National Center and State Collaborative

NCSC Math Activities with Scripted Systematic Instruction (MASSI): High School Data Analysis

National Center and State Collaborative

The National Center and State Collaborative (NCSC) is applying the lessons learned from the past decade of research on alternate assessments based on alternate achievement standards (AA-AAS) to develop a multi-state comprehensive assessment system for students with significant cognitive disabilities. The project draws on a strong research base to develop an AA-AAS that is built from the ground up on powerful validity arguments linked to clear learning outcomes and defensible assessment results, to complement the work of the Race to the Top Common State Assessment Program (RTTA) consortia.

Our long-term goal is to ensure that students with significant cognitive disabilities achieve increasingly higher academic outcomes and leave high school ready for post-secondary options. A well-designed summative assessment alone is insufficient to achieve that goal. Thus, NCSC is developing a full system intended to support educators, which includes formative assessment tools and strategies, professional development on appropriate interim uses of data for progress monitoring, and management systems to ease the burdens of administration and documentation. All partners share a commitment to the research-to-practice focus of the project and the development of a comprehensive model of curriculum, instruction, assessment, and supportive professional development. These supports will improve the alignment of the entire system and strengthen the validity of inferences of the system of assessments.

IDEAs that Work
U.S. Office of Special Education Programs

The contents of this lesson were developed as part of the National Center and State Collaborative by Keri Bethune and Diane Browder at University of North Carolina at Charlotte and verified by Amy Lehew, math content expert, under a grant from the Department of Education (PR/Award #: H373X100002, Project Officer, Susan.Weigert@Ed.gov). However, the contents do not necessarily represent the policy of the U.S. Department of Education and no assumption of endorsement by the Federal government should be made. Some images were obtained from www.pdclipart.org and www.school-clip-art.com.

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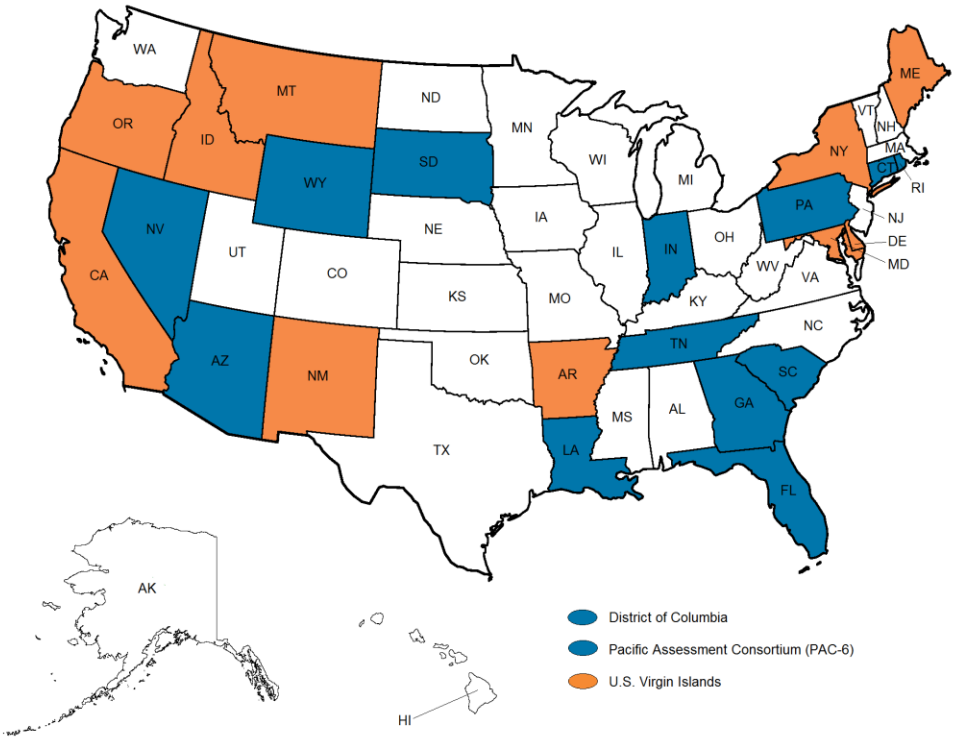
This document is available in alternative formats upon request.

National Center and State Collaborative

NCSC is a collaborative of 15 states and five organizations.

The states include (shown in blue on map): Arizona, Connecticut, District of Columbia, Florida, Georgia, Indiana, Louisiana, Nevada, Pacific Assessment Consortium (PAC-6)[1], Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, and Wyoming.

Tier II states are partners in curriculum, instruction, and professional development implementation but are not part of the assessment development work. They are (shown in orange on map): Arkansas, California, Delaware, Idaho, Maine, Maryland, Montana, New Mexico, New York, Oregon, and U.S. Virgin Islands.



*Core partner states are blue in color and Tier II states are orange in color.

[1] The Pacific Assessment Consortium (including the entities of American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Republic of Palau, and Republic of the Marshall Islands) partner with NCSC as one state, led by the University of Guam Center for Excellence in Developmental Disabilities Education, Research, and Service (CEDDERS).

National Center and State Collaborative

The five partner organizations include: The National Center on Educational Outcomes (NCEO) at the University of Minnesota, The National Center for the Improvement of Educational Assessment (Center for Assessment), The University of North Carolina at Charlotte, The University of Kentucky, and edCount, LLC.

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NCSC Math Activities with Scripted Systematic Instruction (MASSI): High School Data Analysis

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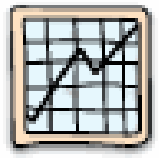
MASSI: Math Activities with Scripted Systematic Instruction

Activity: Analyzing Weather Patterns



Grade Band: High School

Concept: Data Analysis

Common Core State Standard	Core Content Connectors	MASSI OBJECTIVES
S-ID.4 Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. 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.	HS HS.DPS.1c1 Use descriptive stats; range, median, mode, mean, outliers/gaps to describe the data set	Identify Range, Mean/Average, Median, Mode, and Outliers/Gaps
S-ID.5 Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.		

Be sure to provide specific practice to students on the skills that correspond to their grade level.

