



# Properties of Integers

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**Target Grade:** 4<sup>th</sup> – 6<sup>th</sup> grade Math

**Time Required:** 60 minutes

## Standards

### *Common Core Math Standards*

- CCSS.MATH.CONTENT.6.NS.C.5  
Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

## Lesson Objectives

Students will:

- Understand that negative numbers describe real quantities, such as temperature and debt, that represent the opposite quantity of their positive counterpart (ex. 5 and -5).
- Be able to compare the value of integers and use inequalities to show which numbers are larger than others.

## Central Focus

Students will learn about negative numbers through real life examples throughout the lesson. Students have learned the positive numbers, but in this lesson they will explore negative numbers. The class will begin with a visual exercise using a runner to move left and right. Learning about negative numbers will allow students to express more real life examples such as ones that require direction.

Key Terms: origin, natural number, integer, positive, negative, sign



## Background Information

The activities in this lesson are adapted from PBS learning media (<https://tnlearn.pbslearningmedia.org/resource/vt107.math.number.numbers.lpnegnumb/introduction-to-negative-numbers/>) and Nrich.org (<https://nrich.maths.org/6693>).

Prior to this lesson students should be familiar with inequality, greater than, less than, number line, and quantity.

- Inequality
  - An inequality compares two values, showing if one is less than, greater than, or simply not equal to another value.  
([Inequality Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)](https://www.mathsisfun.com/definitions/inequality.html))

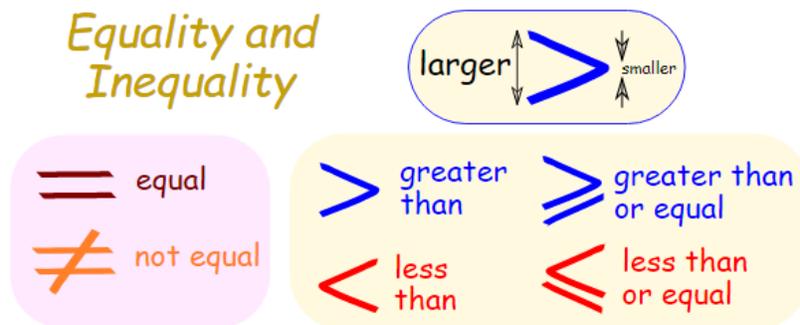


Figure 1: <https://www.mathsisfun.com/definitions/inequality.html>

- Greater Than
  - Bigger
  - The symbol  $>$  means greater than.  
([Greater Than Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)](https://www.mathsisfun.com/equal-less-greater.html))

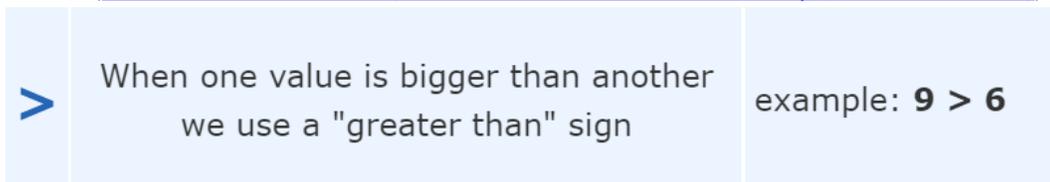


Figure 2: <https://www.mathsisfun.com/equal-less-greater.html>



- Less Than
  - Smaller
  - The symbol  $<$  means less than.

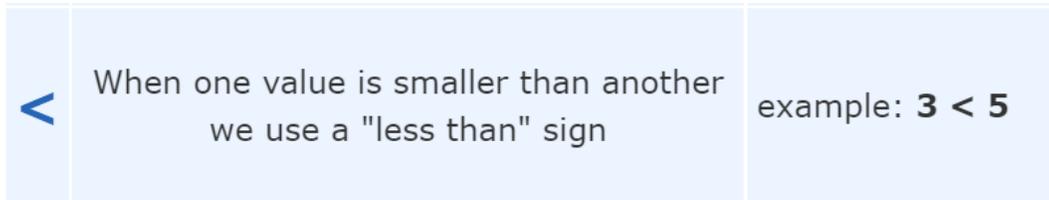


Figure 3: <https://www.mathsisfun.com/equal-less-greater.html>

- Number Line
  - Writing numbers down on a number line makes it easy to tell which numbers are greater or lesser.
  - A number on the left is less than a number on the right.  
([Number Line \(mathsisfun.com\)](#))

