Ray's for Today

Level 2
Student Text

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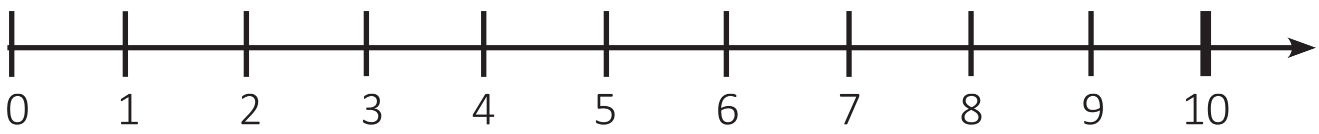
Numbers are very useful. They are tools we use to help us:

- count objects
- group objects
- make equal fair shares
- count how many there are when more items have been added
- count how many there are when items have been taken away
- tell time
- and measure

We use **numerals** as short-cuts for writing out the names of the numbers when we count. You should already know how to count from one to one hundred. You should already know how to write those numbers using the numerals 1 through 100.

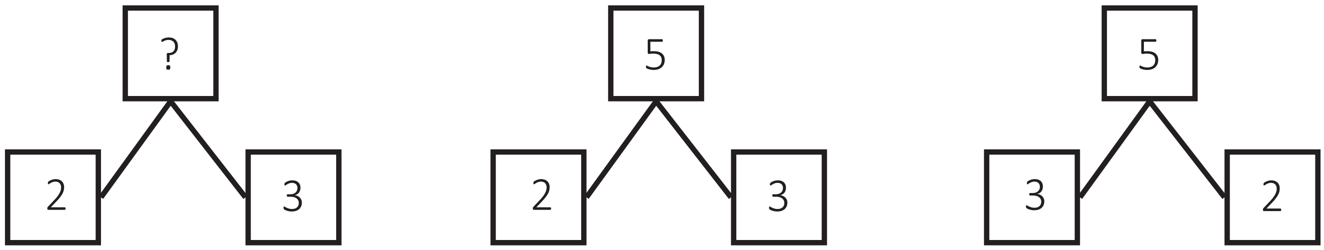
Do you remember that the number **zero**, written as 0, shows there are no objects to count? Zero is also the starting point we use when **skip-counting** and on a number line of the whole numbers. A **number line** shows the numbers in order. The arrow at the end of the line tells us that the numbers keep going, even though they are not shown on the number line that has been drawn.



When we **add** numbers together, we **add on** to the number we already have.

- ➢ Do you remember that whenever we add, we can add the numbers in any order and still get the same answer?
- ➢ Do you remember that we can use number bonds to show how some numbers are related? An addition number bond uses boxes to show how the numbers are connected.

The number in the top box is the answer. The two numbers on the bottom row are the numbers that are added together.

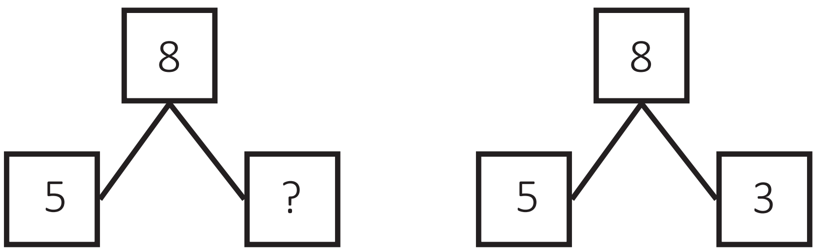


Do you remember that we can write these as **addition facts**?

2 + 3 = 5 and 3 + 2 = 5

When we **subtract** numbers, we **take away** from the number we start with. Do you remember that when we are subtracting numbers that stand for real objects we can only subtract a smaller number from a larger number? Do you remember how we use number bonds to show how these numbers are related?

A subtraction number bond uses the same boxes as an addition number bond. The number in the top box is the number we start with, the larger number. One of the boxes in the bottom row has a number in it, the number that is taken away or subtracted from the larger number. The other box on the bottom row is empty or has a question mark. It stands for the number we want to find, the number that is left.