Teaching Materials: Rainfall Scatterplot, Monthly Rainfall/Temperature Table, Annual Rainfall Line Graph, Annual High Temperature Line Graph, Equations for Range and Mean/Average, Table and Line Graph for Tuscan Total Rainfall

Other Materials: Rainfall Scatterplot, Monthly Rainfall/Temperature Table, Annual Rainfall Line Graph, Annual High Temperature Line Graph, Equations for Range and Mean/Average, Table and Line Graph for Tuscan Total Rainfall

Worksheets: There are student worksheets to review each component of the lesson

Assessments: Progress Monitoring for taking data during the lesson; Skills Test

TEACHING OVERVIEW: The first section of the MASSI provides remedial practice on identifying outliers in a data set, and reading tables and graphs. Students will then learn to use descriptive statistics (range, mean/average, median, mode, and outliers/gaps) in a data set.

SCRIPT FOR LESSON

BUILDING ESSENTIAL UNDERSTANDING: CONCEPT AND SYMBOLS: Given a Scatterplot, Identify Outliers in the Data Set *(Skip this section for students who understand these relationships and can identify these concepts).*

INTRODUCE THE ACTIVITY: Today we are going to analyze data on weather patterns. One way we can analyze data on the weather is to look at how many hours it rained and how many inches of rain fell. Another way that we can learn about the weather in an area is to keep data on how much rainfall happens and how the average daytime temperature changes from month to month.

INTRODUCE PROBLEM: One of the first things we need to do is look at the data for how many hours it rained and how many inches of rain fell total. To do this, we will use a scatterplot. A scatterplot lets us look for patterns in data by charting data according to two variables; it shows the data for one variable on one axis and another variable on the second axis. Show students the rainfall scatterplot. Point to each feature as you read the following: **Here is the scatterplot for rainfall. The x axis shows us the total number of hours that it rained. The y axis shows us the total inches of rain that fell. Look at this first data point. It shows us that it rained for half an hour and rained a total of half an inch. Let's look at the next data point. It shows us that it rained for one hour and it rained a total of half an inch.**

MODEL THE PROCESS: Continue to show students the rainfall scatterplot. Point to the corresponding locations as you read the following: **When you analyze the data from this scatterplot, you can see a general trend, or pattern, that the longer it rains, the more inches it rains.** Lay a pen diagonally across scatterplot. **If I drew a line diagonally on this scatterplot, most of the data points would be fairly close to the line. But, sometimes there is a data point that does not fit that pattern. When a data point does not fit a pattern, we call it an outlier. I see some data points on this scatterplot that are outliers. Here is one outlier.** Point to the data point at 1.5 hours and 4.5 inches of rain. **Look how far away this data point is from all the others; it doesn't fit the pattern. This data point shows us that it did not rain for very long, only 1.5 hours, but there were a lot of inches of rain during that time, 4.5 inches."**

STUDENT PRACTICE: Give each student the scatterplot. **Now it's your turn. I want you to find the outliers on this scatterplot.** Use the CONSTANT TIME DELAY script to teach students to identify the highest and lowest value in the data set.
***Note: The students can identify the three outliers in any order they choose, as long as they find all three outliers.*

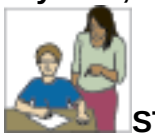
CHECK AND SCORE

Step	Teacher Says/Does	Student Response
1.	Give student the rainfall scatterplot and say **"Find an outlier on this scatterplot."**	Student circles, marks, or otherwise identifies the outlier at 1.5 hours and 4.5 inches of rain.
2.	Student still has the rainfall scatterplot. Say **"Find another outlier on this scatterplot."**	Student circles, marks, or otherwise identifies the outlier at 0.5 hours and 3.0 inches of rain.
3.	Student still has the rainfall scatterplot. Say **"Find one last outlier on this scatterplot."**	Student circles, marks, or otherwise identifies the outlier at 4.5 hours and 1.0 inches of rain.

BUILDING ESSENTIAL UNDERSTANDING: SYMBOLS: Reading a Table (Finding Data By Category) *(Skip this section for students who understand these relationships and can identify these concepts).*

INTRODUCE PROBLEM: Another way to analyze data on weather is to look at the rainfall and average temperature by month. Show students the table showing rainfall and average temperature by month. Point to the corresponding locations as you read the following: **Let's look at this table together. In this column it shows us the months of the year, this column shows the total rainfall in inches, and this shows average high temperature.**

MODEL THE PROCESS: Show students the table showing rainfall and average temperature by month. Point to the corresponding locations as you read the following: **When we look at the table we can see different data by category. So, if I want to see what the total rainfall was for January, I find January and move my finger across to the rainfall category. It says 1, so I know there was 1 inch of rain in January. If I want to know about the average temperature in January, I find January and move my finger across to the average high temperature category. It says 51°, so I know the average high temperature in January was 51°.**



STUDENT PRACTICE: Give each student the table showing rainfall and average temperature by month. **Now it's your turn. Look at the table and answer these questions.** Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.
***Note: Teachers should vary the months they ask about daily to prevent memorization of answers.*

CHECK AND SCORE

Step	Teacher Says/Does	Student Response
4.	Student has table showing rainfall and average temperature by month. **"How much rainfall was there in April?"** Teacher can point to the word April on table if needed.	Student states, points to, or otherwise identifies 2 inches.
5.	Student has table showing rainfall and average temperature by month. **"What was the average temperature in April?"** Teacher can point to the word April on table if needed.	Student states, points to, or otherwise identifies 72°.
6.	Student has table showing rainfall and average temperature by month. **"How much rainfall was there in June?"** Teacher can point to the word June on table if needed.	Student states, points to, or otherwise identifies 8 inches.
7.	Student has table showing rainfall and average temperature by month. **"What was the average temperature in June?"** Teacher can point to the word June on table if needed.	Student states, points to, or otherwise identifies 86°.
8.	Student has table showing rainfall and average temperature by month. **"How much rainfall was there in August?"** Teacher can point to the word August on table if needed.	Student states, points to, or otherwise identifies 6 inches.
9.	Student has table showing rainfall and average temperature by month. **"What was the average temperature in August?"** Teacher can point to the word August on table if needed.	Student states, points to, or otherwise identifies 88°.

