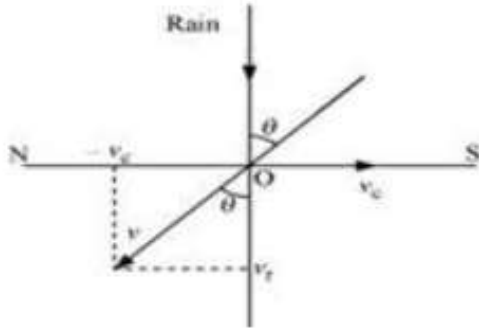**Q 5** Rain is falling vertically with a speed of 30 ms^{-1}. A woman rides a bicycle with a speed of 10 ms^{-1} in the north to south direction. What is the direction in which she should hold her umbrella?

Sol. The described situation is shown in the given figure.

Here,

v_c = Velocity of the cyclist

v_r = Velocity of falling rain

In order to protect herself from the rain, the woman must hold her umbrella in the direction of the relative velocity (v) of the rain with respect to the woman.

$v = v_t + (-v_c)$

$= 30 + (-10) = 20$ m/s

$\tan\theta = \frac{v_c}{v_r} = \frac{10}{30}$

$\theta = \tan^{-1}(0.333) \approx 18°$

Hence, the woman must hold the umbrella toward the south, at an angle of nearly 18° with the vertical.

So these problems can be solved using relative velocity concept which requires conversion of non inertial frame into inertial frame.