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## Learning Intentions

- How to calculate the velocity produced by motion in two different directions.


## Questions

1. A plane is pointing straight North, with an airspeed of $120 \mathrm{~m} / \mathrm{s}$. The wind is blowing at $50 \mathrm{~m} / \mathrm{s}$ [E].
a. What is the resulting velocity of the plane, relative to an observer on the ground?
b. In what direction should the plane fly so that the resulting velocity is straight north? What will be the resulting velocity?

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2. A hiker heading west comes across a river flowing south at $0.35 \mathrm{~m} / \mathrm{s}$. The hiker decides to swim directly across at a speed of $1.0 \mathrm{~m} / \mathrm{s}$.
a. What is the resulting velocity of the hiker?
b. If the river is 75 m wide, how long will it take the hiker to reach the other side?
c. How far downstream will the hiker reach the other side?
d. What direction should the hiker swim to reach the opposite shore of the river perpendicular to where she started?
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3. A plane with an airspeed of $560 \mathrm{~km} / \mathrm{h}$ is flying in wind that is blowing at $87 \mathrm{~km} / \mathrm{h}$ [34 ${ }^{\circ}$ North of East].
a. What direction should the plane fly in order to have a velocity whose direction is $19^{\circ}$ South of West, relative to an observer on the ground?
b. What will be the magnitude of the velocity of the plane, relative to an observer on the ground?

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## Answers

1. 

a. $\mathbf{v}_{\text {rel }}=130 \mathrm{~m} / \mathrm{s}\left[23^{\circ} \mathrm{E}\right.$ of N$]=130 \mathrm{~m} / \mathrm{s}\left[67^{\circ} \mathrm{N}\right.$ of E$]$
b. $\mathbf{v}_{\text {rel }}=110 \mathrm{~m} / \mathrm{s}[\mathrm{N}]$
$\mathbf{v}_{\text {plane }}=120 \mathrm{~m} / \mathrm{s}\left[25^{\circ} \mathrm{W}\right.$ of N$]=120 \mathrm{~m} / \mathrm{s}\left[65^{\circ} \mathrm{N}\right.$ of W$]$
2.
a. $\mathbf{v}_{\text {rel }}=1.0 \mathrm{~m} / \mathrm{s}\left[19^{\circ} \mathrm{S}\right.$ of W$]=1.0 \mathrm{~m} / \mathrm{s}\left[71^{\circ} \mathrm{W}\right.$ of S$]$
b. $t=75 \mathrm{~s}$
c. $\mathbf{d}_{\mathrm{y}}=26 \mathrm{~m}$ [S]
d. $\mathbf{V}_{\text {hiker }}=1.0 \mathrm{~m} / \mathrm{s}\left[2 \underline{0}^{\circ} \mathrm{N}\right.$ of W$]=1.0 \mathrm{~m} / \mathrm{s}\left[7 \underline{0}^{\circ} \mathrm{W}\right.$ of N$]$
3.
a. direction $=\left[76^{\circ} \mathrm{W}\right.$ of S$]=\left[14^{\circ} \mathrm{S}\right.$ of W$]$
b. $v_{\text {rel }}=480 \mathrm{~km} / \mathrm{h}$

