Title: Interpreting Slope as a Rate of Change

Brief Overview:

In this learning unit, students will graph linear equations by using a table of values or the slope-intercept method for a given equation. Then students will identify the slope as a rate of change in order to interpret linear and non-linear graphs that represent real world situations. In addition, students will create a story to describe the situation displayed on non-linear graphs.

NCTM 2000 Principles for School Mathematics:

- **Equity:** *Excellence in mathematics education requires equity - high expectations and strong support for all students.*
- **Curriculum:** *A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.*
- **Teaching:** *Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.*
- **Learning:** *Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.*
- **Assessment:** *Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.*
- **Technology:** *Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.*

Links to NCTM 2000 Standards:

- **Content Standards**

Number and Operations
Students will add, subtract, multiply, and divide rational numbers in order to complete a table of values.

Algebra
Students will graph linear equations by using a table of values or the slope and *y*-intercept method. Students will interpret linear and non-linear graphs in order to describe the rate of change that models real world situations.

- **Process Standards**

  Problem Solving and Representation
  In order to solve real world problems, students will organize, interpret, and use relevant information. Students will communicate their conclusions with appropriate mathematical justification.

  Reasoning and Proof
  Students will draw conclusions and make predictions from given linear and non-linear graphs. Students will justify why an answer or approach to a problem is reasonable.

  Communication
  Students will discuss, read, listen, and observe to obtain mathematical information from a variety of sources. Students will represent situations and express their solutions using algebraic and graphical methods.

  Connections
  Students will identify the relationship among graphical and algebraic mathematical models and concepts.

Grade/Level:

The appropriate level for this learning unit would be for Algebra I students.

Duration/Length:

This learning unit will take approximately 4 sixty-minute periods.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- Using integer operations
- Graphing ordered pairs
- Using substitution
- Creating a table of values to produce ordered pairs
- Rewriting equations in slope-intercept form
- Identifying the slope and *y*-intercept in a given equation ($y = mx + b$)
- Determining the slope given two points on a graph

Student Outcomes:

- Students will use a table of values and/or the slope-intercept method in order to graph linear equations.
- Students will interpret the slope of linear and non-linear graphs in order to identify the rate of change representing real world situations.
- Students will interpret non-linear graphs in order to create a story that represents the information provided by the graph.

Materials/Resources/Printed Materials:

- Rulers
- Colored pencils
- Worksheets
- Graphing calculators
- Newspapers (have students bring in newspapers prior to beginning of unit)

Development/Procedures:

Day 1: Identifying types of slope or rate of change

Materials: Activity packet ("Identifying types of slope or rate of change"), colored pencils, straight edge, graphing calculators (optional)

Warm Up: Graphing equations

Students will complete the "Identifying the types of slope or rate of change packet".
Students will work in cooperative groups to generate rules for determining whether the slope is either positive, negative or zero.
Students will discuss and interpret graphs by using the rules developed.

Day 2: "What does the steepness of the slope or rate of change tell us?"

Materials: Activity packet ("What does the steepness of the slope or rate of change tell us?"), colored pencils, straight edge, graphing calculators (optional), newspapers

Warm Up: Vocabulary development/link to real life

Students will complete the "What does the steepness of the slope or rate of change tell us?"
Students will work in cooperative groups to develop rules in determining the relationship between the steepness and the coefficient of "*x*".
Students will discuss, interpret and mathematically justify which slope is greater on graphs.

Day 3: Interpreting Non-linear Graphs

Warm Up: Review of new knowledge gained from previous two lessons.

Students will complete the "Interpreting Non-Linear Graphs"
Students will answer questions in order to interpret the graphs.
Students will draft stories based on the information obtained from non-linear graphs.

Day 4: Hiking Performance Assessment

Warm Up: Students will share and write a brief explanation of non-linear graphs located from the newspaper. (Tie into weeklong homework assignment)

Students will complete a performance assessment on interpreting graphs.
Students will work with a partner and brainstorm ideas for a creative writing piece based on a given graph.
Students will then write a story about the graph on their own.
*Note: Teaming with the students' English teacher would enhance this assignment.

Performance Assessment:

Students will be given a picture of a non-linear graph with varying slopes as well as a title to go along with the graph. Students will use a graphic organizer while working in pairs to brainstorm ideas that could represent the various parts of the graph. Students will then work individually to create a story to represent each part of the graph while keeping the theme of the title. Students will be assessed on their creativity and their use of mathematical justification incorporated into the story.

Extension/Follow Up:

- Students will create their own graph, title, and "story" analysis to accompany their graph.
- Students will use the CBL or ranger to collect real life data to be displayed on a graph.
- Students will change the slope of the graph by walking faster or slower towards the motion detector.

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County/Jurisdiction: Baltimore County

NOTE: Worksheets/resources may be included on following pages; label them appropriately and keep them in the correct order.

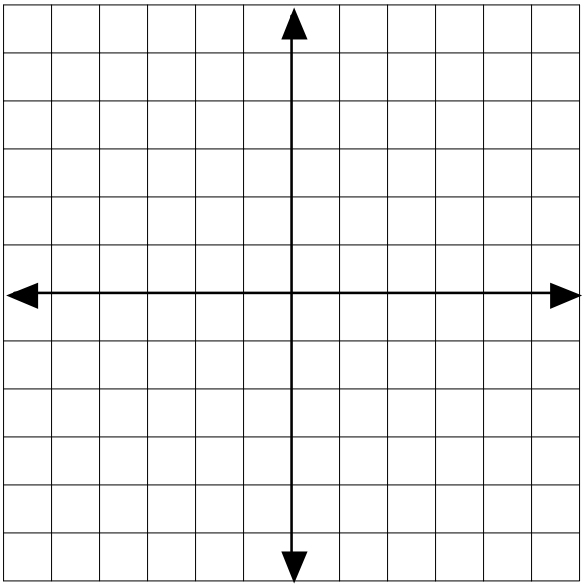
Identifying Types of Slope or Rate of Change

Warm-Up: Graph the following three linear equations using a different color for each line. Label each line with the appropriate equation. You may use a table of values or the slope-intercept method.

$y = -2x + 3$

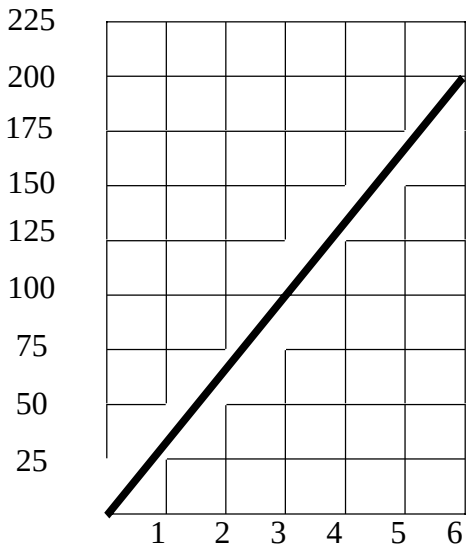
$y = 2x + 3$

$y = 3$



Now let's look at some linear graphs.

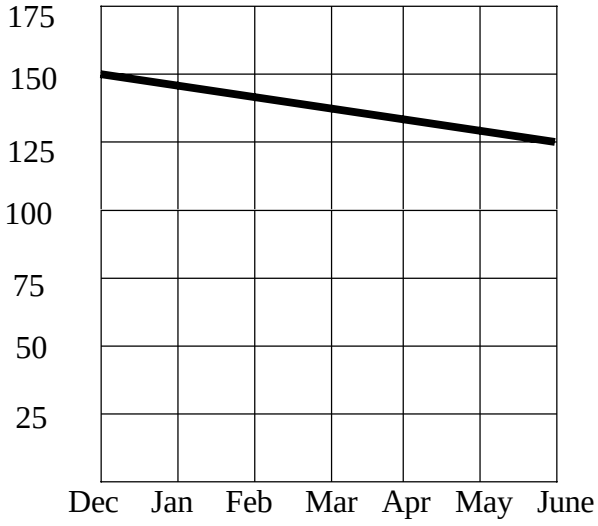
Miles Traveled Per Hour



Hours

When the line is moving in an upward direction when reading from the left to the right, the hours increase, as the miles _____.

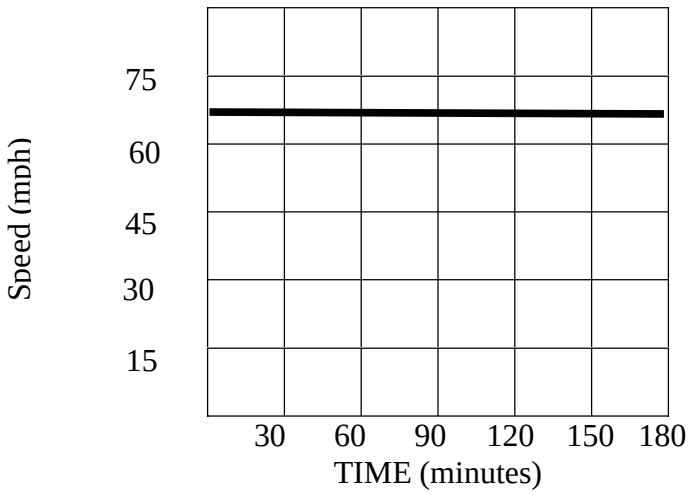
Weight Changes over the Last Six Months



Month

When the line is moving in a downward direction when reading from the left to right, the months progress as the weight _____.

Average Speed Traveled on I-95



When the line is moving straight across when reading from left to right, there is _____.

Now Let's Compare

1. Whenever you interpret slope from a graph you always read from the _____ to the _____.
2. Which linear equation on the drill shows an increase? _____
3. Which linear equation on the drill shows a decrease? _____
4. With a partner, compare the 2 linear equations and determine which part of the equation determines whether the line is increasing or decreasing. Try and develop a rule that will fit for all increasing and decreasing lines.

   _____

   _____

   _____
5. Now with a partner, try and determine a rule for when the line remains horizontal.

   _____

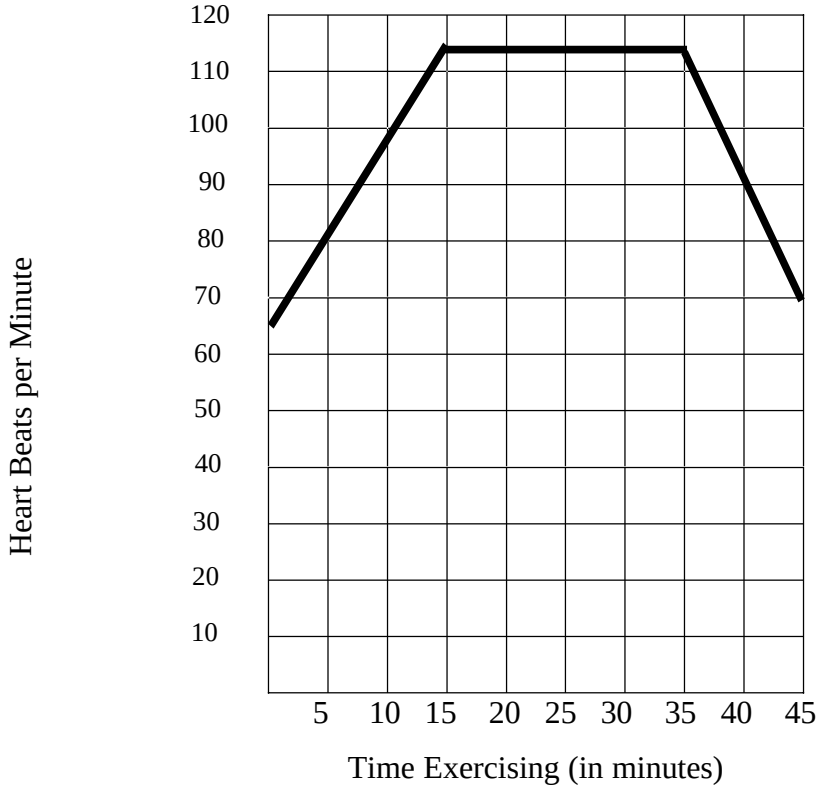
   _____

Rules

1. If the _____ or _____ is _____, then the line moves up when read from left to right.
2. If the _____ or _____ is _____, then the line moves down when read from left to right.
3. If the _____ or _____ is _____, then the line remains horizontal when read from left to right.

