Adding Integers

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CONCEPT 1 Adding Integers

Introduction

The Trouble with Time Zones

Cooper is having a great time getting to know his pen pal in New Zealand. He and his pen pal Riley are the same age and both love sports. The one thing that Cooper is having a hard time with is the whole idea of time zones.

"I get it if we are talking here, New York and California," Cooper tells his friend Emma. "That's a difference of four hours. It is a loss of four if I go to California and it is a gain of four if I travel from California back to here. It is 9 am right now, so it is 5 am in California."

"Well if you get that, what's so hard about New Zealand? You can use integers to figure out the time just like you did with New York and California," Emma says smiling.

"What do you mean?"

"Well, you said it is nine am right now. Then there is a loss of four hours to travel to California. You can write an addition problem and figure it out."

$9 + -4 = 5$

"See?" Emma says jotting the numbers on a piece of paper.

"Nope, not really," Cooper says shaking his head. "I know that New Zealand is 16 hours ahead of us, but I don't know what to do from there. Is that a loss or a gain?"

Cooper is definitely puzzled. Emma is correct though. Adding integers will definitely help Cooper figure out his time zone trouble. Pay attention and you will understand time zones and adding integers by the time this lesson is over.

What You Will Learn

By the end of this lesson, you will be able to:

- Find sums of integers on a number line.
- Identify absolute values of integers.
- Add integers with the same sign.
- Add integers with different signs.

Teaching Time

I. **Find Sums of Integers on a Number Line**

In the last lesson, you learned how to identify and compare integers. To review, an ***integer*** is a member of the set of whole numbers and their opposites. We can say that integers are both positive and negative whole numbers.

Besides writing, identifying, and using integers, we can add integers too. We can find the sum of more than one integer.

How can we find integer sums?

One of the best ways to find integer sums is to use a number line. We can add integers by looking at where they fall on the number line.

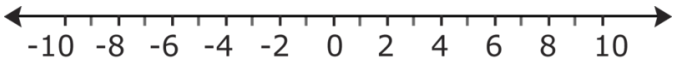
Let's look at an example.

Example

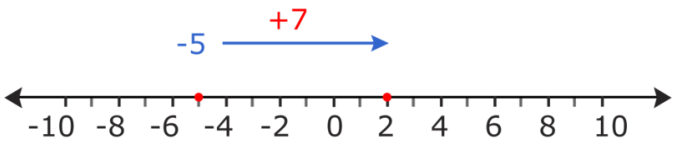
-5 + 7 = ____

Here we have a negative five plus a positive 7. You can think of this in terms of losses and gains. We start with a loss of five and then we have a gain of seven.

That is a great question! It can be a little confusing to try to figure out how to add a loss and a gain or a negative and a positive number. We can use a number line to help us clarify the sum of these two integers.



Next, we start with the first integer. It is a loss of 5 or we start at negative five.



Next we add a positive seven. Since we are adding a positive seven we move toward the positive side of the number line. We start at negative five and count up seven units.

-5 + 7 = 2

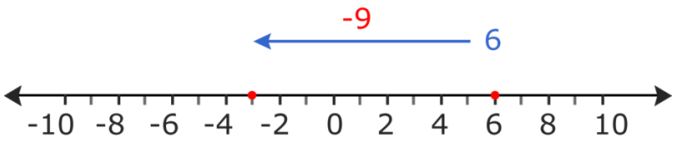
Our answer is positive 2.

Let's look at another one.

Example

6 + -9 = _____

Let's start with a number line.



Our first integer is positive 6, so that is where we will begin.

We add negative nine next. Since we are adding a negative number, it is a loss, so we move toward the negative side of the number line. We are adding a negative nine, so we move to the left nine units.

6 + -9 = -3

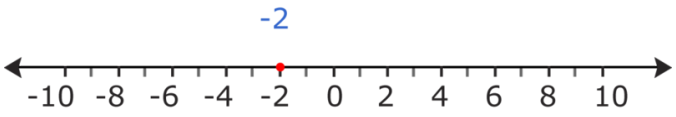
Our answer is -3.

Here is an example where we are adding two negative numbers.

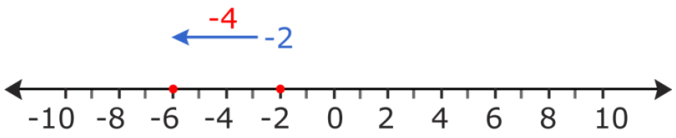
Example

-2 + -4 = ____

Since we are adding two negatives, we are adding a loss and another loss, so we have a greater loss. Negative plus negative is more negative. Let's look at this on the number line.



Next, we add a negative four. Since we add a negative we move toward the negative or left side of the number line four units.

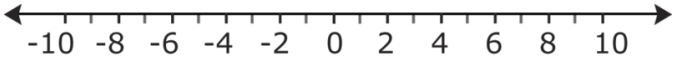


-2 + -4 = -6

Our answer is -6.

You can use a number line for a reference anytime you would like. Many times this will help you until you develop more skill adding integers.

