Fachbereich Mathematik
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11th Exercise Sheet Analysis II (engl.)
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(G11.1) Let $D = \{(x, y) \in \mathbb{R}^2 : x^2 + y^2 \leq 1\}$ be the unit disk in $\mathbb{R}^2$. Find the global maximum and minimum of the function $f(x, y) = x^2 + y^2 - \frac{1}{2}x - \frac{1}{2}y$ on D.

(G11.2)
Let $\gamma : [-1, 1] \to \mathbb{R}^2$ be the curve defined by $\gamma(t) = (t^3, t^6)^T$, $t \in [-1, 1]$. Show that $\gamma((-1, 1))$ is a one-dimensional differentiable submanifold of $\mathbb{R}^2$.

(G11.3)
Find the triangle with greatest possible area for a given perimeter p.
Hint: Recall that if x, y, z are the lengths of the edges of a triangle, then its perimeter is $p = x + y + z$. Use Heron's formula for the area:

$$A = \sqrt{s(s-x)(s-y)(s-z)}, \quad \text{where } s = p/2.$$