Let's Practice!

Heart Rate during Aerobics



Using the graph, answer the following questions.

1. During which time period was the heart rate increasing? _____
2. Using math, determine the exact rate of change for the increase (warm-up).

   _____

3. During which time period did the heart rate remain constant? _____
4. Using math, determine the exact rate of change for this time period. _____

5. During which time period did the heart rate decrease? _____
6. Using math, determine the exact rate of change for the decrease (cool down).

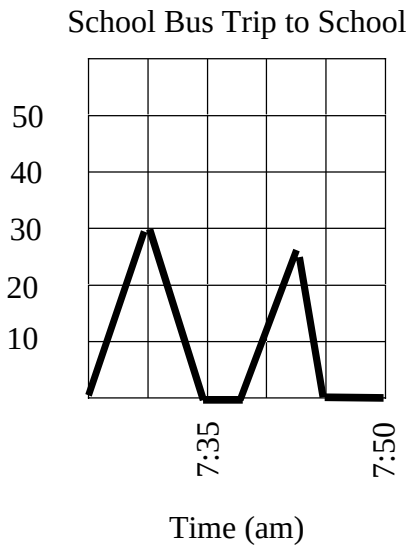
   _____

7. Explain why your rate of change for the cool down period was a negative value.

   _____

   _____

Now with a partner complete the activities for the following graph.



1. The line on the graph touches the *x*-axis 3 times. What does this represent?

   _____

   _____

2. Which pedal is the bus driver using when there is a positive slope? Negative slope? A zero slope?

   _____

   _____

   _____

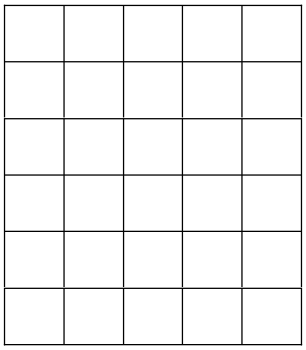
3. Which parts of the graph would you have to change if the title was changed to "School Bus Trip from School"?

   _____

   _____

   _____

4. Sketch the graph “School Bus Trip from School,” if your school dismisses at 3:00.



Quick Check

_____Locate 2 graphs in the newspaper that show positive, negative, and zero slopes.

_____Label the slopes as positive, negative, and zero.

_____Determine mathematically the exact rate of change of each segment.

_____Describe the real life situation that models each segment of the graph.

I will collect the graphs and your answers on a separate sheet of paper. Please tape the graphs to your answer sheet.

What Does the Steepness of the Slope or Rate of Change Tell Us?

Warm Up:

With a partner, define the word "steeper". Give at least three examples of things that represent steepness in the real world.

_____

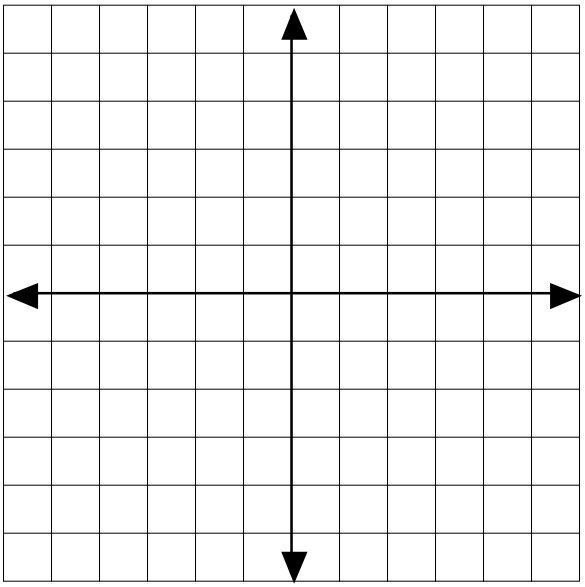
_____

_____

Predict which linear equation you and your partner believe will be steeper? Circle the equation you choose. Explain why you choose the equation you picked.

$y = x - 2$ OR $y = 4x - 2$

Graph and label the two linear equations using two different colors in order to show which one is really steeper.



With a partner, try to determine the rule for the slope/rate of change and the steepness of the line.

_____

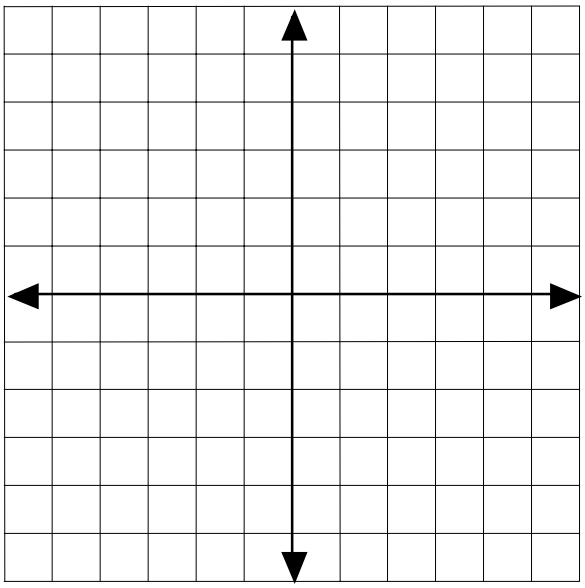
_____

You graphed two equations with positive slopes or rate of change. What do you think will happen to the rule you created, if you have two equations with negative slopes or rates of change?

_____
_____
_____

Graph the two linear equations given on the graph below.

$y = -5x + 2$ $y = -2x + 2$



Which linear equation is steeper? _____

Does the rule you and your partner developed for comparing two positive slopes still work? _____
If not, create a new rule for the relationship between the steepness of the line and the slope.

_____
_____
_____

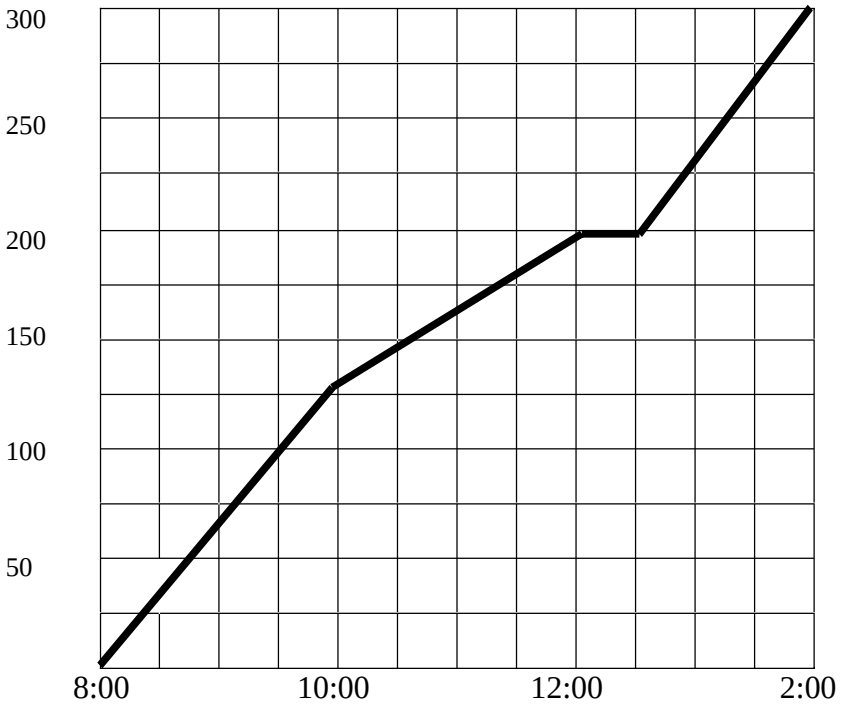
Rule

The steeper the line, the _____the slope or rate of change.

Let's Practice

The following graph illustrates a trip in four parts. Using the graph and your new knowledge gained, answer the questions following the graph.

A Drive to Virginia Beach



By interpreting the graph, we will be able to determine several aspects of the trip.

1. When did the family take a break? _____
2. When was the speed the slowest? _____
3. When was the speed the fastest? _____

Visually, it was difficult to determine whether the speed was quicker from 8:00-10:00 OR from 12:30 to 2:00. With a partner, use your prior knowledge to try and develop a method you can use to help you determine which speed was the fastest.

_____

_____

_____

_____

Mary Sue's Weight Changes Over One Year

Months

By interpreting the graph, we will be able to determine several aspects of Mary Sue's weight loss and gain.

1. During which time period was there no change in Mary Sue's weight? _____
2. Using your new knowledge, explain how you were able to determine when there was no weight change.

   _____

   _____

   _____
3. During which time period did Mary Sue's weight increase? _____
4. Using your new knowledge, explain how you were able to determine when she gained weight.

   _____

   _____

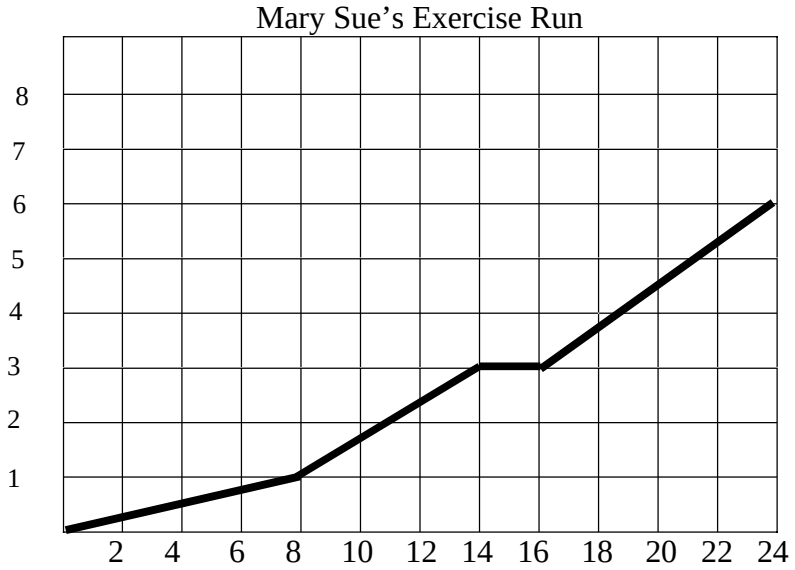
   _____
5. There were two major drops in her weight. Which drop shows the greatest rate of change? Justify your answer by using math.

   _____

   _____

   _____

Quick Check



By interpreting the graph, we will be able to determine several aspects of Mary Sue's exercise run.

1. During which time period did Mary Sue walk? _____
2. Using your new knowledge, explain how you determined which time period displayed when she walked.

   _____
   _____
   _____
3. During which time period did Mary Sue probably stop? _____
4. Using your new knowledge, explain how you determined that this was when she stopped.

   _____
   _____
   _____
5. During which time period did Mary Sue run? _____
6. During which time period did Mary Sue jog? _____
7. Using your new knowledge, explain how you were able to determine when she was running and when she was jogging. Justify your answer using math.

