Let's go measure in Valencia

By Rosa W. Bockian, 2015 CTI Fellow
Collinswood Language Academy

This curriculum unit is recommended for:
Math, Social Studies and Science/ Grade 3.

Keywords: Spain, measurements, pendulum, electromagnetic force, oscillation, data, average, unit square, pictograph, bar graph, line plot.

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: This unit is to expose the students to the City of Arts and Science in Valencia. While virtually touring the complex of five buildings, they will be measuring and collecting data to chart in different graphs. The graphs included in third grade Common Core Standards are pictographs, bar graphs and line plots.

They will solve problems involving measurements and estimation using the concepts of intervals of time; liquid volumes, and masses of objects in metric system.

I plan to teach this unit during the coming year to 45 students in Third Grade's Math/ Social Studies class.

I give permission for the Institute to publish my curriculum unit and synopsis in print and online. I understand that I will be credited as the author of my work.

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Overview

I was awarded a scholarship to study in Spain for two weeks. This opportunity was offered by the Department of Education through the Embassy of Spain in Washington, D.C. It was required to present a final project that was related to the culture and the language. This curriculum unit was created for that main reason. I expanded the unit to include classroom activities to be used as well for Charlotte Teacher Institute.

This unit will encompass many subject areas: Math, Social Studies, Science and Spanish. It will be taught in Spanish which is the target language in the immersion program at the school where I work. It will explore measurement and data according to the Math Common Core standards. It will allow the students to discover the region and culture where the City of the Arts and Science is located. It will identify some scientific concepts like how a pendulum works when affected by electromagnetic force.

School and Student Background

I am a third grade teacher at Collinswood Language Academy, a K-8 CMS Magnet Language School. It was the first bilingual immersion program offered in the state of North Carolina back in 1997. This is my third year teaching third grade after being an elementary teacher assistant for almost ten years in the Charlotte-Mecklenburg Schools district. I have a Language Arts- Science partner with whom I share my wonderful students as we switch at half day. That allows us to teach the required courses in our target languages: English and Spanish. Our school has been awarded many honors. In 2014, Collinswood Language Academy was awarded the Magnet Schools of America School of Excellence Award. In the same year, we received another award as the International Spanish Academy School of The Year.

Our mission statement is *"Celebrating World Cultures and Embracing Diversity Through Two Languages".* Our beliefs include that every child can learn to cherish diversity, build strong character traits and support the community for the common good.

The demographic of my school is about 45% Hispanic, 35% White and 20% Black American. Over half of the 750 students receive free or reduced lunch. Our program has high expectations for achievement as well as a high level of parent involvement; even though the previous percentages should show a different outcome.

To keep up with the pace of higher education and modern technology, all our classrooms are outfitted with Smart Boards, document cameras, and Smart TVs in the Special Areas' classrooms. Last year, we acquired iPads and Chromebooks for all the students to enhance our teaching standards.

I plan to teach this unit during the coming year to 45 students in my 3rd Grade Math/ Social Studies class. I use a simple system to encourage students to participate and demonstrate good citizenship in our classroom community. I give out stickers, which they collect on a sticker chart and for which they are completely responsible to keep secure. They earn stickers for making the right choices: finishing classroom work in a timely manner, participating in our daily discussions, and doing their weekly jobs to improve the living conditions of our small classroom community.

They lose stickers for not following our classroom rules, interrupting our learning time, and not completing classroom work. This small community atmosphere that I try to create in the classroom reflects the life of any citizen in a real town. As a resident, you get rewarded for your hard work with your paycheck or getting a promotion; or receive consequences like losing your job for not completing your work. This atmosphere allows my students to realize that anything they do can influence their lives and the lives of the people around them, in a positive or negative way.

Rationale

I had been awarded a scholarship to study the Spanish Language in Santander, Spain on July 2015. We were required to turn in a project that illustrates the culture and the language that we were exposed to. At the same time, I had to create a curriculum unit for Charlotte Teacher Institute, so I decided to create a curriculum unit along with a project that serves a dual purpose. I decided to make a curriculum unit about measurements using the City of the Arts and Science in Valencia, Spain.

