

Math: Grade 7, Lesson 8, Adding and Subtracting Positive and Negative Rational Numbers

Lesson Focus: Solve 2-step, real-world problems involving adding and subtracting positive and negative decimals

Practice Focus: Students will focus on practicing addition and subtraction of rational numbers in order to solve contextual problems.

Objective: Students will use addition and subtraction of rational numbers to solve problems with a focus on two-step, real world problems.

Key Vocabulary: Rational Numbers

TN Standards: 7.NS.A.1d

Teacher Materials:

- Paper or white board
- Pen/pencil/marker
- Student practice packet

Student Materials:

- Paper and a pencil, and a surface to write on
- Calculator, optional

**To save time, go ahead and have the problems written. Be sure to give plenty of wait time for the student to think and write.*

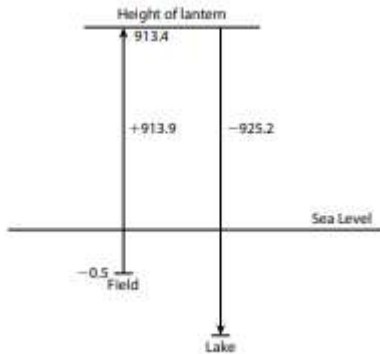
Teacher Do	Student Do
<p><u>Opening:</u> (1 min)</p> <p>Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 7th graders out there, though all children are welcome to tune in. This lesson is the eighth in our series.</p> <p>My name is ____ and I'm a ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!</p> <p>If you didn't see our previous lesson, you can find it on the TN Department of Education's website at www.tn.gov/education. If you don't already have the student packet for this lesson, you can find it online at www.tn.gov/education. You can still tune in to today's lesson if you haven't see any of our others. But, it might be more fun if you first go back and watch our other lessons since we'll be talking about things we learned previously.</p> <p>Today we will be learning about Adding and Subtracting Positive and Negative Fractions and Decimals in mathematics! Before we get started, to participate fully in our lesson today, you will need:</p> <ul style="list-style-type: none">• Paper, pencil and a surface to write on <p>Ok, let's begin!</p>	<p>Students get materials ready for the lesson.</p>

<p><u>Intro</u> (4 minutes)</p> <p>Let's start with a quick review of adding and subtracting rational numbers. Remember that rational numbers are integers, fractions and decimals. They can be positive numbers or negative numbers.</p> <p>Which of the following expressions are equivalent to $10.5 - (-3)$?</p> <p>A. $10.5 + 3$ B. $-3 - 10.5$ C. $-10.5 + 3$ D. $3 + 10.5$</p> <p>[Pause]</p> <p>Did you say yes for letter A? [Pause] Good! This is an equivalent expression! The subtraction has been changed by adding the opposite.</p> <p>This is not an equivalent expression for letter B. Remember that subtraction is not commutative.</p> <p>The expression for letter C is not an equivalent expression. The subtraction has been changed to addition, but the sign of the first addend was changed. Remember that we change the sign of the addend FOLLOWING or AFTER the subtraction sign.</p> <p>Did you say yes for letter D? [Pause] This one was a challenge. I hope you said yes! Notice that this expression is very similar to choice A, except the addends have switched places. Addition is commutative, so this is an equivalent expression!</p> <p>Great job! Is your brain warmed up now?</p>	<p>Student determines the equivalent expressions.</p> <p>Student looks at their work and thinks about their own reasoning.</p>
<p><u>Teacher Model</u> (12 minutes)</p> <p><u>Objective 1:</u> Solve a real-world, 2 step problem involving decimals</p> <p>Let's think about what positive and negative rational numbers look like in a real-world situation.</p> <p>Mei releases a lantern for the Lantern Festival. She stands in a field that is 0.5 meters below sea level. The lantern rises 913.9 meters. Then the candle in the lantern goes out. The lantern comes down 925.2 meters to land on the surface of a lake. What is the elevation of the lake relative to sea level?</p>	<p>Student will think about positive and negative numbers in a real-world situation to better understand the concept of "above and below 0" while solving two-step, real world situations involving decimals..</p>

There are a couple of strategies I'd like for us to look at for this problem.

