MASTERING MATH

TEACHER EDITION

YELLOW LEVEL

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Mastering Math: Yellow Level

Dear Educators,

Welcome to "Mastering Math: Yellow Level," a comprehensive and standards-based math curriculum that introduces students to addition, subtraction, geometry, and measurement in the form of a set of engaging thematic units of study.

The curriculum was designed to be rigorous, thorough, age-appropriate and standards-aligned by a team of certified and experienced elementary educators. It was also designed to engage elementary students by incorporating interactive activities and thematic interdisciplinary units of study.

This introduction to the curriculum includes the following:

Overview of Skills and Standards

In this curriculum, students will learn the following skills (linked to the Common Core Standards for Fourth Grade Math):

Decomposing Numbers by Their Place Value and Writing Them in Different Ways
Comparing and Ordering Whole Numbers, Fractions, and Decimals
Rounding Numbers to the Nearest Place Value
Using Rounding to Estimate and Check Answers
Adding and Subtracting Multi-Digit Numbers
Identifying Different Types of Lines, Including Parallel, Perpendicular, Segments, and Rays
Identifying and Drawing Right, Acute, and Obtuse Angles
Classifying Shapes by Angles and Lines
Identifying and Drawing Shapes With Line and Radial Symmetry
Using a Protractor to Measure and Draw Angles
Composing, Adding, and Subtracting Angles
Continuing and Finding Rules for Math and Geometric Patterns
Identifying Features of a Pattern That Aren't Explicit in the Rule
Fluently Multiplying and Dividing One-Digit Numbers
Multiplying and Dividing by Multiples of 10, 100, and 1,000
Identifying Prime and Composite Numbers

Solving Multi-Digit Multiplication Equations Using Vertical Multiplication (Standard Algorithm)
Solving Multi-Digit Division Equations With and Without Remainders Using Long Division
Finding the Factors and Factor Pairs of a Given Number
Writing, Identifying, and Modeling Fractions
Converting Mixed Numbers to Improper Fractions and Improper Fractions to Mixed Numbers
Finding Equivalent Fractions
Simplifying Fractions
Adding Fractions (Including Mixed Numbers) With the Same Denominator
Adding and Subtracting from and to a Whole Number to Get a Fraction
Multiplying Whole Numbers by Fractions
Writing Decimals to the Second Decimal Place (Tenths and Hundredths)
Converting Decimals to Fractions and Fractions To Decimals
Understanding the Relative Size of Different Measurement Units
Converting Units of Length, Mass, Volume, Time, and Money from Smaller Units to Larger Units and Larger Units to Smaller Units
Solving Word Problems Related to Area and Perimeter

Lesson Components

Each lesson contains the following components:

The highlighted components are found only in the teacher's edition.

UNIT OVERVIEW: At the beginning of every unit in the teacher's book, there is an introductory section containing concepts, standards, and vocabulary related to the unit.

LESSON OBJECTIVE/THEMATIC UNIT/STANDARD: At the beginning of every chapter in the teacher's book, there is a small box with information for the teacher about the common core standard linked to the lesson, the lesson's objective (what the student should be able to accomplish after the lesson), and the thematic, cross-curricular unit of study that the math unit is linked to.

VOCABULARY: Each lesson contains a list of relevant math vocabulary, along with the definition. Teachers can use this to guide how they explain words and concepts to students. They can also print the vocabulary anchor chart for each chapter from the USB and hang it in the classroom to help students remember the vocabulary. The vocabulary words are also found in student workbooks alongside the definitions.

MINI-LESSON: The mini-lesson is designed to be taught by the teacher to the students in a whole-group setting. During the mini-lesson, the teacher presents the relevant vocabulary and math concepts. The teacher models how to solve math problems related to the lesson objective and how to solve problems that will be on the independent practice worksheets.

GUIDED PRACTICE: Immediately following the mini-lesson is a scripted guided practice section. In this section, students complete hands-on math activities related to the lesson, and the teacher offers support and assesses if students have mastered the lesson content or require more modeling and practice. The guided practice exercises are in both the teacher's and students' books.

EXIT TICKET: This is an optional part of the lesson that the teacher can use at the end of each lesson as a quick formative assessment to determine if students have mastered the lesson objective. The exit ticket consists of a single question that students can answer quickly. We recommend asking students to put their names on the exit ticket so the teacher can later review them and note which students require extra support or would benefit from one-on-one or small group review of the lesson's content without having to flip through dozens of workbooks to see how students completed independent math tasks.

Please note that the exit ticket can also be printed from the USB.

INTERVENTION: For students who require extra support to master the lesson objective, the intervention section lists ways that teachers and assistant teachers can support these students or review and reteach the lesson content.

EXTENSION: The extension section contains suggestions for extra challenges that teachers can assign to advanced students who master the lesson objective and complete the independent practice quickly.

MATH STATIONS: Just like the pre-activity section, the centers are OPTIONAL suggestions for teachers. Every teacher structures their classroom differently, and this curriculum aims to be flexible enough to meet the needs of all teachers and all classroom setups. For teachers who do use math stations (see the Guided Math section of the teacher introduction below), this part of the lesson contains suggestions for learning centers related to the lesson objective. Occasionally, the stations require additional materials that can be printed from the USB.

UNIT INTRODUCTION: Every unit in the curriculum is linked to an interesting and age-appropriate cross-curricular thematic unit of study. The unit introduction in the student workbook contains the vocabulary, information about the unit, and a story and activity that introduces the theme and links it to the math.

STUDENT WORKBOOK COMPONENTS: The student workbook contains the following components:

MATH IN A NUTSHELL

MATH IN A NUTSHELL: For every lesson in the student workbook, there is a section containing the concepts, steps, and strategies taught in the lesson in a visual format. This allows students to review and learn concepts on their own and take agency over their own learning.

VOCABULARY

VOCABULARY: The vocabulary for each lesson is included at the beginning of each lesson in the student workbook, along with relevant visuals.

LET'S TRY IT TOGETHER

LET'S TRY IT TOGETHER: This is where the guided practice activities are included in the student workbook. This section consists of exercises for students to complete with teacher support.

INDEPENDENT PRACTICE: The independent practice portion of the lesson contains worksheets in the student workbook for students to complete.

The independent practice contains a mixture of math equations, word problems, cumulative review, and application of concepts, including:

CHECK YOUR SKILLS

CHECK YOUR SKILLS: Check Your Skills questions require students to solve basic equations and problems where they demonstrate mastery of knowledge and concepts taught in the lesson.