10.	Student has table showing rainfall and average temperature by month. **"How much rainfall was there in September?"** Teacher can point to the word September on table if needed.	Student states, points to, or otherwise identifies 7 inches.
11.	Student has table showing rainfall and average temperature by month. **"What was the average temperature in September?"** Teacher can point to the word September on table if needed.	Student states, points to, or otherwise identifies 81°.
12.	Student has table showing rainfall and average temperature by month. **"How much rainfall was there in December?"** Teacher can point to the word December on table if needed.	Student states, points to, or otherwise identifies 3 inches.
13.	Student has table showing rainfall and average temperature by month. **"What was the average temperature in December?"** Teacher can point to the word December on table if needed.	Student states, points to, or otherwise identifies 53°.

MODEL THE PROCESS: Show students the line graphs for annual rainfall and annual high temperature. Point to the corresponding locations as you read the following: **We can also take the data from this table and put it in a graph. This line graph shows the data for total inches of rainfall by month. It shows the months across the x axis and the inches on the y axis. This graph shows the data for average temperature by month. When I look at the table, I can see that there was 1 inch of rainfall in January. This is where I can see that on the graph. I can do the same for average temperature. This graph shows the average temperature by month. It shows the months on the x axis and the degrees on the y axis. When I look at the table I see that the average temperature in January was 51°. Here is the average temperature for January on the line graph, it also shows 51°.**

STUDENT PRACTICE: Give each student the table showing rainfall and average temperature by month and the line graphs. **Now it's your turn. Look at the table and the graphs to find the corresponding data.** Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.
***Note: Teachers should vary the months they ask about daily to prevent memorization of answers.*

CHECK AND SCORE

Step	Teacher Says/Does	Student Response
14.	Student has table showing rainfall and average temperature by month and the line graph for rainfall per month. Point to the data on the table and say: **"There were 2 inches of rain in April. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.
15.	Student has table showing rainfall and average temperature by month and the line graph for rainfall per month. Point to the data on the table and say: **"There were 8 inches of rain in June. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.

16.	Student has table showing rainfall and average temperature by month and the line graph for rainfall per month. Point to the data on the table and say: **"There were 6 inches of rain in August. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.
17.	Student has table showing rainfall and average temperature by month and the line graph for rainfall per month. Point to the data on the table and say: **"There were 7 inches of rain in September. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.
18.	Student has table showing rainfall and average temperature by month and the line graph for rainfall per month. Point to the data on the table and say: **"There were 3 inches of rain in December. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.
19.	Student has table showing rainfall and average temperature by month and the line graph for average temperature per month. Point to the data on the table and say: **"In April the average high temperature was 72°. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.
20.	Student has table showing rainfall and average temperature by month and the line graph for average temperature per month. Point to the data on the table and say: **"In June the average high temperature was 86°. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.
21.	Student has table showing rainfall and average temperature by month and the line graph for average temperature per month. Point to the data on the table and say: **"In August the average high temperature was 88°. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.
22.	Student has table showing rainfall and average temperature by month and the line graph for average temperature per month. Point to the data on the table and say: **"In September the average high temperature was 81°. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.
23.	Student has table showing rainfall and average temperature by month and the line graph for average temperature per month. Point to the data on the table and say: **"In December the average high temperature was 53°. Where does it show that on the graph?"**	Student points to or otherwise identifies the corresponding data point on the graph.

This may be a good stopping point. Have the student analyze the local weather patterns. They can either take data by reading a thermometer and tracking rainfall, or lookup the information online. They can then graph the data in scatterplots and line graphs to identify outliers or patterns in the data. Graphing can be done using Microsoft® Excel. There is a generalization worksheet with this level. You can use this for additional guided practice or to send home as homework.

	Teacher Says/Does	Student Response	Error Correction
INDEPENDENT PRACTICE: Data Analysis Skills Test	Give each student the *Data Analysis Skills Test 1*. **Read directions for each problem and have student select response. Record whether response is correct or incorrect.**	Only provide praise for completing assessment (if student needs encouragement). Do not provide specific praise for correct answers while student is testing.	Once the student has completed the test, review missed problems with the student.
NOW *Stop the lesson here and repeat tomorrow if student is not yet getting at least 13 independent correct responses. Score responses 1-23 on the Data Analysis Progress Monitoring Sheet.*		*NEXT* *Remember the goal is for students to be able to analyze data using descriptive statistics, move into the second half of the lesson to hit the target CCC for this grade level. You can skip this Conceptual Foundation section to move on.*	

HS BUILD A GRADE ALIGNED COMPONENT: Use Descriptive Statistics to Describe a Data Set (Range, Mean/Average, Median, Mode, Outliers/Gaps)

INTRODUCE THE ACTVITY/PROBLEM: Remember before when we looked at the data for the inches of rain and average temperature per month? Now we are going to analyze that data in more detail and learn some new ways to talk about the data, like how to find the range, the average, the mode, the median, and any outliers/gaps in the data. For this portion of the lesson, students will need the tables reporting data.

MODEL THE PROCESS: First we will work on how to find the range. Range is the difference between the highest and lowest values in a data set. Let's all say it together. Range is the difference between the highest and lowest values in a data set. Students who are unable to respond vocally can use a voice output device to respond. Show students the rainfall/temperature table and range equation. **Here is an equation to show how to calculate range. It says highest value minus lowest value equals range. Now look at the data for the average temperature by month. Watch me as I fill out the equation and calculate the range. First, I find the highest value, 89, and I write it here. Then I find the lowest value, 51, and I write it here. Now I solve the equation to find the value, 38.**

STUDENT PRACTICE: Give each student the rainfall/temperature table and range equation. **Now it's your turn. Look at the table and use it to calculate the range for total rainfall and average temperature.** Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.

**Note: Have the students write the numbers into the formula, but do not score writing ability. If students are unable to write the number, they can use number stamps or direct the teacher to write it for them.

**Note: In the following problem, students are required to subtract. If students are unable to subtract independently, it is ok to provide them with a calculator or other visual, however they must do the work independently. Be consistent with the type of accommodation provided here.

