

**Base  
Running**

**Growing Mathletes**

# Base Running Lesson Overview

**Key Ideas in This Session:** Youth explore the effects of different base running paths and connect these experiences to other experiences learning a new skill for the first time.

**Driving Questions:**

1. How do different base running paths (straight line path vs. circular path) impact the **distance** that a player runs around the bases?
2. How do different base running paths (straight line path vs. circular path) impact the **time it takes** for a player runs around the bases?

**Math Standards:**

**4.MD.A.2** Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

**4.NF.C.7** Compare two decimals to hundredths by reasoning about their size.

**5.NBT.A.3.** Read, write, and compare decimals to thousandths.

**5.NBT.A.4** Use place value understanding to round decimals to any place.

**6.SP.A.2** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

**6.SP.B.4** Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

Activity	Time	Description
<b>Activity 1</b>	<b>45 minutes</b>	On a baseball field, you will run from home plate around the bases in a straight line as fast as possible. Then you will try it with the circular path and compare running times. Results will be plotted on a line plot.
<b>Activity 2</b>	<b>15 minutes</b>	You will learn about how the brain changes when you learn something new.

## Materials

- Pencils and Markers
- Stopwatch (one per youth pair)
- Baseball bases (1-2 sets per whole group)
- Tape measure (to set out bases, 1 per whole group)
- Blank paper for drawing (1 per youth)
- Butcher paper or white board for drawing line plot
- Copy of Worksheet 1 (1 per youth)

## Set-Up

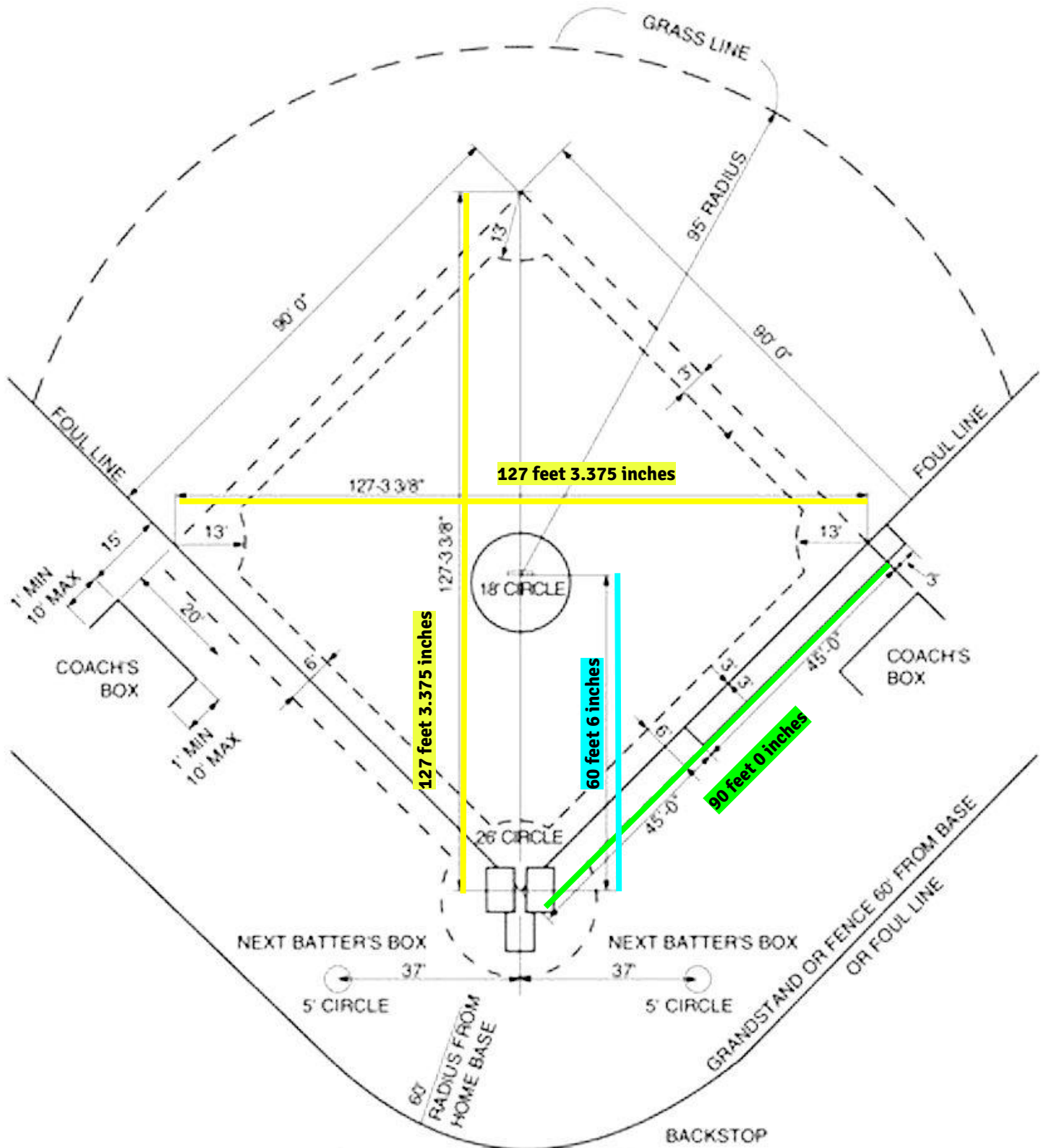
- For **Activity 1**, set up bases according to the instructions on Set Up pages (following pages).
- Prepare the line plots by either sketching a blank line plot on large poster or butcher paper (see third set up page) or by displaying Youth Slide 8. Distribute copies of **Worksheet 1**.
- For **Activity 2**, distribute blank paper for youth to draw or write on.