   _____
   _____
   _____
8. Based on the information on the graph above, PREDICT what you think the trend would be if we added four more minutes to the graph.

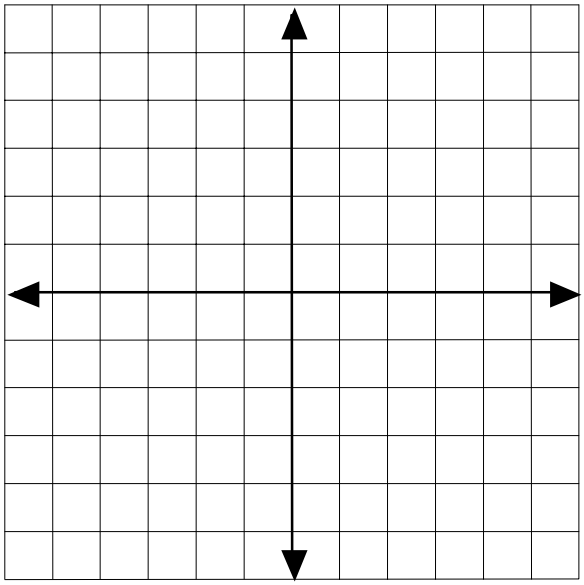
   _____
   _____

9. Now look in the newspaper and locate a graph that contains different rates of change. Create questions for interpreting the rate of change (use the previous questions as models). Give the graph and questions to your partner and have them complete.

Interpreting Non-linear Graphs

Warm Up/Review:

1. On the graph below, draw a blue line that represents an equation with a positive slope, a red line that represents an equation with a negative slope, and a green line that represents an equation with a slope of zero.



2. Using your knowledge about steepness, identify which line will have a greater steepness and explain using the rule generated.

$y = 4x + 8$ $y = 5x + 2$

_____

_____

_____

$y = -4x + 8$ $y = -5x + 2$

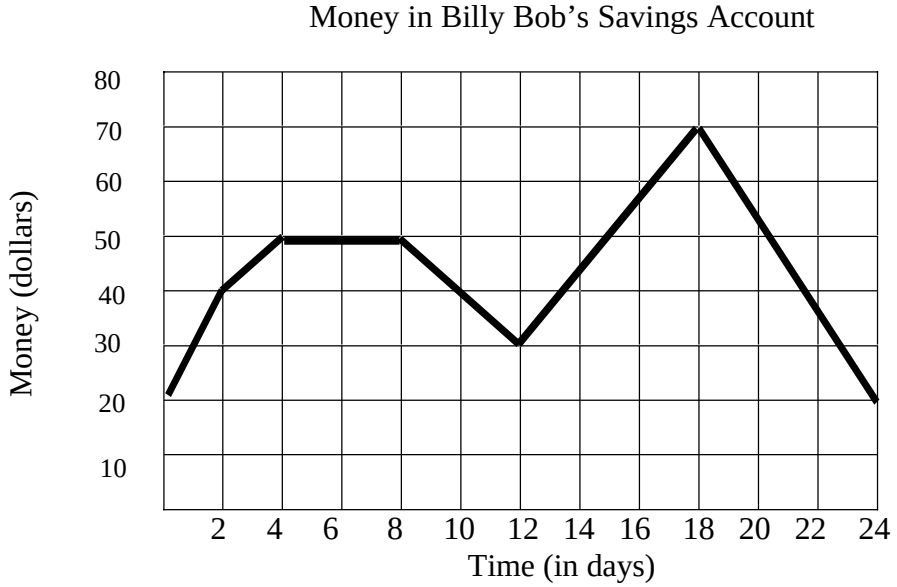
_____

_____

_____

Let's Tell Stories

Today we are going to use the knowledge we have learned in the last two lessons to interpret non-linear graphs.



1. During which time period did he deposit the most amount of money? _____
2. Using your new knowledge, explain how you knew which time period displayed the greatest deposit.

   _____

   _____

   _____

   _____
3. During which days did Billy Bob not complete any transactions? _____
4. Using your new knowledge, explain how you knew that he did not complete any transactions.

   _____

   _____

   _____
5. During which time period do you think Billy Bob withdrew money to attend a movie with a friend? _____
6. During which time period do you think Billy Bob withdrew money in order to purchase gifts for his mom, dad, grandparents, and even his sister? _____

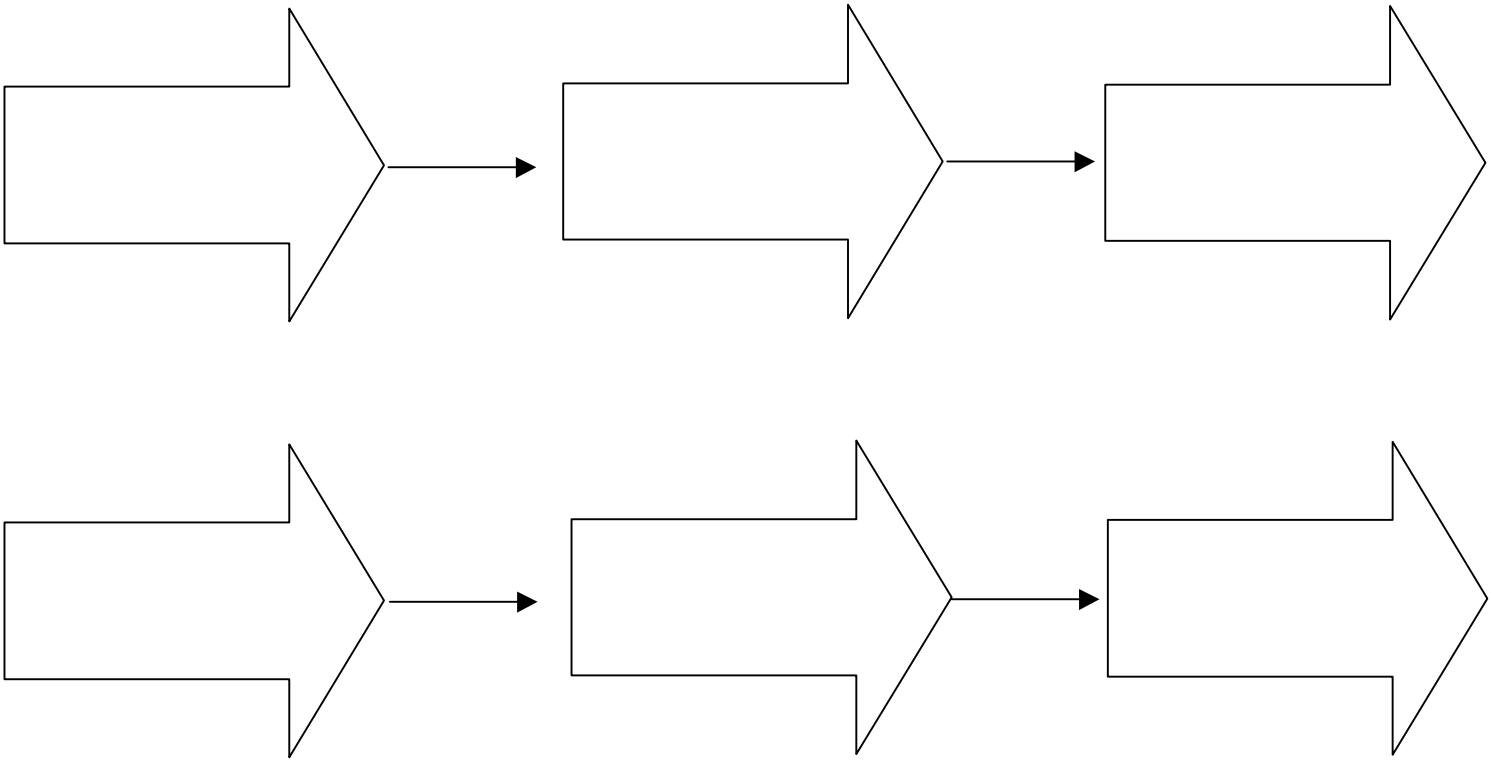
7. There were two times periods that show that Billy Bob made withdrawals. Using your new knowledge and mathematical terms, explain how you were able to determine when he took out money to go to the movies and when he took out money to purchase presents for his family.

_____

_____

_____

Every graph has a story to tell. Let's look back at the graph "Money in Billy Bob's Savings Account" and write a story about what we believe has occurred. We will begin by completing a story map or flow chart to describe each portion of the graph.



Now we will turn the story map or flow chart into a story.

With a partner, interpret the following graph.

Charlie Brown's Parachute Jump

1. During which time period was Charlie Brown free falling without a parachute?

   _____

2. Using your new knowledge, explain how you determined your answer.

   _____

   _____

3. During which time period was Charlie Brown using his parachute? _____
4. Using your new knowledge and any prior knowledge, explain how you determined your answer.

   _____

   _____

   _____

5. At several points on the trip, Charlie Brown's height rose. When did the greatest positive rate of change occur? _____

6. Using your new knowledge and any prior knowledge, explain how you were able to determine when the greatest change occurred.

_____

_____

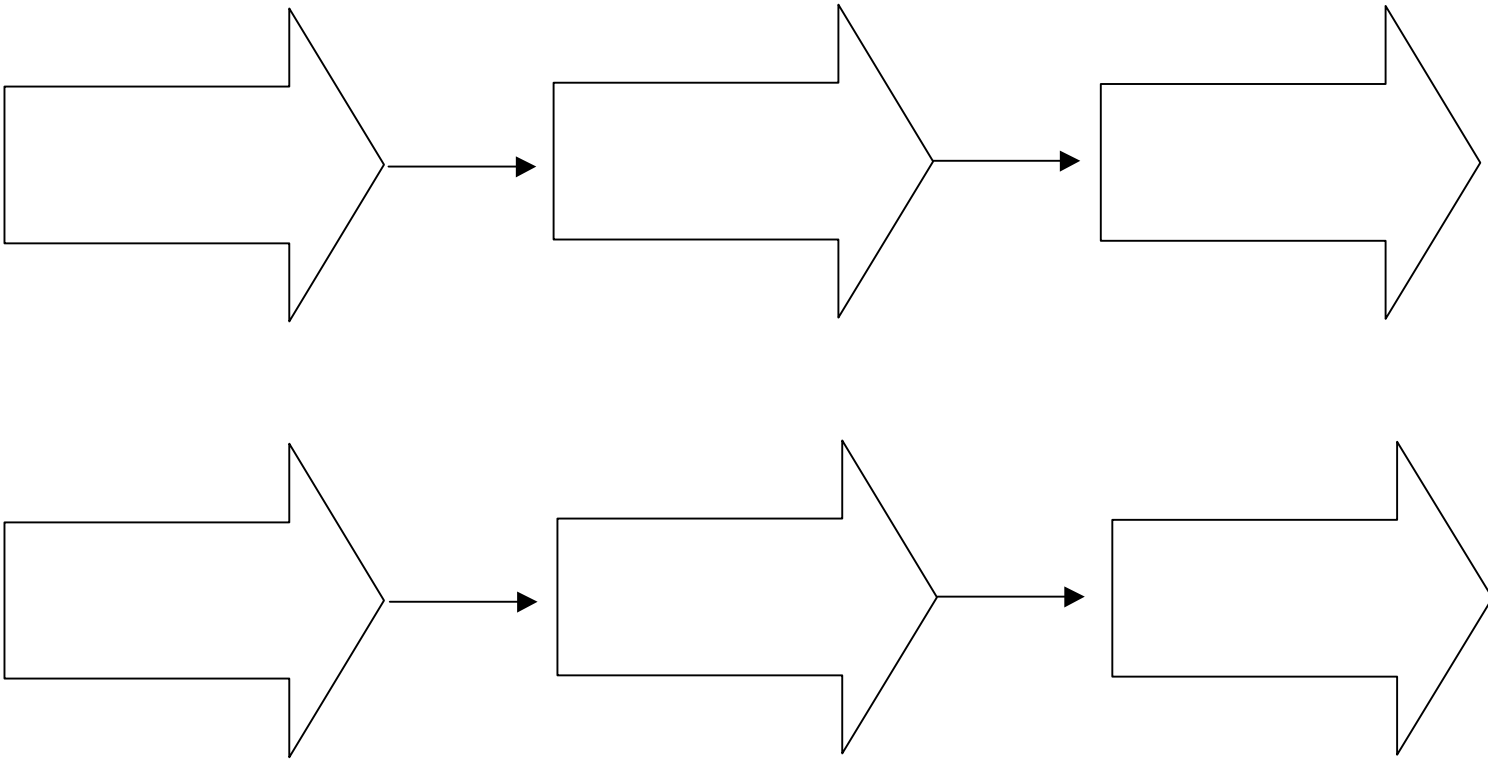
_____

7. What do you think caused the dramatic increase in the height?

_____

_____

We have already discussed that every graph has a story to tell. Let's look back at the graph "Charlie Brown's Parachute Jump" and write a story about what we believe has occurred. You will begin by completing a story map or flow chart to describe each portion of the graph.