CHECK AND SCORE

STEP	Teacher Says/Does	Student Response
24.	Give each student the rainfall/temperature table and a blank range equation and say **"Find the range for the total rainfall across the year."**	Student writes, stamps, or otherwise identifies the highest value (8) in the corresponding place in the equation.
25.	Wait for students to independently initiate this step or say **"What's next?"**	Student writes, stamps, or otherwise identifies the lowest value (1) in the corresponding place in the equation.
26.	Wait for students to independently initiate this step or say **"Now solve for the range."**	Student subtracts 8-1 to get the correct answer (7) and writes it in the equation.
27.	Give each student the rainfall/temperature table and a blank range equation and say **"Find the range for the average temperature across the year."**	Student writes, stamps, or otherwise identifies the highest value (89) in the corresponding place in the equation.
28.	Wait for students to independently initiate this step or say **"What's next?"**	Student writes, stamps, or otherwise identifies the lowest value (51) in the corresponding place in the equation.
29.	Wait for students to independently initiate this step or say **"Now solve for the range."**	Student subtracts 89-51 to get the correct answer (38) and writes it in the equation.

MODEL THE PROCESS: Now we need to learn to calculate the average, or mean, of a data set. The average/mean is one way to describe the middle of a data set. The average is the sum of the data divided by the total number of values. Let's say that together. The average is the sum of the data divided by the total number of values. Students who are unable to respond vocally can use a voice output device to respond. Show students the monthly rainfall/temperature table and mean/average equation. **Let's practice finding the average high temperature for the year by using this data set** (point to right column with "average high temperature")**. We will use our calculator to calculate our answer. First, I add up all of the data to get the sum. So to find the average temperature for the year, I add 51 + 55 + 63 + 72 + 79 + 86 + 89 + 88 + 81 + 72 + 62 + 53 = 851. Next I need to divide 851 by the total number of values. To find that number I just count the number of months, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. We have 12 total values, or months of data. Now I divide 851 ÷ 12 = 70.9. The mean or average high temperature for the year is 70.9 degrees.**

STUDENT PRACTICE: Give each student the rainfall/temperature table, mean equation, and a calculator. **Now it's your turn. Look at the table and use it to calculate the average/mean.** Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.

**Note: Have the students write the numbers into the formula, but do not score writing ability. If students are unable to write the number, they can use number stamps or direct the teacher to write it for them.

CHECK AND SCORE

STEP	Teacher Says/Does	Student Response
30.	Give each student the rainfall/temperature table, a blank average equation, and a calculator. Say **"Find the average/mean inches of rainfall for the year. First you need to find the sum of the values."**	Student adds the values using the calculator to find the sum (46) and writes, stamps, etc. in the corresponding place in the equation.
31.	**"Now you need to count how many values there were in the data set. That means how many months in the year."**	Student counts twelve values and writes, stamps, etc. the number of values (12) in the corresponding place in the equation.
32.	**"Ok, now use your calculator to solve for the average or mean."**	Student enters 46 into the calculator, presses divide, enters 12, and presses equals to get the average (3.8) and write, stamps, etc. the average (3.8 inches) in the corresponding place in the equation.
33.	Say **"Now find the average/mean for the high temperature. First you need to find the sum of the values."**	Student adds the values using the calculator to find the sum (851) and writes, stamps, etc. in the corresponding place in the equation.
34.	**"Now you need to count how many values there were in the data set. That means how many students were in the election."**	Student counts twelve values and writes, stamps, etc. the number of values (12) in the corresponding place in the equation.
35.	**"Ok, now use your calculator to solve for the average or mean."**	Student enters 851 into the calculator, presses divide, enters 12, and presses equals to get the average (70.9) and write, stamps, etc. the average (70.9°) in the corresponding place in the equation.

MODEL THE PROCESS: Next we are going to learn about how to find the mode of the data. The mode is the number that appears the most often in a data set. Say it with me. The mode is the number that appears the most often in a data set. Students who are unable to respond vocally can use a voice output device to respond. Show students the monthly rainfall/temperature table. **Let's look at the average high temperature column again** (point)**. I'm looking to see which number I see the most often. I only see 51° one time, I see 55° one time, I see 63° one time, but look, 72° occurs two times, once in April and once in October. If we keep looking, each of the other numbers only happen one time. That means the mode is 72° because it appears the most often in the data set. We see 72° two times. If there was another number that we saw three times, then that would be the mode.**

STUDENT PRACTICE: Give each student the rainfall/temperature table. **Now it's your turn. Look at the table and use it to find the mode.** Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.

CHECK AND SCORE

STEP	Teacher Says/Does	Student Response
36.	Give each student the rainfall/temperature table and say **"Find the mode for total rainfall."**	Student vocally states or points to the mode (2).
37.	Give each student the rainfall/temperature table and say **"Find the mode of average high temperature."**	Student vocally states or points to the mode (72°).

MODEL THE PROCESS: Now we are going to learn about how to find the median of the data. The median is the number that is in the middle of a data set after you put the numbers in order. Say it with me. The median is the number that is in the middle of a data set after you put the numbers in order. Students who are unable to respond vocally can use a voice output device to respond. Show students the rainfall/temperature table. **Let's look at the data for average temperature. We are going to look at the data for fall only. The fall months are September, October, and November** (point to months)**. They are shown with a brown background in the table. The first thing I'm going to do is write all the numbers in order from least to greatest. Watch me write 62, 72, 81. There are three numbers here, so the middle is the second number. Count two numbers in one, two,** (while pointing to 62, 72)**. The middle number is 72°, so the median is 72°.**

STUDENT PRACTICE: Give each student the monthly rainfall/temperature table. **Now it's your turn. Look at the table and use it to find the median.** Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.

**Note: Have the students write the numbers, but do not score writing ability. If students are unable to write the number, they can use number stamps or direct the teacher to write it for them.

CHECK AND SCORE

STEP	Teacher Says/Does	Student Response
38.	Give each student the rainfall/temperature table and say **"Find the median for total rainfall for summer months. Summer months are June, July, and August. They are shown in blue on the table."**	Student puts the numbers in order (either by writing them or using Velcro numbers or number stamps, etc.).
39.	Wait for the student to initiate this step or say **"Keep going."**	Student identifies the middle number (7).
40.	Give each student the rainfall/temperature table and say **"Find the median for total rainfall for spring months. Spring months are March, April, and May. They are shown in green on the table."**	Student puts the numbers in order (either by writing them or using Velcro numbers or number stamps, etc.).

