**Unit 5: Scatter Plots & Trend Lines**

**(4 weeks)**

**UNIT OVERVIEW**

Students will begin the unit by exploring measures of central tendency and spread and displays of one-variable data including, dot plots, histograms, and box-and-whisker plots. They will use the five number summary to create box-and-whisker plots and identify outliers with the 1.5 X IQR rule. They will be introduced to using the STAT menu on the graphing calculator.

In investigation two, students will be introduced to scatter plots and trend lines. They will fit a trend line to a scatter plot by hand and find its equation.. They will use the equation of the trend line to make predictions by interpolating or extrapolating. The students will develop a deeper understanding about the meaning of the slope and intercepts in context. These ideas are revisited in subsequent inestigations.

In Investigation three, students will continue to explore trend lines and predictions. They will use technology (either a graphing calculator or a spreadsheet) to calculate the linear regression equation and to find the correlation coefficient. The students will be able to interpret the meaning of the correlation coefficient and explain the difference between correlation and causation.

During investigation four, students will perform experiments in which they collect and analyze data using linear models. In this investigation, students will apply their knowledge from the previous two investigations. In this investigation the teacher will get the class prepared and organized, and then will walk around to observe and ask questions.

Investigation five, students will work with data sets that contain outliers to identify the influence that outliers have on the calculation and interpretation of the slope, y-intercept, linear regression equation, and correlation coefficient.

In the last investigation students will explore situations in which the data represents more than one trend, will fit a line to each section of the data set, and will use the lines to make predictions. In this way they will be introduced to piecewise linear functions.

**Essential Questions**

* How do we make predictions and informed decisions based on current numerical information?
* What are the advantages and disadvantages of analyzing data by hand versus by using technology?
* What is the potential impact of making a decision from data that contains one or more outliers?

**Enduring Understandings**

* Although scatter plots and trend lines may reveal a pattern, the relationship of the variables may indicate a correlation, but not causation**.**

**Unit Content**

Investigation 1: One Variable Data (three days)

Investigation 2: Introduction to Scatterplots and Trend Lines (two day)

Investigation 3: Technology and Linear Regression (two days)

Investigation 4: Explorations of Data Sets (four days)

Investigation 5: Exploring the Influence of Outliers on Trend Lines (two days)

Investigation 6: Piecewise Functions (two days)

Performance Task: Linearity is in the Air — Can You Find It? (three days)

(Note: The performance task should begin early in the unit to give students time to collect data.)

Suggested Time line: Day 1- Following investigation 3 - brainstorming and research

Day 2- Following investigation 5 - collecting and analyzing data

Day 3- Following investigation 6 – work day

Review (one day)

End-of-Unit Test (one day)

**Common Core Standards**

*Mathematical Practices #1 and #3describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning. Practices in bold are to be emphasized in the unit.*

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

3. Construct viable arguments and critique the reasoning of others.

**4. Model with mathematics.**

**5. Use appropriate tools strategically.**

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

**Standards Overview**

* Analyze functions using different representations
* Summarize, represent, and interpret data on a single count or measurement variable
* Summarize, represent, and interpret data on two categorical and quantitative variables
* Interpret linear models

**Standards with Priority Standards in Bold**

8-SP 1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

8-SP 2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

8-SP 3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

**S-ID 2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.**

**S-ID 3. Interpret differences in shape, center, and spread in the context of the data sets,**

**accounting for possible effects of extreme data points (outliers).**

**S-ID 6.** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

**a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data.**

c. Fit a linear function for a scatter plot that suggests a linear association.

**S-ID 7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.**

S-ID 8. Compute (using technology) and interpret the correlation coefficient of a linear fit.

S-ID 9. Distinguish between correlation and causation.

**Vocabulary**

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| --- | --- | --- |
| Boxplot  causation  correlation  correlation coefficient  data  data set  dependent variable  distribution  domain  extrapolation  graphical representation  histogram | independent variable  interpolation  inter quartile range (IQR)  line of best fit  linear regression  linear relationship/model  mean (average)  median  measures of central tendency  mode  nonlinear relationship/model  ordered pair | outlier  piecewise function  prediction  regression equation  scale  scatter plot  skewed distribution  slope  trend line  variable  *x*-intercept  *y*-intercept |

**Assessment Strategies**

**Performance Task: Linearity is in the Air — Can You Find It?**

During the unit, have students develop a hypothesis about a real-world ‘nearly’ linear situation interesting to them, find relevant data, model the data, analyze the mathematical features of the model, and make and justify a conclusion. By the end of the unit, all students will present their findings to the class. NOTE: The performance task should be spread out over the entire unit.

**Other Evidence (Formative and Summative Assessments)**

* + - * Exit Slips
      * Class work
      * Homework assignments
      * Math journal
      * Unit 5 Test