



Pearl Diver Teacher Guide

Pearl Diver is available at mathsnacks.org

General Information

In *Pearl Diver*, players learn the number line while diving for pearls amidst shipwrecks and sunken ships. This game is perfect for students in Grades 2–6 who need to practice locating points on a number line. The number line starts out going from 0 to 10 with whole numbers. As learners progress, it incorporates negative numbers, fractions, mixed numbers and decimals. The “Sushi Round” offers the players a chance to use their approximation skills when they are asked to cut the electric eel in halves, thirds, or quarters. So put on your diving mask and jump in!

Sessions:

Gameplay Introduction 20 to 30 minutes	Supporting Activity ("Number Rights" animation and Human Number Line) 30 to 45 minutes	Gameplay Enrichment 20 to 30 minutes	Reflection/ Assessment 10 to 15 minutes
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Supplies

- Index cards
- Copy paper
- Markers
- Floor space to create a human number line

Common Core State Standards

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	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.

Common Core State Standards (continued)

Standard	Description
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.
Mathematical Practices	MP1: Make sense of problems and persevere in solving them. MP2: Reason abstractly and quantitatively. MP3: Construct viable arguments and critique the reasoning of others. MP4: Model with mathematics. MP6: Attend to precision.

Preparing for the Lesson

1. Watch the "Teaching with *Pearl Diver*" video.
2. View the Gameplay video and review the Game Overview.
3. Explore the game yourself so that you understand the mechanics and the math concepts. Visit all the levels and notice how the ranges on the number line are different.

Level 1	0 to 10
Level 2	-5 to 5
Sushi Round	Cut the eel in halves
Level 3	0 to 5, includes $\frac{1}{2}$
Level 4	$\frac{3}{4}$ to 3
Sushi Round	Cut the eel in thirds
Level 5	1 to $4\frac{1}{3}$

Level 6	0 to $\frac{4}{6}$
Sushi Round	Cut the eel in fourths
Level 7	0 to 5, includes $\frac{1}{2}$
Level 8	$\frac{1}{2}$ to $1\frac{1}{2}$, includes $\frac{1}{2}$
Sushi Round	Cut the eel in fifths
Level 9	$\frac{1}{3}$ to $1\frac{1}{3}$
Level 10	$\frac{3}{2}$ to $3\frac{6}{6}$

4. Secure computers/laptops and make sure *Pearl Diver* is working on all computers.
5. Read the entire Teacher Guide and pay close attention to all Discussion Questions.
6. There is no need to pre-teach the number line before going to the computer lab. Allow students to explore and have the experience with the interactive tool first.
7. Gather supplies needed for the Supporting Activity.
8. Turn the sound up on the game instead of having students use headphones.
9. Students may silence their computer and/or close their laptops for discussion time.
10. If you are using iPads or iPhones, please make sure that *Pearl Diver* is downloaded on all devices.
11. Student work cannot be saved. If students want to keep their scores of the game, they can do a screen shot: Cmd+shift+3 on Mac or Print Screen (PrtSc) on Windows.
12. Talking is allowed! Encourage your students to talk to each other and share strategies.
13. Encourage students to keep using *Pearl Diver* at home to get through all the levels.

Gameplay Introduction & Discussion Questions (20–30 minutes)

1. Give students a blank piece of paper and ask them to draw a number line on it. Do not provide any other directions. Once they are done, ask the following:
 - How many of you did a number line that started with zero?
 - How many had a number line with negative numbers? With fractions? With decimals?
2. Allow students to play the game for 10 minutes.
3. Have students pause the game and lead discussion about gameplay for 10 minutes. You can scribe students' responses if you would like.
 - What do you like about this game?
 - What are some things that make this game challenging?
 - What math do you see in this game so far?
 - What recommendations do you have about getting a high score on the Sushi Round?
 - Did anyone reach the negative numbers on the number line?
4. After the discussion, allow students to continue to play the game for an additional 10 minutes.

Pearl Diver Supporting Activity & Discussion Questions (30–45 minutes)

Objective of the activity: Create number lines to visualize different numbers and identify their approximate and/or exact locations.

Launch (Teacher's turn to model with student input)

View the Math Snacks Animation "Number Rights", available at www.mathsnacks.org.

After viewing the animation, ask these questions:

- What do you think the animation is about?
- How is the animation related to *Pearl Diver*?
- What does it mean when she says, "Zero is the hero of the number line"?
- Why do you think a number line is useful?

Explore (Students' turn)

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
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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 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 students 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.

Summarize (Students' turn to discuss and share)

Have students complete the "Number Rights" Learner Guide. Use the questions in the "Number Rights" Learner Guide to support student discussion of the concepts.

Gameplay Enrichment & Discussion Questions (20–30 minutes)

Allow students to play the game for another 10 minutes.

Lead a discussion about gameplay for 10 minutes. You can scribe student responses if you would like.

- In this game session, I noticed some of you got to the fractions level. How does the number line change when fractions are added?
- What strategies did you use when you were trying to find the fractions/decimals on the number line?
- What did you do to figure out where to dive when you saw fractions and mixed numbers on the same number line, for example $\frac{3}{2}$ and $1\frac{3}{4}$?
- How does *Pearl Diver* relate to "Number Rights"?

Students continue to play for an additional 10 minutes.

Reflection & Assessment (10–15 minutes)

1. Use any of these questions for oral discussion, journal entries or exit tickets.
 - a. Take out the number line you drew at the beginning of class. After doing these activities, would you change anything about your number line? If so, what?
 - b. Describe what the scale does for a number line. (Answer: It resizes the number line.)
 - c. Can you think of real world examples of where you see number lines? (Answer: Timelines, rulers, maps, highways, coordinate grids, thermometers, etc.)

Vocabulary

Do not explicitly pre-teach vocabulary.

Students will develop vocabulary through modeling, gameplay and discussion.

Halves	To divide into two equal parts.
Thirds	One third is one part of three equal parts. When you split an object or number into thirds, you divide it by three.
Fourths	One of four equal parts.
Sixths	One of six equal parts.
Mixed number	A number consisting of a whole number and a proper fraction.
Fraction	Equal parts of a whole or a collection. A fraction has two parts. The number on the top of the line is called the numerator. It tells how many equal parts of the whole or collection are taken. The number below the line is called the denominator. It shows the total divisible number of equal parts the whole into or the total number of equal parts, which are there in a collection.
Decimal	A number that uses a decimal point followed by digits that show a value smaller than one.
Equivalent number	Two values, numbers or quantities, which are the same. Fractions, which have the same value, even though they may look different.
Negative number	A real number that is less than zero and appears to the left of it on the number line.
Whole number	Any of the numbers {0, 1, 2, 3, ...} etc. There is no fractional or decimal part. And no negatives.
Approximation	Anything that is similar, but not exactly equal, to something else. A number can be approximated by rounding.
Number Line	A straight line with numbers placed at equal segments or intervals along its length. A number line can be extended infinitely in any direction. In a number line, negative numbers are used to describe values on a scale that goes below zero.