First, let's draw a picture of what is happening.

[Explain what is happening as you draw the picture as shown below.]



We know that the lantern started 0.5 meters below sea level. How can we show BELOW sea level?

[Pause]

We first draw sea level. This is represented by 0. This means that the lantern starts at -0.5 meters, because it is 0.5 meters below sea level.

Next, we know that the lantern rises 913.9 meters. "Rises" indicates that it is going up.

But it does not start at 0. Where does it start? [Pause]

That's right! It starts at -0.5 m. We need to write an expression to represent this. We are adding 913.9 meters as it is rising. Can you write an expression? [Pause] You got it! $-0.5 + 913.9$. $-0.5 + 913.9 = 913.4$. What does 913.4 represent? You're right! When the candle in the lantern went out. Are we finished? No! The lantern then fell.

We know that the lantern falls and lands on the surface of the lake. The lantern falls 925.2 meters. We can indicate that it is falling by making this distance negative.

So, what is the elevation of the lake? Where did the lantern land? Let's come up with another expression to help us out! What would you write? [Pause] I heard $913.4 - 925.2$. Why subtract? Oh yes. That's right. It fell!

What's another way to write the expression? $913.4 + (-925.2)$. Got it! We know that subtraction can be written as addition. What would be the answer? $913.4 + (-925.2)$ is -11.8.

Student draws and labels a picture of the situation.

Student thinks about using negative numbers to show "below sea level" and positive numbers to show "above sea level" if sea level is 0.

This means that the surface of the lake must be 11.8 meters **BELOW** sea level. Great job!

Another strategy to solve this problem is to think about the elevation points.

The lantern starts at -0.5 m, rises 913.9 m, then falls 925.2 m. So,

$$-0.5 + 913.9 - 925.2$$

Think about the signs. Why is 0.5 negative? [Pause] That's right! The lantern starts below sea level.

Why is 913.9 being added? [Pause] You got it! The lantern is rising.

Why is 925.2 being subtracted? [Pause] The lantern is falling.

Does the order matter? Can I rearrange the terms and get the same answer? [Pause]

Yes! Sometimes rearranging the terms helps us solve the problem more efficiently. We will think about that as we go through our lesson today!

Objective 2; Write 1 expression to represent both steps in a two-step, real-world problem involving decimals

Reth is playing a game. First he loses 4.8 points. Then he gains 2.5 points. Finally, he loses another 7.8 points. What is the overall change in Reth's score? Show your work.

Let's think about what we are given. The context of the problem is very important. Just like the lantern problem, we must determine if the numbers are positive or negative. How can we determine this? [Pause] In this situation, we see words such as lose and gain to help us determine the signs of the numbers.

Can you read the problem and determine which numbers are positive and which are negative?

[Pause]

"Losing" indicates negative points and "gaining" indicates positive points. Let's write the expression. [Pause]

$$-4.8 + 2.5 - 7.8$$

[Pause]

Student considers the efficiency of the strategies.

<p>Does the order matter? Can I rearrange the terms and get the same answer? [Pause].</p> <p>Yes! As we noticed in our previous problem, sometimes rearranging the terms helps us solve the problem more efficiently. We can also use the fact that we learned in the previous lesson that when we are subtracting, we can add the opposite of that addend.</p> <p>I am going to add the opposite so everything is addition. $-4.8 + 2.5 + (-7.8)$ [Pause]</p> <p>Now I will add the two first terms, but you can add any two terms you choose! $-2.3 + (-7.8)$ -10.1</p> <p>Did you get it? [Pause] YAY! Let's try that same process, but let's rearrange the terms to see what numbers are easily combined. The expression can be rewritten as $2.5 + -4.8 + -7.8$ $2.5 + -12.6$ -10.1</p> <p>They both allow us to get the same answer! As you work more and more with positive and negative rational numbers, you will see that rearranging does help us solve more efficiently.</p>	
<p><u>Guided Practice</u> (10 minutes)</p> <p>Let's continue with a couple of more problems. I want you to help me with these two. Make sure to use the strategies we have learned about today and you can always draw the situation if you need to see it.</p> <p>[Pause and allow students to work through the first problem. Do not write a solution or drawing on the board until after the pause. This section is to allow the students to find their entry point rather than copying work.]</p> <p>Let's try the first one! Take a moment to read the problem. [Pause]. Now that you have read the problem, start working to see what information you are given and how you can use it to solve.</p> <p>An autonomous underwater vehicle (AUV) is at an elevation of -8.25 ft. It dives down 6.8 ft to collect a specimen. Then</p>	

the AUV dives another 15.75 ft. What is the final elevation of the AUV? Show your work.

