

Pearl Diver

Time Required:

40 minutes per session, minimum

Vocabulary:

Halves, thirds, fourths, sixths, mixed number, fraction, decimal, equivalent number, negative number, whole number

Learning Goals:

By playing *Pearl Diver* and engaging in at least one of the recommended bonus activities, students will:

- Understand numbers, ways of representing numbers, and number systems.
- Visualize equivalent representations of commonly used fractions.
- See fractions as part of unit wholes.
- Find negative numbers, fractions and decimals on a number line.
- Compare and order fractions while finding their approximate locations on the number line.

Common Core State Standards Covered:

2.MS.2	Measure the length of an object twice, using length units of different lengths for the two measurements; describes 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	Compare two decimals to hundredths by reasoning about their size....
4.NF.8	Perform operations with multi-digit whole numbers and with decimals to hundredths.
5.NBT	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.
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.
6.NS.6a	Recognize opposite signs of numbers as indicating locations on opposite 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:

1. Please play the game so that you understand the game mechanics and how the math concepts are taught during gameplay. The games are intended to be a fun way for students to learn and you will learn along with them.
2. Secure the proper number of computers, iPads, iPod touches for students to play the game.
3. Please remember that Pearl Diver can be played in multiple ways: individually, in pairs, in small groups, or in one large group, using a Smart board, depending on the technology available in your classroom or computer lab.
4. Have an area on the board, overhead, large paper or other location to record your student's scores.
5. Have a few prizes ready for students or offer extra credit for high scores!
6. Create a handout or have student record their scores for at least 5 games using the table below.

Game	Score
1	
2	
3	
4	
5	

HIGH SCORE: _____
 RANGE OF SCORES: _____
 HIGHEST AVERAGE SCORE: _____

Materials and Technology required:

- Access to computers and the internet
- The Learner Guide

Initial Game play:

1. Allow students to play the game for 15-20 minutes.
2. Have students pause the game, and lead a discussion with the students about the gameplay.

- a. What do you like about this game?
 - b. Did any of you have a hard time figuring out how to play?
 - c. Can anyone give classmates any hints about how to play the game better?
 - d. What math do you see in this game so far?
 - e. What do you think the game is trying to teach you?
 - f. Have you ever seen a number line with fractions on it before?
 - g. When does the game get more challenging?
 - h. What clues did you use to know where to dive?
 - i. Could you create a Pearl Diver level that has different (e.g. bigger or irrational) numbers?
 - j. RECORD HIGH SCORES ON THE BOARD
3. After the discussion, allow students to continue to play the game.
 4. After 10-15 minutes, offer a challenge to the students. Have a number line on the board (written or digital) and ask students to plot points. Start with positive whole numbers and then expand to negative numbers, decimals and fractions as they become more comfortable with those concepts.
 5. Students will not necessarily finish all levels of a game in one class period. Each game is designed to accommodate various levels and could be played multiple times for increased understanding and practice. Encourage students to continue to play the game at home and use the games often in class as time allows.

Extended Game Play Lesson: (Sushi Round)

1. Allow students to play the game again.
2. Ask them to focus on the math concepts they see in the game, especially negative numbers, fractions, decimals and mixed numbers.
3. Once everyone has done 1-2 Sushi rounds, have the students stop at the end of a round for a discussion
4. Have students share their strategies for cutting the sushi.
5. Have students share their strategies for labeling numbers on a number line that includes mixed numbers, decimals, fractions, negative numbers and equivalent numbers from one of the more advanced rounds.

Bonus Activities:

View the Math Snacks Animation: Number Rights available at www.mathsnacks.org and complete the Number Rights Learner Guide.

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, $\frac{1}{4}$, 2.5, -5, $-\frac{5}{8}$, -2, $\frac{3}{2}$, 4, $-\frac{1}{3}$, -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, an 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 rich 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.

Human Number Line: Birthday Fractions –

1. Have students get a blank piece of notebook paper and draw a horizontal line across the middle of the paper. On the top of the line, have the students write the month of their birth as the numerator of a fraction. Have the students write the day of their birth as the denominator. For example, someone born on September 25 would have $9/25$ on his or her paper. Someone born on December 3 would have $12/3$ on his or her paper.
2. After each student has written down their fraction, have them reduce it or if possible, convert their number into a whole or mixed number.
3. Finally, have them line up from smallest to biggest.
4. Additionally, have students post their number on a number line and approximation will be necessary. Many of the numbers will be between 0 and 1. The nice thing about this activity is that you will have very small fractions, mixed numbers and whole numbers. Be ready for a lot of discussion. Have students discuss the strategies they are using to decide where numbers go.

Other Recommended Activities:

- Keep track of a classroom HIGH SCORE SHEET or HIGH SCORE NUMBER LINE and allow students to continue playing the game and adding their score to the classroom HIGH SCORE SHEET/NUMBER LINE. After one week, have prizes for the top three scores.
- Watch the video Number Rights and have students complete the learner guide.

Assessment of learning:

1. Have students complete the learner guide from Number Rights.
2. Give students a number line with an upper and lower bound and have them place numbers on the number line using decimals, fractions, and whole numbers appropriately.