

So Many Ways to Order!

Strand: Number and Number Sense

Topic: Ordering Real Numbers

Primary SOL: **8.NS.1 The student will compare and order real numbers and determine the relationships between real numbers.**

- c) Use multiple strategies (e.g., benchmarks, number line, equivalency) to compare and order no more than five real numbers expressed as integers, fractions (proper or improper), decimals, mixed numbers, percents, numbers written in scientific notation, radicals, and π . Radicals may include both positive and negative square roots of values from 0 to 400. Ordering may be in ascending or descending order. Justify solutions orally, in writing, or with a model.

Related SOL: 8.NS.1a, 8.NS.1b

Materials:

- “Convince me that...” routine (attached)
- Number Line Benchmark activity sheet (attached)
- Activity sheet for each station: Number line, Benchmarks Numbers, Decimals, Fractions, Fractions with Denominators of 100 (Percents) (attached)
- Station Recording sheet (attached)
- Comparison Reflection Sheet (attached)

Vocabulary

ascending, descending, benchmarks, irrational numbers, real numbers, integers, scientific notation

Student/Teacher Actions: What should students be doing? What should teachers be doing?

1. Teachers begin with a number sense routine, “Convince me that...” Display the “Convince me that...” page to the class.
2. Lead this discussion into a review of benchmarks that can be helpful when comparing and ordering different numbers. Depending on the value of the number, benchmarks might be different.
3. Place students in groups of three. Provide each group of students with a copy of the **Number Line Benchmark** activity sheet. Ask students to work with their group to discuss their placement of benchmarks and then write them on the provided number lines. As students work, the teacher should monitor and determine which group should share their benchmarks for each question. The teacher then displays the number line with benchmarks created by the group and the group explains why they placed what they placed. Alternatively, the teacher may ask another group to explain the placement of the benchmarks by the first group.

4. Set up the five stations using **Station Activity Sheets**.
5. Provide each student with a copy of the **Station Recording Sheet**. Explain that there are five stations with different ways of comparing and ordering numbers. Students will need to visit all five stations and complete at least two problems at each station. Then students may decide which station(s) to return to and complete five more problems. Teachers may allow students to move freely through the stations and monitor work. Alternatively, teachers could assign students to a starting station, provide a time limit to complete two problems at that station, then rotate until all five stations have been visited. Then have students decide which station they are returning to for the next amount of time to begin to complete their additional five problems and set a timer for that work time. Students may need to return to more than one station for their remaining five problems. Teachers should monitor student progress during all station work.
6. Provide each student with a copy of the **Comparison Reflection Sheet** to complete individually.

Assessment

- **Questions**
 - How can you generalize ordering negative numbers compared to positive numbers?
 - How can benchmarks assist in ordering numbers?
 - Give an example of numbers in order and an estimation of each value that helps place them in order.
 - What is the difference between ascending and descending?
- **Journal/writing prompts**
 - Explain why all numbers don't need to be in the same form to compare them. Use self-created examples as justification.
 - Use a model or write an explanation to demonstrate how you know these numbers are in descending order: 1.2×10^2 , $1\frac{3}{5}$, 20%, $-\frac{1}{5}$
- **Other Assessments**
 - Give each student a card with a fraction, decimal, mixed number, square root, number in scientific notation, or pi written on it as they enter the room. Prior to sitting down, instruct students to place their number on a number line hanging in the hallway or classroom. Students must base their placement on those placed before theirs. Doing this multiple times throughout the year allows for a spiral review of content.
 - Provide students with manipulatives such as: laminated 10x10 grids, fraction tiles, fraction circles, Cuisenaire rods, etc. Have students use these to explain their thinking to the class or teacher.

Extensions and Connections (for all students)

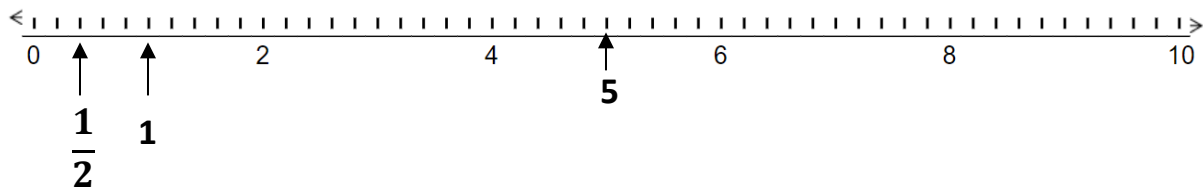
- Allow students to use calculators after estimating non-perfect square roots to check their accuracy.
- Have students write examples that would be easiest to compare in different forms (e.g., write one proper fraction, one mixed number, one decimal, and one square root that will be easy to compare using decimals).

Strategies for Differentiation

- Allow students to work with a partner during the station activity.
- Provide anchor charts on making fractions that have denominators of 100, writing equivalent fractions, converting decimals to fractions, converting fractions to decimals, percents, scientific notation, and square roots. Allow students to refer to anchor charts.

