1. Consider the following conditions for a differentiable function $f(x,y)$:

❶ $f(2,1)=8$

❷ An equation for the tangent line to the level curve $f(x,y)=8$ in the xy-plane at the point $(2,1)$ is $3x-5y=1$

Let $\mathscr{P}$ be the tangent plane to the graph of $z=f(x,y)$ at the point $(2,1,8)$.

In each of the parts (a-e) below a ❸rd condition is given.

- If there is no function satisfying the conditions ❶-❸, then ✓ the ☐ next to NONE.
- If there are functions satisfying the conditions ❶-❸, but they do not all have the same tangent plane $\mathscr{P}$, then ✓ the ☐ next to MANY.
- If there are functions satisfying the conditions ❶-❸ and all of these functions have the same tangent plane $\mathscr{P}$, then ✓ the ☐ next to UNIQUE and write an equation of $\mathscr{P}$ inside the box.

a. ❸ $f(3,2)=11$

☐ NONE ☑ MANY ☐ UNIQUE $\mathscr{P}$:

b. ❸ $f_x(2,1)=-1$

☐ NONE ☐ MANY ☑ UNIQUE $\mathscr{P}$: $3x-5y+3z=25$

c. ❸ $\left.\dfrac{d}{dt}f(t^2+1,t^3)\right|_{t=1}=6$

☐ NONE ☐ MANY ☑ UNIQUE $\mathscr{P}$: $6x-10y+3z=26$

d. ❸ The line with parametric equations $x=4t+2$, $y=2t+1$, $z=t+8$, $(-\infty<t<\infty)$, lies in $\mathscr{P}$

☐ NONE ☐ MANY ☑ UNIQUE $\mathscr{P}$: $3x-5y-2z=-15$

e. ❸ The line with parametric equations $x=-t+2$, $y=2t+1$, $z=t+8$, $(-\infty<t<\infty)$, is perpendicular to $\mathscr{P}$

☑ NONE ☐ MANY ☐ UNIQUE $\mathscr{P}$: