Orient Yourself to the Physical System & the Graph: The surface represents measurements of internal energy on a kilogram of water vapor in a piston (a graduated cylinder with a moveable top). The purple surface graph is $U(S, V)$.

Make Predictions: Starting at the red star, as you increase the volume of the system, what happens to the internal energy of the water vapor?
Consider a Special Case: Is it possible to change the volume without changing the internal energy? (Is your answer consistent with your answer to the previous prompt?)

Signs of Partial Derivatives: Using the purple surface graph, determine if the following derivatives are positive, negative, or zero.

$$\left(\frac{\partial U}{\partial V}\right)_S \qquad \left(\frac{\partial U}{\partial V}\right)_T \qquad \left(\frac{\partial U}{\partial V}\right)_p$$