Today's Topic: Relative Motion
- One-dimension
- Two-dimensions
- Airplane problem

Moving Sidewalk at Hartsfield Airport
1. Elizabeth is standing on a moving sidewalk that is moving at 5.0 ft/s.
   1. How fast is she going?
2. Abby is standing on the same moving sidewalk.
   1. How fast is Abby going?
   2. From Elizabeth's view, how fast is Abby going?
3. Motion depends on _________________________

Moving Sidewalk at the Hartsfield Airport
Moving sidewalks: 5.0 ft/s
E: Elizabeth walking at 4.0 ft/s on moving sidewalk
D: Lazydog running at 7.0 ft/s on moving sidewalk going in opposite direction.

- How fast does Elizabeth appear to be moving to Lazydog?

Relative Motion
\[
\mathbf{v}_{B/ground} = \mathbf{v}_{B/A} \\
\mathbf{v}_{B/A} = \text{velocity of B with ________ to A}
\]

Position:
\[
\mathbf{r}_{B/G} = \mathbf{r}_{A/G} + \mathbf{r}_{B/A} \\
\mathbf{r}_B = \mathbf{r}_A + \mathbf{r}_{B/A}
\]

Acceleration:
\[
\mathbf{a}_{B/G} = \mathbf{a}_{A/G} + \mathbf{a}_{B/A} \\
\mathbf{a}_B = \mathbf{a}_A + \mathbf{a}_{B/A}
\]
Example: Swimming across the river

- Swim at 4.0 ft/s in still water
- Current flows at 2.0 ft/s
- Start swimming straight across river
- How long does it take to reach bank?
- Where does swimmer end up?

Example: Swimming across the river

- Swim at 4.0 ft/s in still water
- Need to swim to point B 30 ft downstream
- Current flows at 2.0 ft/s
- At what angle should you swim?
- How long does it take to reach bank?

Example: Airplane

An airplane can maintain an air speed of 380 mph and needs to fly to a city that is 500 miles @ 20° E of N of where it starts. The wind is blowing at 70 mph in a direction of 40° W of N. Determine the direction the airplane needs to head and how long it will take for the trip.

Keys to working 2-D relative motion problems:
1. __________________
2. __________________
3. __________________