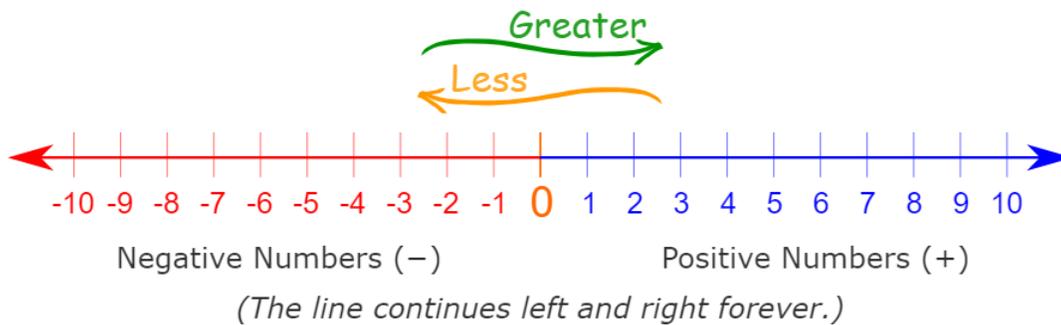


Figure 4: <https://www.mathsisfun.com/number-line.html>

- Quantity
  - How much there is of something.
  - Example: What is the quantity of rice?
    - We can say “ a handful”
    - Or use a measuring cup and say “55 milliliters”
    - Or we can count them and say “1563”  
([Quantity Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)](#))



Figure 5: <https://www.mathsisfun.com/definitions/quantity.html>



Prior to this lesson teachers should be familiar with the following terms: origin, natural number, integer, positive, negative, and sign.

- Origin
  - The starting point.
  - On a number line it is 0.

[\(Origin Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)\)](#)

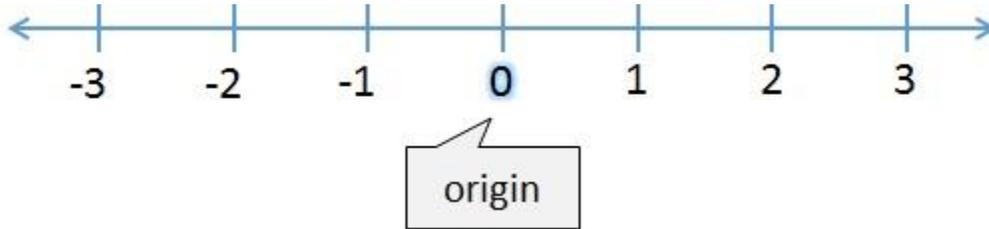


Figure 6: <https://www.mathematics-monster.com/glossary/origin.html>

- Natural number
  - The whole numbers from 1 upwards: 1, 2, 3, and so on.
  - From 0 upwards in some fields of mathematics: 0, 1, 2, 3, and so on.
  - No negative numbers and no fractions.

[\(Natural Number Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)\)](#)

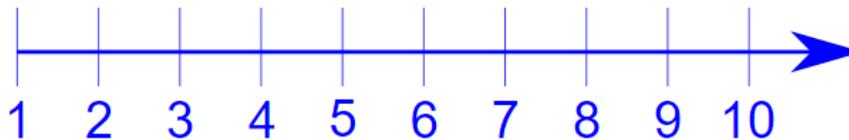


Figure 7: <https://www.mathsisfun.com/definitions/natural-number.html>

- Integer
  - A number with no fractional part (no decimals).
  - Includes:
    - The counting numbers {1, 2, 3, ...}
    - Zero {0}
    - And the negative of the counting numbers {-1, -2, -3, ...}

[\(Integer Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)\)](#)



Figure 8: <https://www.mathsisfun.com/definitions/integer.html>



- Positive
  - Greater than zero.
  - Note that zero is neither negative nor positive.  
([Positive Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)](#))

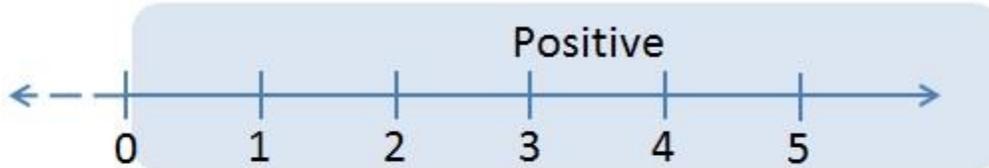


Figure 9: [https://www.mathematics-monster.com/glossary/positive\\_numbers.html](https://www.mathematics-monster.com/glossary/positive_numbers.html)

