Curriculum Sample Template
Max. 8 Pages

Grade Level	6	**Content Area**	Mathematics
Course Title (grades 9-12 Only)			
Expected Prior Knowledge *The knowledge/skills mastered earlier in the year foundational to the mastery of the required Standard in the current sample.*	Students know how to construct and interpret dot plots and histograms. Conceptually, students understand statistical questions and data collection processes. Students have a procedural knowledge of how to organize a set of data in a table or chart. Students can also represent quantities with tables and charts.		
Alignment to Program of Instruction *Briefly outline methods of instruction found in this sequence of lessons that align to the Program of Instruction described in A.3.*	This sample also demonstrates the three distinctive features of SySTEM Phoenix's Program of instruction: 1) Integration: Math and Science standards are taught in a mutually reinforcing manner 2) Problem-Based Learning: The standard is introduced to students within the context of a real-world problem that they continually hook their new knowledge into in order to create a viable solution or make an evaluative judgment 3) All final products are authentic documents that students will present to an audience of stakeholders.		
Standard Number and Description *List the Number* and full description for the required Standard or Science Performance Objective listed in A.6.*	6.SP.2 Understand that a set of data collected to answer a statistical question has a distribution, which can be described by its center, spread, and overall shape.		
Materials/Resources Needed	Case Material: "Natural Disasters with the Worst Economic Impact" http://visual.ly/natural-disasters-worst-economic-impact Graphic Organizer: Know, Want to Know, How to find information, Learned, Still need to find out (KWHLS) Illustrative Mathematics: "Electoral College" Problem 1199, "Puppy Weights" Problem 1026 "Line Plot", "Describing Data Using Statistics"		

* ***Standard Number****: For English Language Arts (Reading and Writing), use Grade, Strand, Standard (e.g., 3.RI.2). For K-8 Math, use Grade, Domain, Standard (e.g., 6.EE.7). For HS Math, use Conceptual Category-Domain, Standard (e.g., A-REI.6). For Science, use Grade, Strand, Concept, PO (e.g., 4.1.3.1).*

Lesson (add as needed)	**Instruction**	**Student Activities**
1	***1. Essential Question:*** How can you summarize and display numerical data? ***2. Launch/Introduction:*** **The Case:** You are a Preparedness Analyst for the Arizona Division of Emergency Management. Over the past decade, natural disasters such as Hurricane Katrina and the Indian Ocean Earthquake have cost thousands of lives and billions of dollars in damage. Global warming advocates claim climate change has caused natural disasters to become more common and more dangerous than ever before. Others claim the earth naturally goes through cycles of high and low activity. Your task is to develop a report for the Federal Emergency Management Agency (FEMA) to answer the question "Are natural disasters becoming more dangerous over time?" Your challenge is to include the necessary data and graphical representations to support your position. ***4. Vocabulary:*** Student Glossary Graphic Organizer of Tier 2 academic) and Tier 3 (content) vocabulary. "Term, Definition, Example." Center, shape, spread ***5.*** The teacher will pose a statistical question (e.g. the length of pinky finger, number of people in their family). 7. The teacher will assist students in creating a common line plot using the same scale. Once determined, the teacher will use questions to guide a discussion through student observations about the center, spread, and overall shape of the data on the line plot. Based on student observations, the teacher will ensure the following aspects of the line plot are identified: shape, center, spread. The teacher will also ensure the following learning targets are formalized: *1) student can*	3. ***PBL Casework:*** **Meet the Problem:** Students will be organized into collaborative working groups of four, which will stay consistent throughout the entire case. *S*tudents will examine the case and get familiar with the provided case material. **Know/Need to Know:** Students will identify information and ideas into a KWHLS (see Resources) chart. The group facilitator will prompt group members to **Define the Problem Statement.** Though the definition of the problem may evolve as the team progresses. ***6. Survey***: Students will survey the class and, using the data generated, to create a line plot. Students will *attend to precision.* ***8. Reflection/Closure:*** How would the data representation differ if we included data from all the 7th and 8th grade students as well? Explain. ***9. Differentiation/Additional Exploration:*** Using the "Line Plots" Gizmo, students will build a data set using a line plot. ***10. Formative Assessment:*** Given two distributions, students are asked to make the observations about the shape, center, and spread of each. ***11. PBL Casework:*** **Explore:** Students will revisit their KWHLS chart and reflect on how their new knowledge relates to the case. In teams, students will create a plan to: gather information, acquire skills/knowledge, share information, and generate possible solutions. The group may delegate tasks to individual group members.