REAL–WORLD MATH

REAL-WORLD MATH: Most, but not all, lessons contain real-world math questions where students are required to solve word problems related to the math objective taught in the lesson.

REVIEW & REMEMBER

REVIEW & REMEMBER: Some lessons contain Review & Remember questions. Review & Remember questions are cumulative review problems that require students to apply concepts learned in previous lessons.

BONUS

BONUS: Some lessons contain bonus questions. Bonus questions are "extra credit" problems where students need to apply the information they learned in the lesson in a way that hasn't been explicitly taught to them, using their mastery of math concepts and critical thinking skills. It should be noted that it is beneficial for students to challenge themselves and think critically about the math concepts they learned. **However, if students cannot solve the bonus questions, that is okay. They can still meet the lesson objective even if they cannot solve the bonus questions.**

THINK SMARTER

THINK SMARTER: Some lessons contain Think Smarter questions. Think Smarter questions are questions that are either open-ended and require students to come up with their own creative solutions or answers or require students to write their answers in more than a sentence, describing how they solved a problem or explaining a certain math concept or principle. (Note: The answers to these questions often vary, and there may be more than one correct answer.)

Guided Math

As mentioned earlier, this curriculum is designed to be flexible enough to be used in a wide variety of classroom structures and setups.

Many teachers nowadays choose to structure their classrooms according to research-based guided math routines. The benefit of guided math is that it balances whole group instruction (the mini-lesson) with small group work where the teacher can meet students at their ability level. A one-size-fits-all rarely works in a classroom environment that contains students of various ability levels.

For teachers who want to structure their classroom according to this method, we recommend the following:

- Begin with a mini-lesson that is whole group. Afterwards, transition the students to math workstations. During the stations, students explore and review the lesson's concepts through a variety of hands-on activities.
- One of the workstation activities that teachers will have access to on the USB is a math journaling activity. Math journaling provides students with the opportunity to make connections, apply their knowledge, and reflect on what they have learned. The journaling resource consists of open-ended questions related to the theme or math objective for each lesson. There are two journaling questions for each lesson, so the teacher can choose which one to give to students. The teacher can print the journal questions, and students can place them in a math journal and write/draw a response.
- While the students are engaging in stations, teachers and assistants can pull groups of students based on their math proficiency and work with them in small groups. This gives teachers the opportunity to reteach concepts to students who are struggling with these concepts and extend the learning for students who have mastered them. Students can also complete their independent practice worksheets as a workstation during this time.
- There are many ways to structure the transition to workstations and groupings and to ensure students know where they should be at each point during this time. Each teacher can choose the system that works best for their classroom.

A Note on Assessment

Assessments help teachers evaluate if students have mastered the material. There are many uses for assessments, including:

- Identifying the students' level and mastery of material
- Identifying which students require additional review and support
- Adjusting the learning to meet the needs of the classroom
- Determining when a concept has been mastered by the majority of the class and the teacher can move on to the next concept
- Identifying where the breakdown in understanding is happening for a specific standard
- Creating homogenous groupings for small group work based on mastery of content

There are two types of assessments:

- **Summative:** These are the chapter and unit tests. They are administered at the end of a unit of study and used to determine how much of the unit students have mastered and give students grades.
- **Formative:** Formative assessments take place during the learning process itself. The exit ticket is a form of formative assessment that the teacher can use to determine groups and the need for review. The teacher can also use their observations of student work during the guided practice as a formative assessment.

Opportunities for Differentiation

Differentiation in the classroom is the recognition that not all students learn the same way or at the same pace and that teachers should endeavor to reach every learning style and level as much as possible.

There are a number of ways to differentiate. This curriculum encourages differentiation in the following ways:

- Allowing opportunities for small group and one-on-one instruction
- Providing suggestions for intervention and extension activities
- Encouraging manipulatives and visuals
- Creating many opportunities for assessment that can be used to identify student strengths, weaknesses, and needs
- Offering suggestions for open-ended centers and math activities
- Worksheets contain a variety of math problems, including ones that are more difficult and ones that are more straightforward

Using Manipulatives/Resources Strategically

The curriculum comes with a number of manipulatives, and the USB also contains resources and printables.

We recommend using these resources in the following ways:

- Each chapter comes with printable anchor charts related to vocabulary and concepts in the lessons. We recommend that teachers hang these charts in the classroom to provide students with a visual of the material learned. This will help reinforce the material, and students can also use them as a reference.
- The curriculum comes with printables and other manipulatives that can be used to make math kits for students. These kits can be used during the guided practice section of the lesson, but students should also be encouraged to use the manipulatives in the kits to solve problems during independent practice and centers. The goal is to empower students to solve math problems autonomously, finding the resources they need to apply math strategies and using them.
- Flashcards that can be printed from the USB resources can and should be used to review and reinforce material.
- Math journaling prompts can be printed out and placed into a math journal for students to respond to during their math centers or as an extension activity.

Place Value and Number Sense

UNIT AT A GLANCE

In this unit, students will build a strong foundation in number sense and place value. Students will learn to decompose numbers using place values and write them in different ways. Students will round, compare, add, and subtract multi-digit numbers using their knowledge of place value and the value of numbers. This unit equips students with essential number sense skills that they can use to build more advanced mathematical concepts and skills later on.

STANDARDS:

By the end of Unit 1, students will have been introduced to the following common core standards:

4.NBT.A.1
Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

4.NBT.A.2
Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

4.NBT.A.3
Use place value understanding to round multi-digit whole numbers to any place.

4.NBT.B.4
Fluently add and subtract multi-digit whole numbers using the standard algorithm.

THEME

Students will practice counting through the context of learning about animals and the way they interact and communicate with people and with each other.