Do you remember that we can write this as a **subtraction fact**?

8 – 5 = 3

Look again at the number bond on the right. It shows us the subtraction fact 8 – 5 = 3. It also shows us the addition fact 5 + 3 = 8. When we add, the order of the numbers does not matter, so we can say the subtraction number bond also shows us the addition fact 3 + 5 = 8.

Do you remember why the same number bond can show both addition and subtraction? It is because subtraction is the reverse of addition.

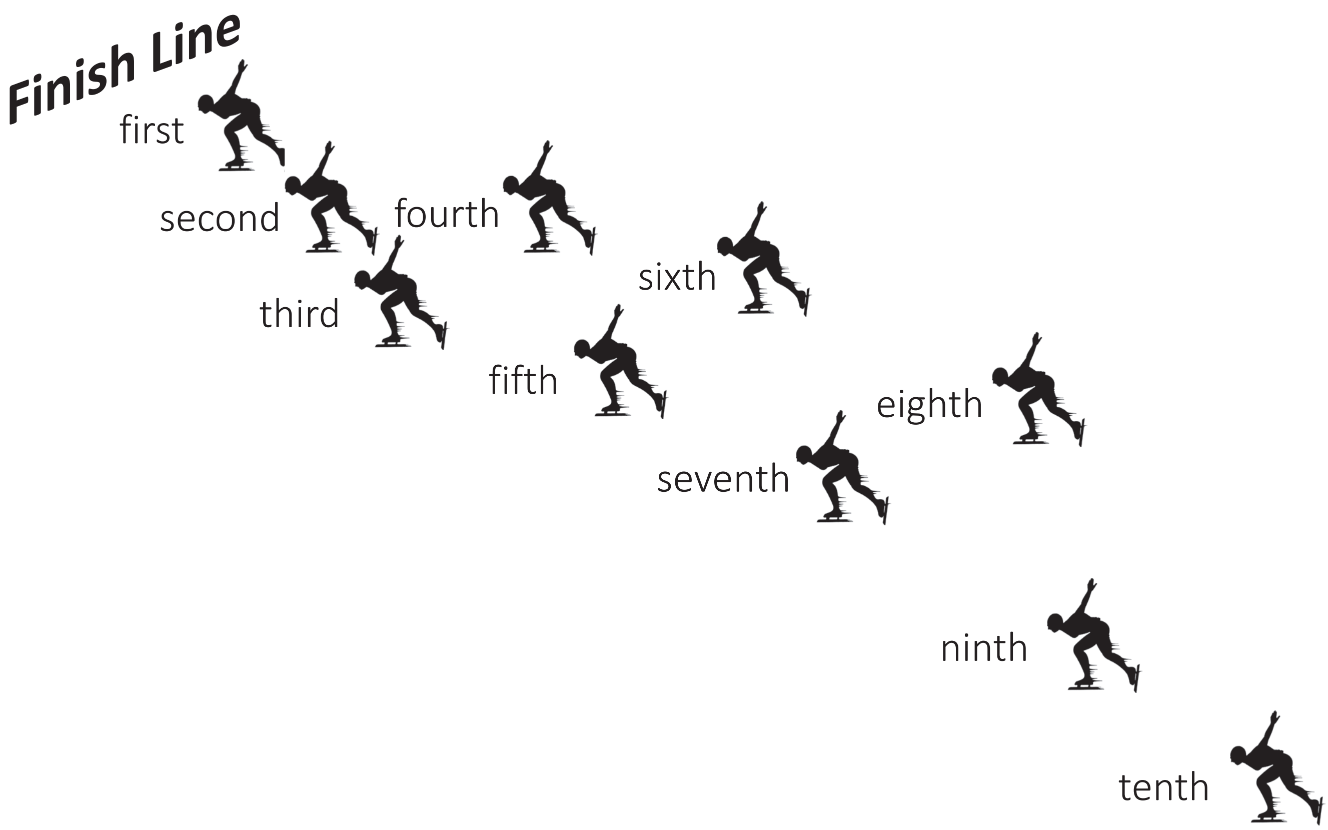
Here are some real-life story problems that use these math facts.