	represent data on graphs to show the shape of the distribution of data and 2) student can describe data by its center (median/mean).	
2	2. The teacher will guide a discussion about the advantages/disadvantages of each representation. Students will recognize that sets of data with a large spread are better represented in a histogram. ***4. Debrief/Summarize:*** The teacher will guide the class in a whole group discussion; students will present their analysis of the distribution in context of the electoral college. *Students will look for and make use of structure.* The teacher will ensure the following *learning targets are formalized: 1) student can analyze the data collected in response to a statistical question by its distribution and 2) student can describe the distribution of data by its center (mean, median and mode) spread (range), and overall shape.*	***1. Stimulus:*** Using Illustrative Mathematics "Electoral College" problem (1199), students will represent the data as both a histogram and a line plot. ***3. Investigation/Exploration:*** In groups, students will identify the data's distribution, including *center, spread, and overall shape of the data.* Next, students will analyze the distribution and consider what the shape description means in terms of the distribution, discern any outlier values, and defend which central measure best describes the data set. ***5. Reflection/Closure:*** When would the median be best to central measure to describe a distribution? When would the mean be the best central measure? Give examples. ***6. Differentiation/Exploration:*** Using the "Describing Data Using Statistics" Gizmo, students will investigate the mean, median, mode, and range of a data set through its interactive graph. ***7. Formative Assessment:*** Given a data set of data in the context of puppy birth weights from Illustrative Mathematics "Puppy Weights" problem (1026), students will: determine the appropriate graph to represent the data, describe the distribution by its center/spread/overall shape, and analyze the typical weight. ***8. PBL Casework:*** **Explore:** Students will revisit their KWHLS chart and reflect on how their new knowledge relates to the case. In teams, students will create a plan to: gather information, acquire skills/knowledge, share information, and generate possible solutions. The group may delegate tasks to individual group members.
3	***2. Debrief/Summarize:*** The teacher will guide the class in a whole group discussion; students will present their analysis of the distribution in context of the basketball team. *Students*	*1.* ***Stimulus:*** Students will *make sense of problems and persevere in solving them.* Provided a box score from a college or professional basketball game, students will pick out the points scored by each

	will construct viable arguments and critique the reasoning of others. Based on student observations, the teacher will ensure the following aspects of the distribution are identified: clusters, peaks, gaps, symmetry and shape. ***4.*** Throughout casework time, the role of the teacher is facilitative. The teacher will actively observe groups, help students with group dynamic issues if needed, ask probing questions and/or direct towards further resources. ***5. Direct Instruction/Workshop:*** The teacher will workshop how to use Excel to collect, organize, and represent data in a line plot and histogram. Students will *use appropriate tools strategically.*	player. After representing and describing the data, students will answer the following questions: 1. All players who don't score at or above the median points scored have to ride a stationary bicycle for 20 minutes. List the players who have to ride the bicycle and 2. The coach is trying to get the team to play more as a team. He is using the spread of the data as a way to determine if they are playing as a team. How might the coach use the spread to accomplish his goal? ***3. PBL Casework:*** **Explore:** Students will revisit their KWHLS chart and reflect on how their new knowledge relates to the case. In teams, students will create a plan to: gather information, acquire skills/knowledge, share information, and generate possible solutions. ***6. Formative Assessment:*** Students will select 25 data points from their casework to create a preliminary distribution. Students will describe data clusters, peaks, gaps, symmetry and overall shape. ***7. Differentiation/Exploration:*** Using the "Real-Time Histogram" gizmo, students will observe and measure the characteristics of the resulting distribution when large amounts of data are collected.
4	***1. Introduction:*** Teacher will review the product expectations/rubric for the PBL case. ***3. Conferencing/Feedback:*** As students continue their casework, the teacher may observe or participate in group dialogue. The teacher will conference with each group to ask probing questions and discuss components of the rubric. The teacher will record level of mastery of the standard demonstrated by the product thus far (adequate, proficient, expert)	***2. PBL Case:*** **Resolve:** Student groups will **determine the best fit solution** to the case and draft their report. Students will send their draft to an employee of Arizona Division of Emergency Management for feedback. ***4. Closure/Self-Assessment:*** Individually, each student will self-assess their learning through a written summary which details how their individual contributions furthered the group's effort in addition to a reflection of learning. Students will provide evidence of their efforts.
4	3. Throughout the revision/completion process, the role of the teacher is facilitative. The teacher will actively observe groups, help students with group dynamic issues if needed, ask probing questions and/or direct towards further resources.	***1. Summative Assessment:*** Students will take summative assessment. ***2. PBL Case:*** **Resolve:** Students will continue to refine their report and presentation based on the feedback received. 4. ***Closure/Group-assessment:*** Groups will meet for group self-

