
Number & Operations in Base Ten

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ITL 516

Professor Myers

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Kindergarten

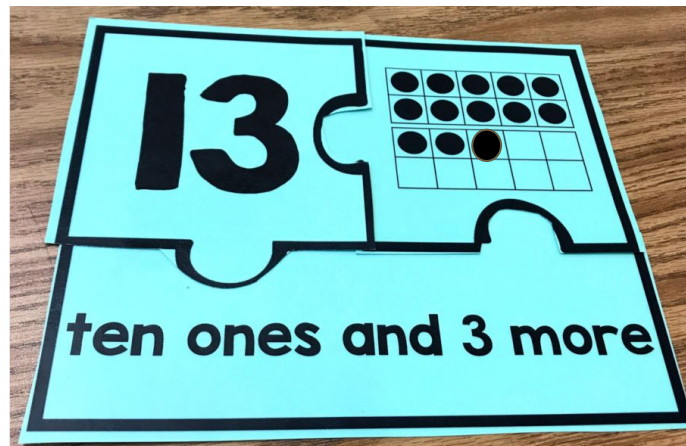
Standards addressed: K.NBT.A.1 Students compose and decompose numbers from 11-19 into ten ones and some further ones (Common Core, 2019)

-This can be done by counting objects or drawings and the use of visuals, manipulatives or technology (e.g., linking cubes, double ten frames, a cup of 10 and some ones)

Misconceptions: Students may have trouble with the concept that 1 group of 10 ones and some more ones can represent the same idea as the number they counted. Teen number names may cause students confusion e.g., Group of 10 and two more is called “twelve” (Common Core, 2019).



Resource: Primary



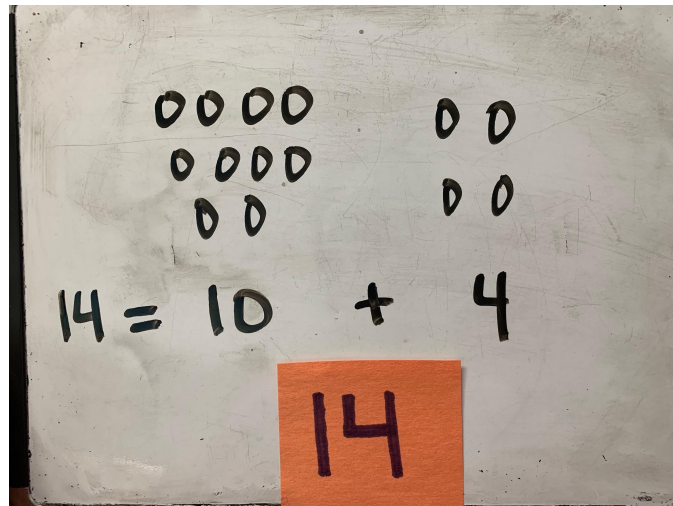
Resource: A Kinder Teacher Life, 2018

Sample Activity

Goal: Students develop the concept of decomposing numbers 11-19 as a group of 10 ones and some more ones (Gojak & Myles, 2016, p. 80)

Materials: whiteboards, markers, cards (numbers 11-19), and ELMO

Activity: *Daily routine*- The teacher will display a numeral card (using the ELMO) and the students must draw circles representing the number in two sets (one to represent 10 ones, the other to represent the leftover ones). Once students are done drawing they will turn to their assigned partner and discuss what they did. During this time, the teacher will walk around and assess student understanding. The teacher will welcome them back and ask for volunteers to show and tell what they did. Teacher will then show how to write what they drew using numbers. Students will be given opportunities to practice this for the remainder of the numbers. This will be repeated for all teen numbers.



numeral

1st Grade

Standards addressed: 1.NBT.A.1, 1.NBT.B.2, 1.NBT.B.3, 1.NBT.C.4, 1.NBT.C.5, 1.NBT.C.6 In these standards, students will count to 120 (read and write numerals), understand that the two digits of a two-digit number represent tens and ones (that 10 ones is called a “ten”), compare two-digit numbers with symbols $>$, $=$, and $<$, add within 100 (including adding a two-digit number and a one-digit number), mentally find 10 more or 10 less than a given number (without counting), and subtract multiples of 10 from multiples of 10 in the range 10-90 (e.g., $70-40=$ __) (Gojak & Miles, 2015, p. 84-93).

