PBS Lesson Series

Math: Grade 7, Lesson 6, Adding and Subtracting with Integers

Lesson Focus: Adding and subtracting with integers
Practice Focus: Students will focus on practicing addition and subtraction with integers in order to understand and solve real-world problems.
Objective: Students will use addition and subtraction with integers to understand real-world problems with a focus on using integers to solve those problems.
Key Vocabulary: absolute value, integers
TN Standards: 7.NS.A.1d
Teacher Materials:

- Paper or white board
- pencil/pen/marker
- Model with the A, B, C, D expressions (see within the lesson)
- Blank Frayer Model (see within the lesson)
- Student Practice Packet

Student Materials:

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

Teacher Do	Student Do
Opening (1 min) **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 sixth in our series.** **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!** **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.** **Today we will be learning about adding and subtracting with integers in mathematics! Before we get started, to participate fully in our lesson today, you will need:** • **Paper, a pencil, and a surface to write on** **Ok, let's begin!**	Students will need paper and a pencil, and a surface to write on.
Intro (8 minutes)	

In this lesson we will learn about subtracting integers and decimals. Remember that integers are positive numbers, negative numbers and zero. The set of integers does not include fractions or decimals.

Let's think about four expressions.
[Have this ready to display for students.]

14 – 9 **A**	**-14 + 9** **B**
C **3 + 2**	**D** **-3 + (-2)**

How are these expressions the same?
[Pause to give students time to think]

Student thinks about all the ways these expressions are the same.

Let's simplify these expressions.
[Pause and give students time to simplify these expressions.]

Student simplifies expressions

A. **14 – 9**
[Pause]
That's right! It's 5. This is pretty straight forward.

B. **-14 + 9**
[Pause]
How is this different than expression A?
[Pause]
Notice that in A, 14 was positive and we were subtracting 9. In B. 14 is negative and we are adding 9.
-14 + 9 = - 5

