

## Grade 8 Mathematics

### Number and Number Relations: Lesson 3

Read aloud to the students the material that is printed in **boldface type** inside the boxes. Information in regular type inside the boxes and all information outside the boxes should **not** be read to students. Possible student responses are included in parentheses after the questions.

NOTE: The directions read to students may depend on the available materials. Read only those parts of the lesson that apply to the materials you are using.

Any directions that ask you to do something, such as to turn to a page or to hand out materials to students, will have an arrow symbol ( $\Rightarrow$ ) by them.

#### *Purpose of Lesson 3:*

- In this lesson, the tutor and the students will
  - ✓ compare whole numbers and decimals;
  - ✓ use symbols for  $<$ ,  $>$ ,  $=$ ;
  - ✓ order whole numbers and decimals;
  - ✓ understand the meaning of positive and negative integers by using them to describe real-world situations; and
  - ✓ compare and order positive and negative integers.

#### *Equipment/Materials Needed:*

- Sets of 10 number cards with the digits 0-9 for each student and one for yourself (See Student Sheet 6.)
- Copies of Student Sheets 7 and 8
- Paper and pencils

#### *Preparations before beginning Lesson 3:*

- Run off one copy of Student Sheet 6 for each student and one for yourself. Run off on stock or heavy paper. It would be better if each set of cards was a different color.
- Run off one copy of Student Sheets 7 and 8 for each student.
- Have paper and pencils available.

### *Lesson 3: Number and Number Relations*

⇒ Give the students a set of 10 number cards from Student Sheet 6, with the numbers 0 – 9 on them. Have a set for yourself. Each student should shuffle his/her cards. You should turn up 2 cards and have the students do the same.

Say:

**We are going to use two cards each to make 2-digit numbers. You must place the cards in the order that you turn them up. The first card will be in the tens place; the second card will be in the ones place. Turn up your cards. Is the amount that your cards show greater than the amount that my cards show?** (Answers will vary.) **How do you know your number is greater than mine is?** (Sample responses: I have more tens than you do. We have the same number of tens, but I have more ones than you do.) After you have done this activity maybe 5 times, allow the students to change the rules. They can place the digits in either order. On the last round, put the numbers from each student in order from smallest to largest. They need to see that ordering numbers means comparing sets of two numbers over and over.

⇒ Shuffle the cards. This time, you get to use three cards to make a number; but the students can use only two cards.

Say:

**This time, I will use 3 cards to make a number; but you can use only two. How many digits will my number have?** (3) **How many digits will your number have?** (2) **My number will have digits in hundreds, tens, and ones places. In which places will your numbers have digits?** (tens and ones) Both you and the students should show your numbers. **Does anyone have a number that is greater than mine?** (No.) **Why not?** (With the exception of a zero in the hundreds place, you can make numbers in the hundreds; they can make numbers with only tens and ones. This activity is really important to do a few times. You want them to discover that the number of digits and the place value of the digits are important. Be careful not to say something like “My number is larger because it has more digits.” This statement is true only if you are comparing whole numbers: for example, 4.55 is not greater than 45.)

⇒ Shuffle the cards again. This time both you and the students can use 3 cards. Lay yours down and challenge them to use their 3 cards to make a number that is greater than yours, or smaller, or one with the same hundreds digit. Do this activity 2 times.

⇒ Shuffle the cards again. This time you can use 4 cards to make a number and they can use only 3. Hopefully, they will realize that your number will always be greater. If this fact is still not obvious, make a few numbers with the cards.

Shuffle the cards again. This time you and the students both use 4 cards. Lay yours down and challenge them to make a larger, smaller, etc. number.

Say:

**Remember that a few minutes ago, I said that, when we compare numbers, we look to see which number is greater. When comparing whole numbers, it may help you to list the numbers in a column, lining up the ones place. Then start at the left and compare values of the different places. We also use symbols for *greater than* and for *less than* so that we don't have to write the words each time. The symbol for greater than is  $>$ , and the symbol for less than is  $<$ .**

⇒ Write the numbers 1362 and 948 on the board.

Say:

**If you have the numbers 1362 and 948 to compare, line up the ones place.**

1362

948

**Because there are no thousands in the second number, it must be smaller. So we could write  $1362 > 948$  or  $948 < 1362$ .**

⇒ Write the numbers 256 and 358 on the board.