41.	Wait for the student to initiate this step or say **"Keep going."**	Student identifies the middle number (2).
42.	Give each student the rainfall/temperature table and say **"Find the median for total rainfall for fall months. Fall months are September, October, and November. They are shown in brown on the table."**	Student puts the numbers in order (either by writing them or using Velcro numbers or number stamps, etc.).
43.	Wait for the student to initiate this step or say **"Keep going."**	Student identifies the middle number (2).
44.	Give each student the rainfall/temperature table and say **"Find the median for average temperature for summer months. Summer months are June, July, and August. They are shown in blue on the table."**	Student puts the numbers in order (either by writing them or using Velcro numbers or number stamps, etc.).
45.	Wait for the student to initiate this step or say **"Keep going."**	Student identifies the middle number (88°).
46.	Give each student the rainfall/temperature table and say **"Find the median for average temperature for spring months. Spring months are March, April, and May. They are shown in green on the table."**	Student puts the numbers in order (either by writing them or using Velcro numbers or number stamps, etc.).
47.	Wait for the student to initiate this step or say **"Keep going."**	Student identifies the middle number (72°).
48.	Give each student the rainfall/temperature table and say **"Find the median for average temperature for fall months. Fall months are September, October, and November. They are shown in brown on the table."**	Student puts the numbers in order (either by writing them or using Velcro numbers or number stamps, etc.).
49.	Wait for the student to initiate this step or say **"Keep going."**	Student identifies the middle number (72°).

MODEL THE PROCESS: One last thing. We need to check and see if there are any outliers in our data set. Remember, an outlier is a variable that does not fit that pattern. When a data point does not fit a pattern, we call it an outlier. When I look at the table for average temperature by month, I can see that it is colder in the winter months, and gets warmer in the summer, but there aren't really any clear outliers. When I look at the line graph I see the same thing. There are no outliers.

STUDENT PRACTICE: Give each student the monthly rainfall/temperature table for steps 50 & 51, and the Tuscan rainfall table and line graph for steps 52-54. **Now it's your turn. Look at the table and see if you see any outliers.** Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.

CHECK AND SCORE

STEP	Teacher Says/Does	Student Response
50.	Give each student the rainfall/temperature table and say **"Do you see any outliers for total rainfall?"**	Student indicates no.
51.	Give each student the rainfall line graph and say **"Do you see any outliers for total rainfall?"**	Student indicates no.
52.	Give each student the rainfall table for rainfall in Tuscan and say **"Let's look at this table to see total rainfall in Tuscan. Do you see any outliers for total rainfall?"**	Student indicates yes.
53.	**"Which month is an outlier?"**	Student identifies September.
54.	Give each student the rainfall line graph for rainfall in Tuscan and say **"Now show me that outlier on the line graph."**	Student points to corresponding point on graph.

This is the end of the lesson. Have the student analyze the local weather patterns. They can either take data by reading a thermometer and tracking rainfall, or lookup the information online. They can then graph the data in scatterplots and line graphs to identify outliers or patterns in the data. Then, have students find the descriptive statistics using the data set. Graphing and descriptive statistics can be done using Microsoft® Excel. There is a generalization worksheet with this level. You can use this for additional guided practice or to send home as homework.

	Teacher Says/Does	Student Response	Error Correction
INDEPENDENT PRACTICE: Data Analysis Skills Test	Give each student the *Data Analysis Skills Test 2*. **Read directions for each problem and have student select response. Record whether response is correct or incorrect.**	Only provide praise for completing assessment (if student needs encouragement). Do not provide specific praise for correct answers while student is testing.	Once the student has completed the test, review missed problems with the student.

Troubleshooting and Data-Based Decision Making for Data Analysis Skills Test:
If student is unable to complete any items on the data analysis test independently and correctly, go back and teach one problem step-by-step.

MASSI CULMINATING ACTIVITY: Have the student analyze the local weather patterns. They can either take data by reading a thermometer and tracking rainfall, or lookup the information online. They can then graph the data in scatterplots and line graphs to identify outliers or patterns in the data. Then have students complete descriptive statistics on the data. Students can track other relevant weather data as well.

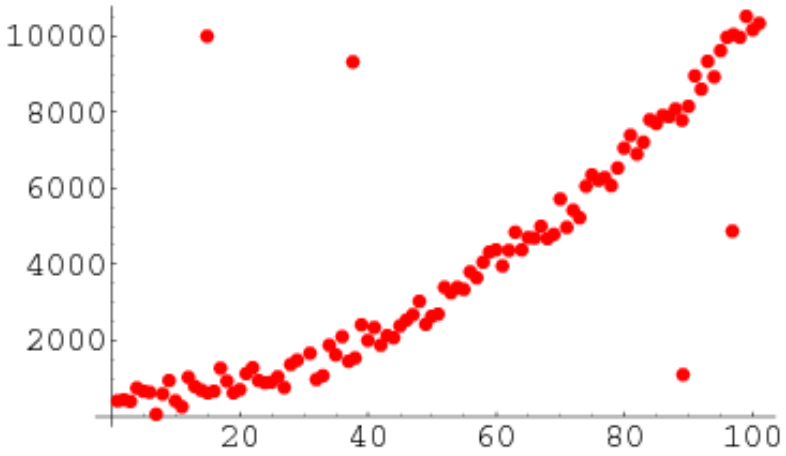
BUILD TOWARDS FULL GRADE LEVEL COMPETENCE

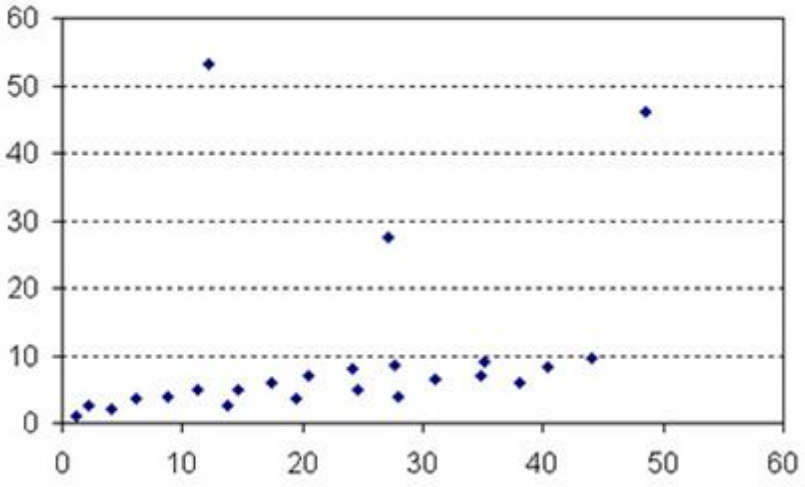
Here are ideas to build competence towards the full grade level competence using this same activity. See the unit plan and talk with the general education teacher for more ideas.