### Growth Mindset Connection

The malleability of the brain and the role of struggle in learning.

# Instructions for Setting Up Baseball Field (1 of 2)

## MLB Infield Dimensions



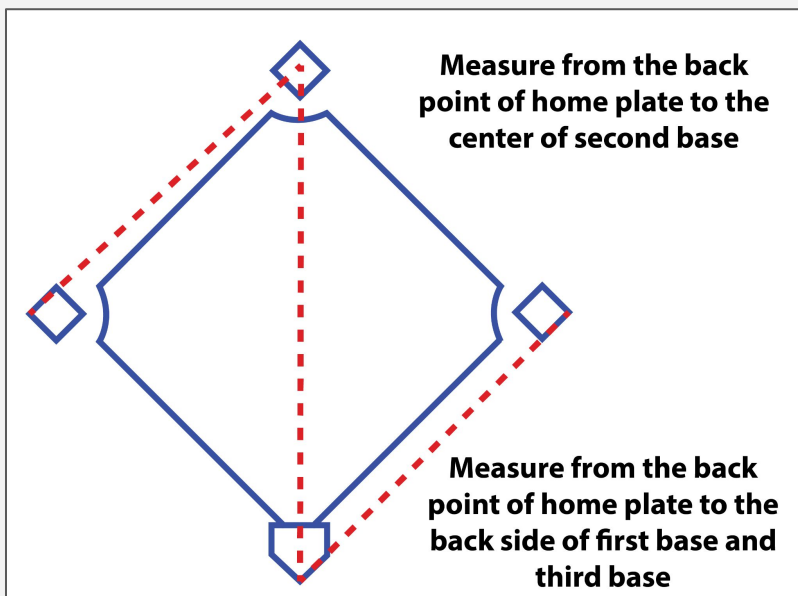
# Instructions for Setting Up Baseball Field (2 of 2)

## MLB, Little League, and Indoor/Small Space Infield Dimensions Chart

	Distance between Bases	Distance between home plate and pitcher's mound	Distance between home plate and second base
<b>MLB</b>	90 feet	60 feet 6 inches	127 feet 3.375 inches
<b>Little League</b>	60 feet	46 feet	~ 85 feet
<b>Indoor and Small Space Set Up</b>	30 feet	20 feet 2 inches	~ 42 feet

MLB dimensions source: <https://www.mlb.com/glossary/rules/field-dimensions>

### How to Measure Between Bases



To measure from each base:

Measure from the back point of home plate along the outer edge of first base (1B) and third base (3B) to the far edge.

