
Regression Relay

Ashley Lumpkin
Wake Forest University
lumpar7@wfu.edu

NCTM STANDARDS: Number and Operations, Algebra, Measurement, Data Analysis & Probability, Connections

NC STANDARD COURSE OF STUDY: Algebra 2, objective 2.04

GOALS: Students will be able to use graphing calculators to fit regression models to a given set of data. They will be able to interpret slope and y-intercept, and use the model to make long term predictions.

INTRODUCTION:

The relay race is the only true team event in track and field, and is traditionally used to close track and field events. They can vary in length; sprint relays include the 4x100m, 4x200m, and long distance relays include the 4x800m and 4x1200m. The only relays at the Olympics and world championships are the 4x400m and 4x100m. Each race is split into four sections called legs, with each of four runners running one leg of the race, and then passing the baton to the next runner.

We modify the traditional relay race to help students collect and interpret linear data.

MATERIALS: stopwatches, a “baton” (the cardboard tube from a paper towel roll is perfect, but anything light will do) activity sheets

LESSON DEVELOPMENT / GUIDED PRACTICE

IN THE CLASSROOM:

- Introduce the activity
- Determine the length to be run in each trial.
- Determine which students will participate in the activity; you need 10 runners and 3 time keepers,
- Determine how discrepancies in time will be handled:
 - Will there be an “official timekeeper” to be defaulted to?
 - Will the average of the different times be used?

OUTDOORS

- Measure and mark the length to be traveled during each run.
- Students will fill out the chart at the top of the activity sheet as each trial is run:
 - At the timers command, one student will run to the set mark, and then run back to the start line.
 - The time will stop when he crosses the start line; this time will be recorded in the running column, in the row marked for 1 runner
 - Repeat with 2 students, 3, 4, 5, and 10 until the chart is complete.

NOTE: Because the first runner also runs in each of the other “heats” (as does the second in the final 4, and so on), it may be best to encourage students not to sprint full out (as they’ll be compelled to do), but to jog at a consistent pace, especially if they will running a considerable distance.

BACK IN THE CLASSROOM:

- Students should work together to complete through # 8 on their activity sheets
 1. Entering data into calculator
 2. Finding the regression line
 3. What is the equation of the line?
 4. What is the slope?
 5. What is the y-intercept?
 6. What does each of those values mean in terms of the data?
 7. Sketch the graph of the plotted points and regression line.
 8. Predict how long it would take for the entire class to run the relay

ACTIVITY EXTENSION:

It may be interesting to see how slope and intercept are affected for types of travel besides running (e.g. walking or skipping). If you have more time to devote to the activity, have the students walk, skip, and some other form of movement. They can work in groups with one of the four sets of data, then as a class compare and contrast the results. (A modified activity sheet is provided if you choose to do the activity in this way)

INDEPENDENT PRACTICE

The USA Track and Field (USATF) website gives the rankings of various athletes in various track and field events. Using the information from the site, have students create a 4x400 m relay “dream team”.

- The records portion of USATF can be found at <http://www.usatf.org/groups/TrackAndField/statistics.asp>
- Students can select male/female athletes, from either indoor/outdoor events
- Scroll down the 400m times, then select 4 athletes
 - The same athlete cannot be used twice (that is, your team cannot be comprised of the same athlete’s times in different races)
 - The times do not have to occurred in the same race
- Using these athletes and their times, they should make a scatter plot, with the number of runners as x-values, and the cumulative time of the runners as y-values
 - Ex: from the site <http://www.usatf.org/statistics/topMarks/2006/outdoorTF/men.asp> if my first two athletes are Jeremy Wariner and LaShawn Merritt, then I should have the points (1, 43.62) followed by (2, 87.76) where 87.76 is the combined time of 43.62 (Wariner’s time) and 44.14 (Merritt’s time)
- The students should use this data to complete the remainder of their activity sheets individually

ASSESSMENT: Assessment is the completed worksheet.

