PART 4

1. $f(x,y)=\frac{\ln y}{x}$ What is the domain of $f(x,y)$?

$g(x,y)=\frac{\sqrt{x-1}}{(y-x)e^{y-2}}$ What is the domain of $g(x,y)$? Evaluate $g(5,2)$

On an (x,y) coordinate axes sketch the domain of function $f(x,y)=\frac{\sqrt{x-y}}{\ln(xy-1)}$

2. Find the requested derivatives. DO NOT SIMPLIFY.

$f(x,y)=(3x+xy^2)^5$ $f_x=$ $f_y=$

$z=x^2e^{x+3y}+y$ $\frac{\partial z}{\partial x}=$ $\frac{\partial z}{\partial y}=$

$f(x,y)=\ln(2y+3x)$ $\frac{\partial f}{\partial x}=$ $\frac{\partial f}{\partial y}=$

$f(x,y)=3x^2-5xy+2y-7$ $\frac{\partial f}{\partial x}=$ $\frac{\partial f}{\partial y}=$

$f(x,y)=\frac{x}{y}+x^2$ $f_x=$ $f_y=$ $f_{xx}=$ $f_{yy}=$ $f_{yx}=$

$f(x,y)=x^2y\ln(x^2+y^2)$ $f_x=$ $f_y=$

$g(x,y)=\frac{xy}{e^{x^2}}$ $g_x=$ $g_y=$

$h(x,y,z)=(xy^2-2x)(e^{yz})$ $\frac{\partial h}{\partial x}=$ $\frac{\partial h}{\partial y}=$ $\frac{\partial h}{\partial z}=$

$z=2yx^3+5y^3x$ $\frac{\partial z}{\partial x}=$ $\frac{\partial^2 z}{\partial x^2}=$ $\frac{\partial^2 z}{\partial y\partial x}=$

3. The first partial derivatives of $f(x,y)=e^{xy}$ are $f_x(x,y)=ye^{xy}$ and $f_y(x,y)=xe^{xy}$.

Calculate the second partial derivatives: $f_{xx}(x,y)$, $f_{yy}(x,y)$, and $f_{xy}(x,y)$

4. Find all points where the functions below have any relative maxima, relative minima or saddle points.

$f(x,y)=2x^3+y^2-9x^2-4y+12x-2$ $f(x,y)=4+2xy+14x-2x^2-y^2-8y$

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

5. Consider the following business situation. You have a total of $100,000 to spend on labor and capital. Labor costs $20 per unit (represent units of labor with the letter x). Capital costs $25 per unit (represent units of capital with the letter y). The function used to measure productivity is $P(x,y) = xy$. Use the method of Lagrange multipliers to find how many how many units of labor and how many units of capital to purchase in order to maximize productivity. What IS the maximum productivity?

6. Use the method of Lagrange Multipliers to find the area of the largest rectangular field that can be enclosed with 600 feet of fencing, given that no fencing is needed along one side.

7. A toy maker makes exactly 15 dolls per day. He has determined that his daily profit can be described by the function $P(b,r) = 2b + 3r + br - r^2 + 200$ where b is the number of dolls he makes with black hair and r is the number of dolls he makes with red hair.

(a) Use the method of Lagrange multipliers to determine how many of each kind of doll he should make in order to maximize his profit?
(b) What is his maximum daily profit?

8. Determine the maximum of the function $f(x,y,z) = xy + 2xz + 2yz$, given that $xyz = 32$.