Optimization

Find the point(s) in the region \( \{(x, y) : x^2 \leq y \leq 4\} \ldots \)

1. closest to the point \((0,1)\).
2. closest to the point \((3,0)\).
3. furthest from the origin.

Order of Integration

Set up a polar double integral in \((r, \theta)\) to find the volume of a cone of height \(h\) and radius \(R\). If you integrate over \(r\) first, what does the remaining 1-dimensional integral represent? What if you integrate over \(\theta\) first? Make some sketches.
Double Integrals

Sketch each given domain and set up an appropriate double integral $\iint_{D} f(x, y)$ on the domain. Then find the integral.

1. $D = \{(x, y) : x^2 + y^2 \leq 1, y \leq x\}, f(x, y) = e^{x^2+y^2}$

2. $D = \{(x, y) : x - 5 \leq y \leq 1 - x^2\}, f(x, y) = x - 2y$

3. $D = \{(x, y) : 2y^2 \leq x \leq 1 + y^2\}, f(x, y) = xy - 1$

4. Given a cone of uniform density with radius $R$ and height $h$, find the smallest $r$ such that at least half of the cone’s mass is within distance $r$ of its axis of symmetry.