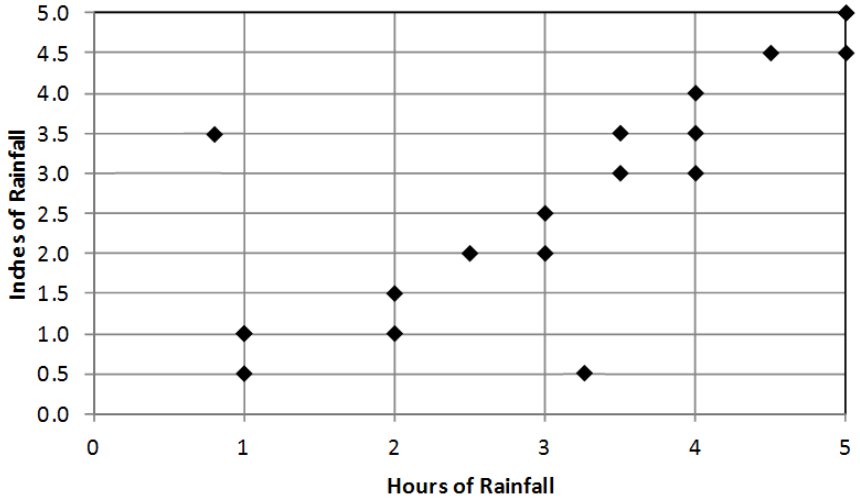
Component	Activity	What Student Does	Generalization/ Fluency
Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.	Students will enter a data set (e.g., average high and low temperatures across a year for a specific location) into an appropriate graphing calculator or computer program to fit into a normal distribution. Students then evaluate the area of normal curves.	Decides if data set is appropriate for distribution analysis. Enters data into graphing calculator (or other appropriate computer program) to run descriptive statistics and fit a normal distribution. Evaluates the area of normal curves.	Have students complete data analysis across different data sets (e.g., different years, different locations, etc.).
Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.	Creates two way frequency data tables (showing a relationship between two categorical variables). Have students create a table analyzing students' participation in sports vs. other extracurricular activities, also showing men vs. women's participation. Interpret relative frequencies and analyze for associations and trends.	Students create tables reflecting categorical data with at least two types of variables. Students then analyze the data looking for associations and trends.	Present as many types of categorical data sets as possible, with multiple categories.

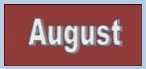
Worksheet 1: Generalization (Concepts and Symbols)

Circle all of the outliers on each of the scatterplots below:







 Month	 Total Rainfall (Inches)	 Average High Temperature
March 	1	65°
April 	2	68°
May 	1	75°
June 	2	77°
July 	2	80°
August 	8	84°

How many total inches of rain fell in April? _____

What was the average high temperature in March? _____

How many total inches of rain fell in June? _____

What was the average high temperature in August? _____

How many total inches of rain fell in May? _____

What was the average high temperature in July? _____

Worksheet 2: Generalization (HS Grade Aligned Component)

Find the range of the data for total rainfall:

_____ highest value - _____ lowest value = _____ range

Find the average (mean) of the data for total rainfall:

List values and add here:

+

_____ sum / _____ number of values = _____ average

Month	Total Rainfall (Inches)	Average High Temperature
March	1	65°
April	2	68°
May	1	75°
June	2	77°
July	2	77°
August	8	84°

Are there any outliers for the total rainfall data?

No Yes If yes, what is the outlier?_____

What is the mode of the data for total rainfall:

_____

Mode

What is the median of the data for total rainfall during summer (blue):

_____

Median

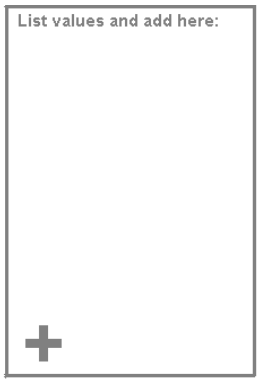
Find the range of the data for average high temperature:

_____ - _____ = _____

highest value lowest value range

Find the average (mean) of the data for average high temperature:

Month	Total Rainfall (Inches)	Average High Temperature
March	1	65°
April	2	68°
May	1	75°
June	2	77°
July	2	77°
August	8	84°



Are there any outliers for the average high temperature?

No Yes If yes, what is the outlier?_____

_____ / _____ = _____
sum number of values average

What is the mode of the data for average high temperature:

