Unit 5 - Functions and Descriptive Statistics

Content Area: **Mathematics**
Course(s): **Honors Algebra I 8**
Time Period: **April**
Length: **1**
Status: **Published**

Unit Overview

Experience with descriptive statistics began as early as Grade 6. Students were expected to display numerical data and summarize it using measures of center and variability. By the end of middle school they were creating scatterplots and recognizing linear trends in data. This unit builds upon that prior experience, providing students with more formal means of assessing how a model fits data. Students use regression techniques to describe approximately linear relationships between quantities. They use graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. With linear models, they look at residuals to analyze the goodness of fit.

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Enduring Understandings

- A deeper look at bivariate data can be taken to describe categorical associations and how to fit models to quantitative data.
- A linear function can be used to model the relationship between two numerical variables.
- A statistical relationship, such as correlation coefficient, is not necessarily the same as a causeand-effect relationship.
- The correlation coefficient will be understood and the focus will be on the computation and interpretation of the correlation coefficient as a measure of how well the data fit the relationship.
- The strength of a relationship and appropriateness of the model used can be determined by analyzing residuals.

Essential Questions

- How do analysis of bivariate data and knowledge of proportions intersect with each other?
- How can you compute correlation coefficients using technology and interpret the value of the coefficient?

- How would you analyze bivariate data using your knowledge of proportions?
- How would you describe categorical variables?
- How would you interpret the parameters of a linear model in the context of data that it represents?
- How would you use your knowledge of functions to fit models to quantitative data?

Student Learning Objectives (SLOs)

- Distinguish between correlation and causation in a data context.
- Interpret the slope, intercept and correlation coefficient (compute using technology) of a linear model.
- Represent and describe data for two variables on a scatter plot, fit a function to the data, analyze residuals (in order to informally assess fit), and use the function to solve problems. a) Uses a given function or choose a function suggested by the context. Emphasize linear and exponential models.
- Represent data on the real number line (i.e. dot plots, histograms, and box plots) and use statistics to compare and interpret differences in shape, center, and spread in the context of the data (account for effects of outliers).
- Summarize and interpret categorical data for two categories in two-way frequency tables; recognize associations and trends in the data.
- Use the mean and standard deviation of a data set to fit it to a normal distribution, estimate population percentages, and recognize that there are data sets for which such a procedure is not appropriate (use calculators, spreadsheets, and tables to estimate areas under the normal curve).
- Write linear and exponential functions (e.g. growth/decay and arithmetic and geometric sequences) from graphs, tables, or a description of the relationship, recursively and with an explicit formula, and describe how quantities increase linearly and exponentially over equal intervals.

Standards/Indicators

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.
MA.F-LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
MA.F-LE.A.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Lesson Titles

- Central Tendency Applications
- Choosing a Data Display
- Frequency Tables & Histograms
- Measures of Center and Variation
- Misleading Graphs
- Analyzing Lines of Fit
- Box-and-Whisker Plots
- Measures of Central Tendency
- Scatter Plots and Lines of Fit
- Scatter Plots and Lines of Fit
- Shapes of Distributions
- Shapes of Distributions
- Stem and Leaf Plots
- Two-Way Tables

Equity Considerations

LGBTQ and Disabilities Mandate

Students will engage in discussions centered around mathematicians from the LGBTQ and Disabilities population.

STEM	LGBTQ: Sir Francis Bacon (1561–1626) Florence NightingaleFrancis Bacon | Philosophy, Scientific Method, & Facts | Britannica(1820-1910) George Washington Carver (1861-1943) Sara Josephine Baker (1873-1945) Alan Turing (1912-1954) Allan Cox (1926-1987) Sally Ride (1951-2012) Ben Barres (1954-2017)

Ruth Gates (1962-2018)

Tim Cook (1960)

Disabilities:

Leonardo da Vinci (1452-1519)- Dyslexia

Isaac Newton (1664-1727)- Epilepsy

Thomas Edison (1847-1931)- Hearing

Charles Darwin (1809-1882)- Stutter, Dyslexia

Alexander Graham Bell (1847-1922)- Deaf

Albert Einstein (1879-1955)- Aspergers

Florence B. Seibert (1897-1991)- Mobility

Stephen Hawking (1942-2019)- ALS

John Forbes Nash (1928-2015)- Schizophrenia

Temple Grandin (1947)- Autism

- Social

Asian American and Pacific Islander Mandate

https://ideas.ted.com/8-asian-americans-and-pacific-islanders-whose-innovations-have-changed-your-life-really/
https://www.ngpf.org/blog/math/math-monday-celebrating-aapi-mathematicians/

Diana Ma is a statistician who has built a career out of her two passions: basketball and math. As a Data Scientist for the Lakers, she works in basketball operations and does analysis involving player evaluation, roster construction, and in-game strategy.