Measure from the far corner of first or third base (3B) along the outer edge to the center of second base (2B), and from the back point of home plate (HP) to the center of second base (2B).

# Instructions for Setting Line Plot (1 of 1)

## Set up: Class Line Plot

Prior to the activity, set up the class line plot:

### Option 1: Project a line plot on a screen.

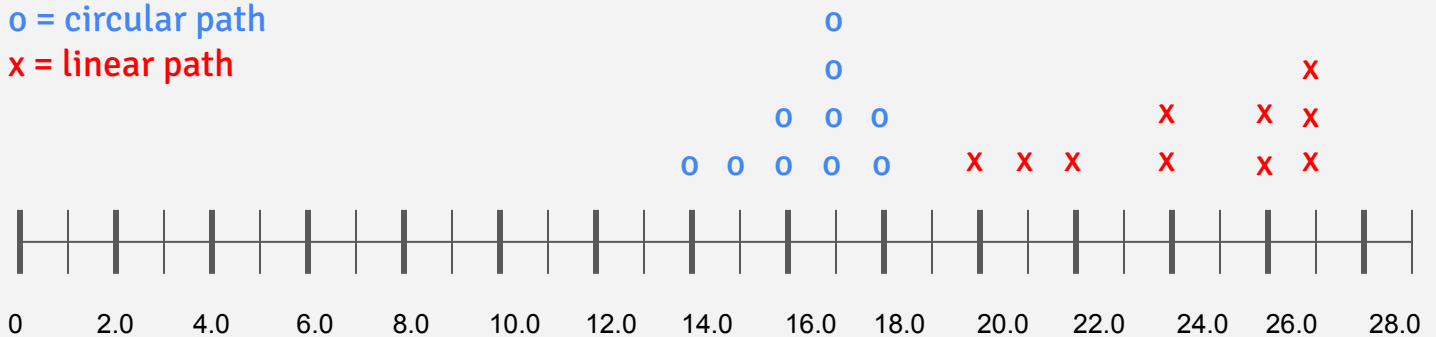
- Display the blank line plot on Slide 11 on a screen or whiteboard.
- Have youth groups plot their bounce height using small Post-It notes directly on the screen or whiteboard.

### Option 2: Draw a line plot on a whiteboard or poster paper.

- Draw a line plot on large poster or butcher paper. Label the line plot with measurements in seconds.
  - For 30ft-base distance, set the line plot to go from 0 to 30.
  - For 60ft-base distance, set the line plot to go from 20 to 60.
  - For 90ft-base distance, set the line plot to go from 30 to 90.
- Have Post-It notes available if the line-plot is on something youth cannot write on, because they will need to be able to mark the line plot with x's and o's of different colors.
- See below for an example.

## Sample Line Plot: Base Running Times

o = circular path  
x = linear path




# Base Running Introduction

Start the session by providing youth with an overview of the key activities.

### Base Running

Activity	Time	Description
<b>Activity 1</b>	45 minutes	On a baseball field, you will run from home plate around the bases in a straight line as fast as possible. Then you will try it with the circular path and compare running times. Results will be plotted on a line plot.
<b>Activity 2</b>	15 minutes	You will learn about how the brain changes when you learn something new.




Growing Mathletes

Base Running Youth Slides, Slide 1

Next, share and discuss this quote.

**“Don’t be afraid to take advice,  
there is always something  
new to learn.”**  
– *Babe Ruth*

### Base Running



“Don’t be afraid to take advice, there is always something new to learn.”  
– Babe Ruth

What does this quote mean to you?

What message is Babe Ruth trying to send?

Activity 1

Base Running Youth Slides, Slide 2

# Activity 1 - Running the Bases (1 of 4)

**Description:** On a baseball field, you will run from home plate around the bases in a straight line as fast as possible. Then you will try it with the circular path and compare running times. Results will be plotted on a line plot.

