



Unit 4 Data Analysis and Sampling MS Advanced 2

Last Update: August 1, 2025

Archdiocesan Curriculum > MS. Advanced 2> Math > Length of unit 24 to 26 days.

Stage 1: Desired Results						
General Information In this unit, students will investigate and analyze data involving two variables. They will use scatter plots to identify associations such as positive, negative, or none, and describe relationships using trend lines. Students will explore how to draw conclusions from data through the use of random sampling and will evaluate how variability in samples affects population inferences. They will compare measures of center and spread—such as mean, median, range, interquartile range (IQR), and mean absolute deviation (MAD)—in dot plots and box plots to draw inferences about populations. Finally, students will construct and interpret two-way frequency and relative frequency tables to analyze relationships between two categorical variables, supporting deeper data-driven reasoning. Mathematical Practices - MP2 – Reason abstractly and quantitatively - MP4 – Model with mathematics - MP5 – Use appropriate tools strategically - MP6 – Attend to precision	Essential Question(s) - How can we use scatter plots and trend lines to analyze relationships between two variables and make predictions? - What makes a sample representative of a population, and how do we use samples to make valid inferences? - How do different data displays—like dot plots, box plots, and measures of center and spread—help us compare and interpret data? - Why does variability exist in sample data, and how does understanding this variability improve our conclusions about a population? - How can we use two-way tables and relative frequencies to describe and interpret relationships between categorical variables?					
	Enduring Understanding/Knowledge Students will: - Display and analyze data with two variables. - Use trend lines to describe a linear relationship between two variables. - Use scatter plots and trend lines to interpret linear data in context. Review/Assess - Understand populations, random samples, and how to select a representative sample. - Use a random sample to make inferences about a population. - Understand that repeatedly sampling a population with the same size random sample will cause the data to vary. Review/Assess - Compare the center and spread of data displayed in dot plots. - Compare data displayed in box plots, and use these comparisons to draw inferences about two populations. - Use means and MADs to compare two populations. Review/Assess - Interpret data by constructing two-way frequency tables. - Analyze and interpret two-way relative frequency tables.	Vocabulary <table><tr><th>New</th><th>Review</th></tr><tr><td> - association - cluster - linear association - negative association - no association - nonlinear association - positive association - scatter plot - trend line - bias - population - random sample - representative sample - sample - two-way table - conditional relative frequency - event - frequency - joint relative frequency - marginal relative </td><td> - data set - outlier - mean - median - range - box plot - interquartile range - lower quartile - upper quartile - mean absolute deviation </td></tr></table>		New	Review	- association - cluster - linear association - negative association - no association - nonlinear association - positive association - scatter plot - trend line - bias - population - random sample - representative sample - sample - two-way table - conditional relative frequency - event - frequency - joint relative frequency - marginal relative
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Review/Assess	frequency - relative frequency - two-way relative frequency table
Connections to Catholic Identity / Other Subjects Religion/Catholic Identity: - The Importance of Every Person: Catholic teachings emphasize the inherent dignity of each individual. When collecting data from a sample, it's important to ensure that every member of the population has a fair chance to be included. This reflects the Catholic belief in justice and fairness. Other Subject Here: Science: Data Collection and analysis of experiment results Social Studies: Show examples from polling (e.g., presidential polls, surveys for consumer products) to demonstrate how random sampling works in the real world.	Differentiation Enrichment Investigate Correlation and Causation – Extend student understanding by exploring the difference between correlation and causation using real-world data sets. Use Digital Tools to Create and Analyze Trend Lines – Challenge students to use statistical software or graphing calculators to draw and interpret best-fit lines, including writing equations for those lines. Design and Conduct a Survey – Have students design their own random sampling surveys, collect data, and analyze findings using dot plots, box plots, and two-way tables. Compare Population Data Using Statistical Measures – Ask students to interpret and compare data using advanced statistical concepts such as interquartile range, mean absolute deviation, and range in various contexts. Create and Interpret Complex Two-Way Tables – Encourage students to construct and analyze two-way relative frequency tables from real-world or peer-collected data and make inferences across categories. Support Provide Real-World Examples of Associations – Use accessible contexts like weather and clothing, or study time and test scores, to introduce types of associations (positive, negative, none). Use Structured Graphic Organizers – Offer scaffolds to help students organize data, identify types of associations, and describe trends in scatter plots or two-way tables. Model How to Interpret Data Displays – Use think-alouds to model how to describe patterns in data sets, including where to locate medians, quartiles, and outliers. Vocabulary with Visuals and Sentence Frames – Reinforce key terms like “trend line,” “bias,” and “random sample” with definitions, visual examples, and academic sentence starters. Provide Step-by-Step Data Analysis Tasks – Break down the process of comparing data displays (e.g., dot plots vs. box plots) and calculating MAD into manageable steps with teacher guidance.
Standards & Benchmarks Scatter Plots: 6.DS.3.d Describe any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered; and AI.L.2 Represent linear functions as graphs from equations (with emphasis on technology), equations from graphs, and equations from tables and other given information (e.g., from a given point on a line and the slope of the line). Find the	