I foresee my students applying in their daily live what they had learned in the classroom as part of this curriculum unit. I expect them to become proficient in measuring and collecting data. After the collection of measurements in diverse settings, they will chart the data in several graphs to extract information. They will answer statements like 'how many more?' or 'how many less?'; which is one of the many standards for Common Core.

Content Objectives/ Essential Questions

Math Objectives of this unit:

1. Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).

2. Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories.

3. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.

4. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch to relate to the concept of fractions. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units – whole numbers, halves, or quarters.

Social Studies Objectives for this unit:

As part of the third grade Social Studies curriculum, we study what makes a community thrive by discovering its location, economy and culture.

1. Understand how the location of regions affects activity in a market economy.

2. Understand how diverse cultures are visible in local and regional communities.

Essential Questions (note that the pendulum activity is described in detail below):

The students will collect measurements from the pendulum experiment to answer the following questions.

How far did the pendulum travel in a single oscillation?

Which is the average distance for an oscillation?

What factors did you observe that could affect the swinging of the pendulum?

What makes the pendulum slow down and eventually stop?

More Essential Questions:

How far is Charlotte, NC from Valencia, Spain?

Which land feature harbors The City of Arts and Science?

Teaching Strategies

The activities planned for this unit will enrich the knowledge of the students by integrating tangible materials to assist in their learning.

Each activity is composed of several teaching strategies like personal observations, visual aids including SmartBoard presentations, web research, data analysis and writing exercises to cover the different learning styles present in the classroom. I will give assessments to the students in accordance with the national and state common core state standards.

Background Information on the Curriculum unit

I will introduce the City of the Arts and Science with a short video that gives an overview of the six buildings that frames the complex. Here is the link to the video: https://www.youtube.com/watch?v=0neu8H9ewYA,

We will visit virtually the L'Oceanografic by watching the following video https://www.youtube.com/watch?v=SOGOBprQoXU. Then, we will visit the Museum of Science Prince Felipe and one of its main exhibits the pendulum of Foucault. Here is the link to the virtual tour of the science museum: https://www.youtube.com/watch?v=9NubUMbAlY8. I will explain how the pendulum works and show this video https://www.youtube.com/watch?v=0cJosxIWISo.

Classroom Activities

Activity One

To introduce this unit, the students will watch an introductory video of the City of the Arts and Science in Valencia, Spain.

After watching this video, they will create a KWL chart to compile ideas on what they already know and what they would like to learn about the exhibits of the museums and about measuring throughout the study of this curriculum unit.

What I know	What I want to learn	What I learned from unit
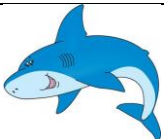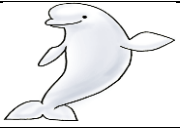
Activity Two

The students will make a tally chart of their favorite aquatic animals that they observed in the virtual tour of L'Oceanografic. Then, we will create a chart showing the results. Using this information, they will create a pictograph to show the results from the chart.

Tally Chart

Aquatic Animal	Tally
Ex. Angel fish	1111
eel	11

Pictograph- Which are the favorite aquatic animals for Third grade?

Aquatic Animal	Results
fish	
eel	
sea horse	
manta ray	
shark	
beluga whale	
= 5 students	

Activity Three:

The students will research several types of sharks to find their average number of teeth. Then, they will create a horizontal bar graph with the information.

Horizontal Bar Graph

Type of shark/ average number of teeth	Number of teeth
Zebra shark- 25 rows of teeth	
Hammerhead shark-17 rows of teeth	
Great white shark- 6 rows of teeth	
Whale shark- 300 rows of teeth	

Number of teeth   0   10   20   30   40   50

Activity Four:

We will build a pendulum for the science experiments. You will need the following materials: a long piece of string of at least one meter long, some metal wire to make a hook, washers or nuts of the same weight, a piece of cardboard, a pencil, tape and a stopwatch.