KEY VOCABULARY:

addend: one of the numbers being added

addition/add: to combine two or more numbers

base ten form: the way of writing a number by making a place value model

compare: note the differences between two groups

decompose: break down

difference: the amount that is left after subtracting numbers

digit: the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 that can be used as a number by themselves or to make up other numbers

equal: the same as or having the same value

equation: a math sentence with numbers and symbols that shows two equal sides

expanded form: the meaning in numbers of each digit in the number

hyphen: a short dash used to join words; in word form, we put a hyphen in between the tens and the ones

less: a smaller amount

minuend: the first number in a subtraction problem; the number that is being subtracted from; if you combine the subtrahend and the difference, you get the minuend

model: to use objects, pictures, or drawings to show the numbers in a math problem

more: a greater amount

number: how many there are of something

number line: a line that shows all the numbers in counting order, with the higher numbers to the right and the lower numbers to the left

numeral: a symbol that tells us the number

ones: the digit in the ones place shows how many single ones are in the number

order: put something in a sequence, for example, from more to less or less to more

place value: the value of the digit depends on where it is in the number (for example, in the number 19, the 9 has a value of 9, but in the number 91, it has a value of 90)

regrouping: rearrange amounts in groups according to place value when solving equations (for example, turning 17 ones into one group of ten and seven ones)

standard form: the simple way of writing a number as a numeral

subtraction: taking away one number from another number

subtrahend: the number in a subtraction problem that is being subtracted from the minuend; the amount that is being "taken away"

sum: the total amount after adding numbers

tens: the digit in the tens place tells us how many groups of ten are in the number

thousands: the digit in the thousands place tells us how many groups of a thousand are in the number

value: the amount that something is

vertical addition: adding two or more numbers by placing them on top of each other so the numbers are lined up by place value

vertical subtraction: subtracting two or more numbers by placing them on top of each other so the numbers are lined up by place value

word form: the way of writing a number where it is spelled out as words

LESSON BREAKDOWN:

CHAPTER 1: PLACE VALUE

- **Lesson 1: What is Place Value?**
  - Introduction to place value
  - Defining key concepts and vocabulary
  - Recognizing place value relationships
  - Understanding a place value chart up to the thousands place
  - Understanding the value of each digit up to the thousands place
  - Using a comma to separate groups of three digits in larger numbers
- **Lesson 2: Thousands, Hundreds, Tens, Ones**
  - Understanding place value relationships
  - Recognizing that in a multi-digit number, each place is ten times the value of the place to its right
- **Lesson 3: Writing Numbers in Different Ways**
  - Reading and writing multi-digit numbers
  - Representing numbers in standard form, expanded form, and word form

CHAPTER 2: ROUNDING AND COMPARING

- **Lesson 1: Comparing Numbers**
  - Comparing multi-digit numbers
  - Understanding that digits in high place values determine size (e.g., 345 > 199 because the three in the hundreds place is greater than the one)
  - Identifying and correcting common comparison mistakes (e.g., 741 > 759 is incorrect because the four in the tens place is less than the five)
  - Using the >, <, and = symbols correctly
  - Understanding the meaning of the equal sign (=)
- **Lesson 2: Comparing and Ordering**
  - Ordering a set of numbers from least to greatest or greatest to least
  - Applying >, <, and = symbols when comparing numbers in a list
- **Lesson 3: Rounding on a Number Line**
  - Locating the number on a number line, finding the two possible rounding choices, and choosing the correct one
  - Applying the rounding rule that digits four and less round down, and digits five or more round up
- **Lesson 4: Rounding Numbers Using Place Value**
  - Identifying the place value being rounded
  - Applying the rounding rule that digits four and less round down, and digits five or more round up
- **Lesson 5: Solving Word Problems**
  - Applying comparison strategies and knowledge of rounding and place value to solve real-world scenarios
  - Interpreting word problems and deciding whether to compare, round, decompose, or compose numbers to find the answer

CHAPTER 3: ADDING AND SUBTRACTING

- **Lesson 1: Vertical Addition and Subtraction**
  - Adding multi-digit numbers using the standard algorithm (vertical addition) without regrouping (carrying)
  - Subtracting multi-digit numbers using the standard algorithm (vertical subtraction) without regrouping (borrowing)
  - Setting up a vertical equation by lining up numbers by their place value
- **Lesson 2: Adding with Regrouping**
  - Adding multi-digit numbers using the standard algorithm (vertical addition) with regrouping (carrying)
  - **Lesson 3: Subtraction with Regrouping**
  - Subtracting multi-digit numbers using the standard algorithm (vertical subtraction) with regrouping (borrowing)
- **Lesson 4: Multi-step Equations and Word Problems**
  - Applying skills and strategies to solve multi-step equations
  - Applying skills and strategies to solve multi-step word problems
  - Breaking multi-step equations and word problems into steps and carrying out each step in sequence
  - Interpreting word problems and deciding what operation or concepts to apply to solve them
- **Lesson 5: Rounding to Check Answers**
  - Rounding numbers before adding or subtracting to estimate answers
  - Using estimates to assess the reasonability of answers

Place Value, Rounding, and More!

Welcome to Unit 1. In this unit, you'll learn how to break down big numbers and understand their value. You'll discover how place value helps us figure out what each digit in a number really means, whether it's in the **ones**, **tens**, or even **thousands** place. You'll also learn how to round numbers to make math easier, how to compare numbers to see which is bigger or smaller, and how to add and subtract very large numbers. As you compare numbers and solve addition and subtraction problems, you'll also connect these math skills to the fascinating world of animals and nature. You'll explore how animals communicate and work together in communities. With challenging activities and real-life examples, you'll see how these math skills help you solve problems and make sense of the world around you. Let's get started!

WORDS TO KNOW:

addend: one of the numbers being added

addition/add: to combine two or more numbers

base ten form: the way of writing a number by making a place value model

compare: note the differences between two groups

decompose: break down

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word form: the way of writing a number where it is spelled out as words

FUN COUNTING ACTIVITIES!

TBD

ANIMAL COMMUNICATION

Have you ever wondered what songbirds are saying in the morning? Are they just making pretty sounds? Or are they sending information to each other? Maybe you think a neighbor's cat is smart because when you make three clicks, it runs across your yard and jumps to your windowsill for a quick snack! Animal communication (the way animals send messages and information to each other) has interested scientists for years. We're going to take a look at a few interesting discoveries.

Koko was a baby gorilla in the San Francisco Zoo in 1971. Dr. Francine Patterson began teaching Koko American sign language. This was the first time anyone had ever done this. As an adult, Koko could make 1,000 signs and understood 2,000 words. A three-year-old child can communicate at the same level as Koko did when Koko was 46 years old.

Credit: *Ron Cohn*

Dr. Patterson wrote many books about her life's work with Koko.

Dr. Irene Pepperberg bought Alex, a one-year-old gray parrot, from a pet shop. She wanted to study parrot communication. For 31 years, Dr. Pepperberg worked with Alex. Alex knew more than 100 words. He could count up to six objects and recognize five different shapes. Once, he looked at himself in a mirror and asked, "What color?" That's how he learned the color gray. He told trainers where to take him by saying, "Wanna Go," and naming a place. Dr. Pepperberg showed that Alex could have two-way communication with humans. Alex proved that even a little bird can be clever.

