Print Your Name Legibly: _____

Score: _____

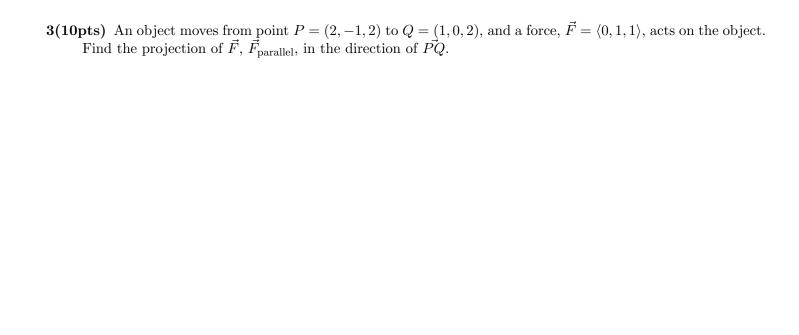
Instructions: You must show supporting work to receive full and partial credits. Textbook, notes, cheat sheets, calculators are not allowed.

1(12pts) For function f(x,y) = 2x - y, sketch a contour diagram with at least 4 labeled contours. Describe in words how they are spaced.

2(15pts) Let $\vec{u} = \langle 1, -1, 1 \rangle$, $\vec{v} = \langle 1, 0, 1 \rangle$. Find the following.

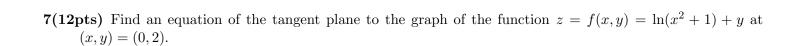
(a) The angle between \vec{u} and \vec{v} .

(b) A vector \vec{w} perpendicular to both vectors.



4(10pts) For $\lim_{(x,y)\to(0,0)} \frac{x^2-y^2}{x^2+2y}$, find the limit if it exists. If the limit does not exist, explain why not.





8(14pts) (a) For functions $z = f(x, y) = ye^x$, $x = u(s, t) = \ln s$, and $y = v(s, t) = \sin(s + t)$, use the chain rule to find $\frac{\partial z}{\partial s}$. (Simplification is not needed.)

(b) Find the value of $\frac{\partial z}{\partial s}$ at (s,t)=(1,-1).