Time to Practice by Adding Integers on the Number Line

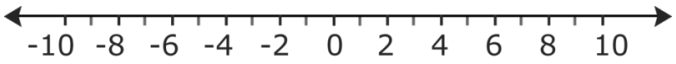


1. **-5 + 9 =** ____
2. **-1 + -8 =** ____
3. **5 + -7 =** ____

Check your answers with a partner. Did you both get the same answers? Double check your work for accuracy.

II. **Identify Absolute Values of Integers**

Using a number line allows you the opportunity to see where a number is in relationship to other numbers. We can also see how far a number is from zero. Let's look at an example.



If you look at this number line, you will see that 2 is two units away from zero. We call each little line on the number line a unit. You will also see that -2 is two units away from zero. Even though these numbers have completely different values, one is a loss and the other is a gain, they are both two units away from zero.

The ***absolute value*** of a number is the distance that the integer is from zero.

When you want to find the absolute value of a number, the distance the number is from zero, you will see this symbol around the number $|5|$. The absolute value of 5 is 5. Five is five units away from zero.

Example

$|-9| =$ ____

The absolute value of negative nine is the number of units that -9 is from zero. It is nine units from zero. So the absolute value of -9 is 9.

$|-9| = 9$

Example

$|9| =$ ____

The absolute value of 9 is the number of units that the number 9 is from zero. Nine is nine units from zero.

$|9| = 9$

Notice that the absolute value of **-9 and 9 is 9.** Both integers are the same distance from zero.

Practice working with absolute values. Find the absolute value of each integer.

1. $|-10| =$ ____

2. $|25| =$ ____
3. $|-2| =$ ____

Take a few minutes to check your work with a friend. Is your work accurate?

III. **Add Integers with the Same Sign**

When you add integers with the same sign, you think in terms of gains OR in terms of losses, but not both at once. Let's look at an example.

Example

5 + 9 = ____

These two integers are both positive. We can add them just as we would any whole numbers. Five plus nine is fourteen. That is our answer.

5 + 9 = 14

The answer is 14.

A positive plus a positive is still positive. The sign stays the same when you add two integers that have the same sign.

What about a negative integer plus a negative integer?

A negative integer is a loss. A loss plus another loss is more loss. **As before, the sign stays the same when you add two integers that have the same sign.** Let's look at the example.

Example

-9 + -8 = ____

A negative nine plus a negative eight is a negative seventeen.

-9 + -8 = -17

The answer is -17.

We can notice two things.

1. **The sign stays the same when you add two integers that have the same sign.**
2. **You can add the integers just as you would whole numbers and keep the sign the same.**

A gain and a gain is more gain.

A loss and a loss is more loss.

Practice adding integers with the same sign.

1. **-9 + -11 =** ____
2. **-8 + -13 =** ____
3. **17 + 12 =** ____

Check your answers with a peer. Do your answers match?

IV. **Add Integers with Different Signs**

You now know how to add integers with the same sign. What about when two integers have different signs? We started working on this when we used a number line for adding earlier in this lesson. But if you don't have a number line, you can still add integers with different sign. Let's learn how to do this now.

How do we add integers with different signs?

We can add integers with different signs by ignoring the sign and by finding the difference between the two values. Then the sign of the greater loss or gain becomes the sign of the answer.

Let's look at an example.

Example

8 + -3 = ____

First, ignore the sign and find the difference between 8 and 3. Difference means to subtract. We subtract 8 and 3 and get 5.

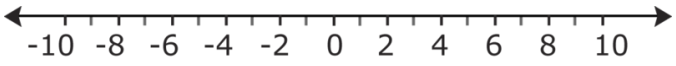
8 - 3 = 5

Next, think about losses and gains. The gain is greater than the loss. So our sign is positive.

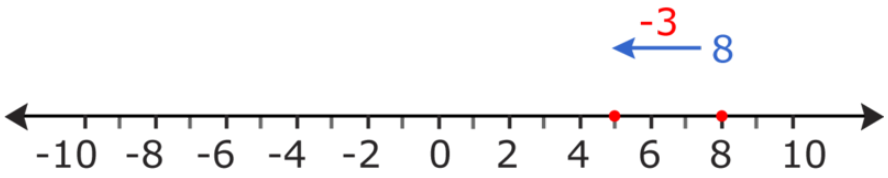
8 + -3 = 5

The answer is positive 5.

We can check our work by using a number line.



We start with positive 8.



We add a negative three to that, so we move three units towards the negative side of the number line.

The answer is 5, so our answer checks out.

Let's try another one.

Example

-9 + 4 = ____

First, ignore the signs and find the difference between the two values.

9 - 4 = 5

Next, think about losses and gains. Here the loss is negative nine. That is a big loss. The loss is greater than the gain. A loss of nine is greater than a gain of four, so our sign in negative.

-9 + 4 = -5

The answer is negative five.

Example

-2 + 8 = _____

First, ignore the signs and find the difference between the two values.

