

# Mathematical analysis 2, WNE, 2018/2019 meeting 23.

21 May 2019

## Problems

1. Show that among rectangles with vertices in the circle of radius 1, the square maximises the area.
2. If we inscribe rectangles in the remaining pieces of the circle so that one of the sides is contained in edge of the square, what dimensions should we choose so that the rectangles maximise area?
3. Among the points which belong to the intersection of the plane  $x + 2y + 3z = 3$  and the cone  $z^2 = x^2 + y^2$  find those closest and farthest from the origin.
4. Determine the maximum and minimum values of the function  $f(x, y)$  on set  $S \subseteq \mathbb{R}^2$ , where:
  - a)  $f(x, y) = x^2 y^2$ ,  $S = \{(x, y) \in \mathbb{R}^2 : x^2 + 4y^2 = 4\}$ ,
  - b)  $f(x, y) = x^2 + y^2$ ,  $S = \{(x, y) \in \mathbb{R}^2 : 2x + 2y = 6\}$ .
5. Determine the maximum and minimum values of the function  $f(x, y, z)$  on set  $S \subseteq \mathbb{R}^3$ , where:
  - a)  $f(x, y, z) = 3x + 2y + z$ ,  $S = \{(x, y, z) \in \mathbb{R}^3 : x^2 + y^2 + z^2 = 1\}$ ,
  - b)  $f(x, y, z) = x^2 + y^2 + z^2$ ,  $S = \{(x, y, z) \in \mathbb{R}^3 : 3x + 2y + z = 6\}$ ,
  - c)  $f(x, y, z) = xyz$ ,  $S = \{(x, y, z) \in \mathbb{R}^3 : x^2 + y^2 + z^2 \leq 1, x + y + z = 1\}$ ,
6. Using the Kuhn-Tucker theorem, find the maximum value of the function  $f(x, y) = x + ay$  on the set

$$M = \{(x, y) \in \mathbb{R}^2 : x^2 + y^2 \leq 1, x + y \geq 0\}.$$

## Homework

### Group 8:00

Among the points which belong to the intersection of the plane  $x + y + z = 12$  and the paraboloid  $z = x^2 + y^2$  find those closest and farthest from the origin.

### Group 9:45

Among the points which belong to the intersection of the plane  $x + y + z = 12$  and the paraboloid  $x = y^2 + z^2$  find those closest and farthest from the origin.