Here are the steps how to build it:

- Tape the pencil firmly to the top of the table, leaving it about 4cm hanging over the edge.

- Make a loop in the string to fit at the end of the pencil, but do not make it too tight.

- At the other end of the string, tie the hook and slide one of the washers or nuts onto the hook.

Put a piece of cardboard flat under the pendulum to mark the place where you are starting to swing to make sure you start from the same place.
- Make sure that everything swings freely.

Activity Five:

I will explain how the pendulum works and show this video to illustrate how it works. The link to the video is https://www.youtube.com/watch?v=iqpV1236_Q0.

This is a hand- on activity with a pendulum to observe how it works. The students will collect measurements with a metric tape in a worksheet to use for graphing in a later activity. There are three possible experiments that can be done.

Experiment One- changing the weight at the end of the string.

In this experiment we are going to find out what effect changing the weight/ mass on the string has on the swing of the pendulum. Here are the steps:

1. Take the string back about 40 - 50 cm. You must mark the cardboard to make sure that you let go from the same place every time.

2. After you let go, start the stop-watch, and count the number of oscillations in one minute.

3. Repeat the experiment 3 times and calculate the average.

4. Put another weight on the hook. Release the weight from exactly the same place. Calculate the period as before.

5. Repeat 3 times and average the results

Experiment Two - changing the angle

In this experiment, we are going to change the angle from where we release the pendulum. Here are the steps:

1. Start again with the original weight you had before in the previous experiment.

2. Take the string back only about 20 cm make a mark on the cardboard as before.

3. Let go and count the number of periods for one minute

4. Repeat 3 times, and then find the average.

Experiment Three- changing the length of the string

We are exploring what will happen when you change the length of the string.

Here are the steps:

1. Take the string of the pendulum and cut off about 20cm. You could also make a shorter string and attached it to the pencil taped to the table.

2. Take the pendulum back to the same angle and let go. Repeat 3 times, and take the average of the periods.

3. Take off another 20cm the string, replace the weight, and try again.

Please see the worksheets for Data Collection for these experiments on Appendix 2.

Activity Six:

The students will make a bar graph with the data collected in grid paper.
Activity Seven:

There will be a survey to collect data about their favorite exhibit in the museums from the virtual tours' videos shown about the City Of the Arts and Science. Then the students will choose either a pictograph or a bar graph to show the results pooled for the class.

Survey about their favorite exhibit

Favorite Exhibit	Tally
Pendulum of Foucault	
Electricity	
Superheroes	
Aquarium with fishes	
Shark tank	
Beluga whale exhibit	

Exit Ticket- the student will create a pictograph or a bar graph showing the results of the survey about their favorite exhibit.

Activity Eight:

There will be a written reflection about the activities previously done. The student will generate questions from the graphs created in this unit.

Some examples could be:
1. How many students like the beluga whale?
2. How many more students like the seahorse than the eel?
3. How many less students like the manta ray than the shark?
4. How many more teeth have the whale shark than the zebra shark?
5. How many less teeth have the great white shark than the hammerhead?
6. How many more oscillations have the lighter weight than the heavier?
7. How many less oscillations have the longer string than the shorter?
8. How many students preferred the Pendulum of Foucault?

Activity Nine- Assessment (See appendix 2)

List of Materials for that will be use in the classroom:

• SmartBoard presentation and a document camera that will help clarify some points of interest in the presentation.

• Books discussed in the unit. (See appendix 2)

• A pendulum.

• IPad and Chromebooks to research some topics of interest.

• Student Writer's Notebooks

Appendix 1: Implementing Common Core Standards

This curriculum unit will include the following Math Common Core Standards:

3. MD.1 Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

3. MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). (Note: Excludes finding the geometric volume of a container.)
Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem.

3. MD.3 Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 pets.

3. MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units – whole numbers, halves, or quarters.

This curriculum unit will illustrate the following Science Essential Standards:

3. P.1.1 Infer changes in speed or direction resulting from forces acting on an object.

3. P.1.2 Compare the relative speeds (faster or slower) of objects that travel the same distance in different amounts of time.

