

Grade 8 Mathematics

Number and Number Relations: Lesson 5

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 5:

- In this lesson, the tutor and the students will
 - ✓ add, subtract, and multiply decimals; and
 - ✓ solve real-world problems involving addition, subtraction, and multiplication of decimals.

Equipment/Materials Needed:

- Copies of Student Sheets 11 and 12
- Paper and pencils.

Preparations before beginning Lesson 5:

- Run one copy of Student Sheets 11 – 12 for each student.
- Have paper and pencils available.

Lesson 5: Number and Number Relations

Say:

In this lesson, we will start with addition and subtraction of decimals. Adding and subtracting decimals is very similar to adding and subtracting whole numbers. Let's see how they are similar and how they are different. When we compare whole numbers, what place do we line up? (ones place) When we compare decimals, what do we line up? (the decimal point) When we add and subtract whole numbers what do we line up? (the ones place) When we add and subtract decimals what do you think we will have to line up? (the decimal point) If you add 2 tens and 3 ones, do you get 5 tens? (No.) Do you get 5 ones? (No.) What do you get? (2 tens and 3 ones) How else could I write this amount? (23) Lining up the ones helps you not to make careless mistakes. If you didn't line them up, you might get 70 or 520 as the sum for 2 tens and 5 ones.

⇒ Write these problems on the board.

$$\begin{array}{r} 20 \\ + 5 \\ \hline 25 \end{array} \quad \begin{array}{r} 20 \\ + 5 \\ \hline 70 \end{array} \quad \begin{array}{r} 20 \\ + 5 \\ \hline 520 \end{array}$$

Say:

It is also very important to line up the decimal points in decimal numbers. If I give you \$1, one (1) dime, and one (1) penny, would you have \$3? (No.) Would you have 3 dimes? (No.) Would you have 3 pennies? (No.) You would have 1 dollar, 1 dime, and 1 penny or \$1.00 + 0.10 + 0.01 or \$1.11.

What if you added 0.3 and 0.42? Write 0.3 and 0.42 on the board. Would you get 0.72 or 0.45? (0.72) Why? (0.42 is the same as 0.4 + 0.02, so I add the 0.3 + 0.4 and get 0.7 and I still have 0.02 so I get 0.72; or I could write 0.3 as 0.30. Then 0.30 + 0.42 = 0.72.)

⇒ Write these problems on the board.

$$\begin{array}{r} 0.3 \\ + 0.42 \\ \hline \end{array} \quad \begin{array}{r} 0.3 \\ + 0.4 + 0.02 \\ \hline 0.7 + 0.02 = 0.72 \end{array} \quad \begin{array}{r} 0.30 \\ + 0.42 \\ \hline 0.72 \end{array}$$

⇒ Write the following problems on the board.

- 1) $.4 + .9$ 2) $.8 + 1.3$ 3) $1.4 + 25$ 4) $.2 + .03$

Say:

How would I write each of these problems horizontally? What is the answer for each problem?

$\begin{array}{r} 1) \quad .4 \\ + .9 \\ \hline 1.3 \end{array}$	$\begin{array}{r} 2) \quad .8 \\ + 1.3 \\ \hline 2.1 \end{array}$	$\begin{array}{r} 3) \quad 1.4 \\ + 25. \\ \hline 26.4 \end{array}$	$\begin{array}{r} 4) \quad .2 \\ + .03 \\ \hline .23 \end{array}$
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Why did you get an answer of one (1) whole and 3 tenths for problem 1? (The answer was 13 tenths, which is one (1) whole and 3 tenths.) **In problem 2, why did you put the 3 under the 8 rather than put the one (1) under the 8?** (I am adding 3 tenths and 8 tenths, so I lined up the decimal point.) **Why did you write a decimal point behind 25 in problem 3?** (All whole numbers have a decimal point.) **Could you put a zero behind the decimal point in 25?** (Yes. 25 is the same as 25.0.) **Why would you want to put a zero behind the decimal point?** (It makes it easier to remember to line up the decimals.) **Could you put a zero behind the .2 in problem 4?** (Yes.)

Say:

I am going to read a problem. Terry drove 456.8 miles on Saturday and 281.9 miles on Sunday. How far did she drive in the 2 days? Let's think for a minute about a reasonable estimate of the number of miles. What do you think? (If students use front-end estimation, they would add 400 + 200 to get 600 and then adjust about 13 or 14 tens to get an estimate of 730 or 740. If they round to the nearest hundred, they might get 500 + 300 or an estimate of 800. If they round to the nearest 10, they would get an estimate of 730.) Any of these ways is fine. **When working with decimals, estimating an answer before you begin can help students avoid careless mistakes.**

⇒ Show this problem on the board.

$$\begin{array}{r} 456.8 \text{ miles} = 400 + 50 + 6 + .8 \\ + 281.9 \text{ miles} = 200 + 80 + 1 + .9 \\ \hline 600 + 130 + 7 + 1.7 \end{array}$$

Say:

In this method, we break apart the numbers. 456.8 can be written as 400 + 50 + 6 + .8 and 281.9 can be written as 200 + 80 + 1 + .9. What do you get when you add the tenths? (17 tenths or 1.7) What do you get when you add the ones? (7) What do you get when you add the tens? (130) What do you get when you add the hundreds? (600) What do you get when you combine all of these? (738.7)

⇒ Show this method on the board.