Credit: *Arlene Levin-Rowe*

Math Connection

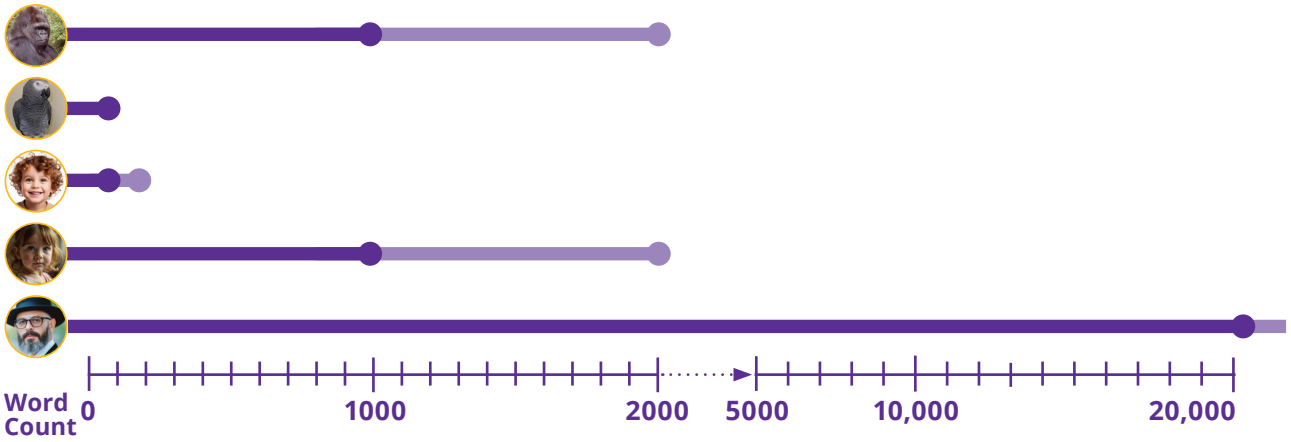
At **46** years old, Koko the Gorilla knew about **1,000** to **2,000** words.

At **30** years old, Alex the Parrot knew about **100** words.

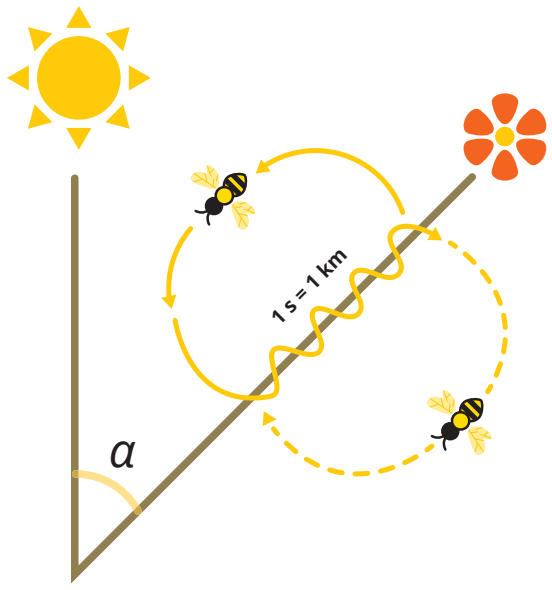
A child of around **two** years knows about **100** to **200** words.

A child of around **three** years knows around **1,000** to **2,000**

By the time a person is **fully grown**, they usually know **20,000** or more words.



We can use rounding to figure out approximately how many words people know. We can use place value to compare the amount of words at each age with the words that Koko and Alex knew.
About how many words do you think you know? What could you do to estimate the number of words?



Bees have even smaller brains than Alex, but they communicate with each other in impressive ways. Honeybees fly around looking for flowers that have sweet nectar. After a tiny honeybee finds flowers with nectar, she returns to her hive. She dances to tell the other bees where to find the flowers. If the flowers are far away, she does a waggle dance that looks like the digit eight.

The direction of her waggle tells the other bees the direction of the flowers. How? Lay the diagram below flat on your desk and pretend you're a bee. The waggle is in a certain direction away from the direction of the sun. Now, the bees understand where the flowers are. They understand which direction to fly. But how far away are the flowers?

The bees need to know this, too. The number of dance circles the tiny bee makes tells how far the bees need to fly. Her body also makes four chemicals that float into the hive. The other bees can sense her chemicals. These chemicals tell more information about all sorts of things. Bees can communicate about nectar, enemies, water, good places to build hives, and other things.

It's not easy for humans to learn about what animals say to each other. Sometimes, we can't even hear all of the sounds that animals make. Birds, for example, can make two sounds at a single time. Other birds can hear both sounds, but humans can't. In the end, people know how to communicate with other people very well, but we've only just begun to understand animal communication.

UNIT 1 • ACTIVITY

HOW DO DOLPHINS COMMUNICATE?

Part of math means looking for patterns in numbers. Place value is one example of patterns in numbers. This activity will get you ready to find number patterns. You will look at patterns in graphs.

You're an animal scientist working at the Saratoga Dolphin Research Center in Florida. Today, you went on a motorboat and recorded calls of free-swimming dolphins. You followed them when they came up for air. Every three minutes, you wrote down what they were doing. The dolphins spent their day eating fish, talking with other dolphins, traveling, or resting.

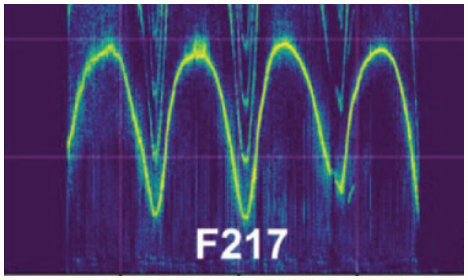
Dolphins can whistle and click at the same time. Humans can't hear all of these sounds. When you come back to your office, you need to turn the dolphin's calls (sounds) into a picture. This picture is called a graph. This year, you will learn how to make graphs. Graphs are drawings that show data or information in a way that can be seen.

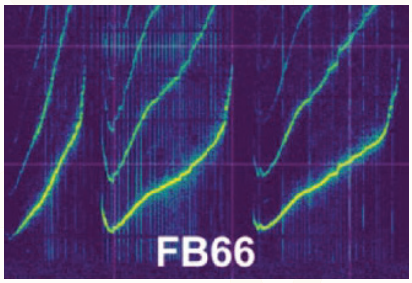
For now, all you need to know is that each of your pictures of the dolphins' whistle calls are different. Some dolphins' whistle calls are longer. Some are shorter. Some make many calls in just a few seconds. Others make one long call in that amount of time.

