

Number Sense and Place Value Progressions K-5

Students' work in the base-ten system is intertwined with their work in counting, cardinality, and the meanings and properties of addition, subtraction, multiplication and division. Work in the base-ten system relies on these meanings and properties, but also contributes to deepening students' understanding of them.

Understanding the Base Ten System

Application of Meanings

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K	<ul style="list-style-type: none"> ● Count from 1 to 100 by ones (rote counting) and by tens <ul style="list-style-type: none"> ○ Begin with a limited range, gradually increase the range through 100 ○ Begin to match number name with the numeral through games and activities (books, nursery rhymes, songs) ○ Recognize patterns with the digits 0 to 9, connect number strips (1-10) to the hundred chart ○ Use fingers on both hands to track counting by tens ● Count on from any given number other than 1 <ul style="list-style-type: none"> ○ Count a full sequence within a given range first, before counting on, e.g. before counting on from 8, be able to rote count 1 to 20 first ● Represent and write numerals from 0 to 20 <ul style="list-style-type: none"> ○ Begin with single digit numerals ○ Match a collection of items with the appropriate numeral ● Relate numbers and quantities, connect counting to cardinality <ul style="list-style-type: none"> ○ Count objects, pair each object with one number name in the standard order ○ Understand the last number said tells the total objects counted ○ Recognize a number of objects is the same, regardless of arrangement or order counted (conservation of number) ○ Understand each successive number name refers to a quantity that is one more than the prior ○ Count up to 20 objects in a line, in arrays, or in circles, and as many as 10 objects in a scattered configuration ○ Given a number from 1-20, count out that many objects ● Compose and decompose numbers from 11 to 19 into ten ones and some further ones <ul style="list-style-type: none"> ○ Use concrete objects (unbundled, ten frames, etc.), drawings (pictures, number bonds, ten frames, place value cards, etc.), and recordings (including equations) ○ Match representations with the written numeral ○ Group objects into a set of 10, and then the remaining as extra ones ○ Connect 10 ones as two sets of 5 ones (five frames, ten frames, etc.) ○ Compare counts of individual objects, to counts when a group of 10 ones is formed, i.e. count 13 items, then make a group of 10 (with 3 items leftover), count again beginning with the group of 10, and then the 3 ones 	<ul style="list-style-type: none"> ● Compare two groups of objects (within 10) <ul style="list-style-type: none"> ○ Develop and use vocabulary of <i>greater than</i>, <i>more than</i>, <i>less than</i>, <i>fewer than</i>, <i>same as</i>, and <i>equal to</i> ○ Use various strategies that make sense to compare items such as matching, lining up, observation, fair share, and comparing counts ○ Identify how many more or how many fewer items one set has than another ○ Justify and explain reasoning ● Compare two written numbers (within 10) <ul style="list-style-type: none"> ○ Connect to prior work with concrete and pictorial items to use in justification ● Count parts of geometric shapes, in 2D count number of sides and vertices/corners, in 3D count number of flat sides or curved sides (see Geometry progressions)
1	<ul style="list-style-type: none"> ● Extend the counting sequence to 120 <ul style="list-style-type: none"> ○ Count on from any number less than 120 ○ Understand and explain patterns with numerals on the hundred chart ○ Read and write numerals through 120 ○ Understand the place of a digit determines its value, e.g. 24 and 42 have the same digit, but different values 	<ul style="list-style-type: none"> ● Compare two-digit numbers <ul style="list-style-type: none"> ○ Make comparisons based on the meanings of the tens and ones digits ○ Record results using the symbols $<$, $>$, $=$ ○ Use concrete materials such as objects, place value charts, tens frames, hundreds charts, and number lines ○ Describe comparisons using terms including greater than, less than, more than, fewer than, equal to, and same as

