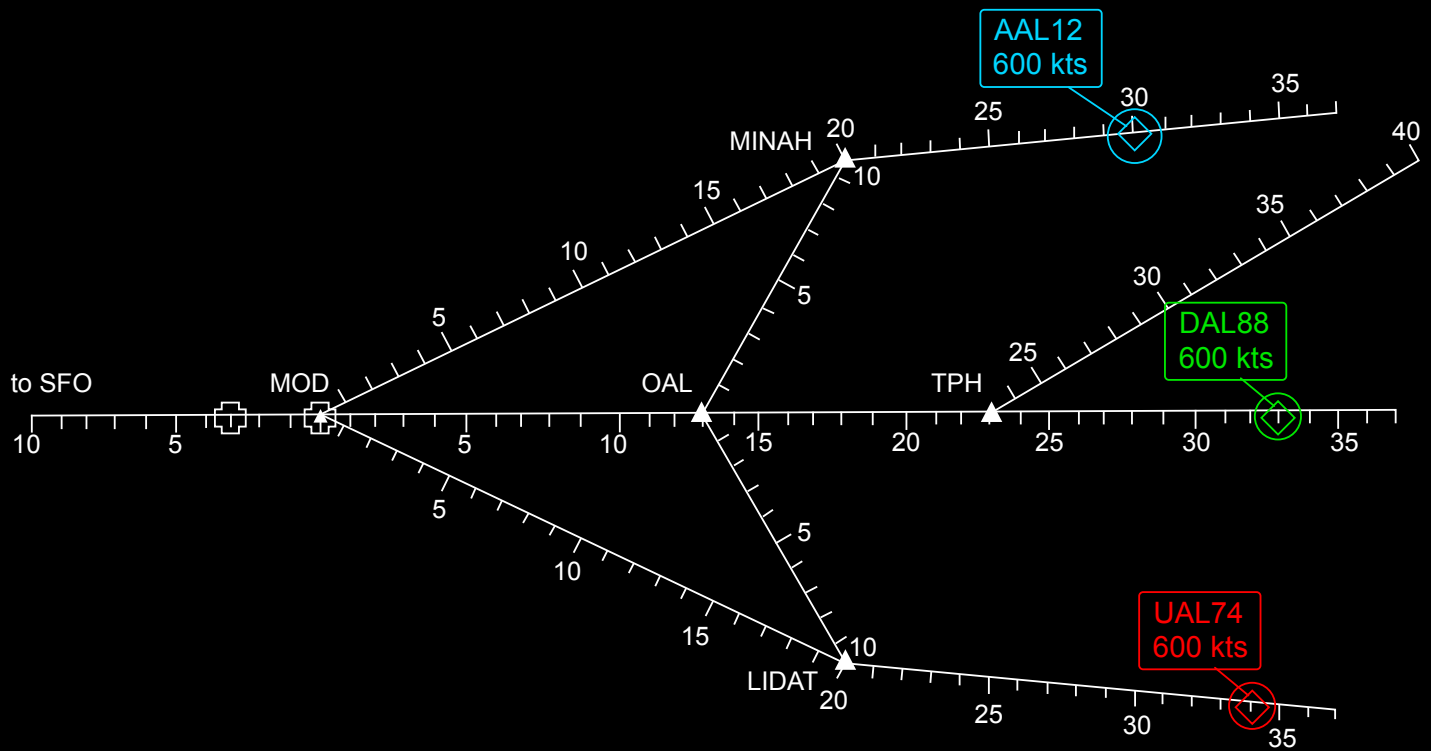




LineUp with Math

Math-Based Decisions in Air Traffic Control

STUDENT WORKBOOK D

Understanding the Effects of Differences in Speed.

- * Plot distances traveled at different speeds.
- * Change knots to nautical miles per minute.