		assessment and score their presentation on final rubric. Each score must be supported with clear evidence.
5	2. The presentation cycle for each group will include: a) Group solution presentation, b) Open forum clarifying questions , c) Open forum probing questions, d) Community member feedback ***3. PBL Case: Resolve:*** After all presentations are finished, teacher will facilitate a **debrief of the problem**.	***1. PBL Case:*** **Resolve:** Student groups will **present the solution** to the case. 2. As groups present, all audience members, teachers, students, and community members will write down key points and questions. All participants will have the opportunity to ask follow up questions after each presentation. ***4. Closure:*** After group debrief, students will incorporate synthesis of learning experience into individual self-assessment.

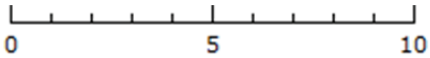
Summative Assessment Items: *Attach here.* For each summative assessment item, include an answer key or scoring rubric describing how points are to be awarded.

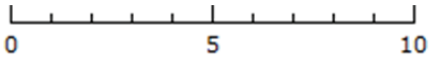
Type I:
A commute is the distance a person regularly travels between work and home each day. The data below records the daily commute for two different groups of students, 6th graders and high school seniors.

6th Grade Commute (miles)				
0	3	3	5	6
4	6	2	3	5
2	3	4	5	1
4	4	3	3	2

Senior Commute (miles)				
4	2	5	3	4
6	4	5	5	6
5	4	2	3	5
3	5	5	4	6

1. Construct a dot plot for each data set.



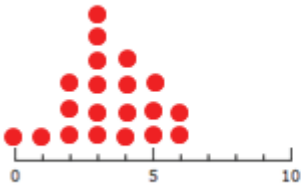


2. Calculate the following measures of central tendency for each data set.

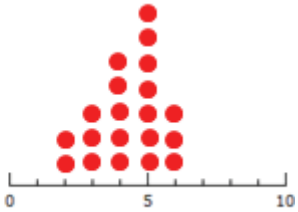
Mean:	Mean:
Median:	Median:

3. What observations can you make about the commute of each group of students?

SOLUTIONS

1.


6th Grader Commute (miles)



Senior Commute (miles)

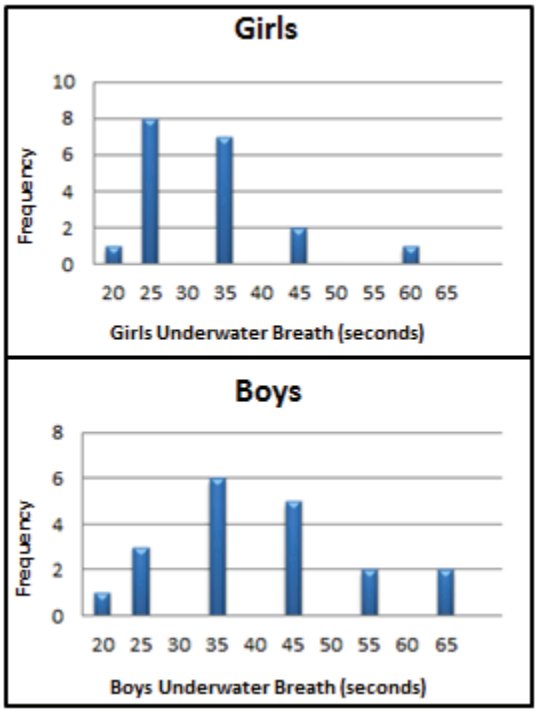
2. 6th Graders: Mean: 3.4, Median: 3 and Seniors: Mean: 4.3, Median: 4.5
3. 6th grade students generally commute shorter distances to school than seniors. 6th grade students generally commute 3 miles to school. Seniors generally commute 5 miles to school.

Scoring: This item represents a level 2 mastery of the standard. To achieve this level, students must answer 80% or more of the questions correctly. The student must demonstrate:

Student can represent data on graphs to show the shape of the distribution of data.

Students can describe data by its center (median/mean).

