

# 8th Grade Math



## Unit 3: One-variable equations, inequalities, and their applications

8.8A, 8.8C, 8.12A, 8.12B, 8.12C, 8.12D

Understanding how to solve equations is fundamental in math—and in life! This unit helps develop practical problem-solving and logical thinking skills.

- Write equations and inequalities to represent situations
- Solve equations and inequalities
- Define variables in order to represent situations and then write and solve the corresponding equations
- Calculate simple and compound interest



TEKS standards	Common misconceptions
<p><b>8.8A:</b> Write one-variable equations or inequalities with variables on both sides that represent problems using rational number coefficients and constants</p>	<p><b>Confusing the inequality symbols</b>   Some students might mix up the inequality symbols: <math>&gt;</math> (greater than), <math>\geq</math> (greater than or equal to), <math>&lt;</math> (less than), and <math>\leq</math> (less than or equal to).</p> <p><b>How to help:</b> Review the symbols regularly with students. Remind them that the wide part of the symbol always opens to the larger value and that the line under the symbol means that both sides can also be equal (the line is like one of the lines in the equal sign). There are many ways that students might have to remember which way the inequality should open. Two favorites are comparing the inequality to an alligator mouth or PacMan—in both cases, it “eats” the bigger number.</p> <div style="text-align: center;">   </div>
<p><b>8.8C:</b> Model and solve one-variable equations with variables on both sides of the equal sign that represent mathematical and real-world problems using rational number coefficients and constants</p>	<p><b>Challenges with algebraic manipulation</b>   Once the equation is set up, some students might have difficulty solving for the variable. They might subtract instead of add, divide instead of multiply, etc. Students may also try to do too much in one step, leading to errors.</p> <p><b>How to help:</b> Solving an equation is like keeping a scale balanced, and we need to make sure to do the same thing to both sides. Students have</p>

**8.12A:** Solve real-world problems comparing how interest rate and loan length affect the cost of credit

**8.12B:** Calculate the total cost of repaying a loan, including credit cards and easy access loans, under various rates of interest and over different periods using an online calculator

**8.12C:** Explain how small amounts of money invested regularly, including money saved for college and retirement, grow over time

**8.12D:** Calculate and compare simple interest and compound interest earnings

solved equations with one variable before, and now they will solve equations with at least one variable on each side. The same solving steps still apply. Encourage students to take it slow, step by step, and to check their work as they go. Some students may benefit from writing the equation out in expanded form and then simplifying before jumping into the algebraic manipulation.

$$5x + 1 = 2x + 4$$

$$x + x + x + \cancel{x} + \cancel{x} + 1 = \cancel{x} + \cancel{x} + 1 + 1 + 1 + 1$$

$$x + x + x + 1 = 1 + 1 + 1 + 1$$

$$3x = 3$$

$$x = 1$$

**Applying the distributive property correctly** | Some students might make mistakes when applying the distributive property, especially when it involves negative numbers or fractions.

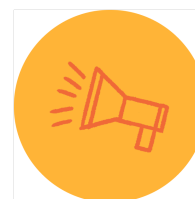
**How to help:** Remind students that the distributive property involves multiplying each term inside the parentheses by the term outside. Some students might forget to distribute a negative sign or a coefficient to every term inside the parentheses. Remind them that the distributive property is like handing out cookies to everyone at a party—you can't leave anyone out!

**Combining like terms** | Students might forget to combine like terms, or they might incorrectly combine terms that aren't alike. For instance, they might incorrectly try to combine a term with a variable and a constant term together.

**How to help:** Review what is meant by like terms with students. Give them colored pencils or highlighters to mark terms that they can combine together, or use different underlining techniques.

**Difficulty with fractions** | Even though students have been working with fractions for a number of years, they still may need extra support when working with them.

**How to help:** Review fractions with students and how to add/subtract and multiply/divide. A short refresher might be enough for many students. Using teacher led groups to give targeted support to the students struggling most with fractions will be beneficial.





















# Unit resources




- For the videos in this unit, use the [Learning summary video notetaking guide](#).
- For the articles in this unit, use the [Article notetaking guide](#).
- For the exercises in this unit, use the [Blank workspace template](#).
- To record key terms and information, use the [Vocabulary and notation notetaker](#).



