Khan Academy

5th Grade Math

Unit 1: Extending whole number operations

5.3A, 5.3B, 5.3C, 5.3K

In the real world, we use multiplication and division all the time. From splitting the bill at a restaurant, to calculating distances on a road trip, to understanding data in the news. It's a skill that opens up a world of possibilities!

- ☐ **Estimate** the solutions to whole number addition, subtraction, multiplication, and division problems
- ☐ Calculate the **exact solutions** to whole number addition, subtraction, multiplication, and division problems
- ☐ Solve **multi-step word problems** involving addition, subtraction, multiplication, and division of whole numbers

START HERE

TEKS standards	Common misconceptions
5.3A: Estimate to determine solutions to mathematical and real-world problems involving addition, subtraction, multiplication, or division	**Misunderstanding the purpose of estimation |** Some students might think that estimation should give the exact answer, but the purpose of estimation is to get a quick, approximate idea of the result. **How to help:** Remind students often that they are trying to get an approximate answer, we're looking for close but not exact. We want to have an idea of the result quickly. Estimation is useful in many areas of life outside of school. For example, when someone is shopping at a store and they have $10, they might keep an estimation of how much each item costs to make sure they have enough money to buy everything.
5.3B: Multiply with fluency a three-digit number by a two-digit number using the standard algorithm	**Place value confusion |** There are multiple places where students can get confused with place value in addition and subtraction problems. They might be confused about how to vertically line up the numbers so the place digits align and they might also be confused about which digits to add or subtract first.
5.3C: Solve with proficiency for quotients of up to a four-digit dividend by a two-digit divisor using strategies and the standard algorithm	**How to help:** Review place value with students and the need to add or subtract digits of the same value. This Place value addition/subtraction graphic organizer may be helpful. Students will have a much more difficult time correctly adding and subtracting in this unit if they don't have a strong foundation in place value. Remind

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5.3K: Add and subtract positive rational numbers fluently	them that when they add or subtract, they always start with the digits on the right.
	
	Confusion with the Standard Algorithm for multiplication and division | Some students will want to jump right into using the Standard Algorithm for multiplication (lining up vertically and multiplying out) and/or division (long division), but they will likely make many mistakes if they don't actually understand what they are doing. The Standard Algorithms are complex and may lead students to memorizing a set of steps without making connections to why they are doing them. This can lead to frustration and confusion for students.
	
	    How to help: Have students use the problem solving methods introduced at the beginning of each lesson. See "Best practices" for more details. Don't rush students into using the Standard Algorithm and only present it when they have shown they're ready to add and subtract using conceptual methods consistently.
	
	Not creating a plan | Jumping straight into solving a problem without a plan can lead to mistakes. Students should read the problems carefully and make a problem solving plan—especially for word problems, which students will see throughout the unit.
	
	    How to help: First, it's important that students understand the context and the question that is being asked of them. Students will need to interpret the operation(s) to be used from the problem. Word problems often contain a lot of information and it can be easy to miss key details. Encourage students to read the problems slowly, carefully, and multiple times. They should determine which operations they need to use and in what order.
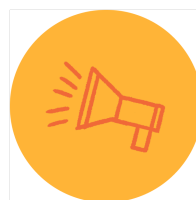
Unit resources

- For Lesson 1 and 2, use this [Place value addition/subtraction graphic organizer](#) to help students organize their work. Put it in a sheet protector and have students use dry erase markers.
- 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
Lesson 1: Estimate addition and subtraction of whole numbers TEKS standard: 5.3A Video 3 Article 0 Exercise 3	Students will be able to estimate addition and subtraction of whole numbers. Students will be able to estimate addition and subtraction of whole numbers from word problems.	- Since this is the first lesson in the unit, be sure to review with students the expectations when working on Khan Academy and how to use the unit resources. - Begin this lesson with a warm up where students round and add or subtract smaller numbers (tens, hundreds, thousands) to prepare them to work with larger numbers. - The third exercise includes the same skills in word problems. Review addition words (in all, combined, between the two, etc.) and subtraction words (how much more, how many more, etc.).
Lesson 2: Add and subtract whole numbers TEKS standard: 5.3K Video 3 Article 0 Exercise 2	Students will be able to add and subtract whole numbers when presented both vertically and horizontally.	- Eventually, students should be able to add and subtract quickly using the algorithm. But until then, see "Best practices" below for a conceptual strategy. It's important for students to have a strong conceptual understanding before introducing the standard algorithm.
Lesson 3: Estimate multi-digit multiplication TEKS standard: 5.3A, 5.3B	Students will be able to estimate multi-digit multiplication.	- For extra practice, students can make up their own multiplication estimation problems! Give students instructions like "create a multiplication problem where one number will be rounded up and the other number will be rounded down, then trade problems with your partner." Students can check