Type II:
Jenni and Jackson are having an argument. In science class, Jenni boasted that girls naturally hold their breath longer than boys. Jackson disagreed and stated that Jenni had no proof. Jenni and Jackson decided to resolve the matter by conducting a school-wide study. First, they collected data on the number of seconds a group of boys and girls could hold their breath underwater. Then, they displayed the data as a histogram.



1. Do the graphs have the same total number of data points? Are their intervals the same?
2. Identify the center, spread, and overall shape of the girl's data.
3. Identify the center, spread, and overall shape of the boy's data.
4. What does the range represent in this data sampling?
5. Who holds their breath the longest, a boy or a girl?
6. Who holds their breath the shortest, a boy or a girl?
7. Based on the data set, explain if Jenni or Jackson won the argument.

SOLUTION

Scoring: This item represents a level 3 mastery of the standard. To achieve this level, students must answer 80% or more of the questions correctly. The student must demonstrate:

Student can describe data using center (mean, median and mode) and spread (range), and overall shape.

1. Yes, both graphs have 19 data points. Yes, both intervals are the same.

2. Girls: Center: Spread: 40 Overall Shape: Left Skewed

3. Boys: Center: Spread: 50 Overall Shape: Balanced and/or Left Skewed

4. The range represents difference between the lowest and highest times for holding breath.

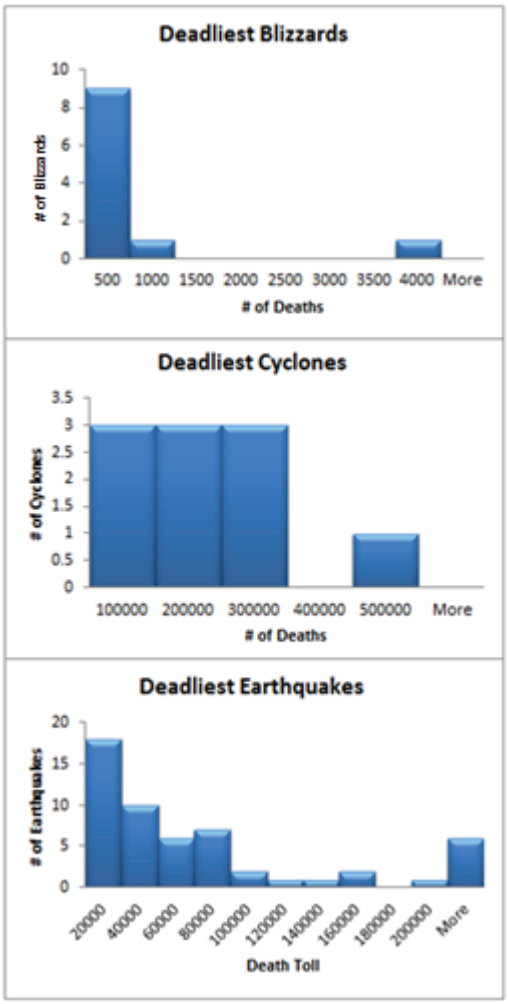
5. A boy, who held his breath for 70 seconds.

6. A boy or a girl. Both groups had a time of 20 seconds.

7. According to the data set, Jackson won the argument. The average time held for boys was 40.5 while the average time for a girl was 32.4.

Type III:

1. Describe the following features about each data distribution: data clusters, data peaks, gaps, symmetry, and overall shape.



2. Of the three natural disasters shown above, which is the most dangerous? What information provided by the distribution supports your claim?

SOLUTION

Scoring: This item represents a level 4 mastery of the standard. To achieve this level, students must answer 80% or more of the questions correctly. The student must demonstrate:

Student can describe data distribution by its data clusters, peaks, gaps, symmetry and overall shape.

1.
Blizzards: Data clusters around 500 deaths. Peak frequency of 9 blizzards. Gap between 1500 and 4000. Data is not symmetric and has an overall skewed left shape.

Cyclones: Data cluster between 100,000 to 300,000 deaths. No peak, but highest frequency of 3 cyclones. Gap between 300,000 and 400,000. Data is not symmetric, but has an overall constant/plateau shape.

Earthquakes: Data cluster between 0 to 20,000 deaths. Peak frequency of 18 earthquakes. Gap between 160,000 and 180,000. Data is not symmetric and has an overall left skewed shape.

2. Overall, both cyclones and earthquakes are more dangerous than blizzards, which cause much smaller numbers of deaths. While cyclones are extremely deadly, as can be shown by the high number of deaths they cause, earthquakes are the most dangerous as they happen more frequently and average a higher average of deaths.