Simulator: <https://atcsim.nasa.gov/simulator/sim2/sector33.html>

WORKSHEET #1

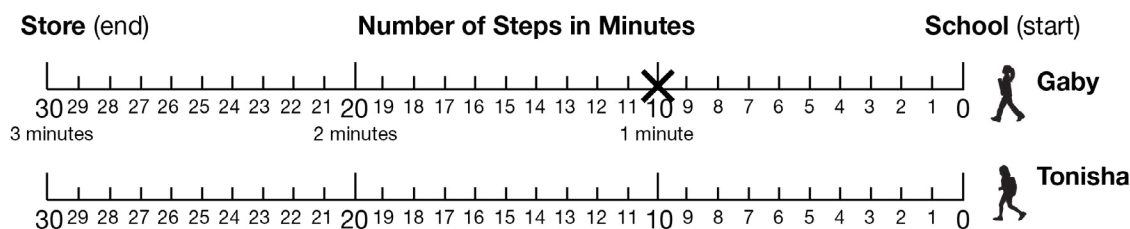
Introduction to Travel at Different Speeds

Gaby and Tonisha are walking together from school to the park. Their steps are the same, but they walk at different speeds, as shown in the Walking Speed Table.

Walking Speed Table

Name	Speed
Gaby	10 Steps/minute
Tonisha	9 Steps/minute

- How many steps does each student take in 1 minute Gaby _____ steps Tonisha _____ steps
- On the first line below, draw an **X** to mark Gaby's position at 1 minute.



- On the second line above, draw an **X** to mark Tonisha's position at 1 minute.
- How many steps is Tonisha behind Gaby after 1 minute? _____ steps
- On the number lines above, mark Gaby's position and Tonisha's position after 2 minutes.
- How many steps is Tonisha behind Gaby after 2 minutes. _____ steps
- On the number lines above, mark Gaby's position and Tonisha's position after 3 minutes.
- How many steps is Tonisha behind Gaby after 3 minutes? _____ steps
- How many steps does Tonisha fall behind Gaby **each** minute? _____ steps
- How many steps would Tonisha fall behind in 5 minutes? _____ steps
- If Tonisha takes 8 steps per minute, how many steps would she fall behind Gaby in 5 minutes? _____ steps

The number of steps Tonisha falls behind each minute is the same as the difference between the speeds.

WORKSHEET #2

Change Knots to Nautical Miles per Minute

Planes fly very fast, so air traffic controllers need to make quick decisions. To be effective, air traffic controllers need to know how many nautical miles a plane will travel in 1, 2, and 3 minutes.

1. There are _____ in one hour. To understand how many nautical miles an airplane travels in one minute, divide by _____.

Speed in Knots (NM/hour)	NM/hr ÷ _____	Speed in NM/minute
600 knots	600 ÷ _____	= _____ NM/min
540 knots	540 ÷ _____	= _____ NM/min
480 knots	_____ ÷ _____	= _____ NM/min

2. Use the completed number line above to fill in the chart below to show the distance a plane travels after 1, 2, and 3 minutes for each speed shown.

	1 minute	2 minutes	3 minutes
600 knots	10 NM	_____ NM	_____ NM
540 knots	_____ NM	_____ NM	_____ NM
480 knots	_____ NM	_____ NM	_____ NM

3. How much less distance does a plane travel after 1, 2, and 3 minutes for each plane speed reduction shown?

Speed Reduction	1 minute	2 minutes	3 minutes
60 knots	1 NM	_____ NM	_____ NM
120 knots	_____ NM	_____ NM	_____ NM

4. If a plane slows its speed by 60 knots, how many nautical miles less will it travel each minute? _____ nautical miles
5. An air traffic controller reduces a plane's speed from 600 knots to 540 knots. How many nautical miles less will the plane travel in 5 minutes? _____ nautical miles

WORKSHEET #2 CONTINUED

Change Knots to Nautical Miles per Minute

Let's look at planes
at different speeds!

Let's translate all of this to airplanes! Use the conversion chart on the previous page as a reference for the remaining questions.

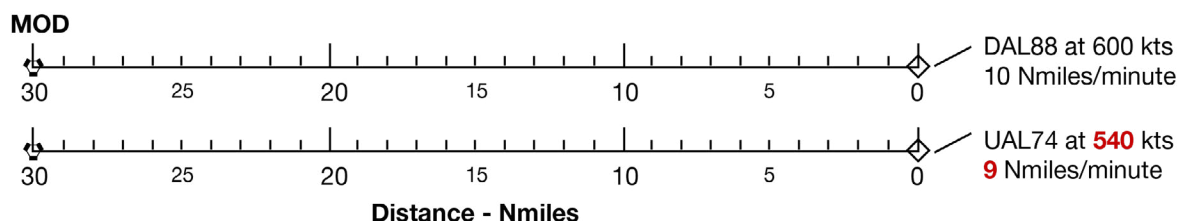
Recall:
1 Knot =
1 Nautical mile
per hour

1 hour =
60 minutes

DAL88 and UAL74 are 30 nautical miles from MOD.

