Calculus II 0314

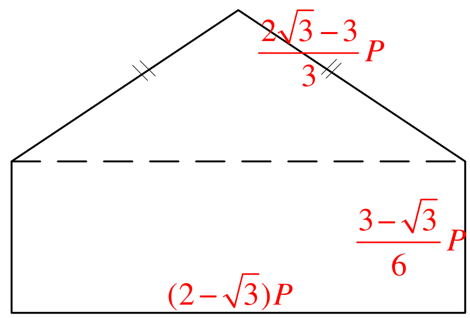
Quiz 5.

(1) (11%) Find the local maximum and minimum values and saddle points of the function $f(x, y) = x^3 - 6xy + 8y^3$. minimum value$=-1$; $(0, 0)$ is a saddle point.

(2) (11%) Find the absolute maximum and minimum values of $f(x, y) = 4xy^2 - x^2y^2 - xy^3$ on the set D, where D is the closed triangular region in the xy-plane with vertices $(0, 0)$, $(0, 6)$, and $(6, 0)$. maximum$=4$; minimum$=-64$.

(3) (11%) Find the points on the surface $xy^2z^3 = 2$ that are closest to the origin. $\pm(\frac{1}{\sqrt[4]{3}}, \pm\frac{\sqrt{2}}{\sqrt[4]{3}}, \sqrt[4]{3})$

(4) (11%) A pentagon is formed by placing an isosceles triangle on a rectangle, as shown in the figure. If the pentagon has fixed perimeter P, find the lengths of the sides of the pentagon that maximize the area of the pentagon.



(5) Let $p(x_0, y_0, z_0)$ be a point on the surface $\Gamma : xy^2z^2 = 1$.

(a) (3%) Find the equation of tangent plane T_p to Γ at (x_0, y_0, z_0). (Write your equation in terms of x_0, y_0, z_0) $y_0^2z_0^2x + 2x_0y_0z_0^2y + 2x_0y_0^2z_0z = 5$

(b) (3%) Find the distance d_p between the origin and the tangent plane T_p. $\frac{5}{\sqrt{y_0^4z_0^4+4x_0^2y_0^2z_0^4+4x_0^2y_0^4z_0^2}}$

(c) (6%) Find p on the surface Γ so that d_p is a maximum or a minimum. $(2^{\frac{-2}{5}}, \pm\sqrt[10]{2}, \pm\sqrt[10]{2})$

(6) Let $u =< h, k >$ be a unit vector.

(a) (4%) Compute the directional derivative D_uf of f in the direction of u. $f_xh + f_yk$

(b) (7%) Compute D_u^2f, where $D_u^2f = D_u(D_uf)$. $f_{xx}h^2 + f_{yx}hk + f_{xy}hk + f_{yy}k^2$

(7) (11%) Evaluate the double integral by first identifying it as the volume of a solid. $\int\int_R(4 - 2y)dA$, $R = [0, 1] \times [0, 1]$. 3

(8) (11%) Find the volume of the solid in the first octant bounded by the cylinder $z = 9 - y^2$ and the plane $x = 2$. 36

(9) (11%) Let $g(x, y) = \int_0^x \int_0^y \sin^2(st)dtds$. Find $g_{xy}(x, y)$. $\sin^2(xy)$