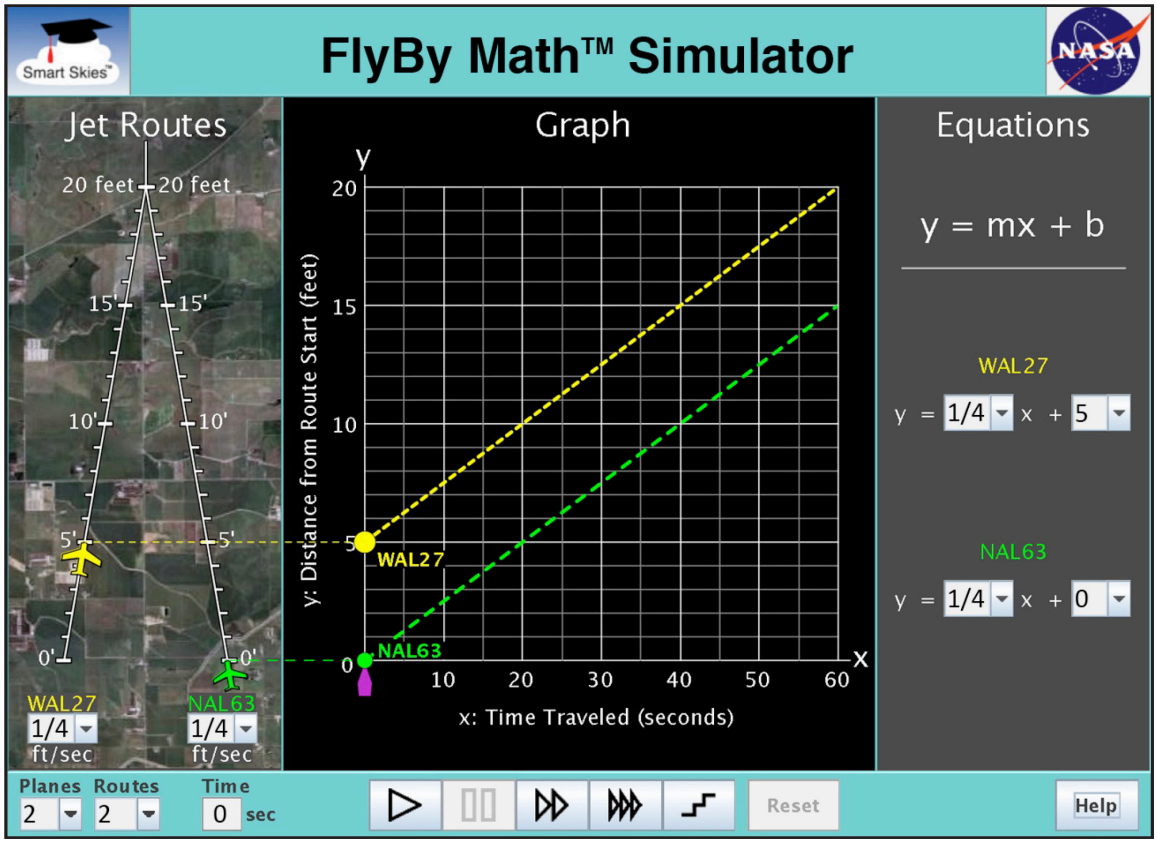
Name _____

# Student Worksheet D

## *Analyzing Headstart: Two Planes Flying at the Same Speed*

In this worksheet, you will work with 2 planes and 2 jet routes.

- The jet route is 20 feet long.
- The jet routes meet at the 20-foot mark.
- The planes are flying at the same altitude.
- The planes are flying at the same speed.
- One plane has a HEADSTART. That is, at the time zero, one plane is closer to the point where the jet routes meet. THe plane has a LEAD.

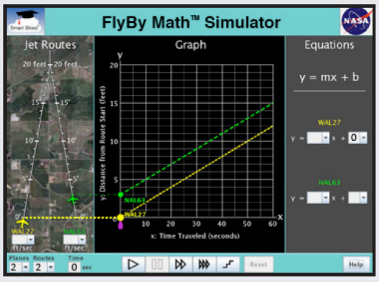



You will use the simulator to learn:

- How to find a plane's headstart using the **Jet Route Panel**, the **Graph Panel**, and the **Equation Panel**.
- What happens to this headstart as both planes fly at the same speed.