3. P.1.3 Explain the effects of earth's gravity on the motion of any object on or near the earth.

This curriculum unit will explain Social Studies Essential Standards:

3. G.1 Understand the earth's pattern by using the 5 themes of Geography: location, place, human environment interaction, movement and regions.

3. G.1.3 Exemplify how people adapt to, change and protect the environment to meet their needs3. E.1 Understand how the location of regions affects activity in a market economy.

3. E.1.2 Explain how locations of regions and natural resources influence economic development (industries developed around natural resources, rivers and coastal towns).

3. E.2.2 Compare Earth's land features (including volcanoes, mountains, valleys, canyons, caverns, and islands) by using models, pictures, diagrams, and maps.

3. C.1 Understand how diverse cultures are visible in local and regional communities.

3. H.1.2 Analyze the impact of contributions made by diverse historical figures in local communities and regions over time.

3. H.1.3 Exemplify the ideas that were significant in the development of local communities and regions.

This curriculum will show World Languages Essential Standards:

1. Use the language to engage in interpersonal communication.
2. Understand words and concepts presented in the language.
3. Use the language to present information to an audience.
4. Compare the students' culture and the target culture

Appendix 2:

Resources

For Teachers

Worksheets for Data Collection on the pendulum experiment:

Data Collection for pendulum experiment

Experiment 1- changing the weight

Weight	Trial 1	Trial 2	Trial 3
Weight 1			
Weight 2			

Experiment 2- changing the angle

Angle	Trial 1	Trial 2	Trial 3

Weight 1 with angle 1			
Weight 1 with angle 2			

Experiment 3- changing the length of string

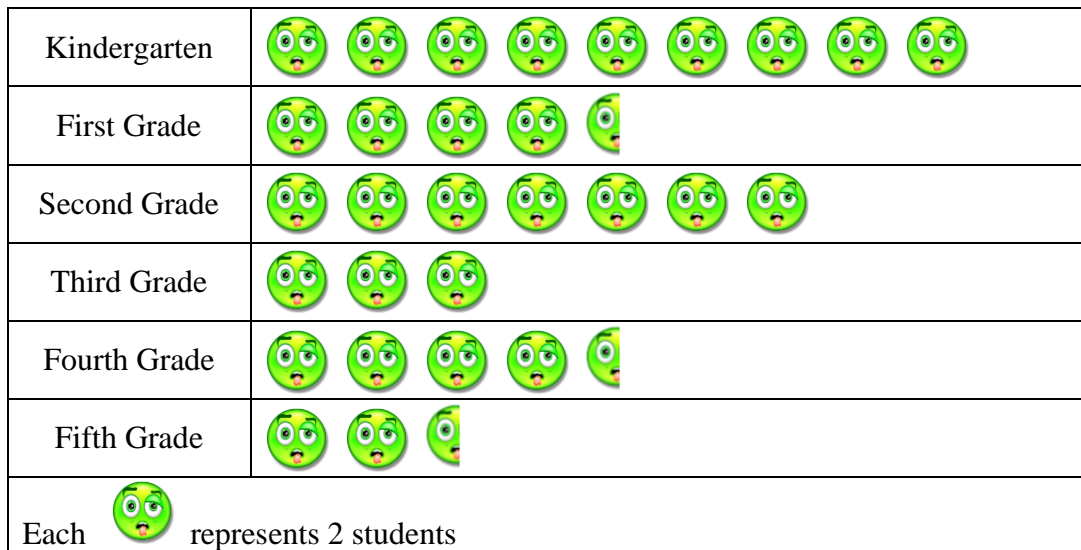| Length	Trial 1	Trial 2	Trial 3
Weight 1 with length 1			
Weight 1 with length 2			

Assessment at the end of the unit:

Name: _____   **Date:** _____

Scaled Picture Graphs 1: 3.MD.3 Draw a scaled picture graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using the information presented in the graph. For example, draw a picture graph in which each picture in the graph might represent 5 items.