8 - 2 = 6

Next, think about losses and gains. This problem starts with a loss of 2, that's the negative two, and then there is a gain of 8. That is a sum of positive 6. Since the gain is greater than the loss, the answer is positive.

The answer is positive six.

Now it's time for you to try a few on your own. Figure out each sum.

1. **7 + -13 = ____**
2. **-22 + 10 = ____**
3. **-1 + 16 = ____**

Take a few minutes to check your work with a peer

Real Life Example Completed

Time Zone Trouble

Here is our introductory problem once again. Reread the problem and underline any of the important information.

Cooper is having a great time getting to know his pen pal in New Zealand. He and his pen pal Riley are the same age and both love sports. The one thing that Cooper is having a hard time with is the whole idea of time zones.

"I get it if we are talking here, New York and California," Cooper tells his friend Emma. "That's a difference of four hours. It is a loss of four if I go to California and it is a gain of four if I travel from California back to here. It is 9 am right now, so it is 5 am in California."

"Well if you get that, what's so hard about New Zealand? You can use integers to figure out the time just like you did with New York and California," Emma says smiling.

"What do you mean?"

"Well, you said it is 8 am right now. Then there is a loss of four hours to travel to California. You can write an addition problem and figure it out."

8 + -4 = 4

"See?" Emma says jotting the numbers on a piece of paper.

"Nope, not really," Cooper says shaking his head. "I know that New Zealand is 16 hours ahead of us, but I don't know what to do from there. Is that a loss or a gain?"

Now that we know about positive and negative integers, let's learn the rest of the discussion.

"Alright, never mind about that," Cooper says. "I'll just add 16 to 8 am and that will give me the time in New Zealand."

Cooper writes the following on his paper.

8 + 16 = 24

Emma smiles.

"You can't do it that way silly. We don't have 16 hour clocks. We have 12 hour clocks. You can use integers to solve this, but you will need to split up the 16 hours into 12 hours and 4 hours. If you start at 8 in the morning and then you gain 12 hours, you end up at 8 at night."

8 am to 8 pm is 12 hours.

"Oh, I see, Cooper said. Now I have four hours more to add. So I start at 8 pm and add four hours."

8 + 4 = 12 midnight

"When it is 8 am here, it is 12 midnight in New Zealand," Cooper said.

What about if Cooper was in New Zealand at 2 pm in the afternoon and could travel instantly back to New York? What time would he arrive?

You can figure this out in the same way. There is still a 16 hour difference-except this time we are going back in time not forward in time.

-16 hours

2 pm to 2 am the day before = 12 hours

2 am + -4 hours = ____

We can count backwards for this one.

2, 1, 12, 11 pm

Cooper would arrive in New York at 11 pm the day before he left.

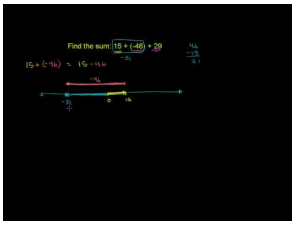
Vocabulary

Here are the vocabulary words that are found in this lesson.

Integer the set of whole numbers and their opposites. Positive and negative whole numbers are integers.

Absolute Value the number of units that an integer is from zero. The sign does not make a difference.

Technology Integration



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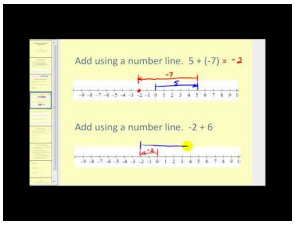
KhanAcademy, AddingIntegers with DifferentSigns



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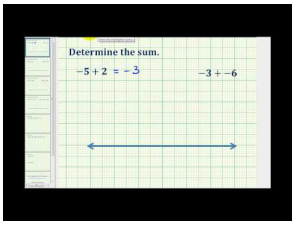
James Sousa,Adding IntegersUsing aNumber Line



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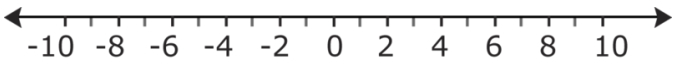
James Sousa,Exampleof Adding Integers

Time to Practice

Directions: Identify the absolute value of integers. Use a number line for reference.



1. $|6|$
2. $|-6|$
3. $|-21|$

4. $|8|$

5. $|12|$

6. $|-7|$

7. $|-17|$

8. $|17|$

9. $|4|$

10. $|-4|$

Directions: Add the following integers that have the same sign.

11. 6 + 7 = _____

12. -9 + -7 = _____

13. -3 + -4 = _____

14. 5 + 12 = _____

15. -12 + -23 = _____

16. 27 + 11 = _____

17. -34 + -13 = _____

18. 25 + 16 = _____

19. -9 + -29 = _____

20. -16 + -12 = _____

Directions: Add the following integers. Notice that they have different signs.

21. -9 + 3 = _____

22. -7 + 5 = _____

23. 1 + -12 = _____

24. 3 + -8 = _____

25. -19 + 11 = _____

26. 7 + -12 = _____

27. 23 + -10 = _____

28. -4 + 16 = _____

29. 15 + -18 = _____

30. -15 + 9 = _____