Note: The following pages are intended for classroom use for students as an aid to learning.

Convince me that these values are appropriately placed on this number line.



Number Line Benchmark

Name _____

Date _____

1. To compare numbers between 0 and 1, draw the benchmarks that would be helpful on this number line.



2. To compare numbers between -1 and 0, draw the benchmarks that would be helpful on this number line.



3. To compare numbers between 0 and 5, draw benchmarks that would be helpful on this number line.



4. To compare numbers between -100 and 100, draw benchmarks that would be helpful on this number line.



Station Recording Sheet

Directions: You will complete a minimum of two problems at each station. You must complete a total of 15 problems.

Station 1: Number Line

Station 2: Benchmarks

Station 3: Decimals

Station 4: Fractions

Station 5: Fractions with denominators of 100 (percents)

Number Line

On your recording sheet, draw a number line for each problem and place the values correctly on each number line.

1. $0.75, 2, -2\frac{3}{4}, 1.2 \times 10^{-2}$

2. $-\frac{1}{2}, -\sqrt{7}, -3, -1.5$

3. $-\frac{12}{4}, 1.7 \times 10^{-2}, 1\frac{1}{5}, -\sqrt{22}$

4. $-\frac{12}{5}, -6\frac{1}{4}, -\frac{13}{2}, -4.2$

5. $\sqrt{90}, \sqrt{25}, 1.2 \times 10^{-2}, 1.2 \times 10^2$

Benchmark Numbers

On your recording sheet, use benchmark numbers to determine the order of the values. Place the numbers in ascending order. Explain the benchmarks used.

1. $\frac{8}{9}, 0.3, \frac{1}{8}, 60\%$

2. $5.6 \times 10^{-1}, -0.8, -\frac{5}{10}, -0.1$

3. $\sqrt{1}, -0.625, -\frac{1}{4}, 6.25 \times 10^{-2}$

4. $\frac{55}{3}, \pi, 5\frac{1}{8}, 12.21$

5. $\sqrt{90}, \sqrt{25}, 1.2 \times 10^{-2}, 1.2 \times 10^2$

Decimals

On your recording sheet, convert all to decimals in each set and write in ascending order.

1. $3\frac{1}{4}$, 5.72×10^{-2} , 120%, 2.5

2. -0.1 , $-\frac{6}{5}$, $-2\frac{2}{10}$, $-\frac{3}{5}$

3. $\frac{3}{4}$, $\sqrt{4}$, $\frac{17}{5}$, π

4. $\sqrt{26}$, 250%, $\frac{31}{4}$, $10\frac{7}{10}$

5. $\sqrt{90}$, $\sqrt{25}$, 1.2×10^{-2} , 1.2×10^2

Fractions

On your recording sheet, convert all values to fractions and write in ascending order.

1. $3\frac{1}{2}$, 6.5 , $\sqrt{81}$, $\frac{17}{2}$

2. $3\frac{3}{10}$, -3.4 , $\frac{7}{10}$, $-1\frac{1}{10}$

3. $1\frac{12}{24}$, $\frac{\sqrt{16}}{16}$, $\frac{5}{2}$, $1\frac{3}{4}$

4. -1.7 , $-\sqrt{49}$, $-10\frac{3}{5}$, $-\frac{5}{2}$

5. $\sqrt{90}$, $\sqrt{25}$, 1.2×10^{-2} , 1.2×10^2

Fractions with denominators of 100 (percents)

On your recording sheet, convert all values to fractions with denominators of 100 (or as close as possible) and write in ascending order.

1. 75% , $-\frac{1}{4}$, $\frac{3}{5}$, $-\frac{1}{10}$

2. $3\frac{1}{5}$, 350% , $\frac{13}{4}$, 3.8

3. 4.1×10^2 , 360% , 317.23

4. $-\frac{5}{8}$, $-\frac{3}{10}$, $-\frac{1}{4}$, $-\frac{1}{5}$

5. $\sqrt{90}$, $\sqrt{25}$, 1.2×10^{-2} , 1.2×10^2

Comparison Reflection Sheet

1. There are many methods for ordering real numbers. Explain why someone should learn more than one way to order real numbers.
2. Which method do you find easiest for most ordering real number problems? Or, if you use multiple methods, what about the problem helps you decide your method?
3. Explain how you know that these numbers are written in descending order. Your answer must include words and should include models, number lines, benchmarks, or equivalency.

$$-\sqrt{2}, -\frac{1}{2}, 16\%, \pi, 4\frac{2}{3}$$

4. Which method do you find most efficient that provides you with the least number of possible steps where you might create an error?
5. Number 5 in each station contained these values: $\sqrt{90}$, $\sqrt{25}$, 1.2×10^{-2} , 1.2×10^2 . Explain which method you found easiest to order these numbers.