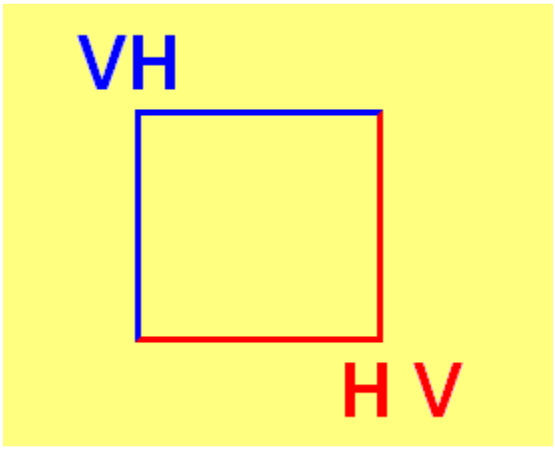
Potential functions for a rectangular region

Following the terminology in classical physics, if we are given a vector field $\mathbf{F}$ we often say that g is a potential function for $\mathbf{F}$ if $\mathbf{F}$ is the gradient of g. The proof of Theorem **V.1.5** in the course notes shows that certain vector fields on rectangular regions in the plane have potential functions. This argument is based upon the following drawing:



The potential function is defined by taking the line integral of the vector field with respect to either of the curves **VH** or **HV**; one uses the condition on partial derivatives and Green's Theorem to conclude that these two integrals have the same value. We then use one of the integrals to compute one partial derivative of the potential function, and we use the second integral to compute the other partial derivative.