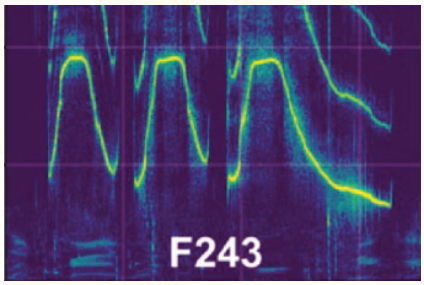
Another thing that differs is how high (squeaky) the calls are for each dolphin. Your computer makes pictures of these sounds.

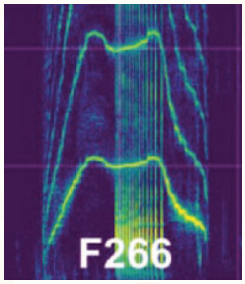
Now, you sit down to study the pictures of your recordings. You collected six new dolphins' whistles. As a dolphin scientist, you know that each and every dolphin has its own whistle. It is called its "signature whistle." Each dolphin's signature whistle is different from any other dolphin's special whistle. It's a little like a name. Other dolphins know who is nearby by hearing these signature whistles. You're trying to understand more about dolphin whistles. You decide to look for patterns in the pictures.

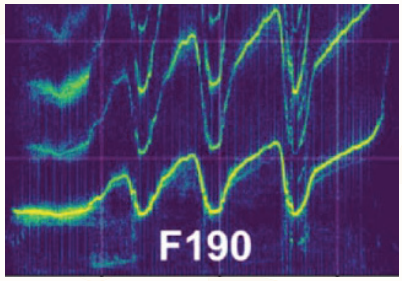
These are your six graphs of the new dolphin whistles.

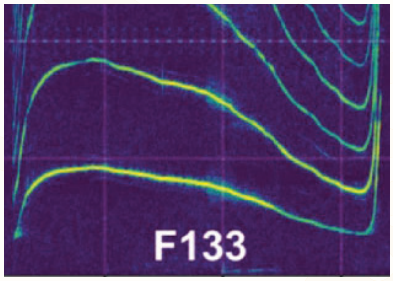












What patterns do you see? Which look similar, and which look different?

The Sarasota Dolphin Whistle Database (SDWD) has almost 1,000 recordings of almost 300 different dolphins. No two signature whistles are the same.

During the first few months of life, a baby dolphin makes its signature whistle for the first time. Dolphins often whistle their signature whistles when traveling or talking to other dolphins.

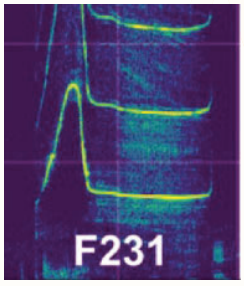
The first thing you notice about the six graphs is some "loops." Loops are patterns that repeat. Look for loops in your pictures. How many of your pictures have loops? _____

Whistles that have just one pattern are called single-loop whistles.

Look at the bottom line in each box.

Does the bottom line have only one special pattern?

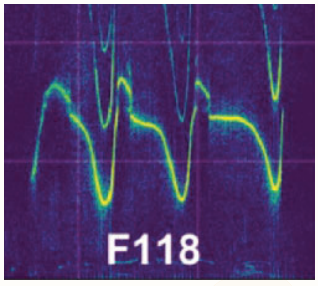
Here's an example of a single-loop whistle with just one special pattern. The bottom picture from Dolphin F231 has a big rise in squeakiness at the beginning. Then, it drops and flattens out. That is the pattern.



Which dolphins from today's six new dolphin whistles have single-loop whistles (just one special pattern)? _____

Next, you discover whistles with more than one repeating part (pattern). These are called multi-loop whistles. Multi-connected loops are repeating patterns that are connected. There's no break between them.

Dolphin F118H has a multi-loop connected whistle. Do you see the three repeated patterns connected together in the bottom line?

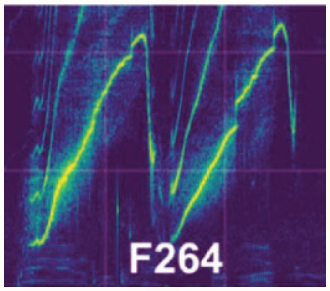


There is a fast-rising high squeak that changes and goes down a little bit slower. Finally, it becomes a very low squeak and then jumps back quickly to a high squeak. Then, it goes down, stays level—that's the straight line part—then dips down to a very low squeak. Next, it jumps back quickly to a high squeak. This is all happening in a few seconds. The same pattern is repeated three times, with no break in between the sounds.

Which dolphins have multi-connected loops?

_____

The third type is a multi-loop disconnected whistle. This means the repeating patterns are not connected together. They are. It could be less than a second of quiet! Dolphin F264 has a multi-loop disconnected whistle.



Which dolphins from today's whistles have multi-loop disconnected whistles? _____

You might be surprised that humans are better at finding the similarities between whistles than computers. Here's how the scientists at the Saratoga Dolphin Research Center classified the six new dolphin whistles. Do their answers match yours?

Dolphins F133 and F266 have single-loop whistles.

Dolphins F217 and F190 have multi-loop connected whistles.

Dolphins F243 and FB66 have multi-loop disconnected whistles.

Dolphins make even more calls than just signature whistles. Even after more than 50 years of research, we are just beginning to understand them.

The Sarasota Dolphin Whistle Database: A unique long-term resource for understanding dolphin communication
Authors: Laela S. Sayigh, Vincent M. Janik, Frants H. Jensen, Michael D. Scott, Peter L. Tyack, Randall S. Wells

Place Value

LESSON OBJECTIVE:

Students will be able to place a multi-digit number into a place value chart and understand the value of each digit in a number.

