)

1. Find the local extrema of the function $f(x, y) = x^3 + y^3 + 3x^2 - 3y^2 - 8$, i.e. find their position, type and value.

2. Determine if the function $f(x, y) = 4xy - x^4 - y^4 - 11$ has local extremes at points $A_0 = [0; 0]$ or $A_1 = [1; 1]$. If the answer is YES, find its type and value.

3. Has the function $f(x, y) = e^x \cos y$ local extrema?

4. Find all critical points of the function $f(x, y) = y \cos x$.

Constrained extremes

5. Given $f(x, y) = 2xy - x^2 - 3y^2 + 4y$, identify the global extremes of f constrained on a line segment $y = 1 - x$ for $-1 \le x \le 1$.

6. Find global (constrained) extremes of function $f(x, y) = x^2 + y - x\sqrt{y} - 6x + 12$ on a line segment AB where $A = [0; 0]$ and $B = [9; 9]$.

7. Given $f(x, y) = 2x^2 + y^2 - xy + 3x + y + 1$,
   a) Find local extremes of the function f, i.e. find their position, type and value.
   b) Find (glob.) extremes of the function f constrained on the line $x = 2 - y$.

8. Find global extremes of $f(x, y) = x^2 - 2x + y^2$ on a set $\mathcal{H} = \{[x, y] \in \mathbb{R}^2; \ x^2 + y^2 = 9\}$.

Global (absolute) extremes

9. Find global extremes of $f(x, y) = x^2 + xy - 3x - y$
   on a set $\mathcal{M} = \{[x, y] \in \mathbb{R}^2; \ x + y \le 3 \ \wedge \ x \ge 0 \ \wedge \ y \ge 0\}$.

10. Find global extremes of $f(x, y) = 2x^2 - 4x + y^2 - 4y + 2$
    on a set $\mathcal{M} = \{[x, y] \in \mathbb{R}^2; \ x \ge 0 \ \wedge \ 2 \ge y \ge 2x\}$.

11. Find global extremes of $f(x, y) = x^2 - y^2$
    on a set $\mathcal{M} = \{[x, y] \in \mathbb{R}^2; \ x \ge -1 \ \wedge \ y \ge -1 \ \wedge \ x + 2y \le 2\}$.