**Regression Relay
Activity Sheet**

Number of Students	Time
1	
2	
3	
4	
5	
10	

1. Enter the data into your calculator, and make a scatter plot

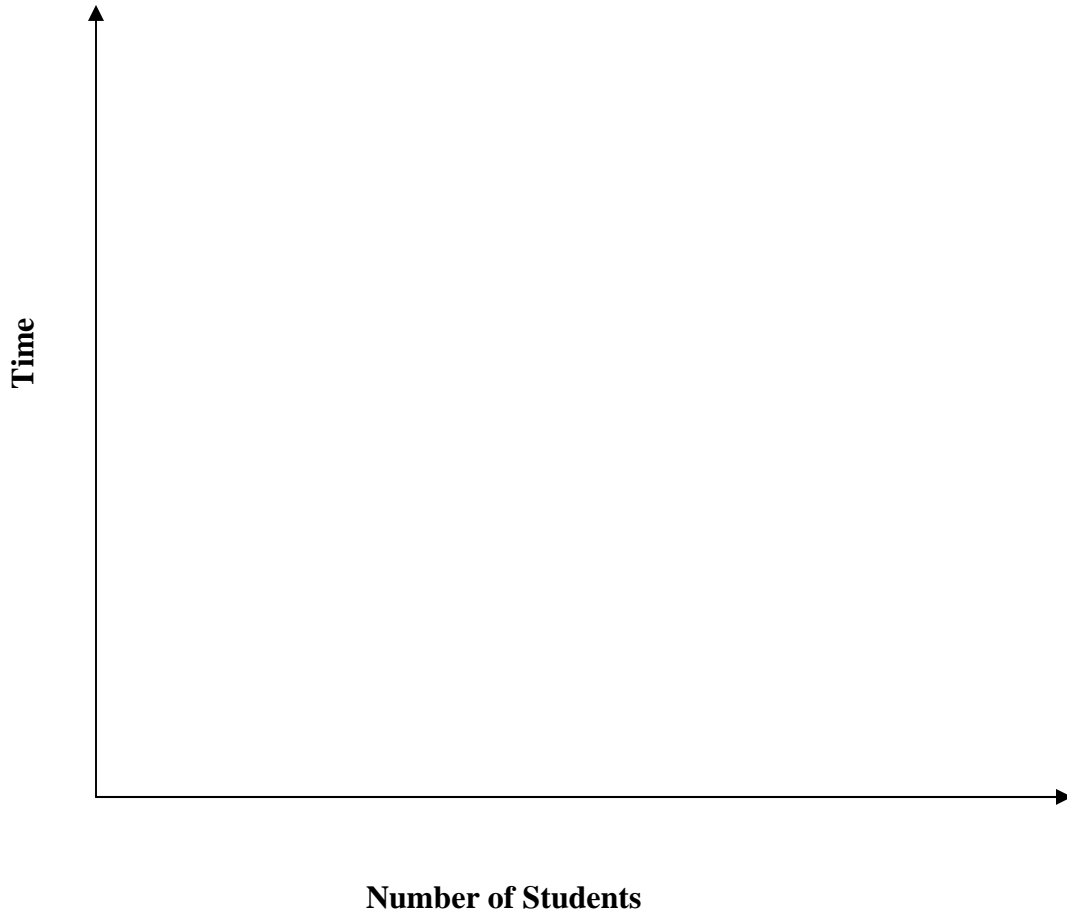
- To do this, hit STAT and select 1: Edit
- If you have anything in L1 and L2, arrow up to the name of the list, hit CLEAR and ENTER.
- Enter in your values one at a time by pressing ENTER after each number (The number of students should be in L₁ and the time should be in L₂).
- Turn your stat plot on. To do this, hit 2nd Y =, select Plot1 BE SURE THAT
 - that ON is highlighted
 - the scatter plot is highlighted,
 - X list is set to L1, and Y list is set to L2.
- Now press ZOOM and select 9: Zoom Stat. The calculator automatically chooses an appropriate window so you can see all of the data points

2. Find the regression line

- To find the regression equation, first hit STAT, arrow right to CALC and select option 4: LinReg (ax + b). Now press 2nd 1, 2nd 2, to specify where you entered your data. (Don't forget the commas). To store the function into Y1 press VARS, arrow over to Y-VARS, choose FUNCTION and then select Y1.
- Your screen should now read LinReg (ax + b) L1, L2, Y1. If it does press ENTER to see the equation of the regression line.

3. What is the equation of the line?**4. What is the slope of the line?**

5. What is the y-intercept of the line?
6. What do the slope and y-intercept mean *in terms of your data*?
7. Sketch a graph, including the data points and the regression line. (Don't forget to draw a scale on both axes)



8. From the graph, how long would it take for the entire class to run our relay?

ON YOUR OWN: “Making the Dream Team”

The USA Track and Field website gives the rankings of athletes in various track and field events. (<http://www.usatf.org/groups/TrackAndField/statistics.asp>) Use the information from the site to make a 4x400 m relay Dream Team.