[Allow students work time. After 1 minute, begin the following solution path. This portion is not as detailed since your students are doing more of the work. Your guidance is to confirm or allow them to adapt their responses.]

Possible work:

First, let's determine what is going on in this problem. It sounds like the AUV is at -8.25 ft and then it dives down 6.8 ft and then dives down again 15.75 ft.

What did you write as an expression? [Pause]

I agree! I also wrote, $-8.25 - 6.8 - 15.75$.

Let's see how we can rewrite this to more easily solve.

Did anyone else change the subtraction signs to addition of the opposites? [Pause] Most of us prefer to add! If we do that, we have

$-8.25 + -6.8 + -15.75$

-30.8

What does our answer mean?

Yes! The final elevation of the AUV is -30.8 ft.

Let's do another one together. Take a moment to read the problem. [Pause]. Now that you have read the problem, start working to see what information you are given and how you can use it to solve.

Scott was flying a small plane at 41,300 ft. To avoid turbulence he increased the altitude by 1,250.75 ft. After some time he then had to drop his altitude by 1,475.5 ft.

What altitude did he end up flying?

Possible work:

What does the problem tell us? [Pause]

While flying, the plane went higher and then dropped. With the numbers from the problem, it looks like this:

$41,300 + 1250.75 - 1475.5$

$42,550.75 - 1475.5$

$41,075.25$

What does our answer mean? It does! Scott ended up at an altitude of 41,075.25 ft.

I'm going to let you work all the way through this one and I will be there to check your answer. You've got this!

[After reading through the problem, allow students time to work. Share the solution after the pause.]

Tamara is riding in a hot air balloon. The balloon takes off at an altitude of 122.5 ft above sea level. They rose a total of

<p>2350 ft over their flight. They then dropped 2,800.65 ft to land in a valley. What is the altitude of the valley where the balloon landed?</p> <p>Possible student work:</p> <p>$122.5 + 2350 - 2,800.65$</p> <p>$2,472.5 - 2,800.65$</p> <p>$2,472.5 + (-2,800.65)$</p> <p>-328.15</p> <p>This answer represents what? [Pause]</p> <p>The altitude of the valley where the balloon landed is -328.15 ft.</p> <p><u>Additional Problems (if needed):</u></p> <p>An autonomous underwater vehicle (AUV) is at an elevation of -28.25 ft. It rises 9.8 ft to collect a specimen. Then the AUV dives another 25.55 ft. What is the final elevation of the AUV? Show your work.</p>	
<p><u>Independent Practice (1 minute)</u></p> <p>Great work, 7th grade! Today, we reviewed adding and subtracting rational numbers using different strategies. I hope you're seeing some connections to positive and negative numbers and their place in the real world! You sure did a great job! After the video, you will have some problems to practice on your own. I will show you the independent practice problems now, or you can find them in the student practice for this lesson posted on our website, www.tn.gov/education.</p> <p>[Teacher shows student practice page under document camera or camera zooms in on student practice page.]</p> <p>Good luck and do your best!</p>	
<p><u>Closing (1 min)</u></p> <p>I enjoyed reviewing adding and subtracting rational numbers using different strategies with you! Thank you for inviting me into your home. I look forward to seeing you in our next lesson in Tennessee's At Home Learning Series! Bye!</p>	

This work is based on an original work of Curriculum Associates made available through licensing under a Creative Commons Attribution-NonCommercial-ShareAlike 3.0 Unported License. This does not in any way imply that Curriculum Associates endorses this work. Licensing terms: <http://creativecommons.org/licenses/by-nc-sa/3.0/>