Joey has 5 bugs in his collection. He found 3 more bugs today. How many bugs does Joey have all together? 5 bugs and 3 bugs come to 8 bugs. 5 + 3 = 8.

Marsha has 8 apples. She gives 3 apples to her brother. How many apples does she have now? 8 apples less 3 apples is 5 apples. 8 – 3 = 5.

Do you remember that when we are counting real-life objects and when we are solving real-life story problems we need to include the **units** that tell us what we are counting? What is the unit in the first story? What is the unit in the second story?

Do you remember what the underlined words above are called? They are **ordinals**. Ordinals tell us the rank or order of an object. Ordinals tell us where an item is placed in a group. Here is a group of animal pictures and the ordinals that show what place or rank they have in this list.



Let’s make sure your math tools are ready to go.

Practice

(1) Start with the number 4 and count on to 20.

(2) Start with the number 28 and count on to 34

(3) Start with the number 46 and count on to 61.

(4) Start with the number 75 and count on to 83.

(5) Start with the number 88 and count on to 100.

Write the number that comes before and after.

(6) _________ 16 _________

(7) _________ 42 _________

(8) _________ 73 _________

(9) _________ 31 _________

Write the missing number.

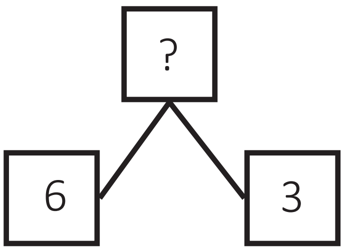
(10) 39 _________ 41 42

(11) _________ 56 57 58

(12) 94 _________ 96 97

Fill in the missing number.

(13)



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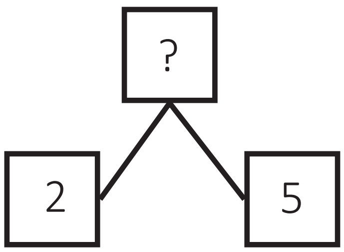

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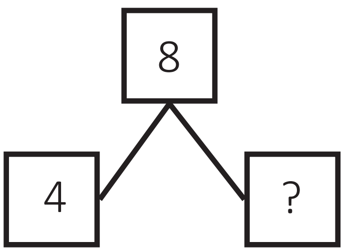

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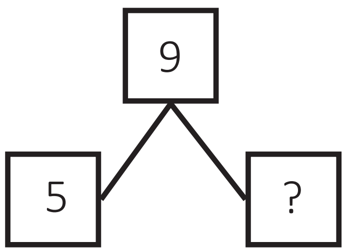


MULTIPLICATION FACT FAMILY – SEVENS

1 times 7 is 7	7 times 1 is 7
2 times 7 is 14	7 times 2 is 14
3 times 7 is 21	7 times 3 is 21
4 times 7 is 28	7 times 4 is 28
5 times 7 is 35	7 times 5 is 35
6 times 7 is 42	7 times 6 is 42
7 times 7 is 49	
8 times 7 is 56	7 times 8 is 56
9 times 7 is 63	7 times 9 is 63
10 times 7 is 70	7 times 10 is 70

Today you will be exploring the multiplication fact family for SEVENS. Multiplying by SEVEN is the same as skip-counting by SEVEN. Look at the Multiplication Chart that we put together using the skip-counting facts.

By now you should know that the top line tells us the number of skips or the number of TIMES a number is added again and the first column on the left shows us how many are in each GROUP when multiplying.

Go to the top row in the Multiplication Chart. Point with your right hand to the box with the numeral 2. This stands for the number of TIMES you add the number. Point with your left hand to the box in the column on the left that has the numeral 7. This stands for how many are in the GROUP. Move your right hand down and move your left hand to the right until your fingers meet. What numeral is in that box?

Yes, 14.   Look at the second line in the fact table above. It also says **2 times 7 is 14**.