**Math Ideas: Recording and Rounding Decimals** Youth will **measure running times in seconds** using stopwatches, and will record their times to the nearest **tenth and/or hundredth of a second**. For example, youth may run the bases in 15.24 seconds. They can record this time as 15.2 seconds (15 and 2 tenths of a second), or as 15.24 seconds (15 and 24 hundredths of a second). Youth may **“round” their times to the nearest tenth of a second** by looking at the hundredths place in their time. If the hundredths place is 0 to 4, then they will leave the tenth value as it is (round down). For example, 15.24 seconds has “4” in the hundredth place, so it rounds to 15.2 seconds. If the hundredth place is 5 or above, then they will add one to the tenth place (round up). For example, 15.28 seconds has “8” in the hundredth place, so it rounds to 15.3 seconds.

**Comparing Decimals** Youth will also **compare decimals** to determine “faster” or “slower” running times. For example, 15.3 seconds is greater than 15.2 seconds, which means that 15.3 seconds is a “slower” running time (a greater value means a slower time). 14.24 seconds is less than 14.8 seconds, which means that 14.24 seconds is a “faster” running time (a lower value means a faster time).

**Line Plots** In this activity, youth will **create a line plot**. A line plot is **a number line that includes the range in values in the data set**. The number line is labelled in equal increments. In this activity, youth will label seconds on the number line (1 second, 2 second, 3 seconds). Each second increment can be further divided into fractions of a second. For example, the number line can be labelled in one-tenth second increments (1 second, 1.1 seconds, 1.2 seconds, etc) or in half-second increments (1 second, 1.5 seconds, 2 seconds, 2.5 seconds, etc). Next, youth place a symbol (an X or an O) above a value on the number line to represent each value in their data set (each running time). If a value occurs more than once in a data set, youth will place an additional symbol over that number for each time it occurs.

## LAUNCH: Connection to Prior Knowledge

Ask youth to share their experience with running bases (in baseball, kickball, or softball).

- What strategies do you use to run as fast as possible around the bases?
- What helps you go faster?
- What slows you down?
- How do you adjust your movement or direction to run as fast as possible?

Share your experience with running bases  
(In Baseball, Kickball, or Softball)



- What strategies do you use to run as fast as possible around the bases?
- What helps you go faster?
- What slows you down?

Activity 1

Base Running Youth Slides, Slide 3

# Activity 1 - Running the Bases (2 of 4)

## Background on Baseball Concepts: Whole Group Discussion

Discuss different ways to run around the bases - with a **linear running path**, or a **circular running path**.

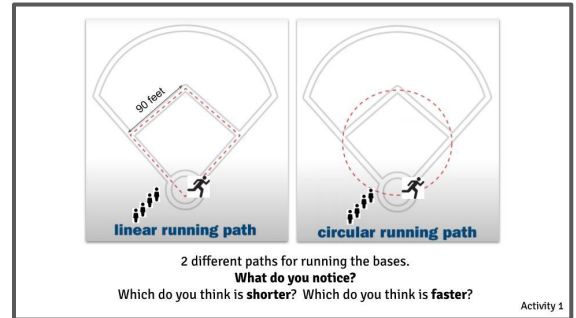
**VIDEO: Baserunning & Angular Motion [2:51]:**

<https://youtu.be/pUD4eLXrKT8>

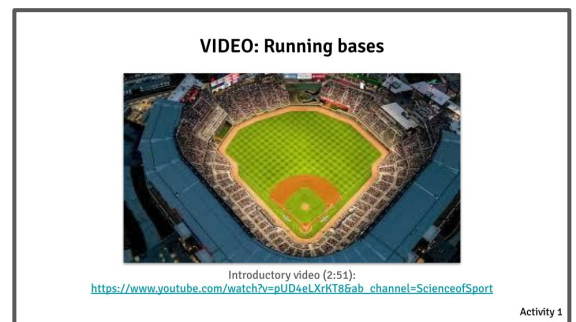
- The shortest distance between bases is a straight line, but is it the fastest?
- In order to run around the bases and compensate for angular momentum, the runner must run in a “circular path” and lean towards the pitcher’s mound.
- This is the same reason why motorcycles lean into their turns (if they didn’t lean, they would roll over at the first high-speed turn).

