Number Rights & Pearl Diver Teacher Guide

Number Rights and *Pearl Diver* are available at mathsnacks.org . *Number Rights* is available on iTunes U (search "Math Snacks") and *Pearl Diver* at the iOS App Store.

Topic: Number line

Time Required: Two class periods

Learning Objectives: after watching the animation, completing the activities in the Learner Guide, and completing at least one bonus activity, students will understand:

- Properties of numbers as shown on the number line.
- How to plot numbers on the number line.
- How to visualize quantity on the number line.
- How to order numbers on the number line.
- How to use the number line as a visual model for mathematical operations (addition and subtraction).

Vocabulary: Number line, fractions, decimals, whole numbers, numerator, denominator, negative numbers, equivalent numbers

Vocabulary in Spanish: Línea numérica, fracciones, decimales, números enteros, numerador, denominador, números negativos, números equivalentes

Materials and Technology required:

- Computer, LCD Projector, Access to Internet or animation
- Copies of numbers for human number line

Common Core State Standards Covered:

Standard	Standard Description
2.MS.2	Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of unit chosen.
3.NF	**Develop understanding of fractions as numbers.**
3.NF.2	Understand a fraction as a number on the number line; represent fractions on a number line diagram.
4.MD	**Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.**
4.NF	**Understand decimal notation for fractions, and compare decimal fractions.**
4.NF.7	Add, subtract, multiply and divide decimals to hundredths, using concrete models or drawings or strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Compare two decimals to hundredths by reasoning about their size....
4.NF.8	Use proportional relationships to solve multistep ratio and percent problems.
6.NS.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values.... use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
6.NS.6	Understand a rational number as a point on the number line. Extend the number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

Common Core State Standards Covered continued:

Standard	Standard Description
6.NS.6a	Recognize opposite signs of numbers as indicating locations on oppositive sides of 0 on the number line; recognize that the opposite of a number is the number itself, e.g. -(-3) = 3, and 0 is its own opposite
6.NS.7	Understand ordering and absolute value of rational numbers
6.NS.7a	Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram.
6.NS.7b	Write, interpret, and explain statements of order for rational numbers in real-world contexts.

Preliminary Preparation

Day 1*: Number Rights* Animation and Lesson:

- Watch the "Teaching with *Number Rights*" instructional video
- Create number cards using blank pieces of paper or large index cards. Make sure to write the numbers large enough to be seen if held up in front of the class. (See numbers below.)
- Make plenty of copies of the learner guide for students to use.
- Go to mathsnacks.com website and make sure the *Number Rights* animation is working for you. If you are using iPads to view the animation, make sure to download the Math Snacks Video Player from iTunes prior to class.

Day 2: Pearl Diver:

- Make sure you have access to a computer lab, a mobile computer lab, an iPad cart or an iPod Touch cart. It is preferable for each student to have access individually, but if necessary, students can be paired up to use the device.
- More than 2 students per device is not recommended.
- Give students a table or template to record their scores for the Pearl Diver Game. A sample is provided below.
- Have an area in the class-(overhead, board, large paper) where you can record scores for the Pearl Diver Game. We would recommend at least three spaces for the following: Highest score, Highest Average score, and Most improved score.

Animation Viewing and Discussion Questions

Tell students: *I want each of you to take out a blank piece of paper and draw a number line on it. I'm going to give you a couple of minutes to complete this. Put your name on the paper and pass it forward.*

On the overhead or on the board, have the following discussion using the following questions: (5 min)

1. What do you think a number line is? Write down student responses for use at a later time.
2. What does a number line look like? Ask students to tell you how to draw a number line on an overhead or on the board.
3. What are some things we should keep in mind when we draw a number line? (Check for understanding in terms of numbers evenly spaced, arrows at the end of each line to show that the line is infinite in both directions, etc.)

Tell students: *Now we are going to watch a short animation.*

Show the *Number Rights* animation. Ask the students what they think about the animation in general, but not specifically about the math. (3 min)

Prepare to show the animation for a second time. Tell students: *This time when you watch the animation, pay attention to the types of numbers you see on the number line, and write down all of the math vocabulary words you hear during the animation.* (3 min)

Animation Viewing and Discussion Questions (continued)

After the animation is over, ask the following questions: (10 min)

1. Have you ever seen fractions or decimals on a number line before? Do you think they belong there? Why or why not? (The goal of this question is for students to understand that the number line is just a visual representation of numbers and all numbers can be represented on it.)
2. According to the animation, are there any numbers that are more important than the other numbers on the number line? (The goal of this question is for students to understand that zero holds a special place on the number line.)
3. How does the number line help you visualize the position of numbers in relation to other numbers – both positive and negative?
4. What are some of the vocabulary words you heard in the animation? (Write them down.) What are some different ways of expressing ratios, e.g., 1:7, 1/7, or 1 to 7? Can you think of situations where one expression might be more appropriate to use than another?