Look at the seventh row of the Multiplication Chart. The first shaded box has the numeral 7, which stands for how many are in the group.

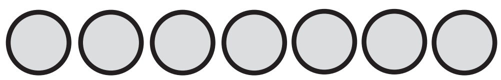
Run your finger across the row, stopping at each box. Can you see how the numeral in each box is the same as the answer for each line of facts in the table above? Can you see how multiplying by SEVEN is the same as skip-counting by SEVEN? Can you see how multiplying by SEVEN is the same as adding SEVEN over and over?

Now let's explore the SEVENS fact family using the counters. Remember, the name of the fact family tells us what number is being used. Every multiplication fact has two parts. The first number tells us how many times the number is being used. The second number tells how many are in each group.

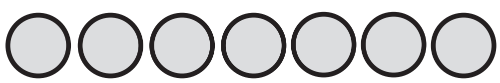
In each multiplication fact family, the first column of facts on the left shows what happens when the number stands for the size of the group. The second column of facts on the right shows what happens when the number stands for the number of times.

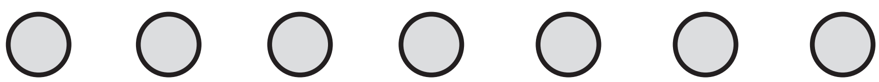
In the SEVENS fact family, the first column shows GROUPS OF SEVEN used one to ten times. The second column shows the numbers 1 through 10 being used SEVEN TIMES.

Let's start with the first line in the table: 1 times 7 is 7 and 7 times 1 is 7. The first fact tells us that we need one group of seven. So start by putting seven counters close together in front of you.


Shows 1 group of SEVEN **1 times 7 is 7**

Let's show the opposite order fact. Keep the seven counters where they are. Move one counter over, but put it a bit away from the counters you already have. Then move one more counter next to it, but leave a small space between them. Keep adding counters until you have seven groups of one.


(counters for first fact)


(counters for the second fact) Shows SEVEN groups of one **7 times 1 is 7**

Both facts show the same answer (7 counters). That's because the order of the numbers being multiplied does not matter in multiplication. The boxes in the Multiplication Chart that show these two facts are already colored in because you learned them when you did the ONES.

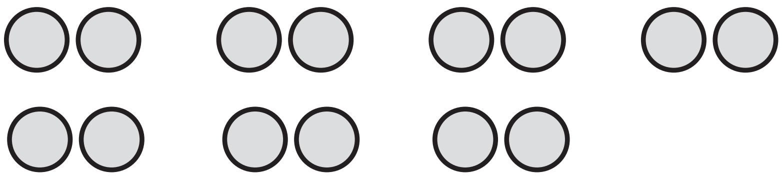
Now let's do the next fact: 2 times 7 is 14. That fact tells us that we need two groups of seven. So how many counters do you need to move over first?

Yes, seven. Then move another set of seven counters over, but put them a bit away from the first group so you can tell them apart. How many counters do you have in all?

Shows two groups of SEVEN OR **2 times 7 is 14**

Yes, 14. Can you show the opposite order fact with the counters? 7 times 2 is 14. This time you need seven groups of two, so how many counters do you start with?

Yes, 2. How many groups of 2 do your need?



Shows SEVEN groups of two
OR **7 times 2 is 14**

Yes, 7. How many counters do you have in all?

Yes, 14 Can you see how both facts have the same answer?

See if you can find both of these facts on the Multiplication Chart. Use a pencil to mark the box that shows the answer to the first fact (2 times 7 is 14). Then find the opposite order fact. The answer will be in a different box. What numeral is there?

Yes, 14. Both facts have the same answer. Can you see that it doesn't matter whether you multiply 2 times 7 or 7 times 2, you get the same answer? Can you see that the box showing the second fact is already colored in because you learned it when you did the TWOS?

Now that you are exploring the SEVENS fact family, circle the facts in the Fact Family table that you already know from learning the facts for ONE, TWO, THREE, FOUR, FIVE, and SIX. Can you see that you don't have as many new facts to learn?