## Running Activity: Small Groups of 3-5

On a youth baseball field (bases are 60 feet apart), youth will each run from home plate around the bases in a straight line path as fast as possible. Then youth will try it with the circular path and compare running times. While one youth is running the bases, their partner will keep track of their time using a stopwatch. Youth will then record their results on **Worksheet 1**.



Base Running Youth Slides, Slide 4



Base Running Youth Slides, Slide 5



Base Running Youth Slides, Slide 6

Base Running

**Worksheet 1 - Base Running Results**

Runner Name	Straight Line Path (seconds)	Circular Path (seconds)

Worksheet 1



# Activity 1 - Running the Bases (3 of 4)

## Running Activity: Small Groups of 3-5 (Cont.)

### Engagement Tip!

Have a plan for youth who finish running. Ex: have them play catch, or have one facilitator facilitate a game, stretching, art activity, etc. This can prevent misbehavior.

Have partners decide who will be running first, and who will be timing.

FIRST, have each "runner" start at home plate and run the bases (home ► first ► second ► third ► home) in a straight line path.

Note: To stay in a straight line runners will have to slow down at each turn, increasing the amount of time it will take them to make it all the way around the bases.

The "timer" (their partner) will time them using the **stopwatch**.

Youth will record their straight line running times on **Worksheet 1**.

Youth will then switch roles, so that each youth has the opportunity to be the "runner" and the "timer"

SECOND, have each "runner" start at home plate and run the bases (home ► first ► second ► third ► home) in a circular path.

Note: The circular path will allow them to maintain a higher speed and a lower time.

The "timer" (their partner) will time them using the **stopwatch**.

Youth will record their circular path running times on **Worksheet 1**.

Youth will then switch roles, so that each youth has the opportunity to be the "runner" and the "timer"

If the use of an outdoor baseball field is not possible, set up a scaled down version of the baseball infield indoors. For example, for a 50% scale: Instead of 60 feet between the bases (as in Little League), place the bases 30 feet apart. (See Set Up page.)

## Indoor Adaptation:

## Reflection Questions:

Ask youth to share what they noticed about their running times:

- How did the straight line running path impact their speed? Their time?
- How did the circular running path impact their speed? Their time?
- Which running path was the shortest distance?
- Which running path was faster?

Groups of 3:  
One person is the "RUNNER"  
One person is the "TIMER"  
One person is the "DATA RECORDER"

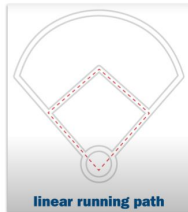
1. First, the "RUNNER" will run the bases, with a STRAIGHT LINE path.
2. Second, the "RUNNER" will run the bases, with a CIRCULAR path.
3. The "TIMER" will use a stopwatch to time the runner.
4. Third, the recorder notes running times on the worksheet.

Switch roles so everyone gets to be the RUNNER, TIMER, and RECORDER.

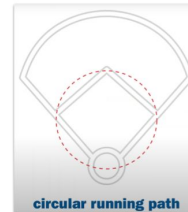
Base Running		
Worksheet 1 - Base Running Results		
Runner Name	Straight Line Path (seconds)	Circular Path (seconds)
Vanessa	22.5	18.8

Activity 1

Base Running Youth Slides, Slide 7



**linear running path**



**circular running path**

What did you notice about our running times with each running path?  
Which running path was the **shortest distance**?  
Which running path was **faster**?