Using the information from the graphic organizer, write a story about Charlie Brown's Parachute jump. This story can be as creative as you want as long as it can be supported by the graph.

"Hiking"
Performance Assessment

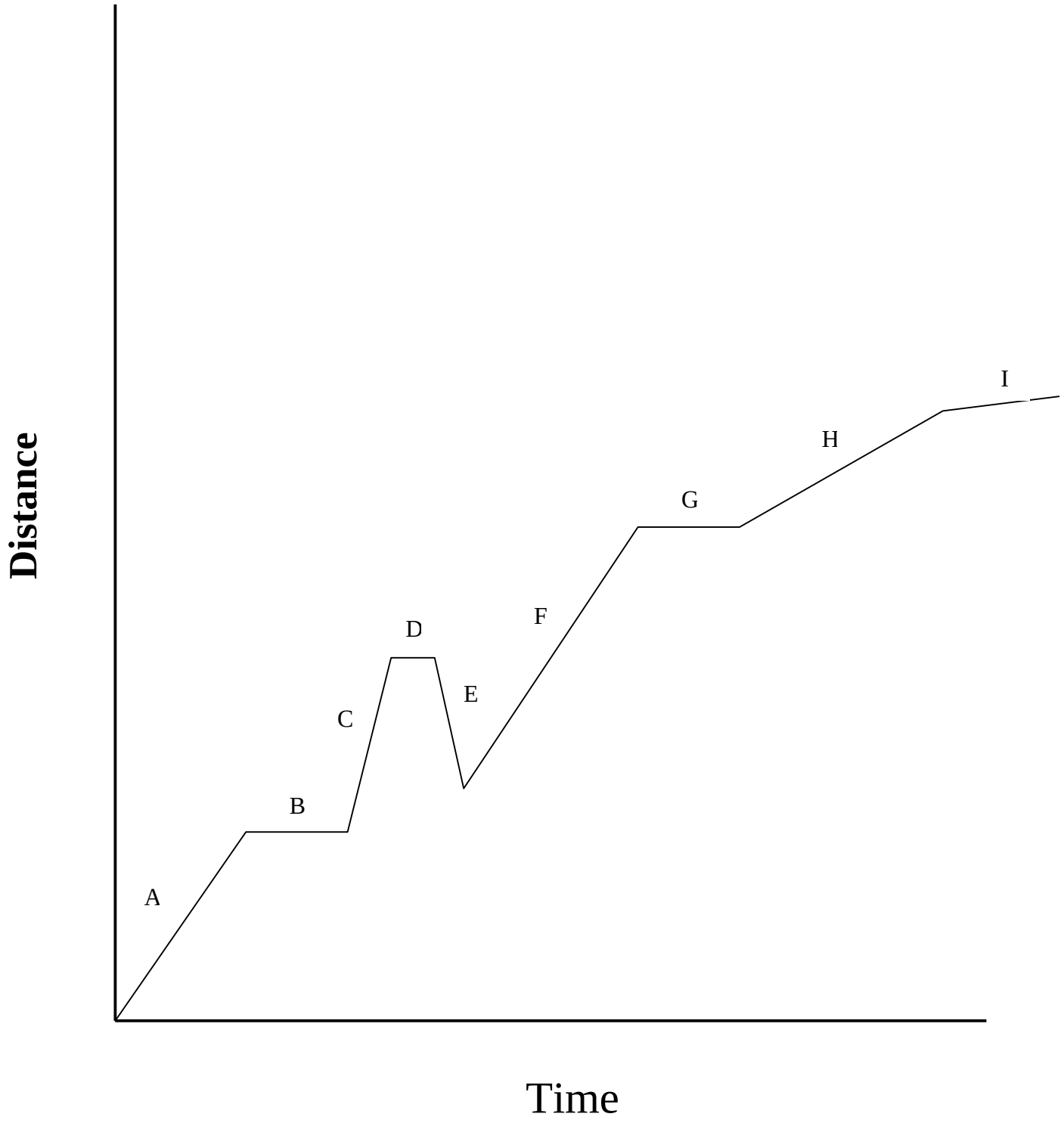
Part 1
Work with your partner to complete the web labeled "Hiking". Use your web to brainstorm ideas for the title, setting, characters and plot that follow the information given from the graph. Your story should be directly based on the information pertaining to the graph. Pay close attention to each labeled part of the graph (including the *x* and *y* axis labels) while documenting your ideas.

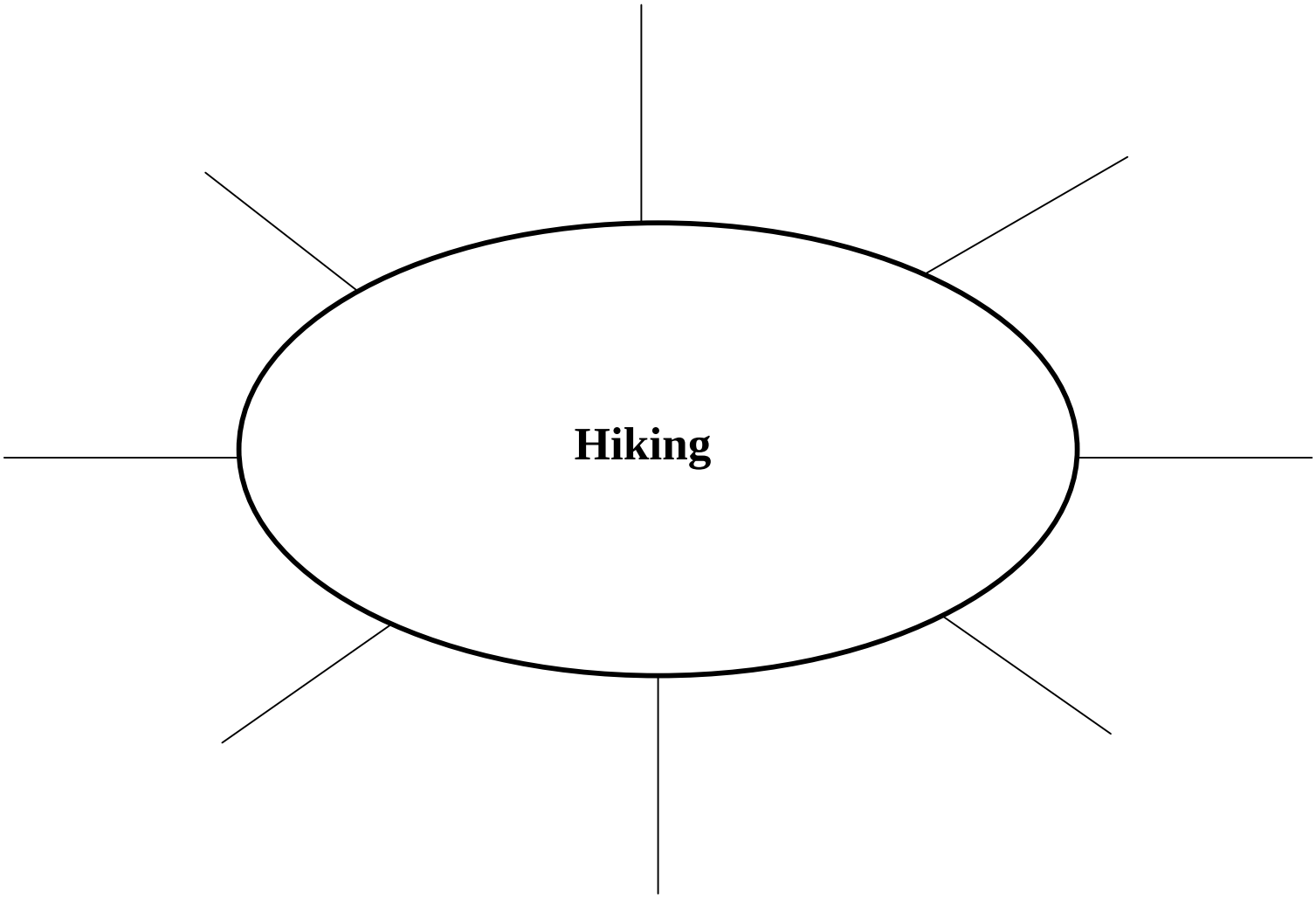
Part 2
Work individually to complete the story map or flow chart. Before you begin, read the scoring rubric that goes along with the story map or flow chart. The title of your flow chart should be the same title for your story. There are nine arrows on your flow chart and nine different slopes depicted on the graph. Each arrow on the flow chart represents a portion (slope) of the graph. As you organize the sequence of events on your flow chart for your story, be sure to address the slope as it relates to the labels on the *x* and *y* axis.