DAL88 is traveling at 600 knots, or ____ NM/min.

UAL74 is traveling at 540 knots, or ____ NM/min.



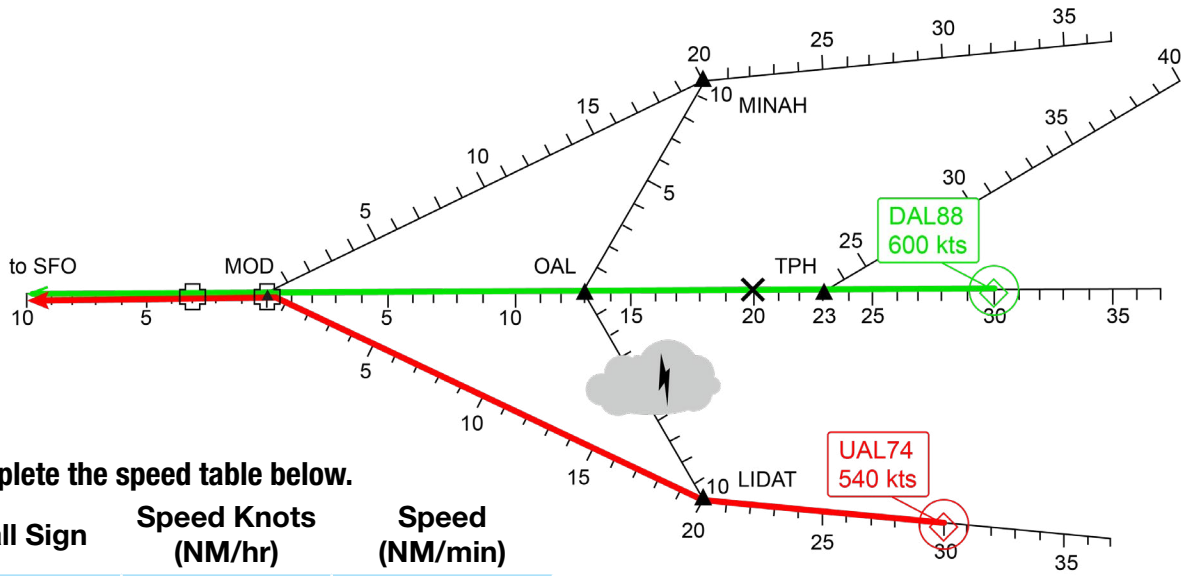
6. Use the number line above to plot an **X** at the travel distances for DAL88 and UAL74 after 1 minute, 2 minutes, and 3 minutes.
7. How many miles is UAL74 behind DAL88 after:
1 minute: _____ NM 2 minutes: _____ NM 3 minutes: _____ NM
8. How many fewer nautical miles will UAL74 travel in **each** minute? _____ nautical miles per minute
9. When DAL88 has traveled 30 nautical miles to MOD, how many nautical miles behind is UAL74?
_____ nautical miles

At 600 knots, a 60-knot speed drop causes a 1 nautical mile distance drop every *minute*.

In 1 minute, a plane travels 1/60th
the distance it travels in 60 minutes.

WORKSHEET #3

Plot Distances for Different Plane Speeds



Complete the speed table below.

Call Sign	Speed Knots (NM/hr)	Speed (NM/min)
DAL88	_____	_____
UAL74	_____	_____

- How many nautical miles does each plane travel in 1 minute?
DAL88 _____ nautical miles
UAL74 _____ nautical miles
- In the diagram above, use an **X** to plot each plane's position at 1, 2, and 3 minutes. Put a 3 near each plane's 3-minute mark.
- How many nautical miles does UAL74 fall behind DAL88 each minute? _____ nautical miles per minute.
- Using the speed table, the difference in plane speeds in nautical miles per minute is _____ nautical miles per minute.
- The number of nautical miles that UAL47 fall behind each minute is the ☐ **same as** or ☐ **different than** the difference between plane speeds in nautical miles per minute.
- How far will UAL74 fall behind in 3 minutes? _____ nautical miles
- Suppose the difference in speed is 2 nautical miles/minute.
 - ➔ How far would UAL74 fall behind in 3 minutes? _____ nautical miles
 - ➔ How many minutes will it take UAL74 to fall 8 nautical miles behind? _____ minutes

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