Keep in mind that wind is defined by the direction the air is coming from. A wind direction of 0° is northerly, 90° is easterly, 180° is southerly, and 270° is westerly.

(1) The 1000 mb wind is from the south at 10 m/s. The 500 mb wind is from the west at 10 m/s. Sketch these vectors and also draw the vertical shear vector between the 1000 and 500 mb levels (from 1000 to 500 mb).

(2) The 500 mb wind is westerly at 10 m/s. The vertical shear in the 1000-500 mb layer is also westerly, at 5 m/s. What is the magnitude and direction of the wind at 1000 mb? Sketch all three vectors below.

(3) What is the temperature advection occurring in the 1000-500 mb layer in the previous question? Answer with warm, cold, or no advection.
(4) Let the 2D horizontal flow field be described by $\vec{V} = u\hat{i} + v\hat{j} = -y\hat{i} + x\hat{j}$. Sketch this flow field below. Compute both horizontal divergence and vertical vorticity. Is this flow field divergent/convergent, rotational, or both?

\[ \nabla \cdot \vec{V} = \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}. \]

\[ \hat{k} \cdot (\nabla \times \vec{V}) = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}. \]