Say:

**In these two numbers, because there are the same number of places, you have to compare the hundreds. Three hundreds is greater than 2 hundreds, so 358 must be greater than 256. You could write  $358 > 256$  or  $256 < 358$ .**

⇒ Write the numbers 3287 and 3209 on the board.

Say:

**These two numbers have the same value in the thousands and hundreds, so you have to look at the tens.**

3287

3209

**Since the 3287 has more tens, it must be greater. Therefore,  $3287 > 3209$  or  $3209 < 3287$ .**

Say:

**When ordering three or more numbers, you can look at two of the numbers and compare them. Then look at the third number and compare it to the larger of those two. You can keep doing this procedure until you get all of the numbers in order.**

⇒ Write the numbers 5235, 6721, 4652, and 356 on the board.

Say:

**Let's order 5235, 6721, 4652, and 356. It is easy to see that 356 is smaller than the other numbers, so it is the smallest. Next compare 5235 to 6721. Which is less? (5235 is less.) Next compare 5235 to 4652. Which is less? (4652) So the order is 356, 4652, 5235, and 6721. Another way of comparing numbers is to think about place value. You know 356 is the smallest. All of the others are in the thousands. 4000 is next, then 5000, then 6000.**

⇒ Give the top half of Student Sheet 7 to the students. This activity will give the students practice in comparing whole numbers. You may want to do this activity as a group and ask one student to explain his/her thinking about each one. Answers:

1) 999 feet

2) 4480 pounds

3) <

4) >

5) >

6) D

7) 90 km; 164 km; 202 km; 1099 km; 1235 km

Say:

**Remember in the last lesson, we said that decimals have place value just as whole numbers do. We can compare decimals just as we do whole numbers. When we compared whole numbers, we lined up the ones place. With decimals, we could line up the ones place, except that all decimals do not have whole number parts. We could line up the decimal points. This process would do the same thing as lining up the ones place.**

⇒ Write the numbers 13.6 and 9.48 on the board.

Say:

**If you have the numbers 13.6 and 9.48 to compare, line up the decimals. 13 is greater than 9, so 13.6 is greater than 9.48.**

13.6        =     13.60     **It may help you to think of 13.6 as 13.60.**  
9.48        =     9.48

**We could write  $13.6 > 9.48$  or  $9.48 < 13.6$ .**

⇒ Write the numbers 2.56 and .358 on the board.

Say:

**Line up the decimals in the two numbers.**

2.56        =     2.560            It may help you to think of 2.56 as 2.560.  
.358        =     0.358            It may help you to think of .358 as 0.358.

**Since there are no whole numbers in .358, 2.56 must be larger. How could I show this comparison? ( $2.56 > .358$  or  $.358 < 2.56$ .)**

⇒ Write the numbers 32.05 and 32.09 on the board.

Say:

**These two numbers have the same value in the tens, hundreds, and tenths places, so you have to look at the hundredths place. Since the 32.09 has more hundredths, it must be greater. So  $32.05 < 32.09$  or  $32.09 > 32.05$ .**

Say:

**When you order decimals, you again take two numbers at a time and compare them. To order 1.6; 82.07, 45.9, 3.09, line up the decimal points.**

1.6  
82.07  
45.9  
3.09

**82.07 is greater than 1.6. It is greater than 45.9. It is greater than 3.09. So 82.07 is the largest. 45.9 is the only other number with tens, so it comes next. 3.09 is greater than 1.6. So the order is: 82.07; 45.9; 3.09; and 1.6.**

⇒ Give the bottom part of Student Sheet 7 to the students.

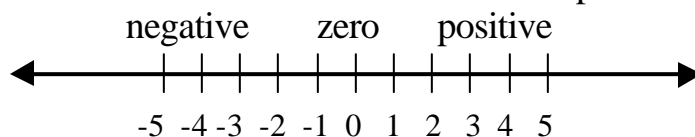
Answers:

- 8) 0.03                      9) 1.13                      10) <                      11) <  
12) >                      13) 0.302; 0.296; 0.248; 0.198  
14) \$90.08; 109.45; 900.98; 1000

Say:

**So far all of the numbers that we have compared and ordered have been positive numbers. What happens if I lose money or if the temperature gets very cold and goes below zero or if our football team is so bad they keep losing yards instead of gaining them? All of these ideas involve negative numbers. *Positive numbers* are numbers greater than zero. *Negative numbers* are numbers less than zero. Zero is neither positive nor negative. We can show negative and positive numbers on a number line.**

⇒ Draw this number line on the board or on a piece of paper.