	1	1	1 1	1 1
456.8 miles	456.8	456.8	456.8	456.8
+ 281.9 miles	+ 281.9	+ 281.9	+ 281.9	+ 281.9
-----	-----	-----	-----	-----
	.7	8.7	38.7	738.7

Say:

Let's look at another method for adding decimals. This time when we add the tenths, we get 17 tenths. We can't write 17 in the tenths place because there is room for only one number. So what can we do? We could think of 17 tenths as one (1) whole and 7 tenths. We could write the 7 in the tenths column; but we can't forget about that one (1). We could write the one above the 6 ones so that we remember to add it when we add the ones column. Now we have 6 ones + 1 one + 1 one or 8 ones. Next add the tens. We add 5 tens and 8 tens to get 13 tens. Thirteen tens is the same as 1 hundred and 3 tens. We write the 3 in the tens column and write a little one above the 4 hundreds, so that we don't forget it. Then we add 4 hundreds and 2 hundreds and 1 hundred to get 7 hundreds. Our answer is 738.7.

Say:

I am going to give you another problem. Add 4.3 + 8.05 + .004. How should you line up the numbers? (Line up the decimal points.) Give me a quick estimate of the answer. (They should see 4 and 8 and tell you 12 or something close to 12.)

⇒ Show this on the board.

	4.3	4.300
	8.05	8.050
+ .004	+ .004	
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Say:

**It may help you to add the zeros in the problem. What is the sum?
(12.354)**

Say:

We are going to look at subtraction now. You still must line up the decimals. Kirin drove 256.5 miles on Saturday and 43.6 miles on Sunday. How much farther did he drive on Saturday than on Sunday? Give me a quick estimate of the answer. (250 – 50 or 200 would be a good estimate.)

⇒ Write this problem on the board.

$$\begin{array}{r} 256.5 \\ - 43.6 \\ \hline \end{array} \quad \begin{array}{r} 200 + 50 + 6 + .5 \\ - 40 - 3 - .6 \\ \hline \end{array} \quad \begin{array}{r} 200 + 50 + 5 + 1.5 \\ - 40 - 3 - .6 \\ \hline 200 + 10 + 2 + .9 = 212.9 \end{array}$$

Say:

In our break-apart method, we write 256.5 as $200 + 50 + 6 + .5$ and 43.6 as $40 + 3 + .6$. Why do you think I wrote $- 40 - 3 - .6$? (because all 3 numbers have to be subtracted.) I need to subtract 6 tenths from 5 tenths, but I am going to need to borrow some tenths from the ones column. So I take one (1) one, think of it as 10 tenths, and add it to the 5 tenths. Now I can subtract 6 tenths from 15 tenths. I get 9 tenths. Now I subtract 3 ones from 5 ones, 40 from 50, and zero from 200. I get 212.9 miles.

⇒ Write this problem on the board.

$$\begin{array}{r} 256.5 = \\ - 43.6 = \\ \hline \end{array} \quad \begin{array}{r} 15 \\ 256.5 \\ - 43.6 \\ \hline .9 \end{array} \quad \begin{array}{r} 15 \\ 256.5 \\ - 43.6 \\ \hline 212.9 \end{array}$$

Say:

Using the standard method, I need to subtract 6 tenths from 5 tenths, but I am going to need to borrow some tenths from the ones column; therefore, I take one (1) one, think of it as 10 tenths, and add it to the 5 tenths. I write a small 15 above the 5 tenths to help me remember. To remember that I borrowed a one, I write a small 5 above the 6 in the ones column. Now I can subtract.

⇒ Write this problem on the board. Subtract 1.02 from 6.1.

Say:

Give me a quick estimate of the answer. (It should be around 5.) **How should we write the problem in vertical format?**

$$\begin{array}{r} 6.1 \\ - 1.02 \\ \hline \end{array}$$

What should I do first? (It may help to put a zero after the one (1) in 6.1. We would get 6.10. Borrow one-tenth from the 1 (one). This process now gives you zero tenths and 10 hundredths. Subtract 2 hundredths from 10 hundredths. Finish subtracting. You get 5.08.)

⇒ Give Student Sheet 11 to the students. Allow the students to work independently, but come back and discuss the answers.

Answers: 1) In addition and subtraction of decimals. Because of the place values. You want to add tenths with tenths, hundredths with hundredths, etc.