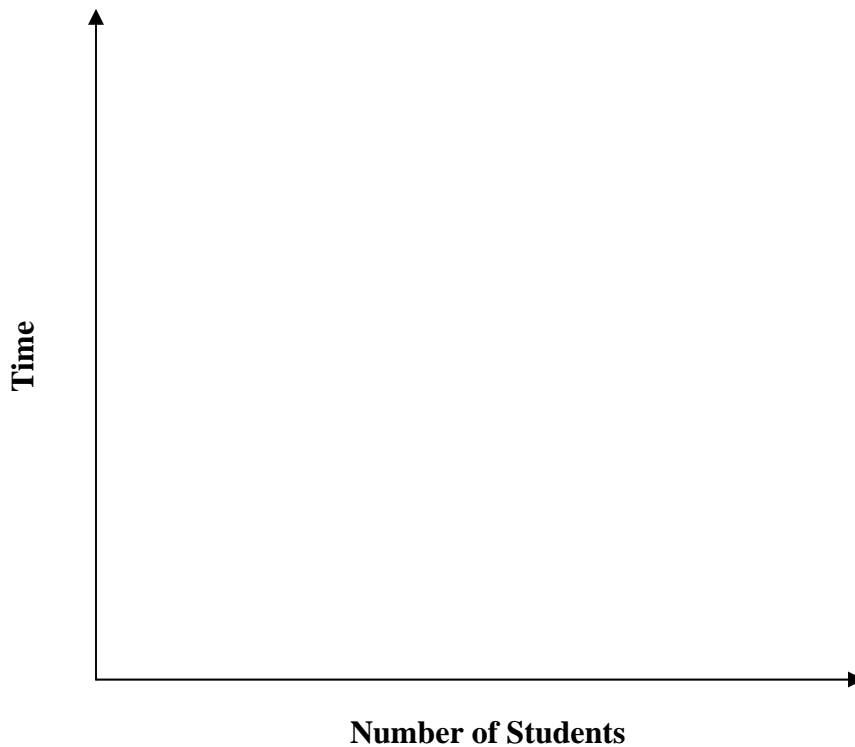
9. Complete the following table

Athlete		Time	Cumulative Time

10. Make a scatter plot of the data: (L1 should be 1,2,3,4; L2 your cumulative time column)

11. Find the regression line

12. Sketch a graph, including the data points and the regression line. (Don’t forget to draw a scale on both axes)



- 13. From the graph, how long would it take for the entire class to run our relay?**

- 14. Sketch the graph.**

- 15. What is the slope of your line?**

- 16. What is the y-intercept of your line?**

- 17. From your line, how long will it take for 25 Olympians to each run 400 meters?**

Regression Relay Activity Sheet

Number of Students	Time			
	<i>Running</i>	<i>Walking</i>	<i>Skipping</i>	<i>Other</i> _____
1				
2				
3				
4				
5				
10				

In the chart, highlight the column of data you have been assigned to work with

1. Enter the data into your calculator

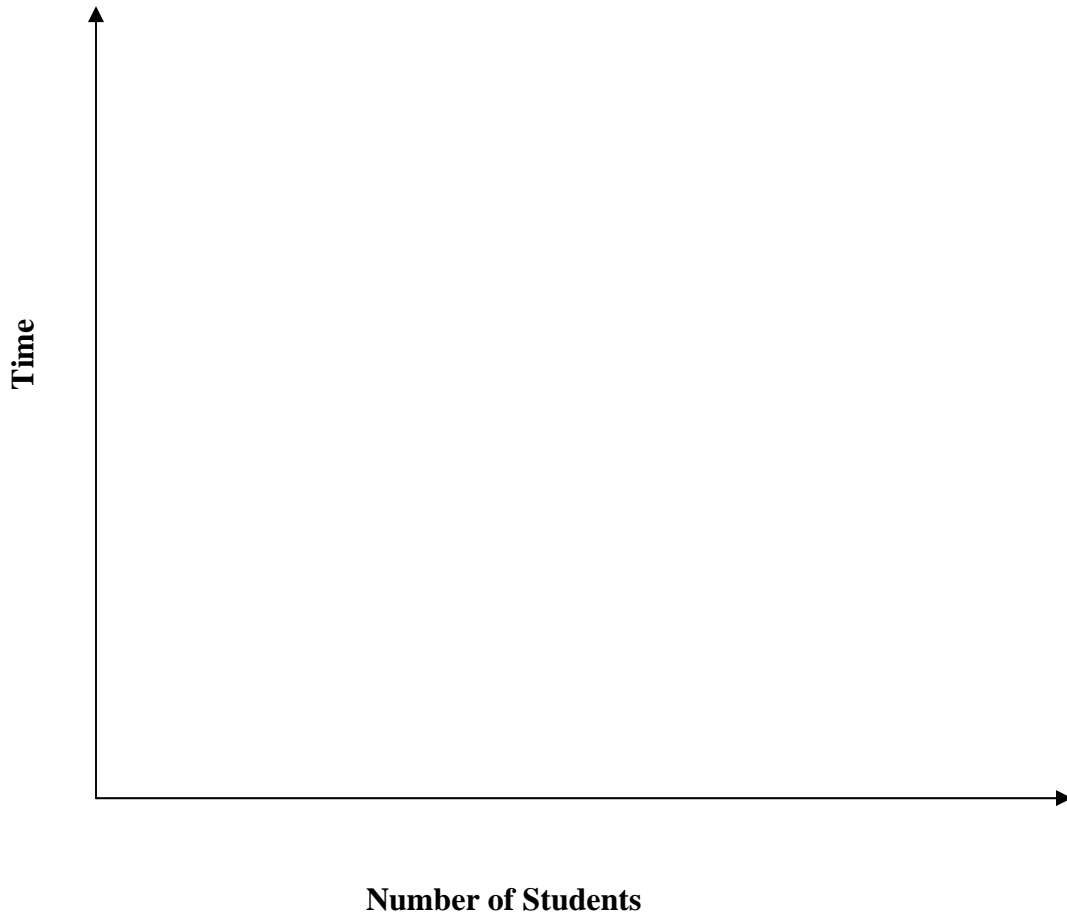
- To do this, hit STAT and select 1: Edit
- If you have anything in L1 and L2, arrow up to the name of the list, hit CLEAR and ENTER.
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- Turn your stat plot on. To do this, hit 2nd Y =, select Plot1 BE SURE THAT
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- To find the regression equation, first hit STAT, arrow right to CALC and select option 4: LinReg (ax + b). Now press 2nd 1, 2nd 2, to specify where you entered your data. (Don't forget the commas). To store the function into Y1 press VARS, arrow over to Y-VARS, choose FUNCTION and then select Y1.
- Your screen should now read LinReg (ax + b) L1, L2, Y1. If it does press ENTER to see the equation of the regression line.