Say:

***Opposite numbers* are numbers that are the same distance from zero in the opposite direction. *Whole numbers* are the *counting numbers* (1, 2, 3, ... and 0.) Every whole number, fraction, and decimal has an opposite number. In this lesson, we are going to be concerned with zero, whole numbers, and their opposites. Zero, whole numbers, and their opposites make up the set of *integers*.**

⇒ Give Student Sheet 8 to the students. Work each item as a group, having one student explain his/her thinking as you go along.

Answers:

- 1) -5, -4, -3, -2, -1, 0, 1, 2, 3, 4, 5. Yes, many others. Answers will vary, but maybe -100 and 100, -10 and 10.                      2) -5                      3) 4  
4) No, it is not a whole number or the opposite of a whole number.  
5) No, it is not a whole number.                      6)  $-10^\circ$                       7) +25 yards  
8) -\$2000                      9) 4                      10) 0                      11) -1                      12) 3  
13) -10, -4, 0, 5                      14)  $-11^\circ$ , or any other temperature less than  $-10^\circ$   
15) -50 ft                      16) -101, or any other number less than -100

⇒ Have one student summarize today's lesson. The students should discuss how comparing and ordering decimals and whole numbers are related.

Student Sheet 6 (Number: Lesson 3)

0	1	2	3	4
5	6	7	8	9

0	1	2	3	4
5	6	7	8	9

0	1	2	3	4
5	6	7	8	9

## Student Sheet 7 (Number: Lesson 3)

1. Write the number that is 1 less than 1000 feet.
2. Write the number that is 1 more than 4479 pounds.

**Write  $<$ ,  $>$ , or  $=$  in each blank.**

3.  $618 \underline{\hspace{1cm}} 622$       4.  $5900 \underline{\hspace{1cm}} 746$       5.  $10,215 \underline{\hspace{1cm}} 10,212$

6. In one company, the most that a shipment can weigh is 210 pounds. The weights of four packages are shown below. Which package could not be shipped?  
A. 209 lbs.      B. 190 lbs.      C. 201lbs.      D. 220 lbs.
7. The following are the distances of 5 cities from Monroe. Put them in order from those closest to farthest away from Monroe. All distances are in kilometers.  
202 km;    1235 km;    90 km;      164 km;      1099 km

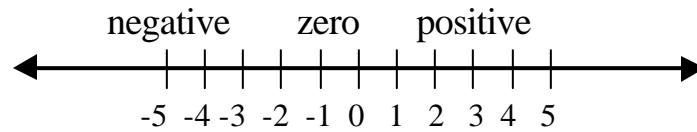
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8. Write the number that is 1 less than 1.03.
  9. Write the number that is 0.1 more than 1.03.

**Write  $<$ ,  $>$ , or  $=$  in each blank.**

10.  $1.25 \underline{\hspace{1cm}} 2.14$       11.  $0.9 \underline{\hspace{1cm}} 1$       12.  $0.19 \underline{\hspace{1cm}} 0.099$

13. The coach is putting the batting averages of his four best players in order. The batting averages are 0.296, 0.248, 0.302, and 0.198. How should he list the batting averages in order from best (greatest) to worst (least)?
14. A bookkeeper had to put the following checks in order from smallest to largest; \$90.08, \$900.98, \$109.45, and \$1000. How should she arrange the checks?

## Student Sheet 8 (Number: Lesson 3)



Use the number line above to help you answer the questions.

1. What integers are shown on the number line above? Are there others? Name 2 other negative integers and their opposites.
2. What is the opposite of 5?
3. What is the opposite of  $-4$ ?
4. Is  $-4.3$  an integer? Explain.
5. Is  $\frac{1}{2}$  an integer? Explain.
6. How would you write  $10^\circ$  below zero?
7. How would you write a gain of 25 yards on the football field?
8. How would you write a loss of \$2000 in the stock market?
9. Which is larger, 4 or 3?
10. Which is larger,  $-5$  or 0?
11. Which is larger,  $-6$  or  $-1$ ?
12. Which is larger, 3 or  $-2$ ?
13. In Anchorage, Alaska, the temperatures for 4 days were  $-10^\circ$ ,  $0^\circ$ ,  $5^\circ$ , and  $-4^\circ$ . Put the temperatures in order from lowest to highest.
14. Write a temperature that is less than  $-10^\circ$ .
15. A fish finder located fish at 50 feet below the surface. How would you write this number?
16. Write a depth that is lower than  $-100$  feet.