Activity 1

Base Running Youth Slides, Slide 8

# Activity 1 - Running the Bases - Line Plot

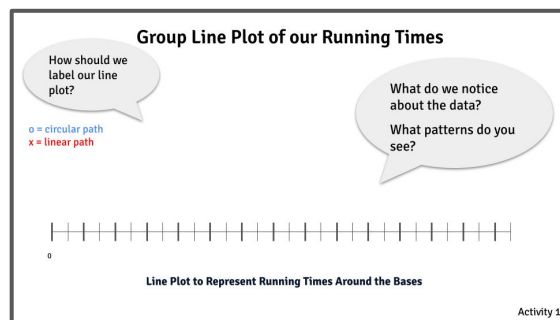
## (4 of 4)

### Represent Running Times on a Line Plot: Whole Group Activity

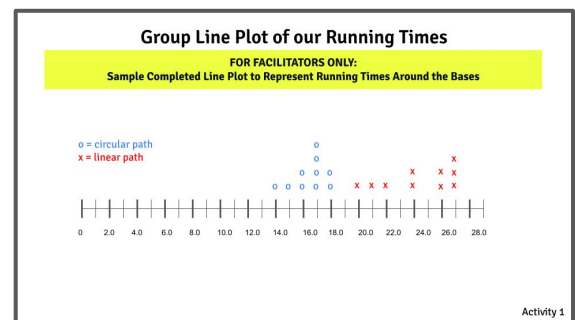
Tell youth they will work together to represent their running times on a line plot.

- Sketch a sample line plot on the board (or on a large sheet of butcher/chart paper), and label the line plot in equal increments.
- Invite youth to provide input on the times and increments used to label the line plot. Ensure that the values and increments selected reflect the range of running times.
- See the two sample line plots below. The first line plot is labelled in half second increments, starting at 13 seconds, and ending at 20. The second line plot is labelled in one-tenth second increments, starting at 15.0 seconds, and ending at 17.5.
- Ask youth to mark the time it took them to run the bases using the linear running path by placing an **X** on the line plot above their time.
- Ask youth to mark the time it took them to run the bases using the circular running path by placing an **O** on the line plot above their time.
- Equivalent running times should be represented with “Xs” that are placed one above the other, directly above the corresponding time.

**If a running time is between increments**, youth will decide where to place their “X” or “O”. For example, the increments on the line plot may include 13.5, and 14 seconds, but one youth may have a running time of 13.6 seconds. The youth can reason that 13.6 is between 13.5 and 14.0, but closer to 13.5, and place the X accordingly, above 13.5. Youth should “round” their running time to the nearest increment on the number line, either to the nearest half second (if the line is labeled in half-second increments) or to the nearest tenth of a second (if the line is labeled in tenth second increments).



Base Running Youth Slides, Slide 9



Base Running Youth Slides, Slide 10

### Whole Group Discussion of Line Plot

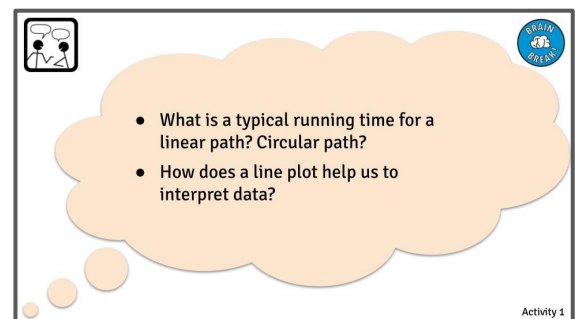
Ask youth to share observations about the plotted data:

- What patterns do you notice?
- Is there a cluster in the data?
- What is the difference between the fastest and slowest times?

### Closing Reflection

Close with a reflective discussion about the concepts in the activity.

- What is a typical running time for a linear path? Circular path?
- How does a line plot help us to interpret data?



Base Running Youth Slides, Slide 11

# Activity 2 - Learning New Habits and Skills (1 of 2)

## Growth Mindset Connection

Our brains are always changing and adapting to new situations and new ideas. This is how we learn! Our brains are **malleable** and can be reshaped to adapt to new ideas and circumstances. Brain scientists call the brain's ability to adapt and change "neuroplasticity." When we try new things (like new running paths), the neurons in our brains continually develop and make new pathways.

## Video: The Malleability of the Brain

Show youth this video about what happens in our brains when we learn something new -- neuroplasticity.