Misconceptions: Students may reverse digits when writing numbers and do not demonstrate understanding that 12 and 21 do not have the same value. Some students may have difficulty with number words that sound alike such as *fifty* and *fifteen*. Students may struggle to understand that the position of the digit determines its value and may have trouble determining the proper mathematical symbol to use ($>$, $=$, and $<$). Finally when subtracting, some students may only subtract the digits in the tens place but ignore the digits in the ones place (Gojak & Miles, 2015, p. 84-93).



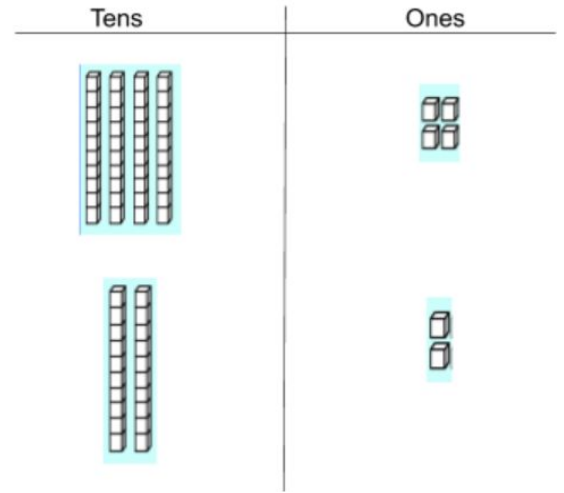
Resource: First Grade Roundup



Resource: Kate's Homeschool

Sample Activity

$$\begin{array}{r} 44 \\ + 22 \\ \hline \end{array}$$



Goal: Students model and solve adding two-digit numbers without regrouping, focusing on adding tens and adding ones.

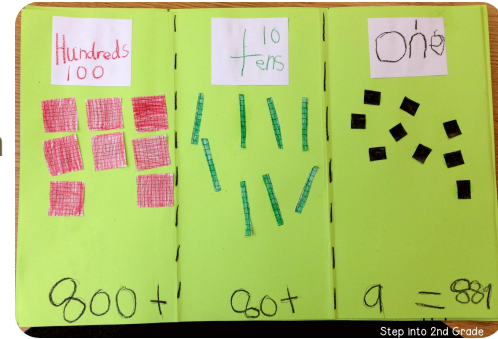
Materials: linking cubes, place value chart, whiteboards, and markers

Activity: *Problem-based learning*- Students will be given the following problem: Max has 44 marbles. Tom gave him 22 more. How many marbles does Max have now? Students will work with their assigned partner to solve the problem. Students will use linking cubes to show the number of tens and ones on their place value chart beginning with 4 tens and 4 ones and directly below that show 2 tens and 2 ones. Students will count the total number of tens and ones to find the total number of marbles Max has. Students will discuss with their partners and explain their work. During this time, the teacher will circulate the room to observe and assess student understanding. Students will be given many opportunities with similar problems to practice this concept.

2nd Grade

Standards addressed: 2.NBT.A.1, 2.NBT.A.2, 2.NBT.A.3, 2.NBT.A.4, 2.NBT.B.5, 2.NBT.B.6, 2.NBT.B.7, 2.NBT.B.8, 2.NBT.B.9 In these standards, students will understand that the three digits in a three-digit number represent amounts of hundreds, tens, and ones (and that ten tens is called a “hundred”), count within 1000 and skip count by 5s, 10s, and 100s, read and write numbers to 1000 using base-ten numerals, number names, and expanded form, compare three-digit numbers with symbols $>$, $=$, and $<$, fluently add and subtract within 100 as well as add up to four two-digit numbers using strategies based on place value and properties of operations, add and subtract within 1000 using concrete models or drawings, mentally add/subtract 10 or 100 to a given number 100-900, explain why addition and subtraction strategies work using place value and the properties of operations (Achieve the Core, 2015, p. 8-11).

Misconceptions: Students may reverse digits when decomposing three-digit numbers. Students may struggle to understand that the position of the digit determines its value and may have trouble determining the proper mathematical symbol to use ($>$, $=$, and $<$). Finally, students who struggle with basic facts may inaccurately add or subtract three-digit numbers (Gojak & Miles, 2015, p. 98-113).



