Norwegian University of Science and Technology Institutt for matematiske fag MA0002 Brukerkurs i Matematikk B Vår 2023

Exercise set 13

1 Find the global maxima and minima for the function

$$f(x_1, x_2) = x_1^2 + x_2^2 - 6x_2 + 3$$

on the disk

$$D = \{(x_1, x_2) : x_1^2 + x_2^2 \le 16.$$

- 2 A rectangular prism consists of six rectangles. Find the largest possible volume of a rectangular prism when the surface area is  $200m^2$ .
- 3 Use Lagrange multipliers to find the maxima and minima of the functions under the given constraints.
  - (a)  $f(x_1, x_2) = x_1 \cdot x_2$  when  $x^2 + y^2 = 4$
  - (b)  $f(x_1, x_2) = x_1^2 x_2^2$  when  $2x_1 + x_2 = 1$
- 4 Solve the following initial-value problem

$$\begin{pmatrix} \frac{dy_1}{dt} \\ \frac{dy_2}{dt} \end{pmatrix} = \begin{pmatrix} 1 & 3 \\ 0 & 2 \end{pmatrix} \begin{pmatrix} y_1(t) \\ y_2(t) \end{pmatrix},$$

where  $y_1(0) = 2$  and  $y_2(0) = -1$ .

5 Solve the following initial-value problem

$$\begin{pmatrix} \frac{dy_1}{dt} \\ \frac{dy_2}{dt} \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ 1 & -2 \end{pmatrix} \begin{pmatrix} y_1(t) \\ y_2(t) \end{pmatrix},$$

where  $y_1(0) = -1$  and  $y_2(0) = -2$ .