The principal at Collinswood Language Academy decided to keep track of the numbers of absences each grade level in her school.   She made a scaled picture graph to show the results for February.

Collinswood Language Academy Absences in February

|	
Kindergarten	😵 😵 😵 😵 😵 😵 😵 😵 😵
First Grade	😵 😵 😵 😵 😵
Second Grade	😵 😵 😵 😵 😵 😵 😵
Third Grade	😵 😵 😵
Fourth Grade	😵 😵 😵 😵 😵
Fifth Grade	😵 😵 😵

Each 😵 represents 2 students

1. How many kindergarten students were absent in February? _____ (1 pt)

2. How many fourth grade students were absent in February? _____ (1pt)

3. The principal noticed that many K-2 students were absent. How many K-2 students were absent in February? _____(2pts: equation + total)

4. How many less 3-5 students were absent than K-2 students? (2pts: equation + total)

5. How many more second grade students were absent than third grade students? (2pts: equation + total)

6. What was the total number of absences for February? _____ (2pts: equation + total)

Scaled Picture Graphs 2:
A group of third graders were surveyed to find their favorite way to spend their free time. They put all of the results into six categories: Playing Sports, Reading, Crafts and Drawing, Playing Games, Building (i.e. forts, Legos), and Watching Television. They created a scaled picture graph to show the results.

Favorite Way to Spend Free Time for Third Graders

Sports	🕐 🕐 🕐 🕐 🕐 🕐 🕐
Reading	🕐 🕐 🕐 🕐
Crafts/Drawing	🕐 🕐 🕐 🕐 🕐
Games	🕐 🕐 🕐
Building	🕐 🕐 🕐 🕐 🕐 🕐 🕐 🕐 🕐 🕐
Television	🕐 🕐
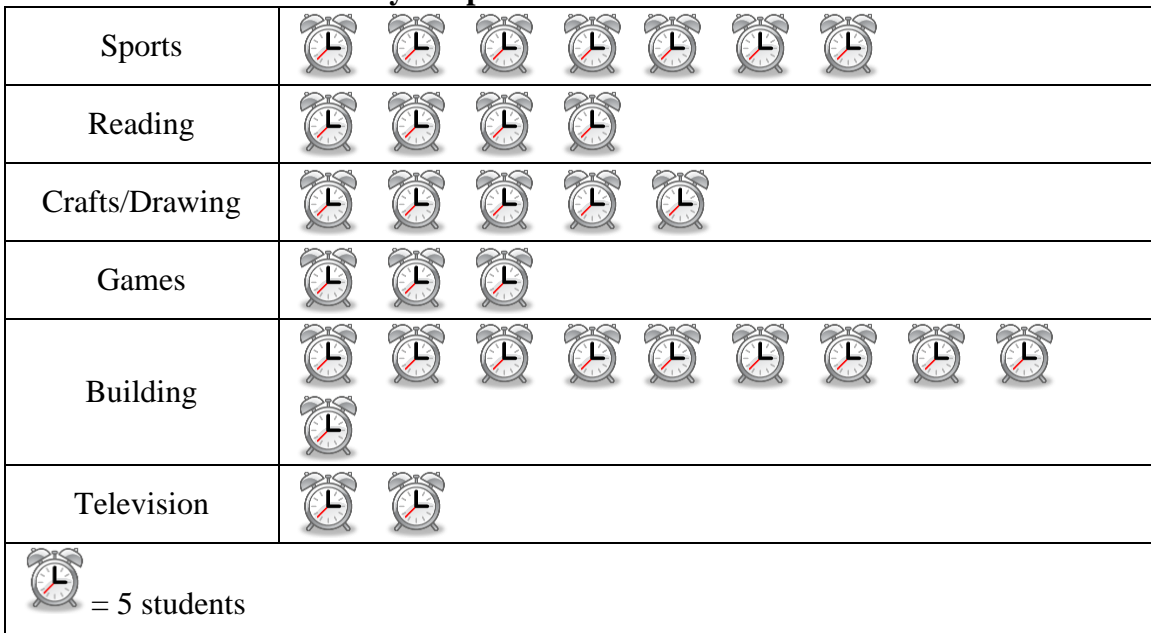
🕐 = 5 students