## Lesson overview

Lesson	Objective	Teaching tips
<p><b>Lesson 1: Using inequalities to solve problems</b></p> <p>TEKS standard: 8.8A</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Video</p>  <p>1</p> </div> <div style="text-align: center;"> <p>Article</p>  <p>0</p> </div> <div style="text-align: center;"> <p>Exercise</p>  <p>1</p> </div> </div>	<p>Students will be able to translate a scenario into an inequality.</p>	<ul style="list-style-type: none"> <li>• <b>Warm up activity:</b> Review solving one- and two-step equations as well as inequalities. For solving equations, give a few simple problems to solve, like <math>3x = 15</math> and <math>2x - 4 = 6</math>. For inequalities, give some problems where students translate words into inequalities, like <i>there are more than 5 paper clips on the desk</i> <math>\rightarrow p &gt; 5</math>.</li> <li>• The exercise in this lesson asks two things of students: to represent a situation with an inequality and then to solve the inequality. Encourage students to read the problems slowly and carefully to ensure they are translating them correctly. Then, connect solving two-step equations, which they have seen before, with solving two-step inequalities. Most of the steps will be the same (the only difference is that when you multiply or divide both sides by a negative number, the inequality symbol flips).</li> </ul>
<p><b>Lesson 2: Representing problems with equations &amp; inequalities</b></p> <p>TEKS standard: 8.8A</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Video</p>  <p>4</p> </div> <div style="text-align: center;"> <p>Article</p>  <p>0</p> </div> <div style="text-align: center;"> <p>Exercise</p>  <p>2</p> </div> </div>	<p>Students will be able to write equations and inequalities that represent given situations.</p>	<ul style="list-style-type: none"> <li>• Building off of the last lesson, students will write equations and inequalities that represent situations and then simplify (not solve) them.</li> <li>• Continue to encourage students to read problems carefully. Drawing a picture of the situation may be helpful. Students may need extra language support to translate words into expressions.</li> <li>• This is a good place for teacher led groups. Students may have difficulty in different places with these problems and it is important to give them targeted support at this point in the unit.</li> </ul>

<p><b>Lesson 3: Equations with variables on both sides</b></p> <p>TEKS standard: 8.8C</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Video</p>  <p>3</p> </div> <div style="text-align: center;"> <p>Article</p>  <p>0</p> </div> <div style="text-align: center;"> <p>Exercise</p>  <p>2</p> </div> </div>	<p>Students will be able to solve equations with variables on both sides.</p>	<ul style="list-style-type: none"> <li>We continue to build off of the previous lessons, now with variables on both sides of the equation. The first video shows a visual model for solving equations like this and is one way to help students build their conceptual understanding.</li> <li>Encourage students to always check their answers! They can know if their answer is correct by plugging it back into the original equation to see if both sides are in fact equal.</li> <li>Problems will get one step more challenging with the addition of fractions and decimals. Teacher led groups may be a good choice to use here, too, depending on the type of support students need.</li> </ul>
<p><b>Lesson 4: Equations with parentheses</b></p> <p>TEKS standard: 8.8C</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Video</p>  <p>1</p> </div> <div style="text-align: center;"> <p>Article</p>  <p>1</p> </div> <div style="text-align: center;"> <p>Exercise</p>  <p>2</p> </div> </div>	<p>Students will be able to solve equations with variables on both sides that include using the distributive property.</p>	<ul style="list-style-type: none"> <li><b>Warm up activity:</b> Give problems where students can practice simplifying by using the distributive property. For example, simplify <math>2(x - 5)</math>.</li> <li>Students continue to solve equations with variables on both sides, now with the addition of parentheses and the use of the distributive property. The last exercise also includes fractions and decimals.</li> </ul>
<p><b>Lesson 5: Basic equation word problems</b></p> <p>TEKS standard: 8.8A, 8.8C</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Video</p>  <p>2</p> </div> <div style="text-align: center;"> <p>Article</p>  <p>0</p> </div> <div style="text-align: center;"> <p>Exercise</p>  <p>1</p> </div> </div>	<p>Students will be able to solve problems with sums of consecutive integers.</p>	<ul style="list-style-type: none"> <li>The problems in this lesson are very specific to writing and solving equations that represent the sums of consecutive integers. They are all solved using the same format and method. It will be important that students get comfortable with defining their own variables. See “Best practices.”</li> <li>Be sure to explicitly review what <i>consecutive</i> means and walk through some examples together. These types of problems are likely new to students.</li> </ul>
<p><b>Lesson 6: Simple &amp; compound interest</b></p> <p>TEKS standard: 8.12C, 8.12D</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>Video</p>  <p>2</p> </div> <div style="text-align: center;"> <p>Article</p>  <p>0</p> </div> <div style="text-align: center;"> <p>Exercise</p>  <p>1</p> </div> </div>	<p>Students will be able to calculate simple and compound interest.</p>	<ul style="list-style-type: none"> <li>This lesson changes gears as students are no longer solving equations, they are plugging values into equations and simplifying.</li> <li>Students will use the simple interest and compound interest formulas to calculate and compare quantities in different situations. They will need to identify which equation to use for different situations before plugging in and simplifying.</li> </ul>