3. What is the equation of your line?

4. What is the slope of your line?
5. What is the y-intercept of your line?
6. What do the slope and y-intercept mean *in terms of your data*?
7. Sketch a graph, including the data points and the regression line. (Don't forget to draw a scale on both axes)



8. From the graph, how long would it take for the entire class to run (walk, skip, or _____) our relay?

9. (As a class) Complete the following table:

Style of Movement	Regression Line	Slope	Y - Intercept
Running			
Skipping			
Walking			

10. How are the graphs similar? How are they different?

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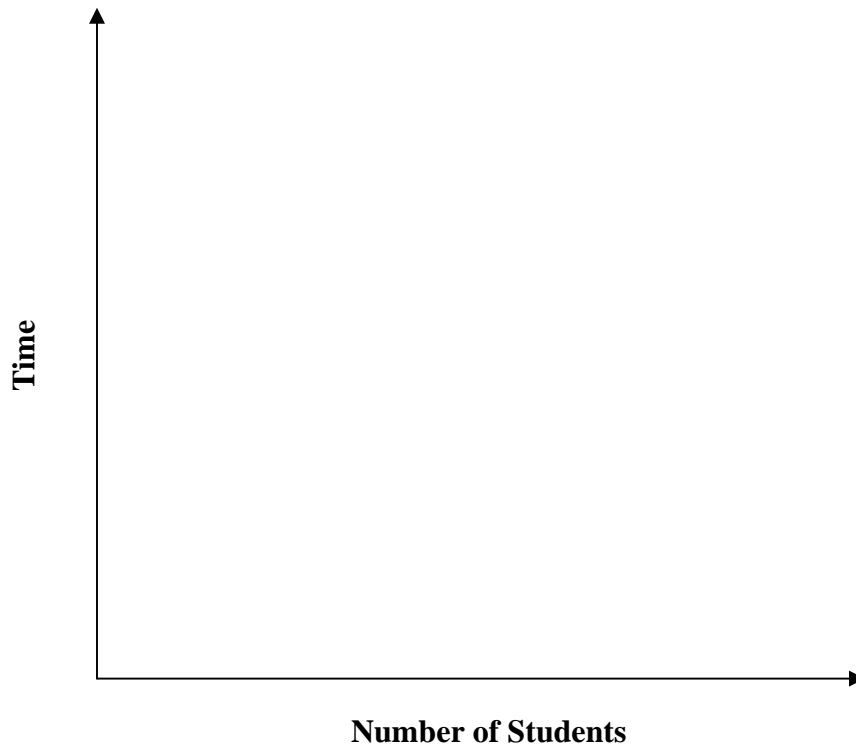
18. Complete the following table

Athlete		Time	Cumulative Time

19. Make a scatter plot of the data: (L1 should be 1,2,3,4; L2 your cumulative time column)

20. Find the regression line

21. Sketch a graph, including the data points and the regression line. (Don't forget to draw a scale on both axes)



22. From the graph, how long would it take for the entire class to run our relay?
23. Sketch the graph.
24. What is the slope of your line?
25. What is the y-intercept of your line?
26. From your line, how long will it take for 25 Olympians to each run 400 meters?