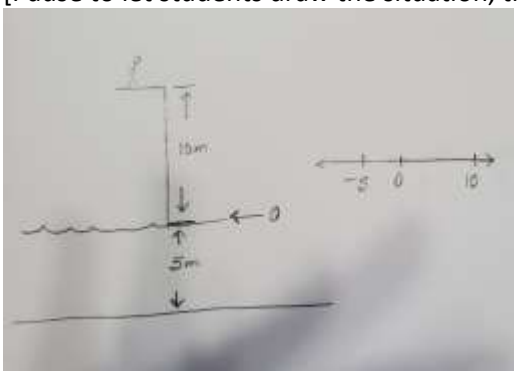
Student answers question

C. **3 + 2**
[Pause]
That's right! It's also 5. Again, this is straight forward.

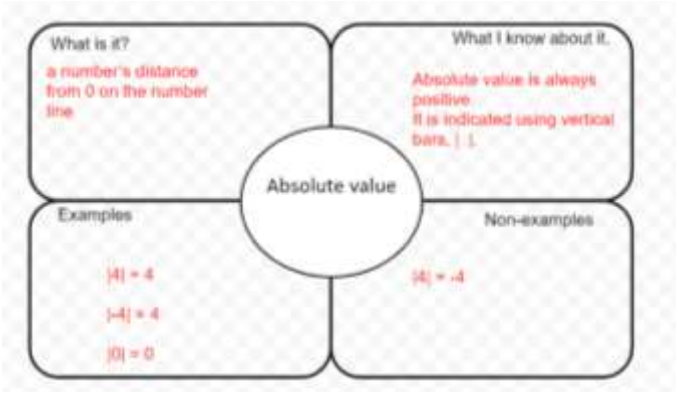
Student simplifies expression

D. **-3 + (-2) what do you think?**
[Pause]

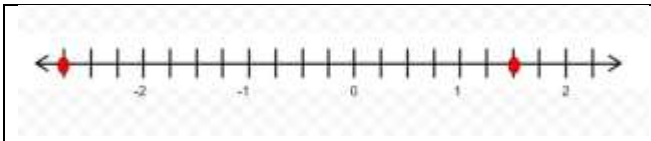
Student simplifies expression

How do we think about adding two negative numbers? [Pause] **They are both below zero, so the sum will also be below zero.** **-3 + (-2) = -5.** **So all 4 of them either equaled 5 or -5.** **How are these expressions different?** [Pause to give students time to think] **A is the only subtraction expression.** **B is the only expression with a negative integer and a positive integer.** **C is the only addition expression with two positive integers.** **D is the only addition expression with two negative integers.**	Student describes how to add two negative numbers. Students think about how expressions are different.
<u>Teacher Model</u> (8 minutes) <u>Objective 1:</u> **We just reviewed how to add positive and negative numbers. In this part of the lesson, let's focus on subtracting positive and negative fractions and decimals.** **Let's think about diving. A diver is standing on a platform that is 10 meters above the surface of the water. The bottom of the pool is 5 meters below the surface of the water. Can you draw a sketch of this situation? How would you label it? How would this look on a number line?** [Pause to let students draw the situation, then you draw it.]  **Does your picture and your number line look similar?** [Pause] **Let's think about the difference in the drawing and the number line.** **Look at the 10 m and the 5 m. What do each represent?**	Students will use a real-world situation to understand that subtraction is adding the opposite. Student draws the situation. They should be thinking about how to label their drawing. Student draws a number line Student answers question

The diver is 10 m above the surface of the water. The surface of the water is 0 m. It is 5 m from the surface of the water to the bottom of the pool. **Now look at the number line. Notice the 10 is positive, but the 5 is negative. Why is the 10 positive and the 5 negative?** [Pause]	Student answers
This is because the platform is 10 m ABOVE the surface of the water (0), while the bottom of the pool is 5 m BELOW the surface of the water (0). We represent 5 m below the surface with a negative 5.	
If the diver dives from the platform and touches the bottom of the pool, how far did he dive? In other words, how far is it from the platform to the bottom of the pool? [Pause so the student can think.]	Student answers question
How can we represent this situation with an expression? Write an expression you think will represent this distance. [Pause for the student to write.]	Student writes an expression to represent the distance
There are two ways to think about this. We could look at our picture and say that the 10 m plus another 5 m is 15 m. **10 + 5 = 15** **OR** **We could say that finding distance between two numbers on a number line is the difference between the two numbers. This thinking leads us to** **10 – (-5) = 15** **Which way were you thinking?** [Pause]	Student responds
Did anyone get 5m? Did anyone say 10 – 5? Does a distance of 5 m make sense in this situation? If you said 10 – 5, what was your misunderstanding?	Student responds
We can think of distance as always being positive. We do not normally think of negative distance. For example if our car is in reverse, we don't think we are going a negative distance. Distance is measured in positive numbers. This is why we can look at our drawing and say "10 m + 5 m = 15 m". But what about distance on the number line? [Pause]	Student responds
The same reasoning applies to the number line. **To show that distance is positive, we use "absolute value". Have you heard that term before?** [Pause]	Student responds

If so, we are going to review. If not, we are going to learn all about absolute value today! We will come back to this problem in a few minutes. For now let's talk about absolute value. Objective 2: Review Absolute Value **Write everything you remember about absolute value.** [pause] **We know that absolute value is a number's distance from 0 on the number line.** **For example, 10 is 10 units from zero, so the absolute value of 10 is 10. We indicate absolute value using vertical bars: |10| = 10.** **-5 is 5 units from zero, so |-5| = 5.** **This Frayer Model may help organize our thoughts:** [Draw the Frayer Model or have one already drawn and complete the red parts with students.]  **This agrees with our reasoning that distance is measured using positive numbers.** Objective 3: **Let's go back to our diving example.** **From our drawing we found 10 + 5 = 15.** **From the number line we found 10 – (-5) = 15.** **This means that 10 + 5 = 10 – (-5).** **Is this always true?** [Pause] **Yes it is!** **We will do some exploration with other expressions! But first, let's revisit our misunderstanding:** **That 10 – 5 = 5.** **This is not reasonable, because the distance from the bottom of the pool to the surface of the water is 5 m, and the diver is going a distance of 10 m before she hits the water. This must**	Students use a Frayer Model to review the concept of Absolute Value so that they can apply it in understanding distance. Student will think about their understanding of distance and its connection to subtraction. Student thinks about if when subtracting, adding the opposite always works. Student thinks about the misunderstanding, and how it is unreasonable.