Video **Article** **Exercise** ▶ 3 📄 0 ✏️ 3		their partner's problem to make sure it meets the requirements before solving it.
Lesson 4: Multi-digit multiplication TEKS standard: 5.3B **Video** **Article** **Exercise** ▶ 5 📄 0 ✏️ 4	Students will be able to multiply three digit numbers by two digit numbers when presented both vertically and horizontally.	• Students are introduced to conceptual multiplication methods first before the standard algorithm is introduced. Allow ample time for students to use a conceptual method to ensure they have a strong understanding of why they are doing what they are doing before they move to using the standard algorithm.
Lesson 5: Estimate multi-digit division TEKS standard: 5.3A, 5.3B, 5.3C **Video** **Article** **Exercise** ▶ 3 📄 0 ✏️ 3	Students will be able to estimate whole number multi-digit division problems.	• Begin this lesson with an activity where students revisit the relationship between multiplication and division. For example they can relate the division equation $12 \div \boxed{?} = 6$ to multiplication like this $6 \times \boxed{?} = 12$ and then solve.
Lesson 6: Multi-digit division TEKS standard: 5.3C **Video** **Article** **Exercise** ▶ 6 📄 0 ✏️ 2	Students will be able to divide multi-digit numbers with and without remainders.	• This lesson begins with finding the answers to division problems with logical thinking about factors and multiplication. It's important for students to develop a conceptual understanding of division before they attempt the long division algorithm. See "Best practices" for more information.
Lesson 7: Multi-step word problems TEKS standard: 5.3A, 5.3C **Video** **Article** **Exercise** ▶ 1 📄 0 ✏️ 3	Students will be able to solve multi-step word problems that involve addition, subtraction, multiplication, and/or division.	• The problems in this lesson are more complicated than problems found earlier in this unit because they're multi-step. Students may need support to figure out what the question is asking for and then what calculations must be done to find the solution. Do a few problems together as a class or have students work in groups. • For students who are struggling with word problems, strip diagrams can be helpful.

Best practices

Many adults know how to use Standard Algorithms when adding, subtracting, multiplying, or dividing large numbers. However, very few understand why the algorithms make sense. In this unit, we focus on developing students' deep understanding of these operations so when they do use the Standard Algorithms, every step will make sense and have a purpose. Let's avoid "tricks!" In order to develop students' conceptual understanding of these operations, this unit introduces the following methods:

Addition and Subtraction
This method looks a lot like the Standard Algorithm, but the intermediate steps are key to developing conceptual understanding.

Addition example	Subtraction example	
$158{,}944$ $+72{,}071$	$158{,}944$ $-72{,}071$	The initial problem must be aligned properly.
$158{,}944$ $+72{,}071$ 5 $4 + 1 = 5$	$158{,}944$ $-72{,}071$ 3 $4 - 1 = 3$	The true value of each digit is being used to show the actual addition or subtraction that is taking place.
$\overset{1}{158{,}944}$ $+72{,}071$ 15 $40 + 70 = 110$	$158{,}\overset{8}{\cancel{9}}\overset{14}{\cancel{4}}4$ $-72{,}0\ 7\ 1$ $7\ 3$ $140 - 70 = 70$	
$\overset{1\ 1}{158{,}944}$ $+72{,}071$ 015 $900 + 0 + 100 = 1000$	$158{,}\overset{8}{\cancel{9}}\overset{14}{\cancel{4}}4$ $-72{,}0\ 7\ 1$ $8\ 7\ 3$ $800 - 0 = 800$	Writing out the true operations that are being done may seem like extra work, but it solidifies for students the math that they are **actually** doing.
$\overset{11\ 1}{158{,}944}$ $+72{,}071$ $1{,}015$ $8000 + 2000 + 1000 = 11000$	$158{,}\overset{8}{\cancel{9}}\overset{14}{\cancel{4}}4$ $-72{,}0\ 7\ 1$ $6\ 8\ 7\ 3$ $8000 - 2000 = 6000$	
$\overset{111\ 1}{158{,}944}$ $+72{,}071$ $31{,}015$ $50{,}000 + 70{,}000 + 10{,}000 = 130{,}000$	$\overset{0}{\cancel{1}}\overset{15}{\cancel{5}}8{,}\overset{8}{\cancel{9}}\overset{14}{\cancel{4}}4$ $-\ 7\ 2{,}0\ 7\ 1$ $8\ 6\ 8\ 7\ 3$ $150000 - 70000 = 80000$	
$\overset{111\ 1}{158{,}944}$ $+72{,}071$ $231{,}015$ $100{,}000 + 100{,}000 = 200{,}000$		

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.