*NOTE: **Students should have learned place value in previous grade levels. Therefore, this chapter only briefly reviews the relevant concepts. However, if students appear to be unfamiliar with the concepts in this chapter, you can spend more time reviewing the topic, as it is an important prerequisite to understanding more advanced math concepts.***

MATH STANDARD:

4.NBT.A.1
Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. For example, recognize that 500 ÷ 50 = 10 by applying concepts of place value and division

4.NBT.A.3
Use place value understanding to round multi-digit whole numbers to any place

THEME:

Animal Communication

VOCABULARY:

digit: the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 that can be used as a number by themselves or to make up other numbers

hundreds place: the third place from the right in a number; tells how many hundreds are in the number

numeral: a symbol that tells the number

ones place: the first place on the right in a number; tells how many ones are in the number

place value: the place where the digit is located in the numeral tells the value of the digit

place value chart: a chart that shows the value of each digit in a number based on the position of that digit

tens place: the second place from the right in a number; tells how many tens are in the number

thousands place: the fourth place from the right in a number; tells how many thousands are in the number

PREPARATIONS AND MATERIALS FOR LESSON:

Prepare place value charts, thousands to ones for each student, millions to ones for extension students

THOUSANDS	HUNDREDS	TENS	ONES

MILLIONS	HUNDRED THOUSANDS	TEN THOUSANDS	THOUSANDS	HUNDREDS	TENS	ONES

LESSON

HOOK:

Say, "Wolves communicate with each other by making different noises. They howl, bark, growl, and whine, and each noise means something else. Each wolf has their own job within their group, and they communicate with the other wolves in their group, warning them about or telling them about something. Each wolf plays their part."

Continue, "With numbers, each digit plays its own part as well. The digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 come together to make countless numbers. Sometimes, they are used to represent thousands, sometimes hundreds, sometimes tens, and sometimes ones. It is important to put digits in the right place in a number as the place they are in helps us figure out their value or the amount they show. For example, a one in the ones column is very different from a one in the thousands column."

Ask, "What would a one in the ones column mean? What would a one in the thousands column mean?"

You can give an example by writing 1,003 and 3,001 on the board and pointing out that these numbers mean different amounts even though they have the same digits.

MINI-LESSON

Explain, "Every digit in a number, however long or short the number is, has a place value."

Draw a chart with thousands, hundreds, tens, and ones columns on the board.

THOUSANDS	HUNDREDS	TENS	ONES

Say, "Give me any number with four digits."

Let students answer.

Take some responses and write the numbers in the place value chart above, placing each digit in the right column. Then, read the number out loud, elaborating on the value of each digit. For example, for the number 5,210, you would say, "This number is 5,210. That means it has a five in the thousands place, a two in the hundreds place, a one in the tens place, and a zero in the ones place. The number 5,210 is made up of five thousands, two hundreds, and one ten."

Explain that a place value chart shows what each digit represents. Pick a digit from the table and ask students to share the value that that digit represents in the given number.

Say, "Each section in our place value chart is ten times the section on the right of it. The thousands are ten times a hundred, the hundreds are ten times the tens, and the tens are ten times the ones. For example, the digit three in the tens place has a value of 30, which is ten times the value the digit three would have in the ones place. The digit four in the hundreds place has a value of 400, which is ten times the value four would have in the tens place, where it would only have the value of 40."

You can also show students numbers with zeros in them and explain that zero has the role of being a placeholder.

Explain, "Let's say we had the number 40. Forty has a zero in it to show that it has nothing in the ones place.

The role of zeros in numbers is crucial. It separates place values, and it is a placeholder that shows the value of other digits in a number.

Zero doesn't contribute to the overall value directly, but it helps to determine the place of other digits in a number. Zero helps us differentiate between the numbers 4, 40, 400, and 4,000."

***NOTE:** It is important to make sure that students understand that the value of a digit depends on where it is in a number and that they can identify the value of a given digit. If students need more time to review this concept, you can elaborate on the difference between digits and numbers and model more examples showing the value of different digits using the place value chart.*

Write the number 5,876 on the board.

Ask, "Other than the digits in this number, what do you notice about the number?"

Let students answer.

Point to the comma in the number and explain that this is a comma. Ask students if they've seen commas used in writing.

Say, "The way we write numbers is that we put a comma after each group of three digits, starting from the right. For example, in the number 5,876, there is a comma after the three digits 876.

When we learn bigger numbers, you will see that after the next three digits, there will be another comma. Why do you think we add a comma? It's to make the number easier to read so we can read the number at a glance. It helps us organize and read large numbers."

GUIDED PRACTICE

Students open their workbooks to page **14**.

Say, "Read the description of each number. Then, write it in the place value chart in your book."

Call on a student to read each description out loud. Then, let students fill in the numbers in their place value charts.

Review the answers with students, highlighting that we know where to put each digit in the chart based on the description that tells us which place that digit is related to.

Say, "Now, for the last line of your place value chart, I want you to find a partner. Write down a four-digit number on a small piece of paper, but don't let your partner see it. You will take turns trying to guess your partner's number by asking yes or no questions related to place value and understanding numbers.

For example, you can ask, "Is the hundreds digit a larger digit than the tens place digit?" "Is the number even or odd?" "Is the number in the ones place greater than one?" Keep track of how many questions you had to ask to find the correct number.

When you've guessed your partner's number correctly, write it on the last line of the place value chart. Afterward, the partner who had to ask fewer questions to find the number is the winner."

EXIT TICKET

You can choose to have students fill out the following exit ticket before starting the independent practice found on the following pages of their workbooks.

Name:_____

1. **Draw a place value chart and place these numbers in it:**
   6,537 739 89 6,575
2. **How much does a 3 in the tens column represent?**
3. **How much does a 1 in the thousands column represent?**

INTERVENTION

Before asking the students to complete an activity, model the process of breaking down a number and explain the place value of each digit separately. Verbalize your thought process, such as, "This four is in the thousands place, so it represents four thousand. The two is in the hundreds place, so it represents 200."

EXTENSION

Challenge students to work with five- and six-digit numbers. They should draw a place value chart and write the numbers in it. Then, they should write out the numbers in word form. For example, 458,299 is four hundred fifty-eight thousand, two hundred, ninety-nine.

Place Value

VOCABULARY

digit: the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 that can be used as a number by themselves or to make up other numbers

hundreds place: the third place from the right in a number; tells how many hundreds are in the number

numeral: a symbol that tells the number

ones place: the first place on the right in a number; tells how many ones are in the number

place value: the place where the digit is located in the numeral tells the value of the digit

place value chart: a chart that shows the value of each digit in a number based on the position of that digit

tens place: the second place from the right in a number; tells how many tens are in the number

thousands place: the fourth place from the right in a number; tells how many thousands are in the number

MATH IN A NUTSHELL

Place value means that the position (the place) a **digit** in a **number** is in matters.

The **value** of the number depends on the placement of each digit. The value changes completely if digits are moved.

A **place value chart** shows the value of each digit in each place.

These numbers:

657 and **765**

both have the digits **6**, **5**, and **7**, but because the digits are in different places, these numbers have different values.

EXAMPLE

Wolves are animals that live in packs. They hunt, feed, live, and travel with their pack, or group. Wolves communicate with their pack by barking, growling, and howling.