- Negative
  - Less than zero.
  - A negative number is written with a minus sign in front.
  - Note that zero is neither negative nor positive.  
([Negative Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)](#))

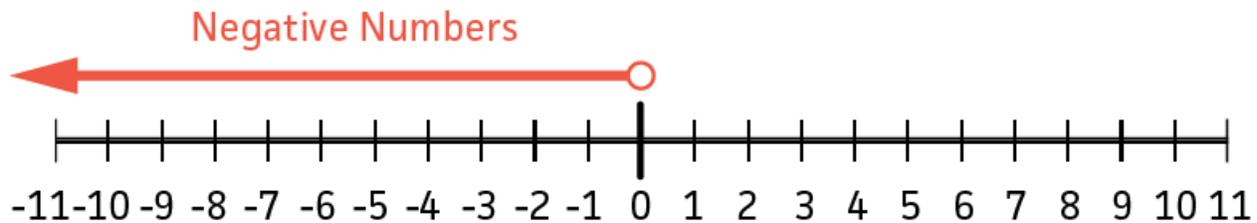


Figure 10: <https://www.exp11.com/t/adding-negatives-or-zero-8960>

- Sign
  - Means negative or positive.  
([Sign Definition \(Illustrated Mathematics Dictionary\) \(mathsisfun.com\)](#))

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Figure 11: <https://jacobsphysics.blogspot.com/2012/08/when-i-have-to-deal-with-negative-signs.html>



## Materials

- Small posters
- Markers
- Large number line
- Tug Harder activity sheets <https://nrich.maths.org/5898/index>
- Smartboard or projector
- Tokens (for Tug Harder activity)
- Pencils
- Paper
- iPad (alternative to paper)
- *Negative Numbers: An Overview* video with CC:  
<https://www.youtube.com/watch?v=6U1kCOuNpR4&t=3s>
- Online version of all worksheets and exit tickets

## Instruction

### Introduction

- Present the runner problem to the students and ask where the origin of the runner is and where the runner will be if they go 4 miles to the left.



Figure 12: <https://www.vectorstock.com/royalty-free-vector/men-and-women-running-silhouette-vector-2545784>

- With this discussion, show how the sign of a number corresponds to different directions in this scenario, modeling how students should think about the meaning of positive and negative numbers in other real-world situations.



- Then show the *Negative Numbers: An Overview* video, which introduces negative numbers and shows how negative numbers are found in temperature and finance.
  - <https://www.youtube.com/watch?v=6U1kCOuNpR4&t=3s>
  - This models how students can come up with new scenarios of positive and negative numbers.



Figure 13: <https://www.youtube.com/watch?v=6U1kCOuNpR4&t=3s>

## Activity

### Part 1

- After watching the video, call for students to give examples of real-world situations that involve integers, both positive and negative.
- Have students speak to their neighbor and then share with the class and organize their ideas in a chart.
- Then discuss the values of the example numbers and compare the numbers with inequalities, emphasizing that a positive number is always greater than a negative number.



Part 2

- Instruct students to get into small groups of 3-4 to create a poster that explores a real-world situation, taken from the list of examples made earlier.
  - In the poster, they must give an example of a positive number and a negative number and explain what both signs mean practically.
  - They must also explain what the origin means.

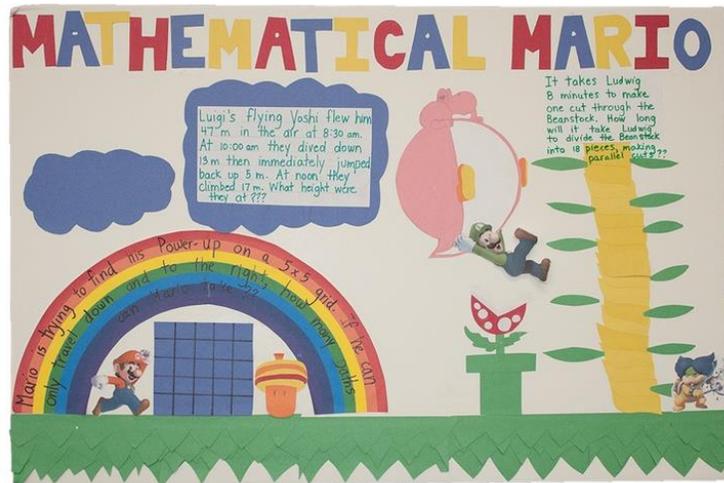


Figure 14: Math Poster Example

<https://www.pinterest.com/pin/341781059191082291/>

- Once the posters are finished, display them around the classroom (digital posters will go on the smartboard/projector).
- Have any group that finishes early play the Tug Harder game that is a precursor to adding and subtracting negative numbers.