**Problem 1: Set up the simulator**

- Time slider: 0 seconds
- 2 planes, 2 routes
- WAL27 starting position: 0 ft.
- NAL63 starting position: Choose any position from 1 ft to 10 ft.
- WAL27 speed: Choose any speed greater than 0 ft/sec.
- NAL63 speed: Choose the same speed as for WAL27.




(a) What NAL63 starting position did you choose? _____ ft

(b) NAL63 is closer than WAL27 to the point where the jet routes meet. So NAL63 has a HEADSTART. What is the NAL63 headstart? _____ ft

(c) What WAL27 speed did you choose? _____ ft/sec

What NAL63 speed did you choose? _____ ft/sec
**Remember**: The *speeds* should be the *SAME*.

(d) Run the problem until it stops.

In the **Jet Route Panel**, notice that NAL63 is still ahead of WAL27. What is the NAL63 lead? (How far ahead is NAL63?) _____ ft

True or False:
This lead is the same as the NAL63 headstart. True False

In the **Graph Panel**, notice the lines. Put a **T** next to all TRUE statements below:

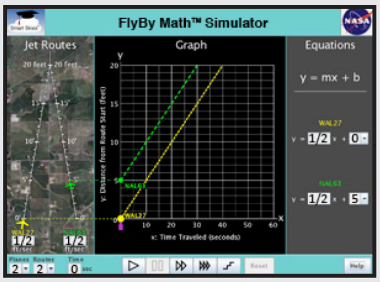
_____ The lines cross.
_____ The lines are parallel.
_____ The vertical (↕) distance between the lines does not change.

(e) In the **Equation Panel**, notice that the lines have the *same* slope (m). So the lines in the **Graph Panel** are parallel. What did you do in the **Jet Route Panel** that made the slopes the same?

_____

**Problem 2: Set up the simulator**

- Time slider: 0 seconds
- 2 planes, 2 routes
- WAL27 start: 0 ft., ½ ft/sec
- NAL63 start: 5 ft. ½ ft/sec




(a) In the **Jet Route Panel**, what is the NAL63 headstart at time zero (0 seconds)? _____ ft

(b) In the **Graph Panel**, how far apart are the dots on the y-axis? _____ ft

(c) Run the problem until it stops at 30 seconds. In the **Jet Route Panel**,

Where is NAL63? _____ ft

Where is WAL27? _____ ft

What is the NAL63 lead? (How far ahead is NAL63? _____ ft

(d) In the **Graph Panel**, at x = 30 seconds, what is the **y-coordinate** for each dot ( • )?

NAL63 dot: (x , y) = (30 seconds, _____ ft)

WAL27 dot: (x , y) = (30 seconds, _____ ft)

(e) Substract the y-coordinates. What is the difference between the NAL63 y-coordinate and the WAL27 y-coordinate? _____ ft

(f) What is the vertical (↕) distance between the parallel lines? _____ ft

(g) In the **Equation Panel**:

What is the value of b (the y-intercept) for the **NAL63** equation? b= _____ ft

What is the value of b (the y-intercept) for the **WAL27** equation? b= _____ ft

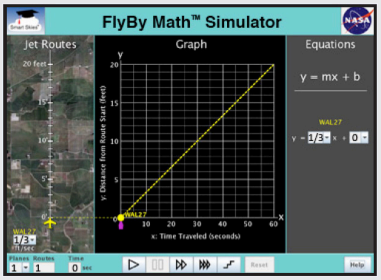
Subtract those values. What is the difference between the NAL63 and the WAL27 y-intercepts? _____ ft

(h) Circle all the items below that are equal to 5 feet?