**VIDEO: The Neuroscience of Learning [3:01]**

<https://www.youtube.com/watch?v=nWMP68DqHE>

Ask youth to share key ideas from the video.

- What did you discover about how our brain learns a new skill?
- How does this relate to something new that you recently learned - such as new pathways for running bases?

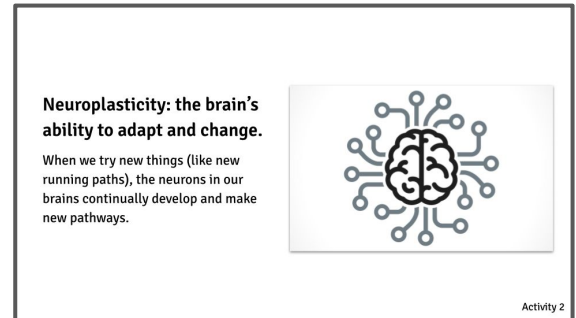
If the "circular path" for running the bases felt less familiar, ask youth to talk about how they had to adapt and make changes to their "typical" base running path.

## Creative Response Activity: Video or Drawing

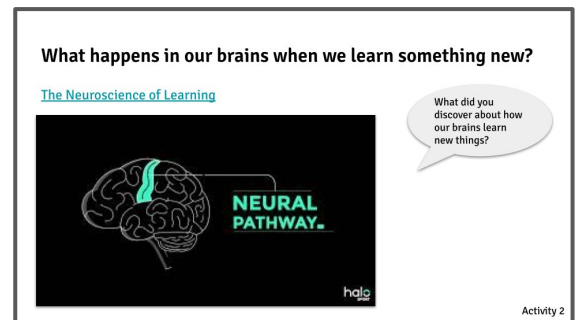
Ask youth to record a video (or write/draw) about their experiences running bases.

- In the video (or drawing/explanation), they should comment on the different methods for running the bases, and what felt more familiar and natural, and what felt less familiar.

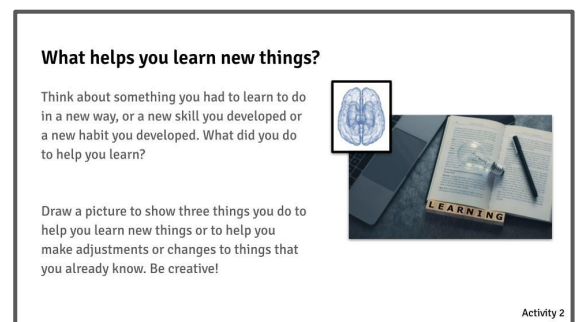
- Encourage youth to connect these experiences to other experiences learning a new skill for the first time.
- In their videos (or drawing/explanation), youth can share other strategies for learning new skills, or for changing habits or ways of doing things to improve performance.



Base Running Youth Slides, Slide 12



Base Running Youth Slides, Slide 13



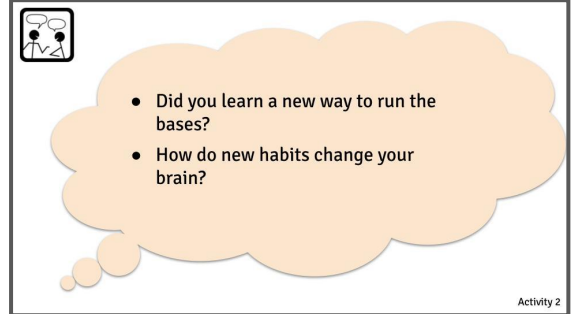
Base Running Youth Slides, Slide 14

## Activity 2 - Learning New Habits and Skills (2 of 2)

### Reflection Questions:

Wrap up the activity with a reflective discussion about the concepts in the activity and the driving questions for the lesson.

- Did you learn a new way to run the bases?
- How do new habits change your brain?



Base Running Youth Slides, Slide 15

## Worksheet 1 - Base Running Results

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<b>Runner Name</b>	<b>Straight Line Path (seconds)</b>	<b>Circular Path (seconds)</b>