

1.2.26

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Question:

Rain is falling vertically with a speed of 35 ms^{-1} . A woman rides a bicycle with a speed of 12 ms^{-1} in east to west direction. What is the direction in which she should hold her umbrella ?

Solution:

$$\text{Velocity of rain } \vec{v}_{rain} = \begin{pmatrix} 0 \\ -35 \end{pmatrix}$$

$$\text{Velocity of woman } \vec{v}_{woman} = \begin{pmatrix} -12 \\ 0 \end{pmatrix}$$

The relative velocity of rain with respect to the woman is:

$$\vec{v}_{rel} = \vec{v}_{rain} - \vec{v}_{woman} = \begin{pmatrix} 0 \\ -35 \end{pmatrix} - \begin{pmatrix} -12 \\ 0 \end{pmatrix} = \begin{pmatrix} 12 \\ -35 \end{pmatrix}$$

$$\text{Let } \vec{a} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

Let θ be the angle with horizontal

$$\cos \theta = \frac{a^T v_{rel}}{\|a\| \|v_{rel}\|}$$

$$\cos \theta = \frac{12}{37}$$

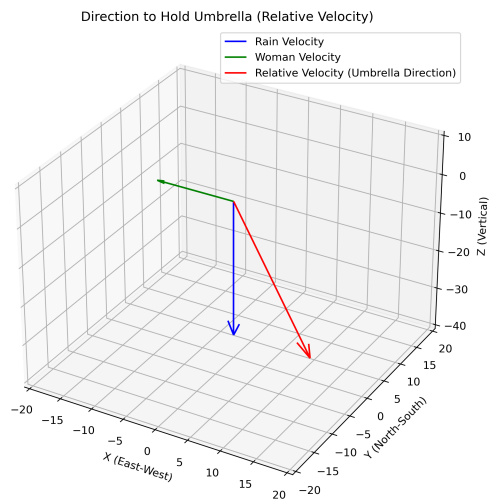


Fig. 0.1