1. Students who enjoy strategizing usually chose sports or games. How many students chose sports or games? (2pts: equation + total)

2. Students who enjoy creating usually chose Crafts/Drawings or Building. How many students chose Crafts/Drawings or Building? (2pts: equation + total)

3. How many less students chose television than reading? (2pts: equation + total)

4. How many more students chose building than games? (2pts: equation + total)

5. How many students were surveyed? (2pts: equation + total)

Horizontal Bar Graph 1: 3.MD.3 Draw a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using the information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 items.
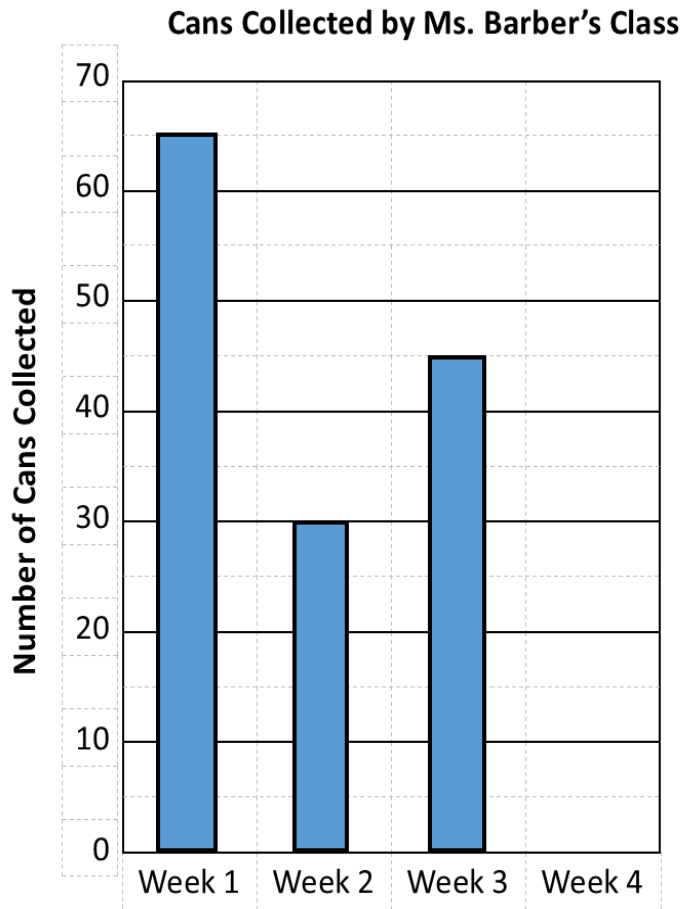
Lydia is practicing for a bicycle race. She is practicing riding every day. She created a graph to show how many miles she practices each week.

Miles of Bike Practice for Lydia
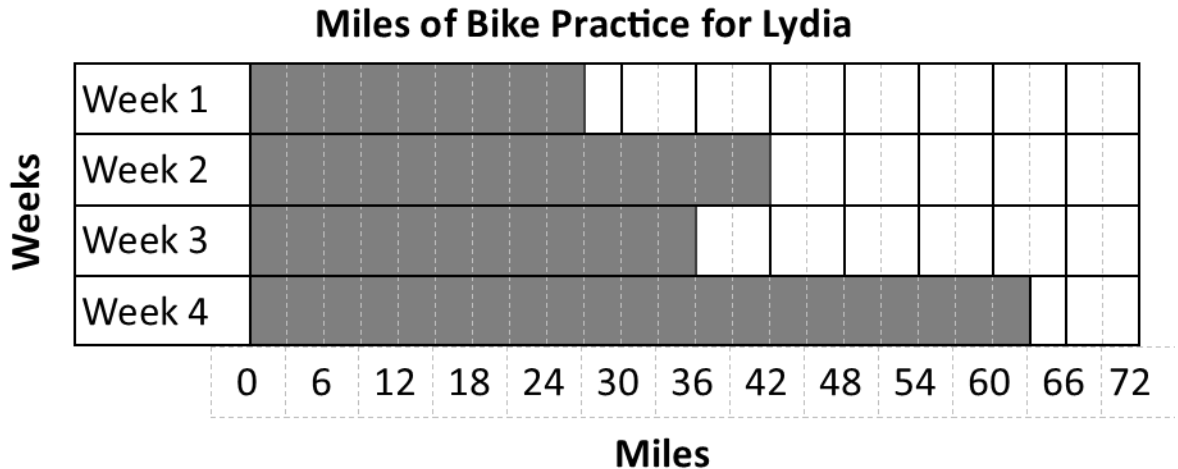
1. How many miles did Lydia practice for during Week 4? _____ (1 pt)