equations of a line in a slope-intercept, point-slope, and standard forms. Recognize that different forms reveal more or less information about a given situation based on the form used.

8.AF.6

Construct a function to model a linear relationship between two quantities given a verbal description, table of values, or graph. Within the context of a problem, describe the meaning of m (rate of change) and b (y -intercept) in $y = mx + b$. (E)

8.DSP.1

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

AI.DS.3

Use technology to find a linear function that models a relationship between two quantitative variables to make predictions and interpret the slope and y -intercept. Using technology, compute and interpret the correlation coefficient. (E)

8.DSP.2

Write and use equations that model linear relationships to make predictions, including interpolation and extrapolation, in real-world situations involving bivariate measurement data. Interpret the slope and y -intercept in context. (E)

8.SP.A.2

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.A.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 has meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.

8.F.B.4

Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values.

8.SP.A.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.3

Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

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.

Proportional Reasoning with Samples:

AI.DS.2

Understand that statistics and data are non-neutral and designed to serve a particular interest. Analyze the possibilities for whose interest might be served and how the representations might be misleading. (E)

7.DSP.1

Understand that statistics can be used to gain information about a population by examining a sample of the population. Understand that conclusions and generalizations about a population from a sample are valid only if the sample is representative of that population and that random sampling tends to produce representative samples and support valid inferences. (E)

7.SP.A.1

Describe how statistics can be used to gain information about a population by examining a sample of the population, recognizing that generalizations about a population from a sample are valid only if the sample is representative of that population. Explain that random sampling tends to produce representative samples and support valid inferences.

7.SP.A.2

Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data and observe the variation in predictions across multiple surveys.

7.SP.1

Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of that population. Understand that random sampling tends to produce representative samples and support valid inferences.

Use Statistics and Graphs to Compare Data:

7.DSP.2

Find, use, and interpret measures of central tendency (mean and median) and measures of spread (range, interquartile range, and mean absolute deviation) for numerical data from random samples to draw comparative inferences about two populations. (E)

7.SP.B.4

Use measures of center (for example, mode, median, mean) and measures of variability (for example, range, interquartile range, mean absolute deviation) for numerical data from random samples to draw informal comparative inferences about two populations. For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.

7.SP.B.3

Informally assess the degree of visual overlap of two numerical data distributions with similar variability, measuring the difference between the centers by expressing it as a multiple of a measure of variability. For example, the mean height of players on the basketball team is 10 cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.

7.SP.3

Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.

7.SP.4

Use measures of center and measures of variability (i.e. inter-quartile range) for numerical data from random samples to draw informal comparative inferences about two populations.

Two-Way Tables:

8.SP.A.4

Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

8.SP.4

Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables.

Teaching Ideas/Resources

Websites/Resources:

Desmos Free Classroom lesson histograms

- [Creating Relative Frequency Histograms](#)

PBS Learning videos on random sampling, penguin population estimate,

- [Simple Random Sampling](#)
- [Estimation from random sampling](#)

Other Resources

- [Free TPT 7.SP Lessons/Worksheets/Activities](#)
- [Illustrative Math 7.SP](#) -This website includes short challenging tasks to reinforce the skills and concepts being taught.
- [Data and Statistics](#) – From fishtank learning, this resource will have students understanding and identifying populations and sample populations for statistical questions.
- **5 Statistical Activities for Middle School**
<https://www.maneuveringthemiddle.com/5-statistics-activities-for-middle-school/>