_____

Mode

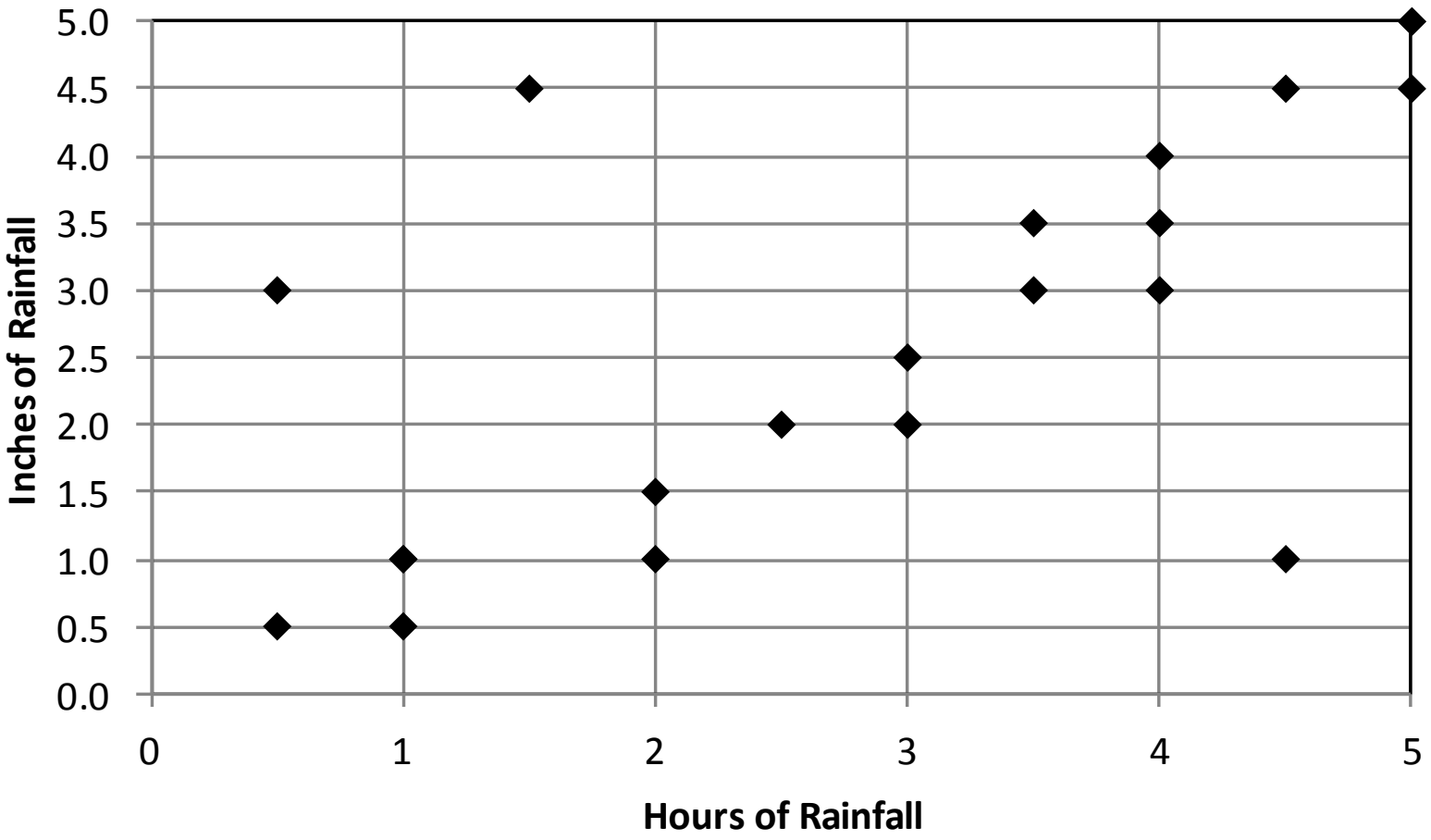
What is the median of the data for average high temperature for spring (green):

