

A

1. Find the boundary ∂S . Is the set S closed, open, bounded?

(a) $S = \left\{ (x, y); \frac{|x|}{|y|} \leq 1 \right\}$.

(b) $S = \{(x, y); y - 2x = 1, 1 \leq y \leq 3\}$

(c) $S = \{ \text{all irrational numbers between 0 and 1} \} \subset \mathbb{R}$

2. Classify all critical points of the function $f(x, y) = xye^{-2x^2 - \frac{y^4}{4}}$.

B

3. Find the boundary ∂S . Is the set S closed, open, bounded?

(a) $S = \{(x, y); \ln(xy) \leq 0\}$.

(b) $S = \{(x, y); 0 < x^2 + y^2 < 4\}$

(c) $S = \left\{ \frac{n}{3n+1} \right\}_{n=1}^{\infty} \subset \mathbb{R}$.

4. Classify all critical points of the function $f(x, y) = 2xy^2 - x^2y + 4xy$.

C

5. Find the boundary ∂S . Is the set S closed, open, bounded?

(a) $S = \left\{ (x, y); \frac{x^2}{y} \geq 1 \right\}$. Sketch the set in the xy -plane.

(b) $S = \{(x, y, z); x^2 + y^2 + 2z^2 = 4\}$.

(a) Find all local extrema of the function $f(x, y) = xy(4 - x - 4y)$;

(b) Find the absolute max/min values of f on the triangle $\triangle ABC$ with vertices $A(0, 0)$, $B(0, 1)$ and $C(1, 0)$.

D

6. Sketch the set S . Find the boundary ∂S . Is the set S closed, open, bounded?

(a) $S = \left\{ (x, y); y \leq \frac{1}{x} \right\}$

(b) $S = \left\{ (x, y); 9 < \frac{1}{x^2 + y^2} \right\}$

$S = \{ \sqrt[n]{n} \}_{n=1}^{\infty} \subset \mathbb{R}$

7. Find all local extrema i.e.

Classify all critical points of the function $f(x, y) = 3y^3 - x^2y + x^2$.