

(1) Find local extrema and saddle points of the functions

(i) $f(x, y) = x^4 + y^4 - 4xy + 2$

(ii) $f(x, y) = x \sin y$

(iii) $f(x, y) = x^2 y e^{-x^2 - y^2}$

(2) Find the points on the surface $z^2 = xy + 1$ that are closest to the origin.

(3) Find the three positive numbers whose sum is 100 and whose product is maximal.

(4) Find the dimensions of a rectangular box of maximal volume for which the sum of the lengths of its 12 edges is equal to c .

(5) A cardboard box without lid is to have a volume of $32,000 \text{ cm}^3$. Find the dimensions that minimize the amount of cardboard used.

(6) If the length of the diagonal of a rectangular box is L , what is its largest possible volume?