Resource: Amy Lemons, 2013



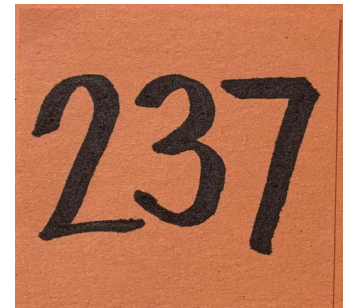
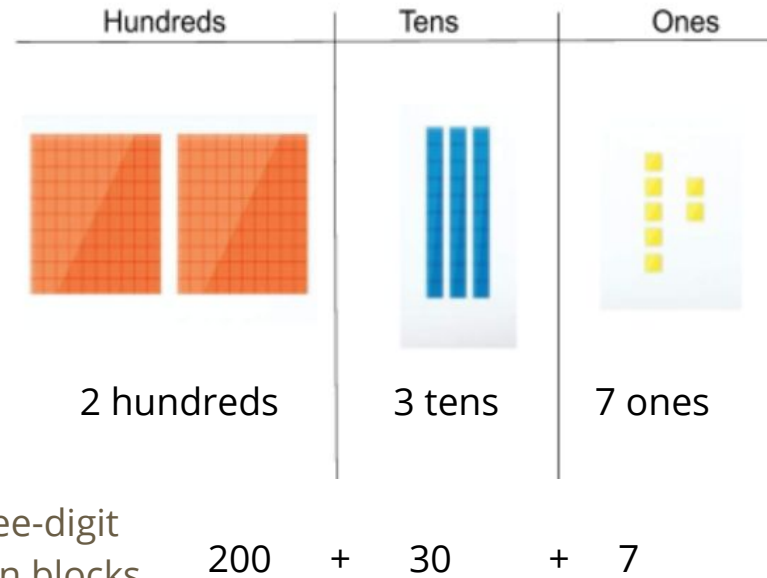
Resource: Teach4Mastery

Sample Activity

Goal: Students will read number names and read/ write three-digit numbers in expanded form.

Materials: whiteboards, markers, place value chart, base-ten blocks, three-digit numeral cards, pre-printed labels for hundreds, tens, and ones (for students to place under the base-ten blocks on place value chart) and ELMO

Activity: *Problem-based learning-* The teacher will display a three-digit numeral card (using the ELMO) and students must use base-ten blocks and place the appropriate amount on place value chart. Students will work with their assigned partner and discuss what they are doing. Students will use pre-printed labels to place under appropriate numeral under base-ten blocks on the place value chart. Students will read the number of hundreds, tens, and ones. Then, they will read and write the number represented in expanded form. During this time, the teacher will walk around and assess students' understanding. Students will be given many opportunities to practice this concept.



3rd Grade

Standards addressed: STANDARD 2 (3.NBT.A.2): Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations and/or the relationship between addition and subtraction. This standard expands upon students' previous experiences to becoming fluent in math- ie. being accurate and efficient in problem solving. Students will continue to add and subtract within 1000, and expand upon place value knowledge. They will develop apply strategies based on place value, properties of operations, and the relationship between addition and subtraction.

Misconceptions: Students who do not have a deep understanding of addition and subtraction will have a more difficult time understanding whether or not their answers are reasonable. According to Gojack & Miles (2016) they often make common errors in their subtraction and could benefit from "experience with concrete models and using place value charts with bundling/unbundling straws" (p. 69).

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Math Common Core State Standards 3rd Grade

Rounding numbers, adding & subtracting multi-digit numbers, comparing fractions, perimeter, area, data, bar graphs, line plots & more!

ROUNDING NUMBERS (3.NBT.A.2)

You can round whole numbers to the nearest ten or hundred.

Rounding Numbers to the Nearest Ten

Nearest tens are numbers that are multiples of 10. They will always have a 0 in the ones place.

To round to the nearest ten, you need to determine which ten the number is closest to.

EX: Round 18 to the nearest ten.
Look at 18 on a number line:

18 is closer to 20 than it is to 10. Round 18 **up** to 20.

To round to the nearest ten, you can look at the value of the **ones** place.

- If the value of the ones place is 1, 2, 3, or 4, round **down** to the nearest ten.
- If the value of the ones place is 5, 6, 7, 8, or 9, round **up** to the nearest ten.

