1. Find max and min values of the function $f(x, y)$ along the given curve. Plot the curve and the level curves of the function in the vicinity of the points where the function achieves max or min values.
(a) $f(x, y)=4 x+6 y$, curve: $x^{2}+y^{2}=13$.
(b) $f(x, y)=x^{2}-y^{2}$, curve: $x^{2}+y^{2}=1$.
2. Evaluate the integral and sketch the domain of integration.
(a) $\int_{1}^{2} \int_{y}^{2} x y d x d y$.
(b) $\int_{0}^{1} \int_{0}^{x} \sqrt{1-x^{2}} d y d x$.
(c) $\iint_{D} x \cos y d A$, where region $D$ is bounded by $y=0, y=x^{2}, x=1$.
(d) $\iint_{D} e^{x / y} d A$, where region $D$ is bounded by $1 \leq y \leq 2, y \leq x \leq y^{3}$.
(e) $\int_{0}^{1} \int_{3 y}^{3} e^{x^{2}} d x d y$. Hint: reverse the order.
(f) $\int_{0}^{1} \int_{\sqrt{y}}^{1} \sqrt{x^{3}+1} d x d y$.
(g) $\iint_{D} \cos \left(x^{2}+y^{2}\right) d A$, where region $D$ is above the x -axis and within $y^{2}+x^{2}=9$.
(h) $\iint_{D} e^{-x^{2}-y^{2}} d A$, where region $D$ is bounded by $y$-axis and $x=\sqrt{4-y^{2}}$.
3. Find the area of the surface:
(a) the part of the surface $z=1+3 x+2 y^{2}$ that lies above the triangle with vertices $(0,0),(0,1)$, $(2,1)$.
(b) the part of the elliptic paraboloid $z=4-x^{2}-y^{2}$ that lies above the $x y$-plane.
(c) the part of the hyperbolic paraboloid $z=y^{2}-x^{2}$ that lies between cylinders $x^{2}+y^{2}=1$ and $x^{2}+y^{2}=4$.
(d) the part of the sphere of radius 4 and center at the origin, that lies abone the plane $z=1$.
4. Evaluate
(a) $\int_{0}^{1} \int_{0}^{z} \int_{0}^{y} z e^{-y^{2}} d x d y d z$.
(b) $\iiint_{E} y d V$, where $E$ is bounded by planes $x=0, y=0, z=0$ and $2 x+2 y+z=4$.
(c) $\iiint_{F} z d V$, where $F$ is bounded by the cylinder $y^{2}+z^{2}=9$ and the planes $x=0, y=3 x$, $z=0$ in the first octant.