Shakuntala Devi is known as “The Human Computer”, Shakuntala Devi was a famous mathematician who holds the Guinness World Record for the “Fastest Human Computation.” In addition to her computational prowess, Devi was also an outspoken LGBTQ+ advocate, novelist, and political hopeful. Her life story was adapted into the biopic Shakuntala Devi in 2020.

Dr. Kamuela Yong is an associate professor of mathematics at the University of Hawai‘i–West O‘ahu. He is the first Native Hawaiian to earn a Ph.D. in applied mathematics and is the co-founder of the organization Indigenous Mathematicians.

- Social

Climate Change

Students will make connections between math and STEM processes.

Students analyze the melting of the polar ice caps and its effects on the Earth and humanity

How fast are the polar ice caps melting, and why is this rate important to human life on Earth?

https://www.oercommons.org/authoring/7876-climate-change-cross-curricular-math-english-scien/view

https://jancovici.com/en/climate-change/risks/will-oceans-submerge-everything/

- Social

SCI.HS-ESS3-6	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change).

Inter-Disciplinary Connections

LA.RH.6-8.1	Cite specific textual evidence to support analysis of primary and secondary sources.
LA.RH.6-8.2	Determine the central ideas or information of a primary or secondary source; provide an accurate summary of the source distinct from prior knowledge or opinions.
LA.RH.6-8.4	Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies.
LA.RH.6-8.5	Describe how a text presents information (e.g., sequentially, comparatively, causally).
LA.RH.6-8.7	Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.
LA.RH.6-8.8	Distinguish among fact, opinion, and reasoned judgment in a text.
LA.RH.6-8.9	Analyze the relationship between a primary and secondary source on the same topic.
LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
LA.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
LA.RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK

- Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
- Students will be able to describe categorical associations using knowledge of functions in quantitative data.
- Students will be able to describe the process of computing correlation coefficients.
- Students will be able to explain the process of analyzing bivariate data. (Orally and in writing)
- Students will be able to interpret the parameters of linear model in the context of data it represents and write the interpretation using complex sentences.
- 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.

Modifications

ELL Modifications

- Content specific vocabulary important for ELL students to understand include: probability, likelihood, expected value, predictions, experimental, theoretical, compound probability, independent events, dependent events, sample, population, biased, un-biased, box and whisker plot, measure of variability, variation, measure of center, median, mean, interquartile range, mean absolute deviation
- Engage students in interpreting slope and intercept using real world applications
- multi-lingual math glossary
- Students create an equation with given information from a table, graph, or problem situation.
- Use graphs of experiences that are familiar to students to increase accessibility and supports understanding and interpretation of proportional relationship. Students are expected to both sketch and interpret graphs including scatter plot.

IEP & 504 Modifications

- Have the students work in groups to generate data
- modify assessments (length, format, etc)
- printed copy of board work/notes provided
- Provide calculator to assist with calculations.
- Provide completed examples for practice work and homework.
- Provide manipulative, such as Uniflex cubes or counting chips, for students to use when calculating probabilities

G&T Modifications

- avoid drill and practice
- Have students design an experiment (project) where they would collect data from different sources, make a scatter plot of the data, draw a line of best fit modeling the data.
- provide additional rigorous challenge problems for advanced students
- student led discussions
- utilize higher level questions that require students to look into causes and facts to draw a conclusion

At Risk Modifications

- Correct errors on assessments to earn back partial credit
- guided notes
- hands-on instruction
- model/show lots of examples
- non verbal redirecting cues
- providing study guides
- reduce homework length
- review, restate, reword directions
- testing modifications

Formative Assessment

- 5 Questions
- Pair share
- senteo
- Stand up
- Thumbs up

Summative Assessment

- Quiz - Analyzing Lines of Best Fit
- Quiz - Measure of Central Tendency
- Quiz - Various Plots
- Test: Descriptive Statistics

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Benchmark Assessments

Skills-based assessment- math practice

Resources & Materials

- Algebra: Structure and Method Book 1
- PMI - Data and Statistics

Technology

- Chromebook
- desmos
- Equatio
- graphing calculator
- Interactive Promethean Board
- IXL
- MathXL
- peardeck
- PMI - Data and Statistics
- www.actuarialfoundation.org
- www.amstat.org

TECH.9.4.2.CI	Creativity and Innovation
TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.DC.6	Identify respectful and responsible ways to communicate in digital environments.