



High School Math Learning Plans

These plans are also available on our website:

www.accomack.k12.va.us

Please note: The online portion of these plans is optional.

High School Learning Plans

Probability & Statistics



Activities to Support Instruction During Extended School Closures

The purpose of this document is to provide an overview of suggested activities available to ACPs students. These suggestions can be used by families to support the continuity of education. The learning experiences developed and provided will give students opportunities to go deeper into concepts, ideas, and skills independently. These activities do not require copies or additional supplies.

Skills:

- I will be able to compare and contrast real world data distributions in terms of shape, center, and spread.
- I will be able to represent real world univariate data graphically.
- I will be able to compute measures of central tendency and dispersion.

Online:

Warm-Up:

[World Distribution](#) Students will analyze the graphs of several countries to compare and contrast the graphical distributions

Focused Instruction:

- [Mode, Median, Mean, Range, and Standard Deviation](#) Retrieved from Simple Learning Pro
- [Symmetry and Skewness](#) Retrieved from Simple Learning Pro
- [How to Create a Histogram](#) Retrieved from Khan Academy

Project Based Learning Activity:

2020 is a census year. The goal of the United States Census is to count every person living in the United States, only once and in the right place. Article 1, Section 2 of the U.S. The Constitution mandates that this population and housing count occur every 10 years. Census data guide how more than \$675 billion in federal funding is distributed to states and communities each year.

For this activity, you will begin by investigating an online US Census Bureau publication from 2010([Guide to State and Local Census Geography](#))

- From the information found in the publication, create a quantitative graph (histogram or box plot) to display the **population** count from all 50 states and the District of Columbia. Label completely and you may even add color.
- Calculate the mean and standard deviation of the **population** count data collected.

Now, investigate information collected by the US Census Bureau on median household income with the website, [US Census Bureau Fact Finder](#).

- On this webpage you will find medium income data from each state listed in the dollar column. Select the year 2010 in the menu on the left side of the data table. Now create a quantitative graph (the same type of graph you created in the first part of the activity) to display the **median income** from all 50 states and the district of Columbia. Label completely and consider adding some color.
- Calculate the mean and standard deviation of the **median income** data.

Finish the activity by writing a comparison of the shape, center, and spread of the data distributions from your two graphs. Is there anything unusual about your data sets? Can you think of contextual reasons why your graphs look the way that they do?

Reflection: Write a journal reflection.

- Graphical comparisons are used in many ways to help people and consumers understand things. Think about the graphical comparisons you may have seen on the news to help the public understand COVID-19. Why are these graphical images utilized by the government and media? Do you think these graphical images are helping the public understand social distancing and the risks associated with COVID-19? Explain.

Offline:

Question:

What does data look like in your world?

Learning Experience:

In this activity, you will investigate the relationship between real world data and the normal distribution. You will collect data from your surroundings and create a graph.

- Choose a data source from which you can collect at least 15 quantitative data values. Some examples are included below, but use your imagination!
- Once you have collected your data, calculate the mean and standard deviation of your data set.
- Next, create a quantitative graph (histogram, stemplot, dotplot, boxplot) of your data.
 - Don't forget to title and label your graph.
 - You can even add some color.
- Use your graph along with your mean and standard deviation to describe the distribution of your data set.
- Analyze the graph.
 - What is the shape, center, and spread of your data set?
 - Does your data set follow a symmetrical distribution or bell curve?
 - Is there anything unusual about your data set?
 - Can you think of contextual reasons why your graph looks the way that it does?

Data Source Examples

- Roll a pair of dice 20 times and record the sum of the values.
- Pour out and measure a $\frac{1}{2}$ cup of dry beans, noodles, or rice. Count and record the number of beans in your measuring cup. Replace the items measured and repeat the process 15 times.
- Take a walk and record the number of bushes in the front yard of 15 different houses in your neighborhood.
- Open a book or magazine and record the number of words written on 15 different pages.

Skills:

- I will analyze the linear association between two variables and interpret the association in the context of a given scenario.
- I will calculate a least-squares regression line and interpret the coefficients.
- I will determine the appropriateness of a least-squares regression plot by analyzing residuals and the effects of unusual points on the line.

Online:

Warm-Up:

- [Interpret Scatterplots](#) Students can practice interpreting scatterplots.

Focused Instruction:

- [Introduction to Regression and Residuals](#) Retrieved from Khan Academy
- [Finding the Line of Best Fit](#) Retrieved from YouTube

Question:

[Is There an Association Between Time of Day and Number of Calories Consumed?](#)

In this activity, you will be asked to count the number of calories each time you eat and record the time that you ate. You can determine the number of calories that you eat by visiting [choosemyplate.gov](#).

- Record the number of calories and the time you ate for several days and then create a scatterplot and describe what you see.
- Do your eating habits change over the course of the day?
- When do you eat the most calories?

Offline:

Project Based Learning Activity:

Monopoly and Linear Regression (Modified from Texas Instruments Lesson)

Warm Up:

Review the definitions of the words listed below.

- coefficient of determination
- correlation coefficient
- explanatory variable
- influential point
- least-squares regression line
- outlier
- response variable
- scatterplot
- slope
- Y-intercept

Question:

Is there an association between the number of spaces from Go and the cost of the property on a standard Monopoly board? The following data are the number of spaces from GO and the cost of the property for each property on a standard Monopoly board.