- | | | | |
|---------------------------------------|-----------|------------|-----------------|
| 2) B | 3) 8.657 | 4) 43.93 | 5) 225.453 |
| 6) 2002 | 7) \$8.26 | 8) \$29.75 | 9) 28.4 miles |
| 10) \$1.05; \$11.05; \$41.05; \$91.05 | | | 11) 54.6 inches |

Say:

I am going to read you a problem. At the store, CD's are on special for \$6.45 each. How would you find the cost of 2 videos? (You could add $6.45 + 6.45$ or you could multiply 6.45×2 .) **Let's look at multiplication. What is an estimate of the product?** (around 12 or 13)

⇒ Write the problem on the board.

$$\begin{array}{r} 6.45 \\ \times 2 \\ \hline \end{array}$$

Say:

To multiply decimals, you multiply just as you would with whole numbers. You do not line up the decimal points in multiplication. Once you have multiplied the numbers, you need to place your decimal point in the answer. How do you decide where to place the decimal point? The number of decimals in the product equals the sum of the decimal points in the factors. Start at the right side of the answer and count 2 spaces to the left. Place the decimal point.

	1	1	1		
6.45	6.45	6.45	6.45	←	2 decimal places
x 2	x 2	x 2	x 2	←	0 decimal places
-----	-----	-----	-----		
	0	90	12.90	←	2 decimal places
Was our estimate close? (Yes.)					

⇒ Write this problem on the board.

$$\begin{array}{r} 8.12 \\ \times 1.5 \\ \hline \end{array}$$

Say:

Let's try another problem. Work the problem I wrote on the board. What is your answer? (12.180) If you were to use a calculator to multiply this problem, the answer on the display would probably be 12.18. Why are there only 2 spaces behind the decimal point in the calculator's answer? (The calculator really got 12.180; but because the 0 was not necessary, it did not display it.) Are the two answers the same? (Yes.)

⇒ Give Student Sheet 12 to the students. In the chart at the top, students must add the 2 numbers and then multiply them. This process will help them see the different rules for addition and for multiplication of decimals. Have the students work problems 1-6 in the chart and discuss their answers. Then have the students work the rest of the page independently. Discuss the answers, especially focusing on problems 12-15.

Answers:

1) 8.9; 7.2

2) 1.5; 0.56

3) 6.8; 9

4) 8.8; 17.92

5) 20.08; 1.6

6) 10.12; 1.002

7) Smaller; you are multiplying by a fractional amount. Think of $\frac{1}{2}$ of \$20 or $.5 \times 20$.

8) \$35.76

9) \$310

10) 212.5 square meters

11) 63.25 miles or 63 miles

12) 3.28

13) .909

14) 8.1

15) .044 You have to add a zero because you need 3 spaces.

⇒ Have one student summarize today's lesson. You want the students to see that the operations on decimals are very similar to the operations on whole numbers.

Student Sheet 11 (Number: Lesson 5)

- 1) When solving problems with decimals, when do you need to line up the decimals? Why do you line them up?
- 2) Which is the correct way to write $10 - 2.1$?
- A.
$$\begin{array}{r} 10 \\ - 2.1 \\ \hline \end{array}$$
- B.
$$\begin{array}{r} 10 \\ - 2.1 \\ \hline \end{array}$$

Add or subtract the following problems. Estimate first so that you do not make careless mistakes.

- 3) $6.31 + 0.8 + 1.547$
- 4) $45 - 1.07$
- 5) $280.503 - 55.05$
- 6) $2001.1 + 0.9$
- 7) Ginny rented a regular videotape for \$3.89 and a newly-released tape for \$7.85. If she gave the clerk a \$20 bill, how much change did she get back?
- 8) Chris wants to buy a new TV. He has \$89.50 saved, but the TV costs \$119.25. How much more money does he need to buy the TV?
- 9) Rhonda went on a backpacking trip for 3 days. They walked 13.6 miles the first day, 8.5 miles the second day, and 6.3 miles the third day. How many miles did they walk in all?
- 10) Jordy spent \$8.95 at the store. How much change would he get if he gave the clerk a \$10 bill?; a \$20 bill?; a \$50 bill?; a \$100 bill?
- 11) Bonnie is 55.8 inches tall. Sandra is 1.2 inches shorter. How tall is Sandra?

Student Sheet 12 (Number: Lesson 5)

In the following chart, you are given two parts. Find the sum and the product.

	Ex.	(1)	(2)	(3)	(4)	(5)	(6)
Sum	2.5						
Part	2	8	0.8	5	3.2	20	10.02
Part	0.5	0.9	0.7	1.8	5.6	.08	0.1
Product	1.0						

- 7) When you multiply a whole number times a decimal less than one (1), will the answer be larger or smaller than the original whole number? Try a few examples.
- 8) Tennis balls cost \$2.98 at a discount store. How much would a dozen cans cost?
- 9) Karen earns \$7.75 an hour. How much does she earn in 40 hours?
- 10) If the Jones' rectangular swimming pool measures 25 meters by 8.5 meters, what is the area of the pool?
- 11) Dottie's car averages 25.3 miles per gallon of gas. About how far could she drive on 2.5 gallons of gas?

Write the decimal in the correct place in the products.

12) $4.1 \times 0.8 = 328$

13) $0.909 \times 1 = 909$

14) $0.9 \times 9 = 81$

15) $2.2 \times 0.02 = 44$