EX: Round 32 to the nearest ten.
Look at the value of the ones place.
2 is in the ones place of 32. Round 32 **down** to the nearest ten, which is 30.

Rounding Numbers to the Nearest Hundred

Nearest hundreds are numbers that are multiples of 100. They will always have a 0 in both the tens place and the ones place.

To round to the nearest hundred, you need to determine which hundred the number is closest to.

EX: Round 128 to the nearest hundred.
Look at 128 on a number line:

128 is closer to 100 than it is to 200. Round 128 **down** to 100.

To round to the nearest hundred, you can look at the value of the **tens** place.

- If the value of the tens place is 1, 2, 3, or 4, round **down** to the nearest hundred.
- If the value of the tens place is 5, 6, 7, 8, or 9, round **up** to the nearest hundred.

EX: Round 567 to the nearest hundred.
Look at the value of the tens place.
6 is in the tens place of 567. Round 567 **up** to the nearest hundred, which is 600.

Tip! Underline the place value that determines whether you will round up or down.

ADDING & SUBTRACTING MULTI-DIGIT NUMBERS (3.NBT.A.1)

When you add and subtract multi-digit numbers, align the numbers by place value. Then add or subtract beginning with the lowest place.

You may need to regroup values when adding whole numbers.

EX: Add $573 + 288$.

$$\begin{array}{r} 573 \\ +288 \\ \hline 861 \end{array}$$

You may need to regroup values when subtracting whole numbers.

EX: Subtract $1,952 - 645$.

$$\begin{array}{r} 1,952 \\ -645 \\ \hline 1,307 \end{array}$$

THE RELATIONSHIP BETWEEN MULTIPLICATION & DIVISION (3.OA.D.8)

Just like addition and subtraction are **inverse operations**, multiplication and division are **inverse operations**. This means they are opposite operations.

You can create multiplication and division **fact families**. A **fact family** will contain two division operations and two multiplication operations with the same three numbers.

EX: What is the fact family of 3, 7, and 21?

$$\begin{array}{l} 3 \times 7 = 21 \\ 7 \times 3 = 21 \\ 21 \div 3 = 7 \\ 21 \div 7 = 3 \end{array}$$

EX: Use your knowledge of multiplication fact families to solve the problem $54 \div 6$.

Since $9 \times 6 = 54$, then $54 \div 6 = 9$.

You Can Do This!

Sarah collected 1,503 baseball cards. She gave 225 to her brother. How many baseball cards does Sarah have left?

$$\begin{array}{r} 1,503 \\ -225 \\ \hline 1,278 \end{array}$$

Sarah has 1,278 baseball cards left.

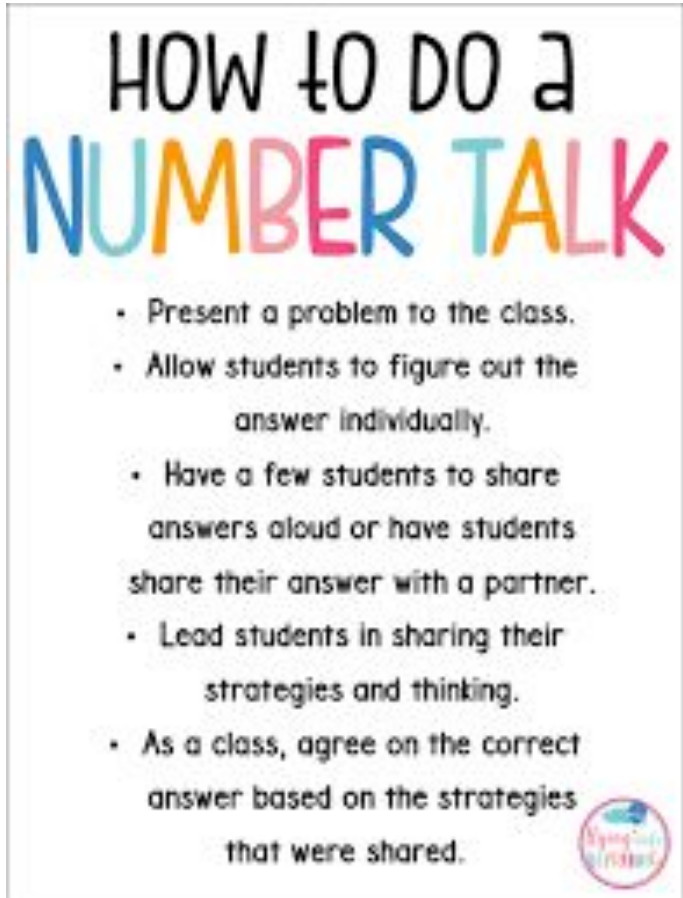
Ask yourself: "What number times 6 is equal to 54?"