	<ul style="list-style-type: none"> • Continue to build an understanding of place value through work with two digit numbers as representations of tens and ones <ul style="list-style-type: none"> ○ Understand that 10 can be thought of as a bundle or group of ten ones, this is called a “ten” ○ Bundle ten objects into a group of ten, differentiate between 1 ten (bundle) and 10 ones ○ Recognize the numbers 11-19 are composed of a “ten” and some ones ○ Begin to work with prebundled tens such as base ten blocks ○ The decade numbers (20, 30, etc.) refer to two tens, three tens, etc. ○ Use concrete materials (both unbundled and prebundled tens) to represent numbers including decade numbers and numbers with tens and ones ○ Use place value language to describe the numbers, i.e. 1 ten and 7 ones is 17 and 34 is 3 tens and 4 ones • Decompose two-digit numbers in different ways, e.g. 74 can be thought of as 7 tens and 4 ones or as 6 tens and 14 ones, etc. 	<ul style="list-style-type: none"> ○ Justify reasoning as they compare, including emphasis on place value, i.e. I know 42 has 4 tens, and 24 has only 2 tens
2	<ul style="list-style-type: none"> • Understand that the three digits of a number represent amounts of hundreds, tens, and ones • Recognize 100 can be thought of as a bundle of ten tens, called a “hundred” <ul style="list-style-type: none"> ○ Given bundles of tens, group them into bundles of 100 ○ Use vocabulary that 1 hundred is made of 10 tens, and 100 ones • Recognize the numbers 100, 200, 300, etc. refer to one hundred, two hundreds, three hundreds, etc. (and 0 tens and 0 ones) <ul style="list-style-type: none"> ○ Use concrete materials to bundle groups of 10 to represent numbers including 100, 200, 300, etc. as bundles of 1 (or 2 or 3) hundred(s) with no tens or ones ○ Describe multiples of 100 using words that include the number of groups of a hundred, e.g. 400 is 4 bundles of 10 tens • Read and write numbers to 1000 using base-ten numerals, number names, and expanded form <ul style="list-style-type: none"> ○ Bundle collections of straws, sticks, etc. into as many group of 100 as possible, then groups of 10 until none can be made ○ Connect groups of objects to place value charts and numeral cards to record numbers ○ Identify and read the number of hundreds, tens, and ones e.g. 456 can be read as 4 hundreds, 5 tens, and 6 ones or four hundred fifty-six ○ Connect numbers to the expanded form, e.g. 456 can be represented as $400 + 50 + 6$ • Count within 1000 <ul style="list-style-type: none"> ○ Count forward from any given number 1 to 1000 ○ Count backward from any given number 1 to 1000 ○ Skip count by 5, 10, or 100 ○ Describe place value patterns as they count ○ Relate all counting to number line representations 	<ul style="list-style-type: none"> • Compare two-digit numbers <ul style="list-style-type: none"> ○ Make comparisons based on the meanings of the hundreds, tens and ones digits ○ Record results using the symbols $<$, $>$, $=$ ○ Use concrete materials such as objects, place value charts, tens frames, hundreds charts, and number lines ○ Describe comparisons using terms including greater than, less than, more than, fewer than, equal to, and same as ○ Justify reasoning as they compare, including emphasis on place value, i.e. I know 412 has 4 hundreds, and 214 has only 2 hundreds
3	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Use place value understanding to round whole numbers to the nearest 10 or 100 (without context) <ul style="list-style-type: none"> ○ Given a two-digit number, identify the tens that the number falls between

