$f(x,y) = x^4 + y^4 - 4xy + 8 \quad \Rightarrow \quad f_x = 4x^3 - 4y$, $f_y = 4y^3 - 4x$, $f_{xx} = 12x^2$, $f_{xy} = -4$, $f_{yy} = 12y^2$. Then $f_x = 0$ implies $y = x^3$, and substitution into $f_y = 0 \quad \Rightarrow \quad x = y^3$ gives $x^9 - x = 0 \quad \Rightarrow \quad x(x^8 - 1) = 0 \quad \Rightarrow \quad x = 0$ or $x = \pm 1$. Thus the critical points are $(0,0)$, $(1,1)$, and $(-1,-1)$. Now $D(0,0) = 0 \cdot 0 - (-4)^2 = -16 < 0$, so $(0,0)$ is a saddle point. $D(1,1) = (12)(12) - (-4)^2 > 0$ and $f_{xx}(1,1) = 12 > 0$, so $f(1,1) = 6$ is a local minimum. $D(-1,-1) = (12)(12) - (-4)^2 > 0$ and $f_{xx} = (-1,-1) = 12 > 0$, so $f(-1,-1) = 6$ is also a local minimum.