Sample Activity

Goal: Students will be able to solve subtraction problems within 1,000.


Materials: Math journals or paper Pencils Subtraction Math worksheet

Activity: *Problem-based learning-* During whole class instruction, the teacher and students will review the number talk sentences. Then the teacher will demonstrate how to do a subtraction problem on the board, being sure to identify each step in the process. Then the teacher will break the students into groups, assigning each person a job. They will come up with different ways to solve the problem and share. During this time the teacher will walk around the class observing. After the groups have completed their work, the class will come back together for whole class instruction and present. The teacher will check for comprehension here.



HOW TO DO A NUMBER TALK

- Present a problem to the class.
- Allow students to figure out the answer individually.
- Have a few students to share answers aloud or have students share their answer with a partner.
- Lead students in sharing their strategies and thinking.
- As a class, agree on the correct answer based on the strategies that were shared.



4th Grade

Standards addressed: 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. This standard expands upon students' knowledge of place value. Based on this understanding, students will compare numbers and use $<$, $>$, $=$ symbols to show their comparisons. Students need to practice explicit strategies, including lining up numbers by place value and describing the place value of given digits to justify their thinking when comparing numbers. The number line provides a model to help students compare two numbers based on their location (lesser numbers are to the left of greater numbers).

Misconceptions: Students need practice reading and writing numbers. Students who struggle should focus on the groups of digits before, between, and after commas. The comma preceding the units group represents the thousands group, the comma preceding the thousands group represents the millions group. Once students know this, they can focus on reading the numbers as usual and then name the group by naming the comma. Some students will need more practice to relate understanding to developing skill reading and writing numbers.

When comparing numbers, students may focus on the number furthest to the left to determine the greater number rather than considering place value. For example, a student may say 952 is greater than 2,354 because 9 is greater than 2. Approximating the location of numbers on the number line will help students to focus on the overall place value to help them determine which number is greater. Later, identifying place value by writing numbers using graph paper and aligning the digits starting with the ones place will help students to see that 2,000 is greater than 900. It is important that students realize they are lining up numbers in column by place value and not by a random rule (Gojack & Miles, 2016).



Sample Activity

Goal: Students will be able to compare two multi-digit numbers.

Materials: Class set of Let's Compare, Three index cards, Projector to display video, Computer or tablet for online number generator

Activity: *Problem-based learning:* The teacher will write two numbers on the board and ask students to look at the numbers and see what they notice. Then they will write each number in expanded form. Show students that, although the value of the digit in the thousands place is the same (2,000), the value of the digit in the hundreds place is different (800 and 900), so the number with the greater value in the hundreds place is greater. Make a chart with columns for each place value (thousands, hundreds, tens, and ones) and write one number in the first row and the other number in the second row. Remind students that when comparing numbers, we compare the digits from left to right. Then, using the chart, compare each place value, pointing out that when we arrive at a place value in which one digit is greater, that number is greater. Write " $2,849 < 2,948$ " on the board. Review the ways that you compared the numbers (word form, expanded form, and a place value chart). Hand out the Let's Compare worksheet and instruct students to complete it independently. Circulate and offer support as needed.

Name _____ Date _____

Let's Compare!

greater than $>$ less than $<$ equal to $=$

Write each number in **word form**, then compare.

1.

6,381	$>$ $<$ $=$	6,831

Write the numbers in **expanded form** to compare.

2.

1,408	$>$ $<$ $=$	1,812

3.

9,534	$>$ $<$ $=$	9,345

Compare the numbers using **place value charts**.

4. 2,075 ○ 2,079

Th	H	T	O

5. 8,623 ○ 8,823

Th	H	T	O

6. 5,331 ○ 5,313

Th	H	T	O

Solve each word problem using the strategy of your choice.