<p><b>Lesson 7: Interest rate, loan length, &amp; cost of credit</b></p> <p>TEKS standard: 8.12A, 8.12B</p> <p>Video  2    Article  2    Exercise  1</p>	<p>Students will be able to explain the variables that go into calculating loan payments.</p> <p>Students will be able to explain the relationship between monthly payments and total price paid for a loan.</p>	<ul style="list-style-type: none"><li>• This lesson focuses on the factors that go into taking out a loan, specifically a car loan. Students will not need to calculate the monthly payments or total amount paid (they will use the financial calculator), but they will explore how the loan amount, interest rate, and loan term impact the monthly payment amount.</li><li>• Students will also explore the relationship between the amount of monthly payments and the total amount paid. It is important to review this with students, as often they will only consider the monthly payments but not the long term debt.</li></ul>
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**TRY THIS  
WITH YOUR STUDENTS**

# Best practices



## Solving sums of consecutive integer problems

In the first four lessons, students solve equations with variables and translate words into algebraic equations, but in those cases, the variables are already defined for them. When solving sums of consecutive integer problems, students will have to define their own variables, which may be new to them.

The idea of consecutive integers may also be new. **Consecutive integers** are numbers that follow each other in an order. Any numbers that are in counting order are consecutive, for example, 1, 2, 3 are consecutive integers, as are 46, 47, 48, 49. When talking about consecutive odd or even integers, they also need to be in order, for example, 8, 10, 12 are consecutive even integers and 23, 25, 27, 29 are consecutive odd integers.

When we solve problems involving sums of consecutive integers, the first thing we need to do is *define a variable*. Usually, we define the variable to represent the smallest number in the sequence, but you could define it for any of the numbers in the sequence and vary what you add or subtract to the other number representations accordingly.

For example, The sum of 4 consecutive even numbers is 100. What are the numbers in the sequence?

Let's call the first number in the sequence  $x$ . If the first number is  $x$  then the second number will be  $x + 2$  because consecutive even numbers differ by 2.

We can write the four numbers in terms of  $x$  and what we know about the relationship of consecutive even numbers.

$$x + (x + 2) + (x + 4) + (x + 6)$$

Then, we can set our expression equal to the sum and solve.

$$\begin{aligned} x + (x + 2) + (x + 4) + (x + 6) &= 100 \\ 4x + 12 &= 100 \\ 4x &= 88 \\ x &= 22 \end{aligned}$$

This tells us that the smallest number in the sequence is 22. We can plug 22 in for  $x$  to find the other numbers in the sequence, or just add two more to each one.

$$\begin{aligned} 22 + (22 + 2) + (22 + 4) + (22 + 6) &= 100 \\ 22 + 24 + 26 + 28 &= 100 \end{aligned}$$

So, the numbers in the sequence are 22, 24, 26, 28. And we can check by adding them all together to make sure they sum to 100.

## CLASSROOM ACTIVITIES

### **Sum of consecutive integer problem creation**

Have students write their own problem involving the sum of consecutive integers. They can choose how many integers they want to add; if they are even consecutive, odd consecutive, or just consecutive; and which numbers they want to use. The problems are easy to create once the list of numbers is created—just add them up! Students can trade problems with peers and try to stump each other. They can create their own solution posters with justification for each step.

### **Interest practice**

Have students write their own problems involving interest. You can decide if you want students to write problems with simple interest, compound interest, or compare the two. Encourage them to think about what they might be interested in saving money for and create problems that are meaningful to them. Students can make a poster for their problems and/or trade with a peer to solve each other's problems.

## GENERAL CLASSROOM IMPLEMENTATION RESOURCES:

- [Weekly Khan Academy Quick Planning Guide](#): Use this template to plan your week using Khan Academy.
- [Using Khan Academy in the Classroom](#): Learn teaching techniques and strategies to support your students and save time with Khan Academy.
- [Differentiation Strategies for the Classroom](#): Discover strategies to support the learning of all students.