be more than 5 m. Therefore, 10 – 5 is not the same as 10 – (-5).	
Guided Practice (14 minutes) **Let's practice.** A. **The top of a molehill is 4 inches above ground level. The bottom of a mole's burrow is at 29 inches relative to ground level. What is the distance between the top of the molehill and the burrow? Show your work.** [Pause for the student to work the problem.] **Did you write 4 + 29 = 33?** **Good! If we think of ground level as 0, we can think of the top of the molehill as 4 inches above (|+4|) and the bottom of the burrow as 29 inches below (|-29|). Then we can add the absolute values.** **Did you write 4 – (-29) = 33?** **This works too! If you think of the distance from the top of the molehill to the bottom of the burrow, the distance is the difference.** **Either way of reasoning is correct!** B. **The city of Jericho in the Jordan Valley sits at an elevation of about 846 feet below sea level. The city of La Paz in Bolivia sits at an elevation of about 11,975 feet above sea level. What is the difference in their elevations?** [Pause for the student to reason through the problem.] **If we assume that sea level is at 0, we know that "above sea level" can be represented as a positive number and "below sea level" can be represented as a negative number.** **We can write 11,975 – (-846) or we can write |11,975| + |-846| using absolute value.** **The difference in elevation is 12,821 feet!** C. **Let's look an example of non-integers using a number line.** **Explain how you can use a number line to find the distance between 1.5 and -2.75.** [Pause for the student to work the problem.] [Draw the number line to use to explain.]	Students are working through problems to solidify their understanding of subtracting integers. Student responds to questions Student draws number line and explains reasoning.

 **The distance from 1.5 to 0 is 1.5, and the distance from -2.75 to 0 is 2.75.** **Did you write 1.5 – (-2.75)?** **Or we can use absolute value:** **|1.5| + |-2.75|** **Are these two expressions the same?** [Pause] **Yes! Both expressions will equal 4.25.** **This means that the distance from 1.5 to 0 is being added to the distance from -2.75 to 0.** **|1.5| + |-2.75| =1.5 + 1.75 = 4.25** D. **Find the distance between – ½ and 3 ¼.** [Pause] **What strategy did you use?** **Did you use a number line?**  **We could count the distance (remember that we are using fourths).** **The distance is 15/4 or 3 ¾.** **We could write an expression: 3 ¼ - (- ½)** **We will need to find a common denominator. Let's make the – ½ be – 2/4. Now our problem becomes** **3 ¼ - (- 2/4)** **Or using absolute value:** **| 3 ¼ | + | - 2/4 |** **This will be 3 ¼ + 2/4 or 3 ¾.** **<u>Additional Problems (if Needed):</u>** **You can subtract to find the difference between 4.5 and -3.75. Explain why -3.75 - 4.5 is the opposite of 4.5 - (-3.75).**	
<u>Independent Practice</u> (1 minute) **Great job today everyone! Today we reviewed what it means to subtract integers and non-integers. We used number lines and absolute value to help us reason.** **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. [Teacher shows student practice page under document camera or camera zooms in on student practice page.] **Good luck and do your best!"**	
Closing (1 min) **I enjoyed reviewing adding and subtracting with integers 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!**	