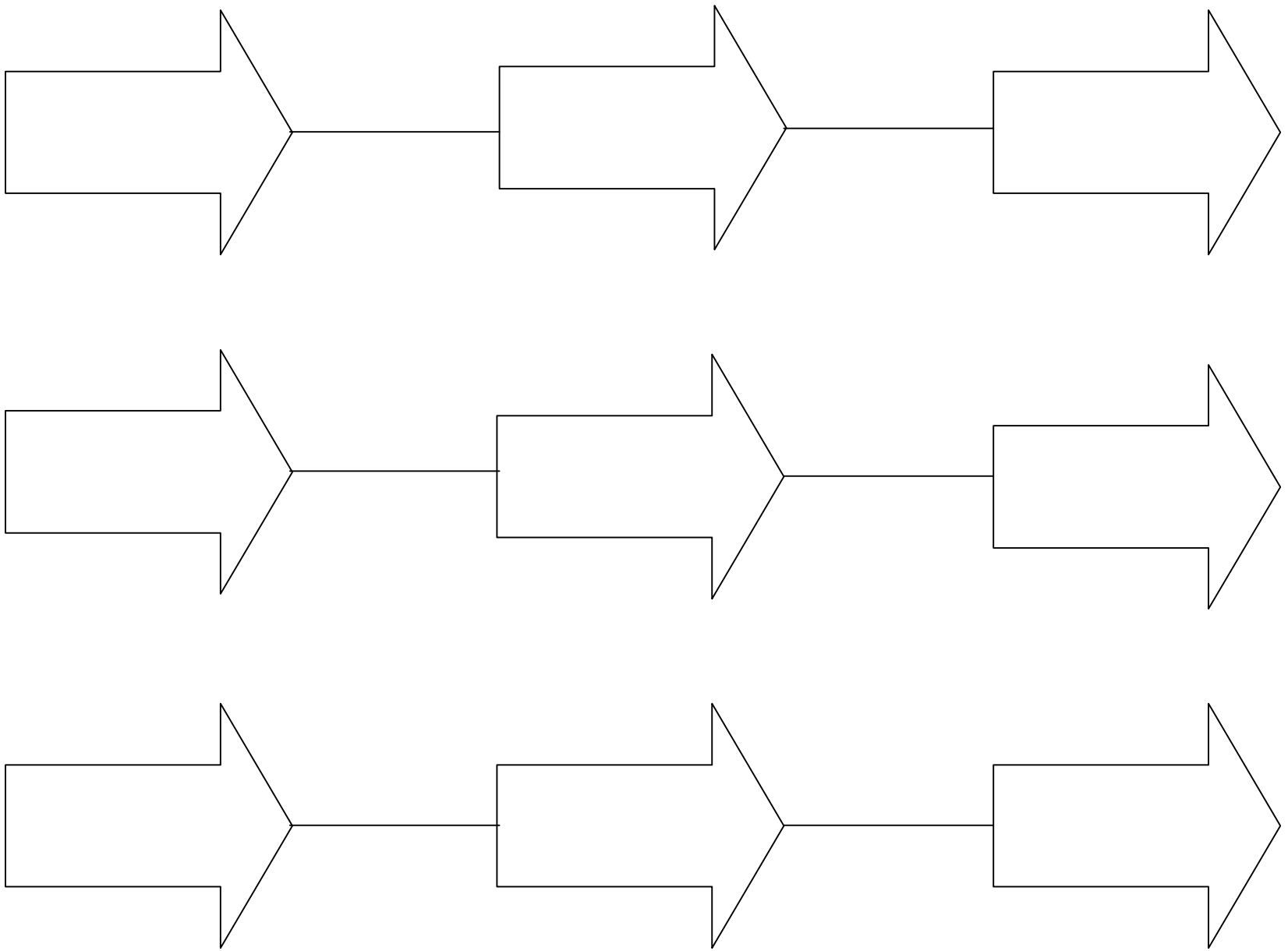
Part 3
Use your flow chart to pull your ideas together and write a draft of your story by yourself. Before you begin, read the rubric for the final copy. Be sure to include your title, setting, characters and plot. You may also add pictures to the graph to help enhance the story line. Be sure to include how the distance (*y* axis) directly relates to the time (*x* axis).

Part 4
With a partner, trade drafts and peer edit your work. Be sure to follow all of the steps indicated on the checklist to ensure that your story meets all of the criteria.

Part 5
For homework, revise the draft of your story by using the suggestions given from the peer-editing checklist and write your final copy. Be sure to include the actual graph with your final copy. Do not forget that you may include pictures on the original graph to enhance your story.


Distance
A
B
C
D
E
F
G
H
I
Time


Hiking



Rubric

Story Map or Flow Chart

3
- ✓ Each arrow of the story map or flow chart is filled in with relevant information.
- ✓ The sequence of events in each arrow follows the same sequence depicted in the graph.
- ✓ The type of slope is correctly identified in each arrow as positive, negative, or zero.

2
- ✓ Each arrow of the story map or flow chart is filled in with relevant information.
- ✓ The sequence of events in the arrows does not follow the same sequence depicted in the graph.

-Or-

- ✓ The type of slope is incorrectly identified in each arrow.

1
- ✓ Each arrow of the story map or flow chart is filled in with relevant information.
- ✓ The sequence of events in the arrows does not follow the same sequence depicted in the graph.
- ✓ The type of slope is incorrectly identified in each arrow.

0
- ✓ Each arrow of the story map or flow chart is not filled in with an event
- ✓ The sequence of events in the arrows does not follow the same sequence depicted in the graph.
- ✓ The type of slope is incorrectly identified in each arrow.

Peer-Editing Checklist

Directions: Trade papers with a partner and read their story first without making any comments or corrections. Next, read the peer-editing checklist found below. Then, re-read your partner's story. Finally, edit your partner's story and complete the checklist.

_____ 1. The story follows the theme of "hiking".

_____ 2. The story includes an appropriate title.

_____ 3. The story includes a complete description of the setting.

_____ 4. The story includes at least one character.

_____ 5. The story has nine different parts to the plot.
(Each part of the line should represent an event that relates to the plot.)

_____ 6. The story talks about what type of slope is portrayed by each part of the graph.

_____ 7. The concept of how the distance is related to time is clearly conveyed throughout the entire story.

_____ 8. The sequence of events "flow" throughout the story.

_____ 9. Grammer, spelling, and punctuation are correct.

_____ 10. The story is easy to read and understand.

Additional Comments:

Rubric

Final Copy of Story

3
- ✓ Story includes title, setting, characters and plot.
- ✓ Each event in the story correctly relates to each part of the line on the graph.
- ✓ Students mathematically connect the part of the story to the part of the graph that they are portraying.

2
- ✓ Story includes title, setting, characters and plot.
- ✓ The events in the story do not relate to each part of the line on the graph.

-Or-

- ✓ Students do not mathematically connect the part of the story to the part of the graph that they are portraying.

1
- ✓ Story includes title, setting, characters and plot.
- ✓ The events in the story do not relate to each part of the line on the graph.
- ✓ Students do not mathematically connect the part of the story to the part of the graph that they are portraying.

0
- ✓ The story is missing a title, description of setting, characters or plot.
- ✓ Students do not mathematically connect the part of the story to the part of the graph that they are portraying.
- ✓ Students do not mathematically connect the part of the story to the part of the graph that they are portraying.

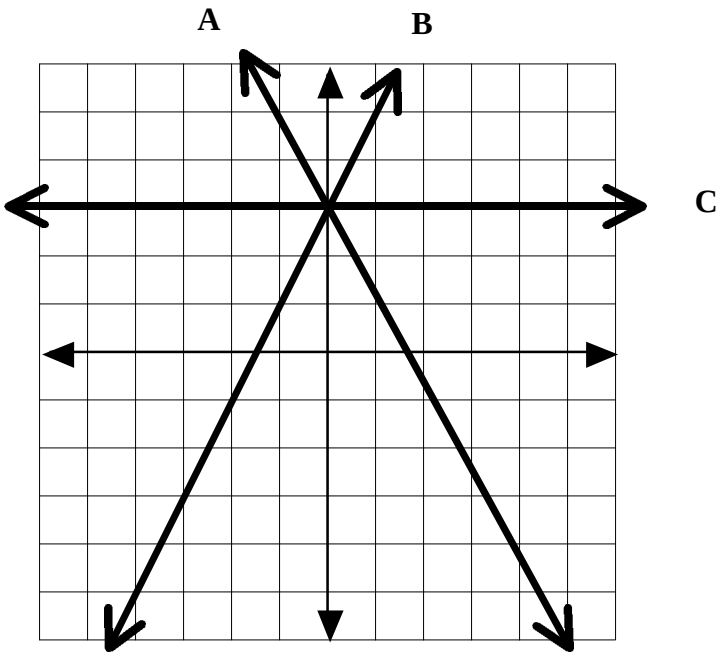
Identifying Types of Slope or Rate of Change (KEY)

Warm-Up: Graph the following three linear equations using a different color for each line. Label each line with the appropriate equation. You may use a table of values or the slope-intercept method.

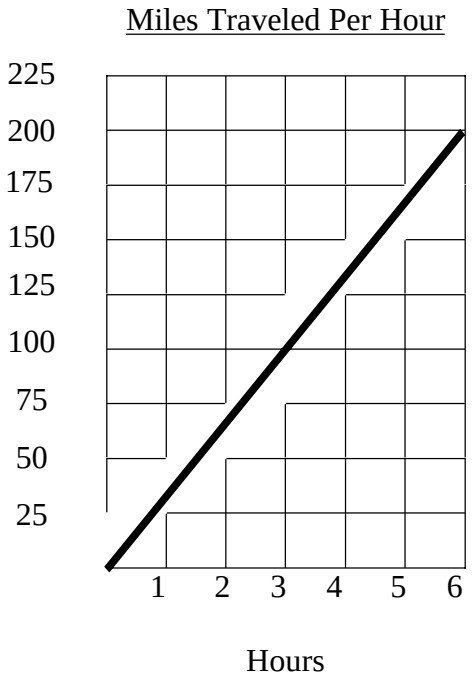
$y = -2x + 3$ **(A)**

$y = 2x + 3$ **(B)**

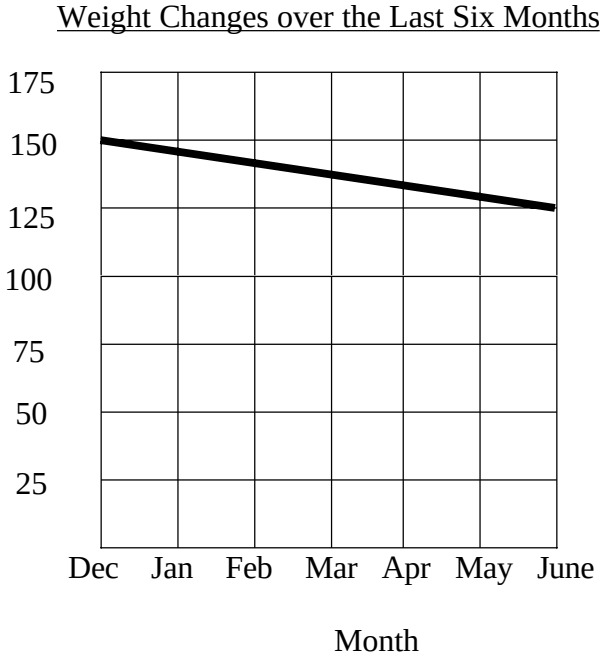
$y = 3$ **(C)**



Now let's look at some linear graphs.

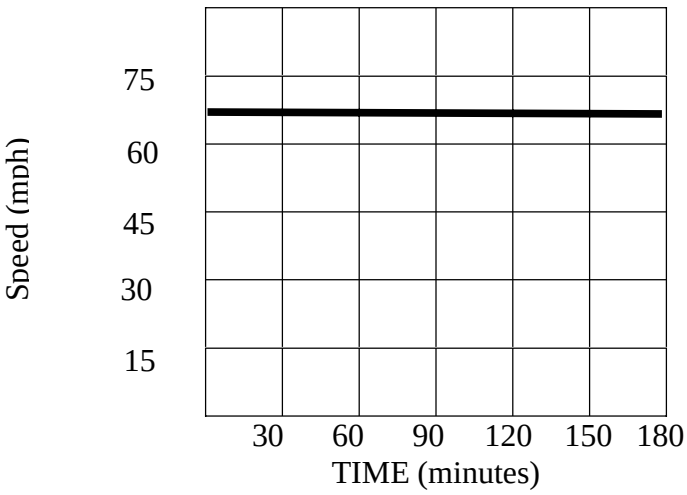


When the line is moving in an upward direction when reading from the left to the right, the hours increase, as the miles **INCREASE**.