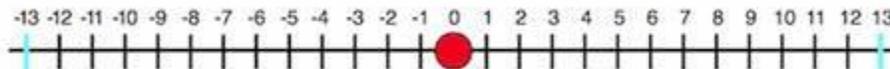


Figure 15: <https://nrich.maths.org/5898>

- During this time, walk around the room to ask and answer questions and provide support for groups that need extra help.



## Closure

- Once everyone is done with the activity, give each student an exit ticket.
  - As part of the exit ticket, students must go around and look at other groups' posters.
  - They must pick one and explain in their own words the meaning of the positive and negative numbers as well as the origin in the situation.
  - They will also fill in inequalities to show they know how to compare integers.
- Because students should have plenty of time to work, ask those who finish to share with their peers which real-life situation was the most unfamiliar to them and if they learned something new.
- If there is time, ask them whether they feel comfortable adding and subtracting with negative numbers.

## Differentiation

### ELL students

- Throughout the lesson, the teacher can articulate their words well and make sure to not speak too rapidly.
- Before class, provide students with a list of vocab words with definitions in both English and their native language.
- Have a transcription of the video for them to have so that they can follow along.
- With quick formative assessments (such as asking for head nods, 1-5 fingers for understanding, or thumbs up), I will be able to assess if this student is following the lesson.
- During the group work, allow the students to access to a computer or iPad with translation technology in case he needs to look up any words.
- As they work on the exit ticket, let them use this online translation to look up words and check.

### Students with learning disabilities

- Make sure to give the students plenty of wait time to process questions and their answer before asking them to respond.
- In order for them to fully process instructions, be sure to verbally state the instructions and have them in written form, whether on the board or on a worksheet.
- For the poster work, it will be helpful for this student to be working in a group.
- Allow them to use visuals instead of words for explanations.
- Group them with other students who can write well so that they can help refine the written explanations on the poster.
- Make sure the students have a chance to give an oral explanation of their answer (whether directly to the teacher or in a recording) to augment the written work.



#### Advanced students

- Allow students to work ahead and have them help other students who may need more support.
- Ask those who finish to share with their peers which real-life situation was the most unfamiliar to them and if they learned something new.

#### Assessment

##### *Formative Assessment*

- During class discussions, the teacher will observe if the students are understanding the material. The class discussion will allow the teacher to see what students are understanding as well as what they may be struggling to understand.
- Before they break up into groups, the teacher will ask for a hand sign to gauge student understanding (students show 1-5 fingers depending on their level of understanding). This will allow the teacher to assess how much the student is understanding the concept.
- Questions that the teacher will ask groups during the group work will also act as formative assessment. The responses will allow the teacher to see where the students may be struggling.

##### *Summative Assessment*

- The finished poster will allow the teacher to see how the students are able to apply their knowledge of negative numbers to a real world situation.
- The exit ticket will allow the teacher to assess what concepts the students understood as well as what concepts they may be struggling with.

Cutout for the warmup:



## Exit Ticket

Name: \_\_\_\_\_

1. Go around the room and explore other groups' posters. Pick one poster. What does it mean if a number is negative in this situation? What does it mean if a number is positive? What is the meaning of the origin? Write in complete sentences.

2. A football team gets penalized for a foul and loses 5 yards. Which sign (+ or -) should go in front of this number to represent the situation?

3. Fill in the blanks with > or <:

$$-1 \square 1$$

$$4 \square -10$$

$$-2 \square -6$$

Rubric for exit ticket:

	Proficient	Meets Expectations	Below Expectations
Problem 1	Includes full and accurate explanation for the meaning of negative numbers, positive numbers, and the origin. Writes in complete sentences with few to no mistakes.	Accurately describes the meaning of at least two of the components. Writes in full sentences; there may be many mistakes, but the meaning is clear.	Little to no explanations of the components of the real-world situation. OR Written explanation incoherent
Problem 2	Accurately says that the negative sign represents the loss of 5 yards.	Accurately says that the negative sign represents the loss of 5 yards.	Incorrectly says a positive sign should be used.
Problem 3	Correctly fills in all 3 blanks.	Correctly fills in 2 blanks.	Correctly fills in 0-1 blank(s).