2. How many less miles did Lydia practice Week 3 than Week 2? (2pts: equation + total)

3. Did Lydia practice more miles during Weeks 1 & 2 or during Weeks 3 & 4? How many more miles? (**3 pts: equations + total**)

4. If Lydia wants to practice for 100 miles during Week 5, how many more miles will she need to ride than on Week 4? (2pts: equation + total)

5. If Lydia rides 100 miles during Week 5, how many miles will she have practiced for so far? (2pts: equation + total)

Vertical Bar Graphs 1: 3.MD.3 Draw a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using the information presented in scaled bar graphs. For example, draw a bar graph in which each square in the bar graph might represent 5 items.

Ms. Barber's class wants to donate 200 cans of food to the local homeless shelter. They are collecting cans over a 4-week period. This graph shows how many cans they have collected in the first three weeks.

Cans Collected by Ms. Barber's Class

(Bar graph — Y-axis: Number of Cans Collected, 0 to 70. Week 1: 65, Week 2: 30, Week 3: 45, Week 4: 0)

1. How many cans did Ms. Barber's class collect the first week? _____

2. How many fewer cans did Ms. Barber's class collect the second week compared to the first week? _____

3. How many cans has Ms. Barber's class collected so far? _____

4. How many more cans does Ms. Barber's class need to collect during Week 4 in order to make their goal? _____

Reading List for Teachers and students that you could use for this unit:

Graph Math books:

1. **Family Reunion** by Bobbie Bader and Mernie Gallagher Cole has a graph project that he does at his family reunion, and use data about family members to make a pie, bar, and line graphs. It was previously titled Graphs.
2. **Tiger Math** by Ann Whitehead Nagda & Cindy Bickel- TJ an orphan tiger is raised by the staff at Denver Zoo. The book shows different charts and graphs showing his growth.

3. **Lemonade for Sale** by Stuart Murphy and Tricia Tusa- friends start a lemonade stand and graph their sales.
4. **The Great Graph Contest** by Loreen Leedy- two friends compete to see who can make the best graph and in the process, they explore (1) data collection methods like surveys and tallies, and (2) graphing methods like line graphs and bar graphs.
5. **Less than zero** by Stuart Murphy & Frank Remkiewicz- a penguin wants a new scooter. He tracks his earnings doing odd jobs and graphs to see his progress.
6. **Pictografias/Pictographs** by Vijaya Khisty Bodach- pictographs make it easy to compare numbers.
7. **Investigating Graphs** by Ed Catherall and David Anstey- gives instruction in making and using pictographs, bar graphs, circle or pie graphs, and line graphs

Science books:

1. **A Little Book of Pendulum Magic** by D.G. Conway- a book that explains how a pendulum works.
2. **1000 Facts on Sharks** by Claybourne, A. - an amazing guide to the lives and habits of these fishes. It has short facts with pictures.
3. **Sharks Keep Losing Their Teeth: And Other Amazing Facts about Sharks** by Claire Llewellyn, Darren Harvey, Jo Moore, Darren Harvey
4. **National Geographic Kids Everything Sharks: All the Shark Facts, Photos, and Fun That You Can Sink Your Teeth Into**

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