When the line is moving in a downward direction when reading from the left to right, the months progress as the weight **DECREASES.**

Average Speed Traveled on I-95



When the line is moving straight across when reading from left to right, there is **ZERO SLOPE.**

Now Let's Compare

1. Whenever you interpret slope from a graph you always read from the **LEFT** to the **RIGHT**.
2. Which linear equation on the drill shows an increase? ***Y* = 2*X* + 3**
3. Which linear equation on the drill shows a decrease? ***Y* = -2*X* + 3**
4. With a partner, compare the 2 linear equations and determine which part of the equation determines whether the line is increasing or decreasing. Try and develop a rule that will fit for all increasing and decreasing lines.

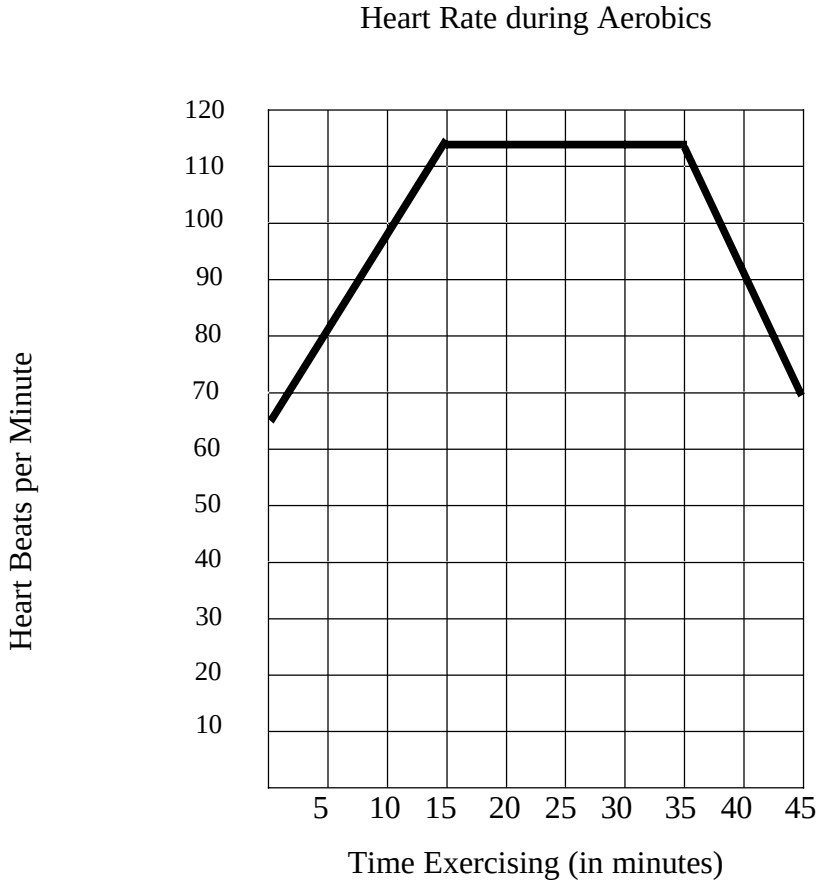
   IF THE COEFFICIENT IN FRONT OF THE X IS POSITIVE, THEN THE SLOPE IS POSITIVE AND IF THE COEEFICIENT IN FRONT OF THE X IS NEGATIVE, THEN THE SLOPE IS NEGATIVE.
5. Now with a partner, try and determine a rule for when the line remains horizontal.

   IF THE COEFFIECIENT IN FRONT OF THE X IS ZERO OR THERE IS NO X THEN THE SLOPE IS ZERO.

Rules

1. If the **SLOPE** or **RATE OF CHANGE** is **POSITIVE**, then the line moves up when read from left to right.
2. If the **SLOPE** or **RATE OF CHANGE** is **NEGATIVE,** then the line moves down when read from left to right.
3. If the **SLOPE** or **RATE OF CHANGE** is **ZERO,** then the line remains horizontal when read from left to right.

Let's Practice!



Using the graph, answer the following questions.

1. During which time period was the heart rate increasing? **0 to 15 minutes**
2. Using math, determine the exact rate of change for the increase (warm-up). **3.33 beats per minute**

3. During which time period did the heart rate remain constant? **15-35 minutes**

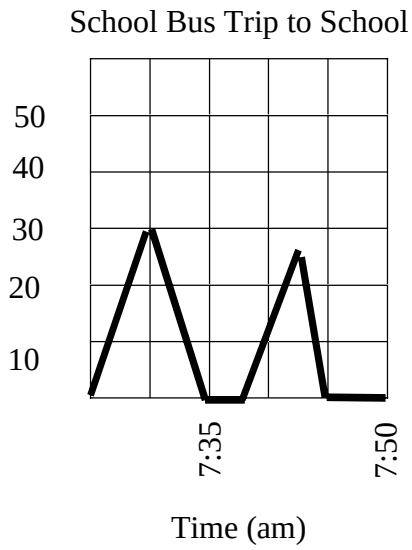
4. Using math, determine the exact rate of change for this time period. **O beats per minute**

5. During which time period did the heart rate decrease? **35-45 beats per minute**

6. Using math, determine the exact rate of change for the decrease (cool down). **4.5 beats per minute**

7. Explain why your rate of change for the cool down period was a negative value. **The heart rate was decreasing or slowing down.**

Now with a partner complete the activities for the following graph.

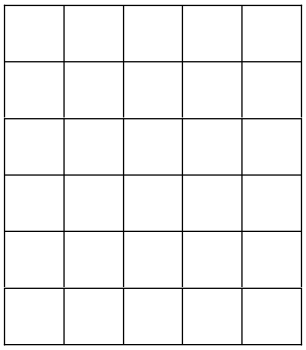


1. The line on the graph touches the *x*-axis 3 times. What does this represent? **The school bus stopped 3 times because the speed was at zero.**

2. Which pedal is the bus driver using when there is a positive slope? Negative slope? A zero slope?
   Positive slope: Gas pedal
   Negative slope: Brake
   Zero slope: Brake

3. Which parts of the graph would you have to change if the title was changed to "School Bus Trip from School"? **The time increments on the x-axis would change and the line on the line on the graph would be the reverse.**

4. Sketch the graph “School Bus Trip from School”



Quick Check

ANSWERS WILL VARY FOR THIS SECTION!!!!!!!!!!!

_____Locate 2 graphs in the newspaper that show positive, negative, and zero slopes.

_____Label the slopes as positive, negative, and zero.

_____Determine mathematically the exact rate of change of each segment.

_____Describe the real life situation that models each segment of the graph.

I will collect the graphs and your answers on a separate sheet of paper. Please tape the graphs to your answer sheet.

What Does the Steepness of the Slope or Rate of Change Tell Us? (KEY)

Warm Up:

With a partner, define the word "steeper". Give at least three example of things that represent steepness in the real world..

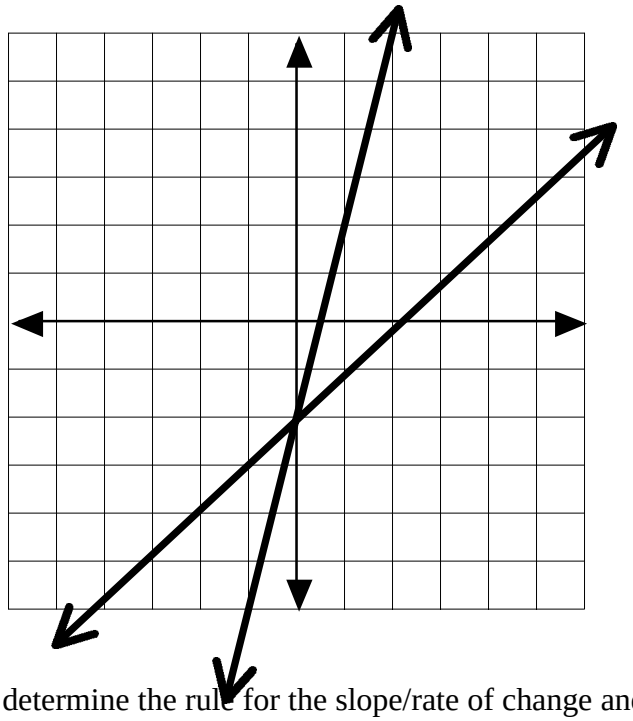
ANSWERS WILL VARY, EXCEPT ALL REASONABLE RESPONSES

Predict which linear equation do you and your partner believe will be steeper? Explain why you choose the equation you picked.

$y = x - 2$ OR $y = 4x - 2$

THE CORRECT ANSWER WOULD BE THE SECOND EQUATION.

Graph and label the two linear equations using two different colors in order to show which one is really steeper.



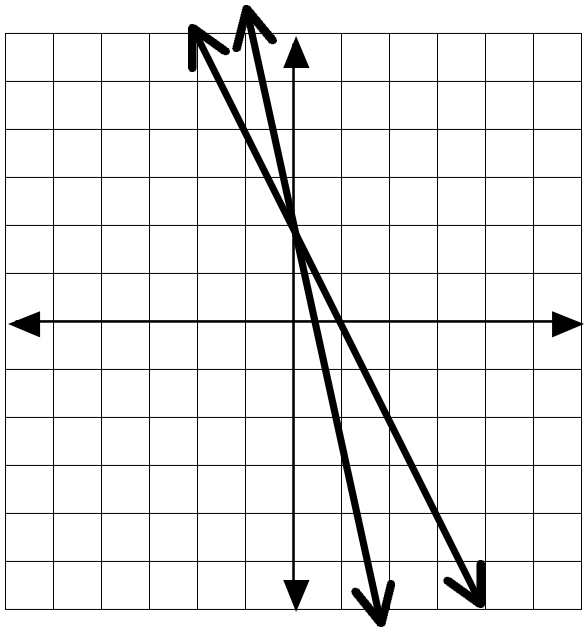
With a partner, try to determine the rule for the slope/rate of change and the steepness of the line.

THE GREATER THE SLOPE THE STEEPER THE LINE.

You graphed two equations with positive slopes or rate of change. What do you think will happen to the rule you created, if you have two equations with negative slopes or rates of change?
ANSWERS WILL VARY.

Graph the two linear equations given on the graph below.

$y = -5x + 2$ $y = -2x + 2$



Which linear equation is steeper? ***Y* = -5*X* + 2**
Does the rule you and your partner developed for comparing two positive slopes still work? **NO**
If not, create a new rule for the relationship between the steepness of the line and the slope.
THE SLOPE THAT HAS THE GREATER ABSOLUTE VALUE HAS THE STEEPER SLOPE.

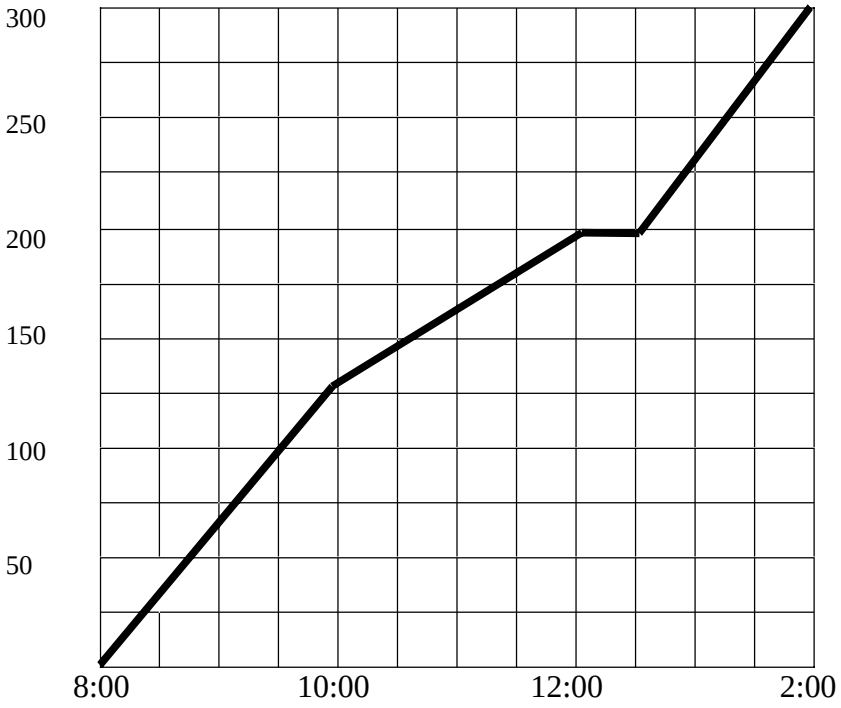
Rule

The steeper the line, the **GREATER THE ABSOLUTE VALUE** of the slope or rate of change.