NAL63 headstart at 0 seconds
NAL63 lead at 20 seconds
NAL63 lead at 30 seconds
Vertical distance between the parallel lines
Difference between the y-intercepts

## Problem 3: Set up the simulator

- Time slider: 0 seconds
- 2 planes, 2 routes
- WAL27 start: 10 ft., ¼ ft/sec
- NAL63 start: 6 ft. ¼ ft/sec




(a) In the **Jet Route Panel**, what is the WAL27 headstart at time zero (0 seconds)? _____ ft

(b) In the **Graph Panel**, how far apart are the dots on the y-axis? _____ ft

(c) Run the problem until it stops at 40 seconds. In the **Jet Route Panel**,

Where is WAL27? _____ ft

Where is NAL63? _____ ft

What is the WAL27 lead? (How far ahead is WAL27? _____ ft

(d) In the **Graph Panel**, at x = 40 seconds, what is the **y-coordinate** for each dot ( • )?

WAL27 dot: (x , y) = (40 seconds, _____ ft)

NAL63 dot: (x , y) = (40 seconds, _____ ft)

(e) Substract the y-coordinates. What is the difference between the WAL27 y-coordinate and the NAL63 y-coordinate? _____ ft

(f) What is the vertical (↕) distance between the parallel lines? _____ ft

(g) In the **Equation Panel**:

What is the value of b (the y-intercept) for the **WAL27** equation? b= _____ ft

What is the value of b (the y-intercept) for the **NAL63** equation? b= _____ ft

Subtract those values. What is the difference between the NAL63 and the WAL27 y-intercepts? _____ ft

(h) Circle all the items below that are equal to 5 feet?

WAL27 headstart at 0 seconds

WAL27 lead at 20 seconds

WAL27 lead at 30 seconds

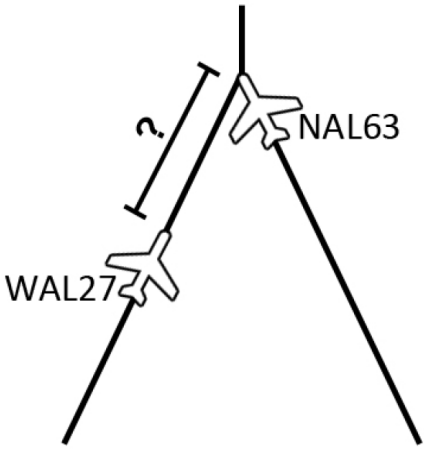
Vertical distance between the parallel lines

Difference between the y-intercepts

**Problem 4: Set up the simulator**

- WAL27 and NAL63 are flying on their jet routes at the same speed.
- WAL27 and NAL63 are flying at the same altitude.
- NAL63 has a headstart.

To answer the following questions, use what you learned in Problems 1 through 3.



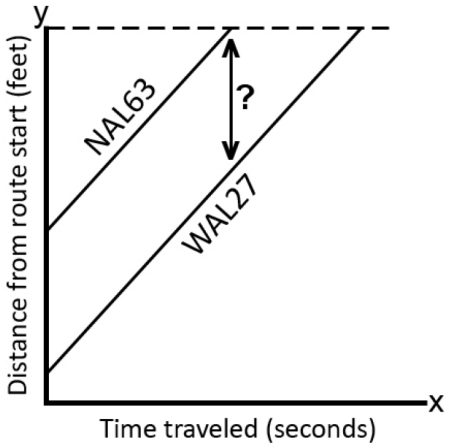

(a) If you know the NAL63 headstart, do you also know the distance between the planes when NAL63 reaches the point where the jet routes meet? Yes No

Why or why not? _____

_____

_____

_____




(b) If you know the NAL63 headstart, do you also know the vertical (↕) distance between the parallel lines on the graph? Yes No

Why or why not? _____

_____

_____

_____

(c) If WAL27 starts at 2 ft and NAL63 starts at 9 ft, their equations might look like this:

| WAL27 |
| --- |
| $y = 0.6\,x + 2$ |
| NAL63 |
| $y = 0.6\,x + 9$ |

Which plane has a headstart? _____

What is the headstart? _____ ft

Why or why not? _____

_____

_____

**Problem 5:**

- Two planes are flying at the same speed.
- One plane has a headstart.

(a) SUMMARIZE: Choose the word or phrase that best completes the sentence.

Unless one plane changes its speed, the lead will:

- ❍ increase
- ❍ stay the same
- ❍ decrease

(b) GO BEYOND: If the two plane are not flying at the same speed, will the lead stay the same?

Yes No

Why or why not? _____

_____

_____