**Introduction to Linear Regression**

1. **TITLE OF LESSON**: This lesson is an introduction to linear regressions. The students will be shown different graphs to figure out what type of regression, if any, they are going to be working with. They will then be taught how to find the line of best fit, given a set of points or a scatter plot.
2. **CONTEXT OF LESSON:** The students should already know how to find the equation of a line given 2 points on the line, or a graph of the line. They should also have knowledge of the different types of slope. The lesson should be interesting to the students because there are a lot of real life applications when it comes to finding patterns, and the line of best fit. Emphasis will be placed on those topics in the unit as a whole.
3. **LEARNING OBJECTIVES and ASSESSMENT**:

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| Learning Objective | Bloom | Assessment (Formative/Summative) |
| The student should be able to identify and distinguish between positive/negative/no linear patterns from a set of data. | U | The students will complete a comparison activity and turn in a sheet that shows their reasoning. |
| The student should define linear regression, correlation, positive and negative correlation, and line of best fit. | R | This will be evaluated by looking at their journal entry at the end of the class period. |
| The student should be able to analyze data with lines already drawn on them, to see if it is an appropriate line of best fit. | A | Line of best fit comparison activity. |
| The student should be able to create a real life scenario for a positive and negative linear correlation. | A | The students will each individually share their example of a positive and negative correlation with the rest of the class.  |
| The student should be able to find the equation of a line given two points or the graph of a line. | R | Take 5 Warm-up activity |

1. **SOL:**

 **A.6** The student will graph linear equations and linear inequalities in two variables, including:

* 1. Determining the slope of a line when given the equation of the line, the graph of the line, or two points on the line. Slope will be describes as rate of change and will be positive, negative, zero, or undefined; and
	2. Writing the equation of a line when given the graph of the line, two points on the line, or the slope and a point on the line.

**A.11** the student will collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve real-world problems, using mathematical models. Mathematical models will include linear and quadratic functions.

1. **MATERIALS NEEDED:**

I supply: Warm up, Activity 1 handout, Activity 2 Handout, Journal Entry Handout (Mulligan), Homework handout

 They supply: pencils, paper

1. **PROCEDURE:**

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| Time | Mathematical Tasks to be Used,Teacher Thoughts/Actions/Questions | Anticipated Student Comments, Questions, Actions, and Strategies |
| 15-20 min | I will be walking around the room making sure that students are completing warm-up and answer any questions that they might have.Ask the students to compare answers to their warm-up buddy. This is only after I have given them a ‘stamp of approval’ that lets me know that they have attempted the warm-up on their own.Ask students to come up to the board and work out the warm up problem and then have their PARTNER explain what they did and why. Answer Any Questions about Warm-up activityAsk students about different data that they might see in the news or on TV about data that may have a linear pattern.Example:The more cigarettes you smoke, the higher your risk of cancer.The more education you have, the more money you make.The higher number of days you miss school, the lower your grade is.Open up a discussion about what makes these important to people, and what they have in common.  | Students will come and pick up warm up from overhead. Students will complete Take 5 Warm up in allowed time alone. They may not want to do the warm-up and chat with friends instead. This can be remedied by talking to the student and coaching them back on task.The students should be comparing their answers and then if they differ work to find a common solution. I cut down on cheating because of checking the warm-up for completion before they partner up, and not after. There may be some talking which could be remedied by splitting up the pairs that are not ‘speaking math’. If a student is missing a partner, I would have them pair with someone else.Students should begin to formulate ideas about data that they have seen. Some may go ahead and announce some facts that they have heard. Some may disagree with some of the facts. For example, a kid could say “Well, my Dad smokes 2 packs a day and he still doesn’t have cancer!” This could very easily lead the class down the wrong path, so it is important to let the kids know that we are looking at a large amount of people, not just 25-100, and that there are always exceptions. |
| ACT1: 20 min | DURING: ACTIVITY 1: Scatter plot Comparison* Hand out activity to students and have them work independently for 10 minutes
* Have them partner for 3 minutes to see what they have in common and what they don’t have in common.
* Have students share what they thought the similarities and differences where and write them on the overhead.
 | Activity 1:* The student should be naming the similarities and differences between a positive linear regression, and a negative linear regression. This should include talking about slopes of lines, how close the points are together, if there looks to be a linear pattern or not.
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| Lecture10-15 | LECTURE/CLASS DISCUSSION:* Talk about what linear regression is, and how it is used.
* Go back to original examples and have them debate if they are a negative, positive, or no correlation.
* Have them come up with an example of each type of correlation that pertains to real life.
* Put student work on display so that the kids can see lots of different examples.
* Ask the students what they think Line of Best Fit is, just by using the words in the name.
 | During Lecture:* The students should be taking notes on their own sheet of paper and asking any questions. They should think about different topics that would qualify as positive and negative linear regressions. They would then share their regressions with the rest of the class, and the class will discuss where they think that topic should go (under positive, negative, or none)They may speak quickly and quietly to a couple of their seat mates to compare what they think LOBF is just by using the name.
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| Act 215 min | * Give out **Handout 2**: Good Fit/Bad Fit