_____

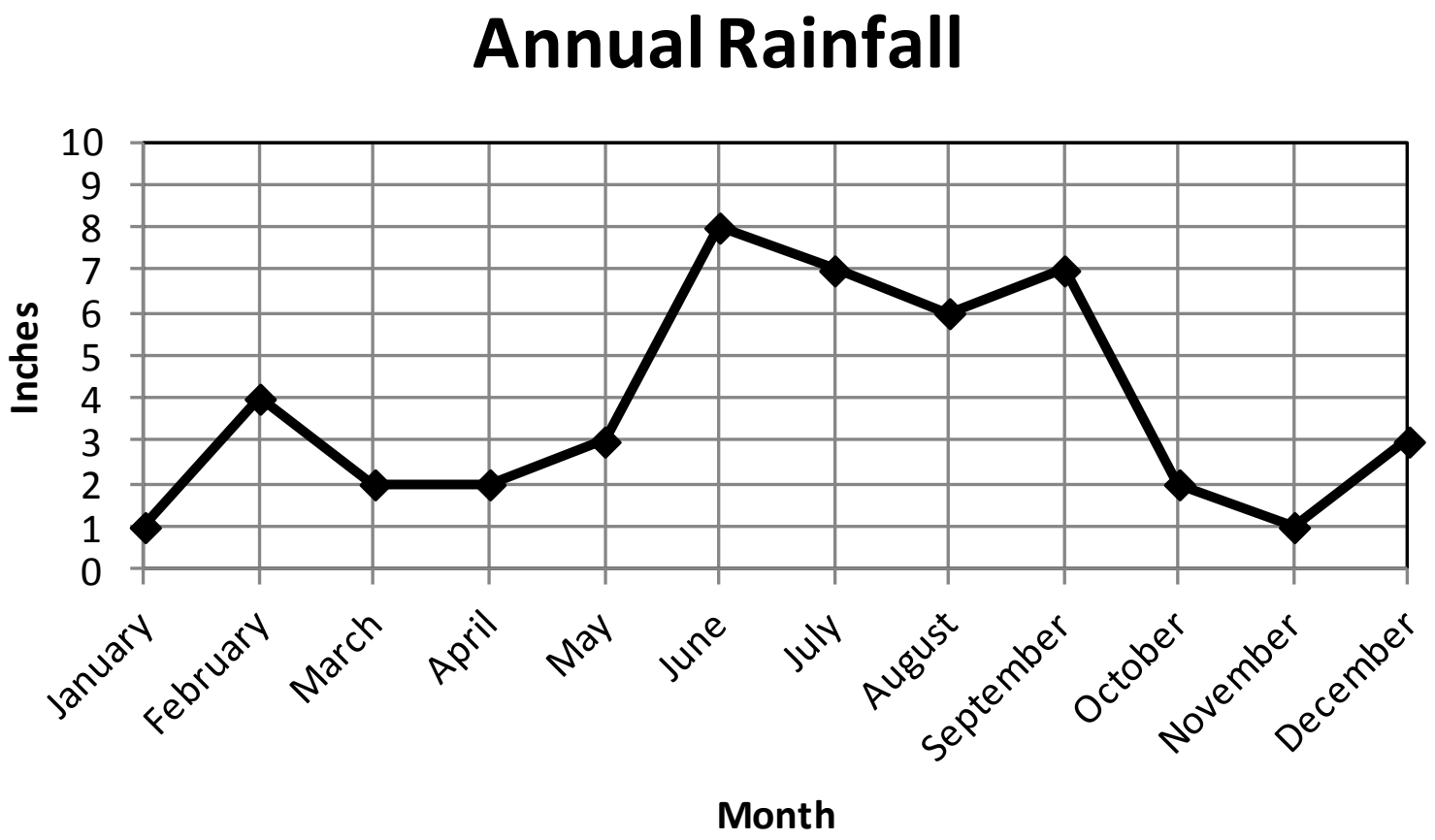
Median

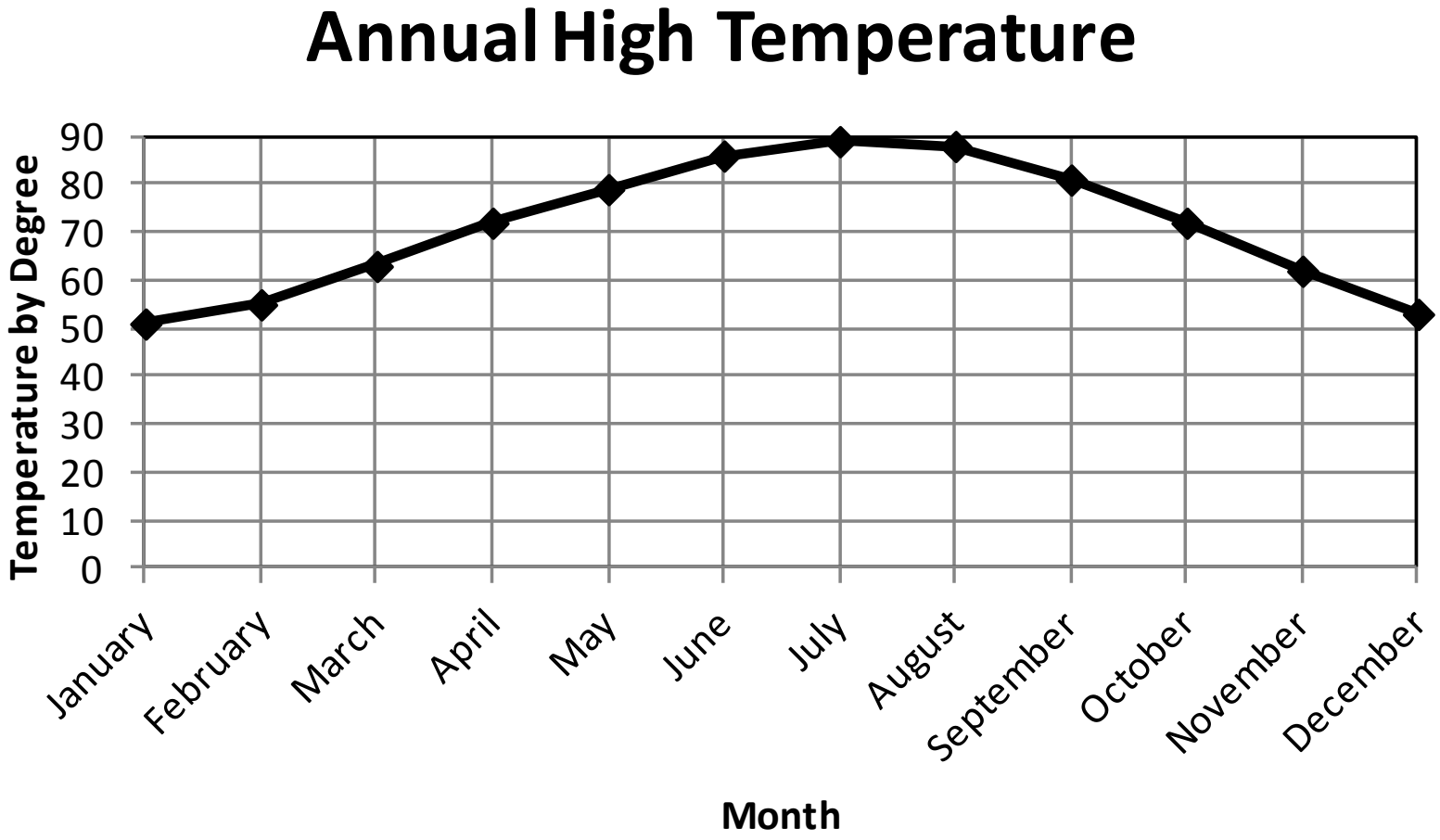
Materials:

Rainfall scatterplot



Month	Total Rainfall (Inches)	Average High Temperature
January	1	51°
February	4	55°
March	2	63°
April	2	72°
May	3	79°
June	8	86°
July	7	89°
August	6	88°
September	7	81°
October	2	72°
November	1	62°
December	3	53°

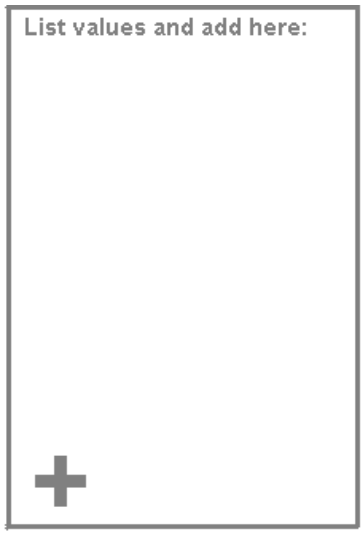

Annual Rainfall
Inches
10
9
8
7
6
5
4
3
2
1
0
January
February
March
April
May
June
July
August
September
October
November
December
Month


Annual High Temperature
Temperature by Degree
90
80
70
60
50
40
30
20
10
0
January
February
March
April
May
June
July
August
September
October
November
December
Month

Equation for Range:

highest value − lowest value = range

Equation for mean/average:



sum / number of values = average

Tuscan Yearly Rainfall

Month	Total Rainfall (Inches)
January	1
February	1
March	2
April	1
May	2
June	0
July	0
August	1
September	8
October	1
November	0
December	0