Let's Practice

The following graph illustrates a trip in four parts. Using the graph and your new knowledge gained, answer the questions following the graph.

A Drive to Virginia Beach



By interpreting the graph, we will be able to determine several aspects of the trip.

1. When did the family take a break? **12:00 to 12:30**
2. When was the speed the slowest? **10:00 to 12:00**
3. When was the speed the slowest? **12:30 to 2:00**

It was difficult to determine whether the speed was quicker from 8:00-10:00 OR from 12:30 to 2:00. With a partner, use your prior knowledge to try and develop a method you can use to help you determine which speed was the fastest**. ANSWERS WILL VARY, THE ANSWERS SHOULD BE BASED ON COUTING THE RISE OVER THE RUN OR USING THE SLOPE FORMULA.**

Mary Sue's Weight Changes Over One Year

By interpreting the graph, we will be able to determine several aspects of Mary Sue's weight loss and gain?

1. During which time period was there no change in Mary Sue's weight? **APRIL-JUNE**

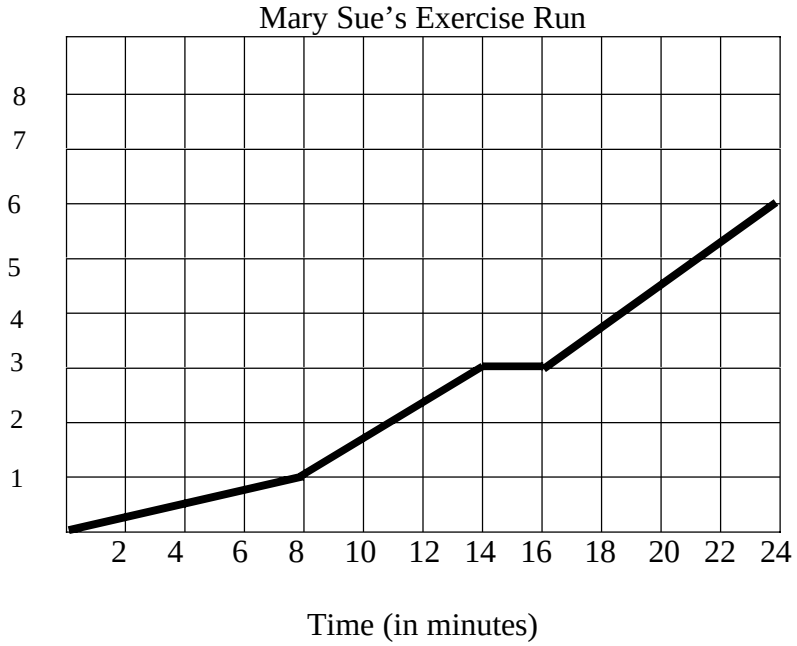
2. Using your new knowledge, explain how you were able to determine when there was no weight change? **IT WAS A HORIZONTAL LINE.**

3. During which time period did Mary Sue's weight increase? **OCTOBER-DECEMBER**

4. Using your new knowledge, explain how you were able to determine when she gained weight? **THE SLOPE OF THE LINE WAS INCREASING**.

5. There were two major drops in her weight. Which drop shows the greatest rate of change? Justify your answer by using math. **JUNE-OCTOBER, THE SLOPE WAS STEEPER, THE STUDENTS USE EXACT DATA.**

Quick Check



By interpreting the graph, we will be able to determine several aspects of Mary Sue's exercise run.

1. During which time period Mary Sue's walk? **0-8 MINUTES**

2. Using your new knowledge, explain how you knew which time period displayed when she walked. **THE SLOPE WAS INCREASING AT THE SLOWEST RATE**

3. During which time period did Mary Sue probably stop? **14-16 MINUTES**

4. Using your new knowledge, explain how you determined that this was when she stopped. **THE LINE WAS HORIZONTAL WHICH MEANS IT HAS A ZERO SLOPE.**

5. During which time period did Mary Sue run? **16-24 MINUTES**

6. During which time period did Mary Sue jog? **8-14 MINUTES**

7. Using your new knowledge, explain how you were able to determine when she was running and when she was jogging. Justify your answer using math. **ANSWERS WILL VARY BUT THEY MUST INCLUDE THE MATHEMATICAL PROCEDURE THEY WENT THROUGH.**

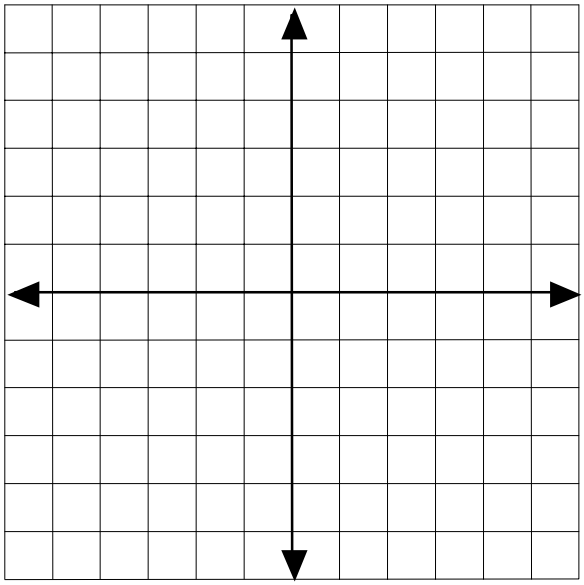
8. Based on the information on the graph above, PREDICT what you think the trend would be if we added four more minutes to the graph. **ANSWERS WILL VARY BUT THEY MUST BE ABLE TO JUSTIFY.**

9. Now look in the newspaper and locate a graph that contains different rates of change. Create questions for interpreting the rate of change (use the previous questions as models). Give the graph and questions to your partner and have them complete.

Interpreting Non-linear Graphs

Warm Up/Review:

1. On the graph below, draw a blue line that represents an equation with a positive slope, a red line that represents an equation with a negative slope, and a green line that represents an equation with a slope of zero.



2. Using the knowledge about steepness, identify which line will have a greater steepness and explain using the rule generated.

$y = 4x + 8$ $y = 5x + 2$

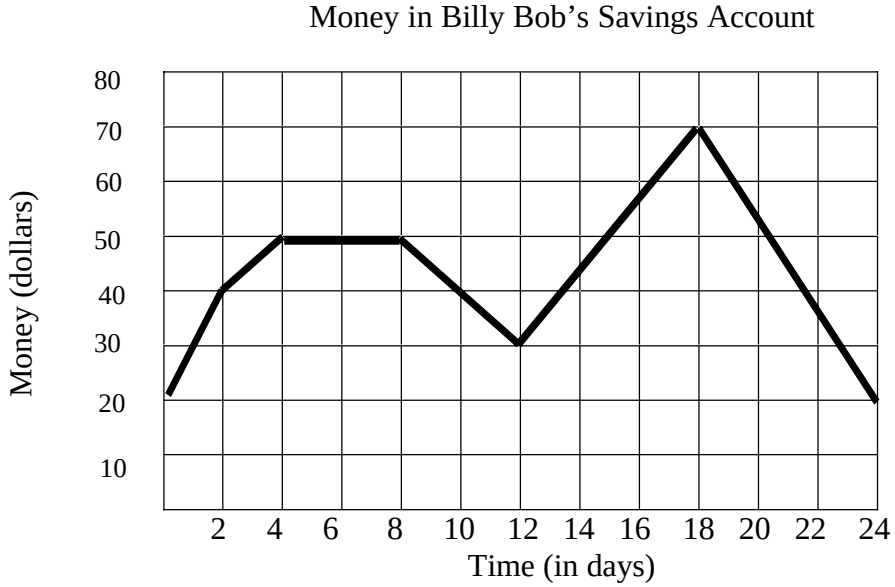
The coefficient of 5 is greater than 4, so the slope of y = 5x +2 is steeper.

$y = -4x + 8$ $y = -5x + 2$

The absolute value of the coefficient of -5 is greater than the absolute vlaue -4, so the slope of y = -5x +2 is steeper.

Let's Tell Stories

Today we are going to use the knowledge we have learned in the last two days to interpret non-linear graphs.



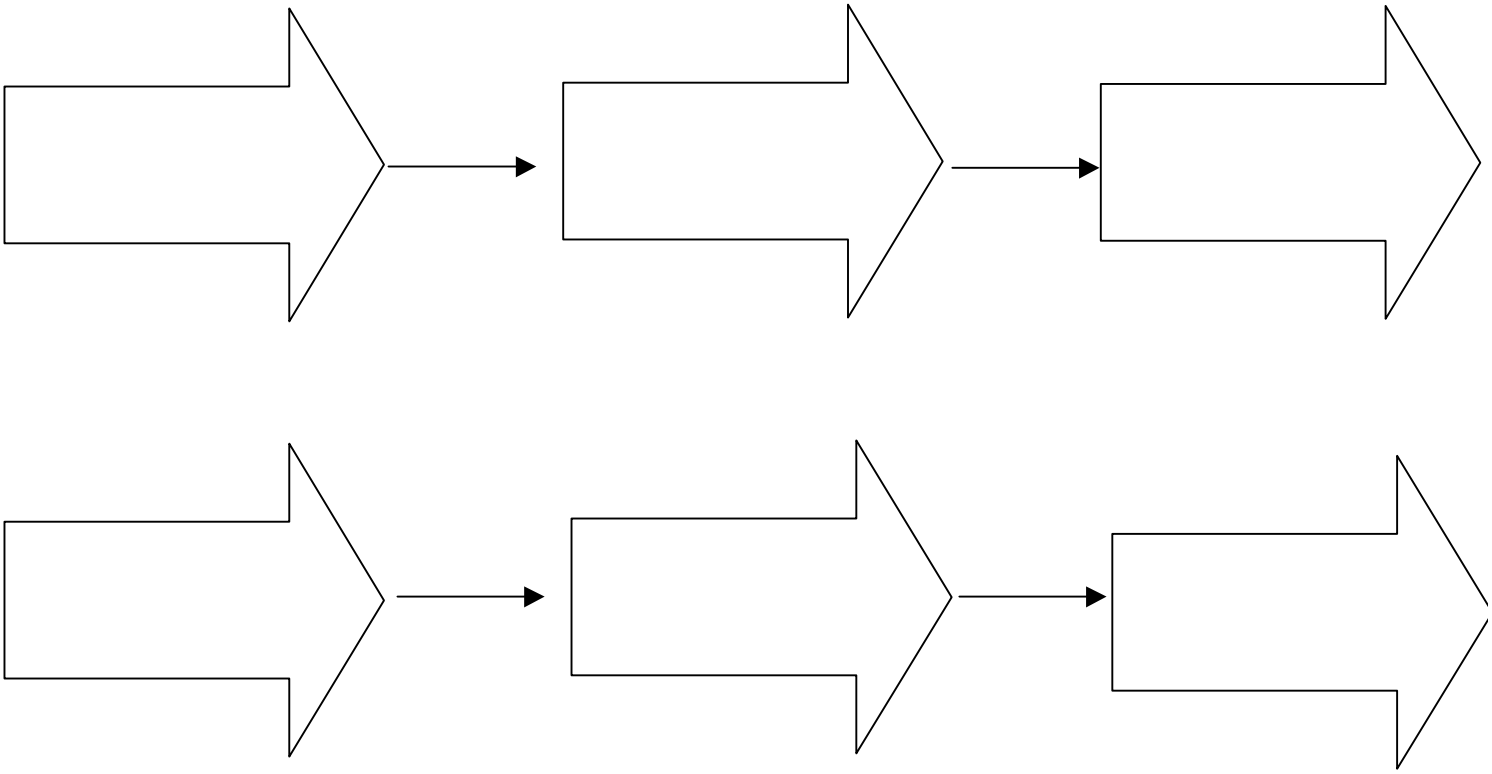
1. During which time period did he deposit the most amount of money? **12^{TH}-18^{TH} DAY**
2. Using your new knowledge, explain how you knew which time period displayed the greatest deposit?