A pack lives and hunts in a specific area called the pack's territory. Arctic wolves live in territories larger than 2,590 square kilometers.

The number 2,590 is a four-digit number, so we need to use a comma (,) to write it. When we write numbers, we put a comma after every three digits, starting from the right.

Here is how 2,590 looks on a place value chart:

THOUSANDS	HUNDREDS	TENS	ONES
2	5	9	0

The digit **2** is in the thousands place. It has a value of 2,000.

The digit **5** is in the hundreds place. It has a value of 500.

The digit **9** is in the tens place. It has a value of 90.

The digit **0** is in the ones place. It means there are no ones in this number.

That means that the number **2,590** has two thousands, five hundreds, and nine tens.

MATH SPOTLIGHT

Zero is a placeholder. It allows us to tell the difference between the numbers **2,590**, **259**, **2509**, and **2,059.**

LET'S TRY IT TOGETHER

Read the description of each number. Then, fill in the number it describes on the matching line in the place value chart.

A. On the first line, write a number that has 2 **tens**, 5 **thousands**, 2 **hundreds**, and 8 **ones**.

B. On the second line, write a number that has 4 **thousands**, 2 **ones**, 6 **tens**, and 5 **hundreds**.

C. On the third line, write a number that has 5 **ones**, 8 **tens**, and 4 **thousands**. The **hundreds** place has a digit that is less than three and an even number.

D. On the fourth line, write a number that has 2 **ones**, 6 **hundreds**, and 3 **tens**. The digit in the **thousands** place is the same as the digit in the **tens** place.

In the last column, write each number. Don't forget to include a comma.

E. Use the fifth line to play "Guess the Number" with a partner.

	THOUSANDS	HUNDREDS	TENS	ONES	
1	5	2	2	8	5,228
2	4	5	6	2	4,562
3	4	2	8	5	4,285
4	3	6	3	2	3,632
5					

*Answers will vary.

CHECK YOUR SKILLS

1. Place these numbers into the place value chart on the right.

A. 7,289

B. 87

C. 923

D. 860

E. 1,087

THOUSANDS	HUNDREDS	TENS	ONES
7	2	8	9
		8	7
	9	2	3
	8	6	0
1	0	8	7

2. What number am I?

A. I have 5 hundreds, the digit in my ones place equals 6 minus 2,and the digit in my tens place is the same as the one in my ones place. 544

B. I have an odd number of thousands, I have less than three thousands, I have 6 tens, the digit in my hundreds place equals 3 + 4, I have zero ones. 1,760

C. I am a three-digit number. My ones digit is 3 times my hundreds digit, my tens digit is 8 times 0, and I have two hundreds. 206

3. Write the value of the digit that is underlined,

A. 8,956 900 **C.** 3,249 40 **E.** 1,631 1

B. 436 400 **D.** 2,254 2,000

4. Fill in the blanks.

A. The number 4,671 has the following place values: 4 thousands, 6 hundreds, 7 tens, and 1 ones

B. The number 567 has the following place values: 5 hundreds, 6 tens, and 7 ones

C. The number 9,803 has the following place values: 9 thousands, 8 hundreds, 0 tens and 3 ones

THINK SMARTER

5. Explain how zero helps us understand the value of a number with more than one digit.

Answer: Zero helps separate different place values. Without zero, we would not be able to tell the value of each digit in a number.

6. Give an example of two numbers that show how zero helps us understand the value of numbers.

*Answers will vary.

REAL-WORLD MATH

7. Devorah brought a packet of 3,600 stickers for her art project.

A. What place is the digit 6 in? hundreds

B. What is the value of the number 3 in 3,600? 3,000

C. Why can't we leave out the zeros in this number?

The zeros act as placeholders. Without them, the number has a totally different value.

8. Daniel has 871 books in his library.

A. What is the value of the digit in the hundreds place? 800

B. What is the value of the digit in the ones place? 1

Groups of Tens

LESSON OBJECTIVE:

Students will demonstrate the understanding that each place value in a number represents ten times the place to its right.

MATH STANDARD:

4.NBT.A.1
Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. For example, recognize that 500 ÷ 50 = 10 by applying concepts of place value and division.

4.NBT.A.3
Use place value understanding to round multi-digit whole numbers to any place.

THEME:

Animal Communication

VOCABULARY:

digit: the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 that can be used as a number by themselves or to make up other numbers

place value chart: a chart that shows the value of each digit in a number based on the position of that digit

ones place: the first place on the right in a number; tells how many ones are in the number

tens place: the second place from the right in a number; tells how many tens are in the number

hundreds place: the third place from the right in a number; tells how many hundreds are in the number

thousands place: the fourth place from the right in a number; tells how many thousands are in the number

numeral: a symbol that tells the number.

multiply: a math operation that means adding the same number over and over

divide: a math operation that means splitting a number into equal groups

LESSON

HOOK:

Ask, "Did you know that some animals, like elephants, communicate using low-frequency sounds called infrasound that can travel for miles? In fact, an elephant's low-frequency rumble can travel many kilometers, in some cases, over six kilometers. That's almost four miles!"

Say, "Let's place the number 6,000 in a place value chart."

Draw a place value chart on the board and write 6,000 in it.

Ask, "What is the value of the zero in the tens? What is the value of six in the thousands? Which digit do you think is most important?"

Let students answer.

Explain, "They are all equally important. Without any of the digits, it would be a completely different number. Imagine if we dropped one of the zeros. The number will only be three digits long and, therefore, 600, not 6,000."

MINI-LESSON

Say: "Let's practice our multiplication and division by ten. What happens to seven when I multiply it by ten?"

Guide students to answer that it becomes 70. Point out that 70 shows the seven moved one place to the left, from the ones place to the tens place.

Ask, "What happens to 50 when I multiply it by ten?"

Students may not yet be familiar with multiplying ten by two-digit numbers, so you can use this to review what multiplication is. Remind students that multiplication is repeated addition, and it can be done in any order. Therefore, when multiplying 50 by ten, we can find the answer by multiplying ten by 50 or by skip counting by tens 50 times to find 50 groups of ten. Or, we can add 50 to itself ten times.

Note: Students should be familiar with what multiplication is, with skip counting by tens, and with the commutative property of multiplication already. If students are unfamiliar, you may need to spend time reviewing these prerequisite concepts.

Ask students to guess what they think 50 times ten will be. Then, model skip counting groups of ten 50 times (or you can add 50 to itself ten times) to reach the product, which is 500.