		<ul style="list-style-type: none"> ○ Given a three-digit number, identify the hundreds (or tens) that the number falls between ○ Plot numbers on a number line between tens (two-digit numbers) or hundreds (three-digit numbers) ○ Determine the midpoint between two tens (or two hundreds) on a number line, and use the midpoint to determine which ten (or hundred) is closer ○ Discuss any patterns, and use justification, to reason about how to determine when to round to the lesser ten (or hundred) or round to the next ten (or hundred) ○ Determine what to do with a number that is exactly on a midpoint
4	<ul style="list-style-type: none"> ● Work with fractions involving denominators of 10 and 100 (decimal fractions) and relate to whole-number expansions in the base-ten system <ul style="list-style-type: none"> ○ Recognize each unit in this decomposition is ten times the unit to its right ○ Connect with the use of base-ten notation to represent numbers in expanded form, e.g. 23.7 as $(2 \times 10 + 3 \times 1 + 7 \times 1/10)$ (see Fractions progressions) ● Extend place value understanding through multi-digit numbers (up to 1,000,000) <ul style="list-style-type: none"> ○ Recognize a digit in one place represents ten times what it represents in the place to its right ○ Relate the relationship of the value of a digit, based on its place in a number, to multiplication and division by multiples of 10 (e.g. the 3 in 3 is worth 3 ones, the 3 in 34 is worth 3 tens, or ten times greater) ○ Explain what is happening to the value of a digit as it appears within various places in a numeral ○ Identify the relationship among places by multiplying by 10 (moving one place to the left) and dividing by 10 or $1/10$ of (moving one place to the right) 	<ul style="list-style-type: none"> ● Accurately read and write numbers through 1,000,000 using place value understanding <ul style="list-style-type: none"> ○ Use various forms of expanded notation, e.g. $12,387 = 10,000 + 2,000 + 300 + 80 + 7$ or $12,387 = 12,000 + 380 + 7$ ○ Recognize the pattern in greater numbers as sequences of three-digits separated by commas, each sequence containing a "family" of hundreds, tens, and ones ○ Recognize each three-digit "family" as a ones "family", thousands "family", millions "family", etc. ● Compare numbers through 1,000,000 using place value <ul style="list-style-type: none"> ○ Use symbols to show the comparison $<$, $>$, $=$ ○ Use various strategies to justify their thinking, lining up numbers, using place value, location on a number line, etc. ● Interact with numbers in real world situations including with data collection ● Use place value understanding to round multi-digit numbers to any place (between 1,000 and 1,000,000) <ul style="list-style-type: none"> ○ Identify and explain situations that call for rounding numbers or estimation ○ Use rounding in a variety of situations, including estimation, problem solving, and reasonableness ○ Identify which two benchmarks numbers the given number would fall between, given the place to round to, e.g. 3,820 is between 3,800 and 3,900 when rounding to the nearest hundred, but 3,820 is also between 3,000 and 4,000 when rounding to the nearest thousand ○ Use various strategies to round and estimate numbers, number lines, hundred charts, etc. ○ Make generalizations that will help them to round without using models
5	<ul style="list-style-type: none"> ● Extend previous work in 4th grade to recognize a digit in one place represents 10 times as much as it represents in the place to its right and $1/10$ what it represents in the place to its left <ul style="list-style-type: none"> ○ Describe patterns they find and why those patterns work ○ Extend work to compare values of digits in places that are not directly the left and right ○ Work with digits from the millions place to the thousandths place ● Identify and explain patterns in the number of zeros of the product when multiplying a number by powers of 10 <ul style="list-style-type: none"> ○ Include work with decimal values multiplied or divided by a power of 10 (including as exponential notation) ○ Use concrete materials, pictures, numbers and words 	<ul style="list-style-type: none"> ● Read and write decimals to the thousandths (numbers from millions through thousandths places) <ul style="list-style-type: none"> ○ Read and write decimals to the thousandths using numerals, words, and expanded form ○ Use place value charts and expanded form ○ Demonstrate understanding of decimal place values, e.g. hundredth = $0.01 = 1/100$ of 1 whole ● Compare two decimals to the thousandths <ul style="list-style-type: none"> ○ Represent the comparison using the symbols $<$, $>$, and $=$ ○ Demonstrate understanding of equivalence of decimal and fractions (or decimals and decimals) by connecting models to reading and writing of equivalent numbers, e.g. $0.5 = 5/10$ or $0.5 = 0.50 = 0.500$

<ul style="list-style-type: none">○ Describe patterns they find and justify why those patterns work○ Work with digits from the millions place to the thousandths place● Use whole number exponents to denote powers of 10<ul style="list-style-type: none">○ Describe patterns and relationships between the exponent and the number of times 10 is used as a factor, e.g. $10 = 10^1$, $100 = 10 \times 10 = 10^2$, etc.○ Build understanding through concrete and pictorial representations, i.e. base-ten blocks and coins	<ul style="list-style-type: none">○ Use place value chart to compare decimals by comparing digits in each decimal place○ Explain and justify using objects, picture, numbers and words● Use place value understanding to round decimals to any place<ul style="list-style-type: none">○ Work with values from the millions place to the thousandths place (the least place a decimal rounds to is the nearest hundredth)○ Extend place value understanding and number line models to round decimals○ Examine various situations to determine where to round in a given situation○ Give clear explanations to justify their thinking
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