   IT HAD THE GREATEST SLOPE.
3. During which days did Billy Bob not complete any transactions? **DAY 4 THRU 8**
4. Using your new knowledge, explain how you knew that he did not complete any transactions?

   THE LINE WAS HORIZONTAL.
5. During which time period do you think Billy Bob withdrew money to attend a movie with a friend? **DAY 8 THRU DAY 12**
6. During which time period do you think Billy Bob withdrew money in order to purchase gifts for his mom, dad, grandparents, and even his sister? **DAY 18 THRU 24**

7. There were two times periods that show that Billy Bob made withdrawals. Using your new knowledge and mathematical terms, explain how you were able to determine when he took out money to go to the movies and when he took out money to purchase presents for his family.
ANSWERS WILL VARY BUT THEY MUST EXPLAIN HOW THEY DETERMINED THE GREATER SLOPE.

Every graph has a story to tell. Let's look back at the graph Money in Billy Bob's Savings Account and write a story about what we believe has occurred. We will begin by completing a story map or flow chart to describe each portion of the graph. **ANSWERS WILL VARY**



Now we will turn the story map or flow chart into a story. **ANSWERS WILL VARY**

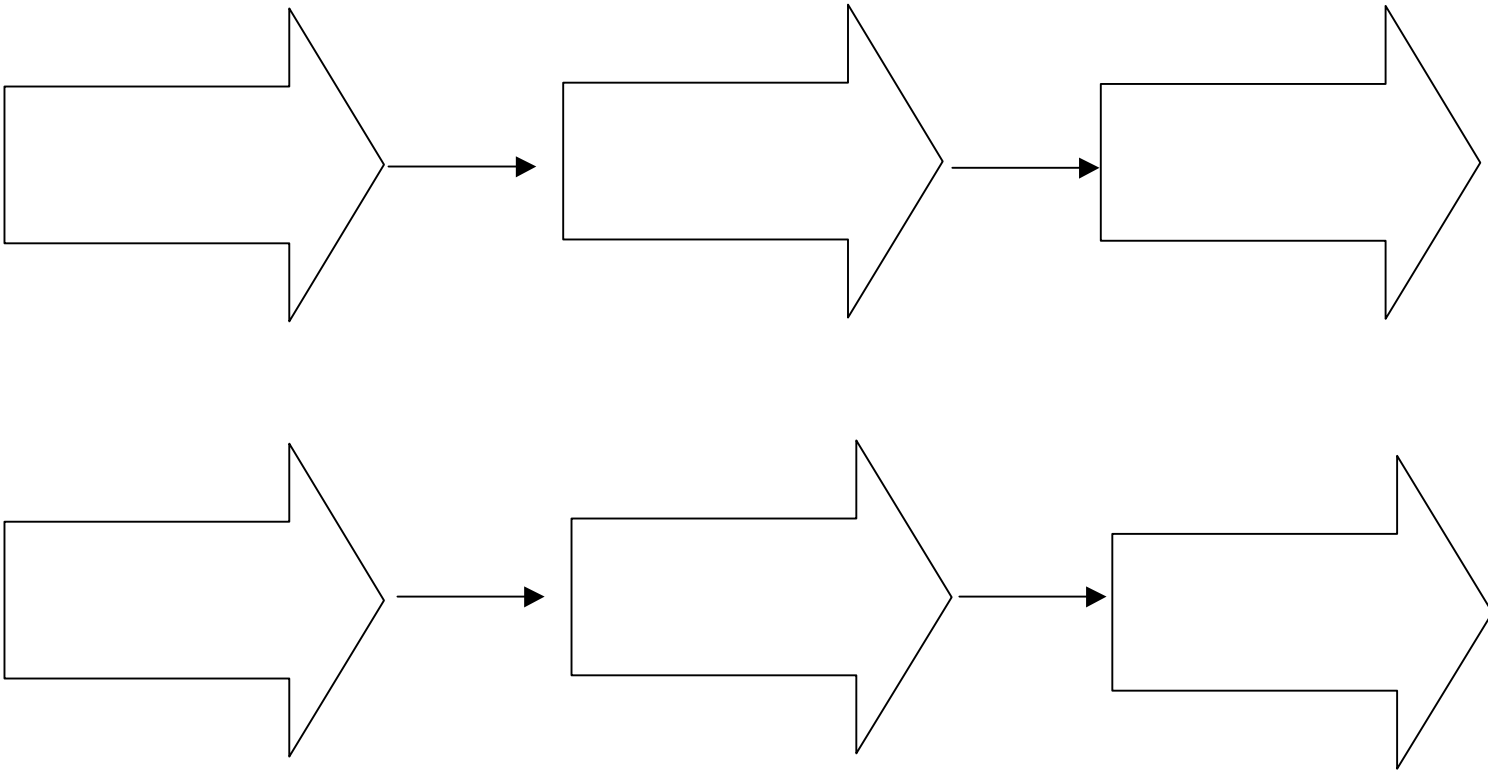
With a partner, interpret the following graph.

Charlie Brown's Parachute Jump

1. During which time period was Charlie Brown free falling without a parachute? **0-8 SECONDS**
2. Using your new knowledge, explain how you determined your answer. **The line has the steepest negative slope.**
3. During which time period was Charlie Brown using his parachute? **8-48 SECONDS**
4. Using your new knowledge and any prior knowledge, explain how you determined your answer. **The line went up dramatically, which shows when he opened his parachute.**
5. At several points on the trip, Charlie Brown's height rose. When did the greatest positive rate of change occur? **8 –16 seconds**

6. Using your new knowledge and any prior knowledge, explain how you were able to determine when the greatest change occurred?
   ANSWERS WILL VARY BUT THEY MUST EXPLAIN HOW THEY DETERMINED THE SLOPE.
7. What do you think caused the dramatic increase in the height?
   ANSWERS WILL VARY, YOU MUST ACCEPT ALL REASONABLE ANSWERS.

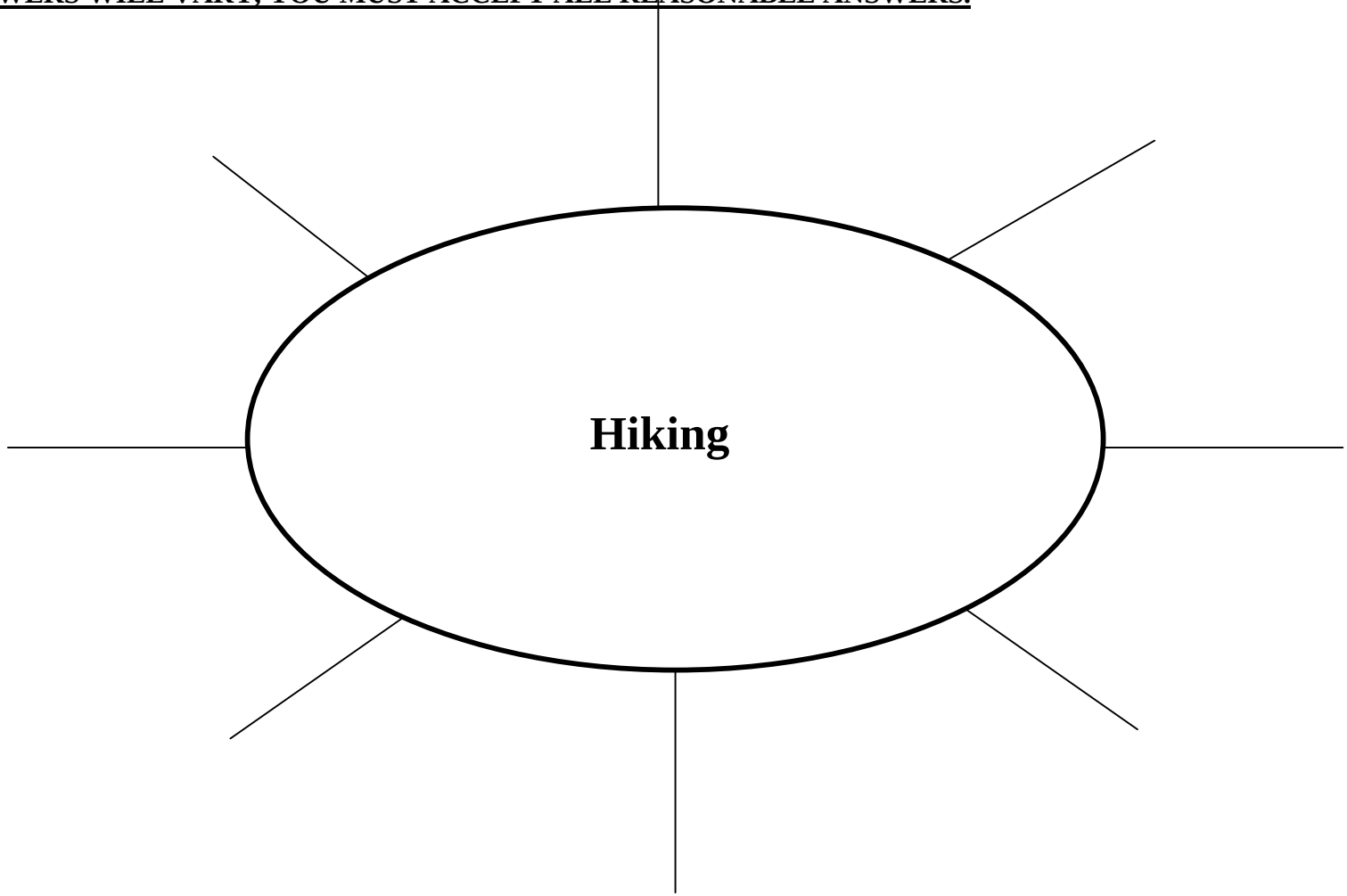
We have already discussed that every graph has a story to tell. Let's look back at the graph "Charlie Brown's Parachute Jump" and write a story about what we believe has occurred. You will begin by completing a story map or flow chart to describe each portion of the graph. **ANSWERS WILL VARY**



Using the information from the graphic organizer, write a story about Charlie Brown's Parachute jump. This story can be as creative as you want as long as it can

be supported by the graph. **ANSWERS WILL VARY, YOU MUST ACCEPT ALL REASONABLE ANSWERS.**

ANSWERS WILL VARY, YOU MUST ACCEPT ALL REASONABLE ANSWERS.



ANSWERS WILL VARY, YOU MUST ACCEPT ALL REASONABLE ANSWERS.