Bonus Activity (15 minutes)

Human Number Line

1. Divide students into groups of 8–10 students
2. Make cards or signs on index cards or copy paper with the following numbers: 0,1⁄4, 2.5,-5,- 5/8, -2, 3/2, 4, -1/3, -2
3. Give each group the same set of numbers and ask them to line up from smallest to largest. Have the groups compare their results. Discuss any discrepancies, if they exist.
4. Once the order is agreed upon, have the whole class decide what the number line should look like. Have them give you a lower bound and upper bound and make sure benchmark numbers are evenly spaced. Draw the basic number line on the overhead or on the board and have each student place their number on the number line.
5. Assign new numbers and repeat the activity. This can be made increasingly difficult by adding fractions, mixed numbers and decimals. It is not necessary to give each group the same numbers this time. In fact, having students do this activity with different numbers will lead to a richer discussion.
6. Have students line up, and then have them create an appropriate number line and place their numbers on that number line to share with the class.

Have a final discussion about this number line activity, including about equivalent numbers, the importance of zero and the significance of spacing.

Learner Guide Discussion

Pass out the *Number Rights* Learner Guide. Have students work alone or in pairs to complete all of the problems. Before students begin working, go over each problem and have students ask questions if they do not understand what is being asked. The concepts covered on the Learner Guide are as follows:

- Equivalent numbers: Pay special attention to 3.5 (1)
- Placing decimals and fractions on a number line (2)
- Addition and subtraction on a number line (3)
- The importance of zero (4)
- Using a vertical model of a number line (5)

Make sure to go over the Learner Guide with the students to clear up any misconceptions.

Depending on the length of the bonus activity, students may need to take the Learner Guide home for homework, and the discussion may need to take place on day 2.

Day 2: Pearl Diver

Pre planning:

1. Have all computers/iPads/iPods ready to go with *Pearl Diver* game.
2. Create an area on the board, overhead, large paper or other location to record student scores.
3. Finally, have a few prizes ready for students, or just offer extra credit!
4. Give students a piece of paper that looks like the following table.

	Game	Score
1		
2		
3		
4		
5		

***Pearl Diver* Introduction:**

Today we are going to play a game called Pearl Diver. I want you to keep track of your scores each time you play. After the end of each game, write down your score. If you run out of room on your scoring form, just keep recording your scores. At the end, we are going to be giving prizes for the following:

- High Score
- Most Improved Score (highest minus lowest)
- Highest Average Score (average of top three scores)

- Allow students to play Pearl Diver for 20 min. Have students record their scores after each complete game.
- On the class scoreboard, have students write down the high scores.
- Have them determine their highest score, their most improved score and the
- average of their highest three scores.
- If there is time, have students place their high scores on a number line.

***Pearl Diver* Discussion Questions:**

1. Did you like playing *Pearl Diver*?
2. Was it easy or hard?
3. When did it get hard?
4. What kinds of numbers were there on the number lines in the game?
5. What did you think of the Sushi Round? What do you need to understand to do well on this part?
6. What clues did you use to know where to dive when the numbers got harder?
7. Would you like to play this game again?

Encourage students to play *Pearl Diver* at home tonight and share it with their families.

The Bow (Tie it all together to bring out the main ideas)

- What are some of the important elements of a number line?
- Why is zero important?

Pass out the number line the students drew at the beginning of the lesson.
Ask students to look at it and to make any changes they need to, then ask them to add the following elements: 3 decimals, 3 fractions, 3 equivalent numbers

This can be used along with the Learner Guide for assessment purposes.
The important elements to bring out during this final discussion are as follows:

- The fact that the number line is a visual representation to show the relationship between numbers including fractions, decimals and mixed numbers
- The importance of zero, spacing, arrows and the concept of infinity, benchmark numbers
  - In other words, if the numbers you want to place on a number line are all fractions, the benchmarks may be 0 and 1. However, if the numbers are between -1,000 and 3,000; the benchmark numbers may be thousands. This can be a reference for future activities when students are doing graphing and have to set up appropriate points on the x and y axis.