This is a sorting activity where the kids have to sort their cards into two piles one where the cards are good fits and one where cards are not good fits.* I will be walking around checking for participation from students.
* Distribute **Handout 2 part 2**: Why?
* Discuss student findings as a classroom group.
 | Complete Handout 2 with a partner with no assistance from any other peers or myself. Students complete the handout 2 part 2 to justify why they sorted the cards in the order they did. They will organize into a group and they will compile this table together. They should also discuss any similarities and differences that they find in their cards. |
| Lecture/Discussion10 min | Ask the students what they would do If they were given a table of data instead of a graph, and ask what they would do to find the line of best fit.Leading Questions: What did we start with in all of our problems? Is there a way to represent a graph a different way?Is the graph of the table

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| X | 1 | 2 | 3 |
| y | 7 | 9 | 11 |

The same as the scatter plot? (I would sketch scatter plot quickly on white board.) | Students should whisper to their seat partners about what they think they would do.They would then share their ideas. They might say that they can’t do it, and we could get into the discussion of why it might not work. Some may say that they have to graph the table, because a table can be represented as a pair of points. |
| Closure | **Distribute Homework and Journal**Discuss what they learned today and how it is used in real life. Encourage students to look in magazines or papers to try and find a linear relationship.Journal Entry: What I learned about linear regression handout.  | Discuss what they learned about positive and negative correlations. Write down any problems that they are having in their math journals on the topic.Keep their homework in a safe location for completion. |

1. **MEETING THE NEEDS OF ALL STUDENTS**: For my lower level kids I would give them fewer cards to sort, maybe four instead of all six. I would also pair kids together in a way so that they can help each other out as the activities are unfolding.
2. **WHAT COULD GO WRONG WITH THIS LESSON AND WHAT WILL YOU DO ABOUT IT?** Students may not be active partners, so they may need a lot of encouragement to get the assignments done. Students may forget how to find the equation of the line, so I would encourage them to look at their notes. In the past if they are really struggling with a warm up I will do a sample problem and then have them complete the warm up. Students may also come up with inappropriate linear regression real life examples, so I would carefully monitor what the students were putting on the overhead.
3. **LINK TO CTA:** I really liked the quote at our opening session that “Knowledge is built through problem solving” and I felt that I needed the kids to explore things on their own before I did a lecture on a topic. I also liked Mulligan’s classroom split of working together, then in pairs, then in groups, then alone. I tried to incorporate that into all of the lessons that I am doing. I also use Mulligan’s “What I know about..” and “These are “handouts throughout the activity. Also, many of my kids have a literacy problem, so I try to get them to write as often as possible so that is why I use a lot of journal entries.

