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This is a 2-D problem involving average velocity and average speed.

A plane flies 350 mi east from airport A to airport B in 50 min, and then flies 500 mi south from airport B to airport C in 1.8 h.

(a) Determine the displacement vector, for the total trip.

(b) Determine the average velocity vector, for the total trip.

(c) Determine the average speed, for the total trip.

Solution:

(a) $\Delta\vec{r} = \vec{r}_2 - \vec{r}_1$

(final position vector) $\vec{r}_2 = \vec{r}_1 + \Delta\vec{r}$

(initial position vector) $\vec{r}_1 = 350\,\hat{i}$

$\Delta\vec{r} = -500\,\hat{j}$

displacement between B and C

$\vec{r}_2 = 350\,\hat{i} - 500\,\hat{j}$ (answer)

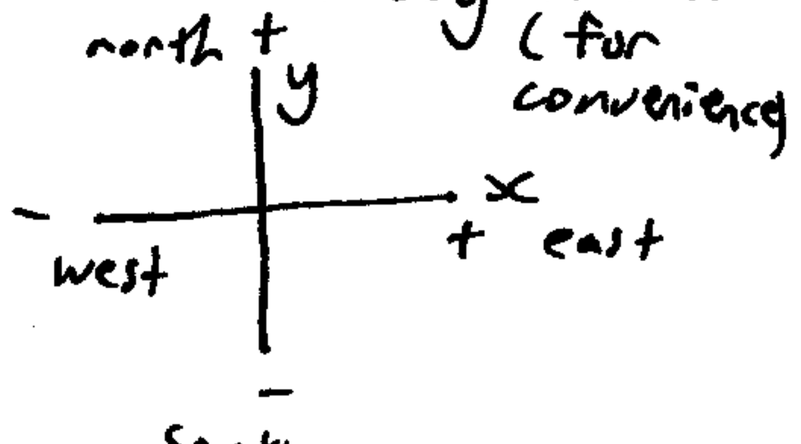
displacement vector for total trip (units in miles)

$\longrightarrow$ + (east)

(sign convention)

$\downarrow$ − (south)

align north-south - east-west with xy frame: (for convenience)



(b) 50 min = 0.833 h

Average velocity, $\bar{V} = \frac{\Delta \vec{r}}{\Delta t}$

$\Delta \vec{r} = \vec{r}_2$ (for total trip)

$\bar{V} = \frac{350\,\hat{i} - 500\,\hat{j}}{2.633}$ $\quad \Delta t = 0.833\,h + 1.8\,h = 2.633\,h$

$\bar{V} = 132.9\,\hat{i} - 189.9\,\hat{j}$ (answer)

units in mi/h

(c) Average speed, $\bar{s} = \frac{\text{total distance}}{\Delta t}$

$\bar{s} = \frac{350 + 500}{2.633} = 322.8$ mi/h (answer)