Question #1 Pick 1 questions, 0 pts per question

Question

(4 points) 1. For the following function, determine and sketch the domain: $f(x, y) = \sqrt{y + x + 1}$

Question

(4 points) 1. For the following function, determine and sketch the domain: $f(x, y) = \sqrt{x - y + 1}$

Question #2 Pick 1 questions, 0 pts per question

Question

(4 points) 2. Given $f(x, y) = x^2 + y$. Sketch the function's level curves for $k = 0,\ k = 1,\ k = 3$.

Question #3 Pick 1 questions, 0 pts per question

Question

(4 points) 3. Find the following limit: $\lim_{(x,y)\to(0,0)} \frac{x^4-y^4}{x^2-y^2}$

Question

(4 points) 3. Find the following limit: $\lim_{(x,y)\to(0,0)} \frac{x^6-y^6}{x^3-y^3}$

Question #4 Pick 1 questions, 0 pts per question

Question

(4 points) 4. Find the following limit: $\lim_{(x,y)\to(3,6)} \frac{x+y-9}{\sqrt{x+y}-3}$

Question

(4 points) 4. Find the following limit: $\lim_{(x,y)\to(16,9)} \frac{x+y-25}{\sqrt{x+y}-5}$

Question #5 Pick 1 questions, 0 pts per question

Question

(4 points) 5. Show that $\lim_{(x,y)\to(0,0)} \frac{x^4-y^4}{x^4+y^4}$ does not exits by using the two-paths approach.

Question #6 Pick 1 questions, 0 pts per question

Question

6. Given $f(x,y) = 4x^3 \sin(x^4y^2)$.

(2 points) a. Find f_x

(2 points) b. Find f_y

(3 points) c. Find f_{xx}

(3 points) d. Find f_{xy}

(3 points) e. Find f_{yy}

Question

6. Given $f(x,y) = 4y^2 \cos(x^3y^4)$.

(2 points) a. Find f_x

(2 points) b. Find f_y

(3 points) c. Find f_{xx}

(3 points) d. Find f_{xy}

(3 points) e. Find f_{yy}

Question #7 Pick 1 questions, 0 pts per question

Question

(4 points) 7. Given $z = x^3 + y^2,\ \ x = 3s^4 + 5t^3,\ \ y = 6s^2 + 7t^5.$ Find $\frac{\partial z}{\partial s}$ and $\frac{\partial z}{\partial t}$.

Question

(4 points) 7. Given $z = x^4 + y^3,\ \ x = 5s^3 + 4t^2,\ \ y = 3s^5 + 6t^4.$ Find $\frac{\partial z}{\partial s}$ and $\frac{\partial z}{\partial t}$.

Question #8 Pick 1 questions, 0 pts per question

Question

(4 points) 8. Use partial derivatives to perform implicit differentiation to find $\frac{dy}{dx}$ if $4y^3 + e^{x^3y^2} = 5x^4y^3 + 6x^2$, where y is a differentiable function of x.

Question

(4 points) 8. Use partial derivatives to perform implicit differentiation to find $\frac{dy}{dx}$ if $3x^4 + e^{x^3y^2} = 4x^3y^5 + 7x^3$, where y is a differentiable function of x.

Question #9 Pick 1 questions, 0 pts per question

Question

9. Given $f(x, y) = y^2 e^{xy}$.

(4 points) a. Find the linearization, $L(x, y)$, of the function at $(0, 2)$.

(2 points) b. Use the linearization to approximate the function at the point $(0.2, 2.1)$.

Question #10 Pick 1 questions, 0 pts per question

Question

(4 points) 10. Find the directional derivative of $f(x, y, z) = x^2y + x\sqrt{1+z}$ at the point $(1, 2, 3)$ in the direction of the vector $\vec{v} = < 2, 1, -2 >$.

Question #11 Pick 1 questions, 0 pts per question

Question

11. Given $xy^2z^3 = 8$ and the point $P_0(2,2,1)$.

(5 points) a. Find the equation of the tangent line at the point P_0.

(2 points) b. Find the equation of the normal line to the given surface at the point P_0.

Question #12 Pick 1 questions, 0 pts per question

Question

12. Given $f(x,y) = x^2y + \sqrt{y}$ and the point $P_0(2,1)$

(2 points) a. Find the direction of most rapid increase at P_0

(2 points) b. Find the direction of most rapid decrease at P_0.

(2 points) c. Find the directions of zero change at P_0.

Question #13 Pick 1 questions, 0 pts per question

Question

(7 points) 13. Given $f(x,y) = x^3 - 6xy + 8y^3$. Find the local maxima, local minima, and saddle points.

Question #14 Pick 1 questions, 0 pts per question

Question

(7 points) 14. Use Lagrange multipliers to determine the maximum and minimum values of $f(x, y, z) = xyz$ subject to the constraint $g(x, y, x) = x^2 + y^2 + z^2 = 3$.

Question #15 Pick 1 questions, 0 pts per question

Question

(7 points) 15. Find the dimensions of a rectangular box with the largest volume if the total surface area is given as 64 cm^2.

Question 16 Pick 1 questions, 0 pts per question

Question

(4 points extra credit) 16. Use the definition of the directional derivative to find the derivative of $f(x, y) = x^2 - 4y^2$ at the point $P_0(2, -1)$ in the direction $\hat{u} = \frac{3}{5}\hat{\imath} - \frac{4}{5}\hat{\jmath}$.