Ask, "What happens to 50 when I multiply it by ten? The five in 50 moves one place value to the left. We go from having a five in the tens place to a five in the hundreds place."

Ask, "What happens to six when I multiply it by ten?"

Let students answer. Show students how the six moves from the ones place to the tens place.

Ask, "What happens to 300 when it's multiplied by ten?"

Model adding 300 to itself ten times. Demonstrate that it becomes 3,000, and the three moves from the hundreds place to the thousands place, which is one place to the left.

Say, "This isn't just a coincidence that every time we multiply by ten, the digit moves one space to the left in place value. It is this way because of the way place value works. Each place in place value always represents ten times the amount of the place to its right. That means a six in the tens place has ten times the value of a six in the ones place. A six in the hundreds place has ten times the value of a six in the tens place. A six in the thousands place has ten times the value of a six in the hundreds place, and so on."

THOUSANDS	HUNDREDS	TENS	ONES
		4	4

Say, "This chart shows the number 44, a number with two digits, one in the tens place and one in the ones place. Both digits are fours. The four in the tens place has the value of 40, which is ten times the value of the four in the ones place, which has the value of four. If we have a four in the ones place, and we want to move it to the tens place, we will need to multiply by ten.

This is the same for tens to hundreds. You multiply by ten."

Draw or place on the board this chart that shows the relationships between different places in a four-digit number.

THOUSANDS	HUNDREDS	TENS	ONES

← ×10 ← ×10 ← ×10

← ×100

← ×1000

Say: "This chart shows it very clearly. To get from ones to tens, we multiply by ten. To get from tens to hundreds, we multiply by ten, and to get from hundreds to thousands, we also multiply by ten. This chart even shows us how to get from ones all the way to hundreds; we times by 100. And if I want to get from ones straight to thousands, I need to multiply by 1,000. That's because the thousands place has the value of 1,000 times the ones place."

"So here we see clearly that a digit in one place represents ten times the digit on its right. Let's say I have the number 1, 656. What is the relationship between both sixes?"

Reference the chart on the board.

Say, "We have a six in the ones place and a six in the hundreds place. To get from the ones to the hundreds, we need to multiply by 100. So, the six in the hundreds place is 100 times bigger than the six in the ones place."

Say, "Let's do this again with another number, 1,077. Here, we are looking at the relationship of the two sevens. One is in the ones place, and one is in the tens place. The seven in the tens place has ten times the value of the seven in the ones place. We need to multiply by ten to move a seven in the ones place to 70. So, the seven in the tens place is ten times bigger than the seven in the ones place. And the seven in the ones place is ten times smaller than the seven in the tens place."

Continue, "As you may have noticed, the digit zero has a really important job. Zero helps us remember the value of a digit and puts it in the right place. If we add a zero to the end of a number, it becomes ten times bigger (for example, 40 is ten times more than four without a zero). And if we take away a zero from the end of a number, it becomes ten times smaller. This happens because each place value is worth ten times more than the one just to its right. Let's try it with the number five."

Write the number five on the board.

Say, "Right now, the five is in the ones place. But what if I wanted to move it to the tens place? What would I have to do?"

Let students answer.

Say, "If I wanted to move the five to the tens place, I would add a zero, changing the value to 50."

Write 5 ⟶ 50 on the board.

Say, "If we move the five another place to the left, it becomes 500. That's ten times bigger than 50, and we can do that by adding a zero."

Write 50 ⟶ 500 on the board.

Say, "So, we started with five, and each time we added a zero, the value of the digit five became ten times greater.

So from five to 500, the value of the five is 100 times greater!"

Write 800 → 80 → 8 on the board.

Say, "Now, let's think about the number 800. If we move the eight one place to the right by removing a zero, the number is now 80. The value of the eight is ten times smaller now. If we move the eight again to the right and remove another zero, the number is now eight. Now, the digit eight is 100 times smaller than the 800 we started with. Each time we remove a zero, the eight becomes smaller by ten times."

Say, "Zeros are very important because they hold the place for other digits. They show us where each digit belongs. Look at what happened in the last example each time I removed a zero. If I were to forget all the zeros and just write eight, that's not the same thing as 800. That's why the digit zero is such an important placeholder. When we see it in a number, it's saying, "Hey! This is the spot of the tens!" or "This is the spot of the ones!" That gives value to the other digit in the number. Even though zero means nothing, it is one of the most important numbers."

GUIDED PRACTICE

Students open their workbooks to page **17**.

Say, "Let's do question 1 together. It shows the number 6,577. What is the value of the seven in the tens place?"

Call on a student to answer. The student should say 70. Instruct students to write the answer in their workbooks.

Ask, "What is the value of the seven in the ones place?"

Call on a student to answer. The student should say seven. Instruct students to write the answer in their workbooks.

Ask, "How can I get from the seven in the ones place to the seven in the tens place?"

Call on a student to answer. They should say by multiplying by ten.

Do question 2.

Say, "For the second question, we are given the number 7,301 and need to figure out the value of each digit."

Call on different students to come up to the board and write the value of each digit and explain how they figured it out.

Continue doing the rest of the questions together as a class, calling on students to come to the board to write their answers.When you've guessed your partner's number correctly, write in on the last line of the place value chart. Afterward, the partner who had to ask fewer questions to find the number is the winner."

EXIT TICKET

Name:_____

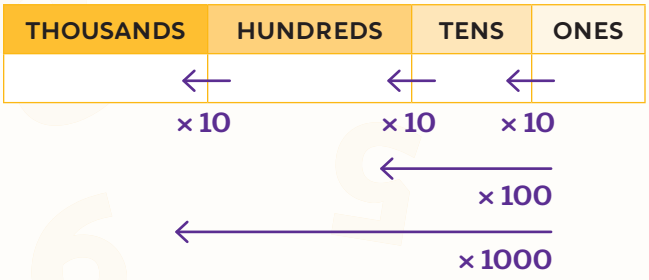
1. In the number 2,707, the seven in the hundreds place is _____ times bigger than the seven in the ones place.
2. What number is ten times less than 90?

   _____
3. True or False: 800 is ten times more than 8?

   _____

INTERVENTION

Print out a place value chart like this for students to use while they work.



EXTENSION

The same rules apply even with bigger numbers.

Put the number 887,943 into a place value chart.

What are the values of the two eights in this number?

Explain how we can get from one eight to the other.

Put the number 64,749 into a place value chart.

What are the values of the two fours in this number?

Explain how we can get from one four to the other.