Property	Spaces from GO	Cost (in dollars)
Mediterranean Avenue	1	60
Baltic Avenue	3	60
Reading Railroad	5	200
Oriental Avenue	6	100
Vermont Avenue	8	100
Connecticut Avenue	9	120
St. Charles Place	11	140
Electric Company	12	150
States Avenue	13	140
Virginia Avenue	14	160
Pennsylvania Railroad	15	200
St. James Place	16	180
Tennessee Avenue	18	180
New York Avenue	19	200
Kentucky Avenue	21	220
Indiana Avenue	23	220
Illinois Avenue	24	240
B & O Railroad	25	200

Atlantic Avenue	26	260
Ventnor Avenue	27	260
Water Works	28	150
Marvin Gardens	29	280
Pacific Avenue	31	300
North Carolina Avenue	32	300
Pennsylvania Avenue	34	320
Short Line Railroad	35	200
Park Place	37	350
Boardwalk	39	400

1. Do you notice any trends or any noteworthy data values?
2. Which variable would make sense to be the explanatory variable? Explain.
3. Which variable would make sense to be the response variable? Explain.
4. Construct a scatterplot of the data.
5. Interpret the scatterplot. (Describe the association between the two variables.)
6. Are there any unusual points? If so, describe them.
7. Find the regression model that describes the association. Define any variables used.
8. What is the slope? Interpret the slope.
9. What is the y-intercept? Interpret the y-intercept.
10. Find and interpret the correlation coefficient, r .
11. Find and interpret the coefficient of determination, r^2 .
12. Delete the following data points for the railroad and utility properties: (5, 200), (12, 150), (15, 200), (25, 200), (28, 150), and (35, 200) and calculate a new regression model.
13. Describe the slope of the new model.

Reflection:

- How can you determine whether a linear model is appropriate for a set of data? Discuss at least two ways.

Skills:

- I can compare and contrast real world data distributions using shape, center, and spread.
- I can represent real world univariate data graphically.
- I can compute measures of central tendency and spread.
- I can compare two distributions using z-scores.
- I can determine if a distribution is normal using the 68-95-99.7% Rule (aka Empirical Rule).

Online:

Warm-up:

Open the [Plinko Probability Applet](#).

1. Click on the Lab option.
2. Click on the Green Play Arrow to release one plinko ball. Click on the Green Arrow again 9 more times. To release 9 more balls into the game board. What do you notice about the shape, center, and spread of the histogram formed at the bottom of the game board?
3. Now change the setting to continuously release balls by clicking on the menu option with multiple balls. This option is found next to the green arrow and under the option for 1 ball. After you have changed the option, click the green

arrow and observe the histogram under the game board. How does the shape, center, and spread of the histogram change as more balls are released into the bin? Explain this change in the graph with the law of large numbers.

Focused Instruction:

- [The Normal Distribution on Stats Center](#) retrieved from TedEd
- [Z-Score Introduction](#) Retrieved from Khan Academy Lesson

Project Based Activity:

In this activity, you will perform the reaction time test to compare distributions of data sets.

- To perform the reaction test, open the [Reaction Test Application](#) to collect your data. Click start and when the box changes color click the stop button. Record your reaction time in a table. Repeat this process for a total of 20 data points. Now, have a family member complete the reaction test 20 times and record their data in a separate table.
- Find and interpret the mean, median, five number summary, standard deviation, and IQR for each person's set of times. Choose an appropriate graph to graph the times. Which measure of center and spread should be used to describe the distribution? Explain.
- Compare the two distributions of times in context in terms of shape, center, and spread.
- Combine your times and your family member times so that you have 40 times total. Find the mean and standard deviation of the 40 times. Time yourself one more time and determine how your new time compares to the mean by using z-scores. Use a z-score table to find your percentile.

Offline:

(Taken from [Stats In Your World](#))

A Normal model can be a useful tool for interpreting what data have to say - sometimes. You have a job as one of several teaching assistants for a statistics professor who wants to help her students understand the Normal model. She is interested in finding some everyday contexts that students could explore in a project using a Normal Model. Your task here is to check the appropriateness of a Normal model for data you collect or create. There are three phases in completing this task:

1. Collect data.
 - a. You need a data set with 30 – 50 values. Find something you are interested in. Use existing data, or create some yourself. Need an idea?
- Put 10 pennies in a glass, put your hand over the top, shake well, then dump them out on a table and count the number that came up heads.
- Roll two dice and record the total.
- Deal cards from a well-shuffled deck one at a time. Count the number of cards you have to turn over until you find an ace.
- Use some data from another class – a science experiment, perhaps.
- Look something up in an almanac. For example, there are lots of tables of data about states - crime rates, population density, median income, etc.
- Use some sports statistics – number of wins for baseball teams, scores in a golf tournament, weights of players on a football team, etc.
- Find something on the Internet – www.census.gov for example.
2. Describe the data.
 - a. Write a brief but thorough description of your data. Start with the W's, and remember to include visual, numerical, and verbal descriptions.
3. Check the Normal model.
 - a. Use the mean and standard deviation of your data to create a Normal model. Compare what this model describes (visually, using the standard deviation, 68-95-99.7 rule, etc) to the distribution of the data you collected and explain why you think the model is or is not useful to describe the context you explored.