7. Glenda sold lemonade on Saturday and Sunday. On Saturday, she made \$328 at her lemonade stand. On Sunday, she made \$238. On which day did she make more money?

8. Lionel plants wildflowers along hiking trails every spring. Last year he scattered 2,247 California poppy seeds. This year he planted 2,479 blue cornflowers. Did he plant more poppies or cornflowers?

5th Grade

Standards addressed: STANDARD 4 (5.NBT.A.4): Use place value understanding to round decimals to any place. This standard builds on students existing knowledge of rounding whole numbers and expands to include decimals.

Misconceptions: It is imperative that students read decimal numbers correctly to reinforce the meaning of the decimal and its place value. For example, 1.12 should be read as “one and twelve hundredths” and not “one point twelve.” Teachers should model this and the expectation should be clear. This not only reinforces the value of the decimal number but also explicitly connects decimal numbers to fraction numbers.

Students who are taught to round decimals by using a rule rather than place value understanding have difficulty determining places when rounding up or down. This is true with both whole numbers and decimals. For example, when rounding to the nearest tenth, a student might round 15.28 to 15.38. When using a number line model, students need to determine the numbers that the given number falls between. In the previous case it would be between 15.2 and 15.3. Using benchmark numbers such as 15.25, which falls exactly in the middle, will help students determine the closest tenth. By plotting the given point on the number line, students can determine to which tenth it is closer. Scaffold examples for students who are struggling with this concept. (Gojack & Miles, 2016).

Rounding to decimal places

Rounding to decimal places is exactly like rounding whole numbers - you just have more numbers (and therefore greater accuracy).

3 is the units digit.

2 is worth 2 tenths, and is the first decimal place.

4 is worth 4 hundredths, and is the second decimal place.

8 is worth 8 thousandths, and is the third decimal place.

You will sometimes see “decimal place” shortened to “d.p.”

3.248 rounded to 1 d.p.

3.248 → 3.2

1st dp
3.2

Look at the next digit.
4 stays down - stay at 3.2.

3248 rounded to 2 d.p.

3.248 → 3.25

2nd dp
3.24

Look at the next digit.
8 rounds up - go to 3.25

Sample Activity

Goal: Students will be able to round decimals to the tenths and ones places.

Materials: Menus from takeout restaurants, Notebook paper, Model menu on chart paper or board

Activity: *Problem-based learning:* Show students a large menu on chart paper or projected at the front of the class. Tell students that you will pick out several dishes for yourself and your family. Discuss with students that in this instance we can round to get an approximate total so we know how much money to have available to pay. Ask students whether it is more beneficial to round to the tenths place or ones place. Model choosing several meals and rounding each amount first to the tenths place and then to the ones place. Compare the two totals and discuss which is more accurate.independently. Divide students into groups of three. Tell them to pretend that they will be ordering from a restaurant together. All students will select a food and drink. Have students list the items by the price listed on the menu on lined notebook paper. Next to each price have the students practice rounding to the tenths place. All students in the group should record their group members' orders. After students have completed this step, have them add each meal together to get a grand total. Circulate and offer assistance as needed.

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THE BURGER JOINT TAKEOUT MENU			
BURGER		HOTDOG	
Classic Burger TBJ's best classic burger	\$2.75	Classic Hotdog TBJ's best classic hotdog	\$1.75
Hawaiian Burger Our take on Hawaiian burger	\$3.00	Cheesy Hotdog Cheese-filled hotdog	\$2.00
Cheesy Burger Don't you just love cheese?	\$3.00	Bacon Wrapped Bacon and hotdog, what's good?	\$2.50
Double Burger Double the goodness	\$3.75	Whammy Hotdog Hotdog, cheese, bacon and more cheese	\$3.00
Double Cheese More cheese, please	\$4.00		
DRINKS		EXTRAS	
Cola	\$1.50	Fries	\$2.50
Iced Tea	\$1.75	Potato Wedges	\$2.75
Red Tea	\$1.75	BBQ Fries	\$2.85

Exit Ticket

Please use the link below to access our exit ticket:

<https://docs.google.com/forms/d/19XxwMRaLzcoDo1xjw7i1AMwINBkU1zSd6jQ6txQBnLk/edit?usp=sharing>

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