It's time for you to explore the rest of the multiplication facts for SEVEN in the table above. Be sure to use the counters. Always keep the counters showing the first fact from each line in front of you, and then move more counters over to show the second fact as we did in the lesson.

Every time you show a fact:

- **say it out loud;**
- **point to it in the fact family list at the top of this lesson;**
- **find it on the Multiplication Chart and shade in the box with that answer.**

MULTIPLICATION FACT FAMILY – SEVENS

1 times 7 is 7	7 times 1 is 7
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6 times 7 is 42	7 times 6 is 42
7 times 7 is 49	
8 times 7 is 56	7 times 8 is 56
9 times 7 is 63	7 times 9 is 63
10 times 7 is 70	7 times 10 is 70

In the last lesson you used counters to show the multiplication facts for the number SEVEN. Let's see if you can use those facts to answer questions that come up in real life. Use the counters to show the numbers in the stories. Remember, when using numbers to count objects in real life, you have to say the units so we know what you are counting.

Here's the story: *Sarah bought 2 pencils that cost 7 cents each. How much did they cost?*

Since each pencil costs 7 cents, move seven counters over for the first pencil. How many pencils were bought?

Yes, 2. So move another group of seven counters over. How many counters do you have?

cents needed for one pencil　　cents needed for one pencil

Yes, 14. Two groups of seven is fourteen. **2 times 7 is 14**

Here's the correct answer: The pencils cost 14 cents.

Practice

Now use the counters to show what happens in these stories. Make sure you say the multiplication fact out loud and the give the units you are counting in the answer. Then point to the multiplication fact in the table at the top of the lesson.

(1) Edward has 3 pockets with 7 marbles in each one. How many marbles does he have?

(2) There are 7 days in a week. How many days are there in 4 weeks?

(3) If 1 melon is worth 5 peaches, how many peaches are 7 melons worth?

(4) If a horse travels 7 miles in one hour, how many miles will it travel in 6 hours?

(5) If each of 7 benches will seat 7 boys, how many boys can sit on all of the benches?

(6) If Steve gives 7 marbles for one cent, how many must he give for 8 cents?

(7) If string costs 9 cents a yard, how many cents will 7 yards cost?

(8) At 2 cents each, what will be the cost of 7 pads of paper?

(9) At 10 cents a pound, how much will 7 pounds of nuts cost?

MULTIPLICATION FACT FAMILY – SEVENS

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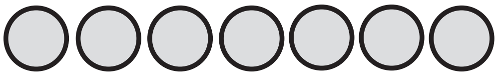
6 times 7 is 42	7 times 6 is 42
7 times 7 is 49	
8 times 7 is 56	7 times 8 is 56
9 times 7 is 63	7 times 9 is 63
10 times 7 is 70	7 times 10 is 70

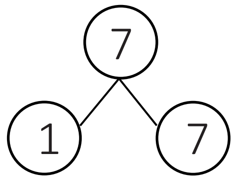
It’s time to go surveying again. You will be mapping out the multiplication fact family for SEVENS using the number bonds.

By now you should know that we use circles to show the multiplication facts, and that the first number on the bottom row tells how many TIMES and the second number tells how many are in each GROUP.

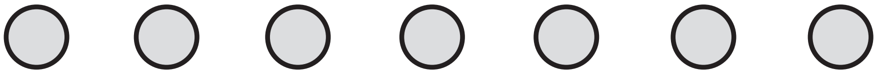
Let's look at the first line of facts. The first fact says we have one group of seven.

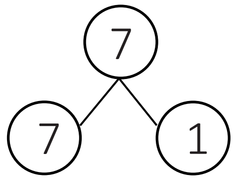


1 times 7 is 7



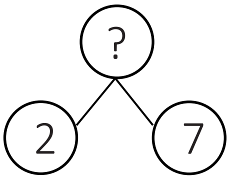
The opposite order fact says we have seven groups of one.

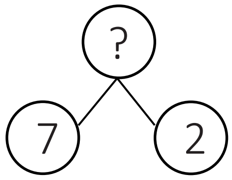




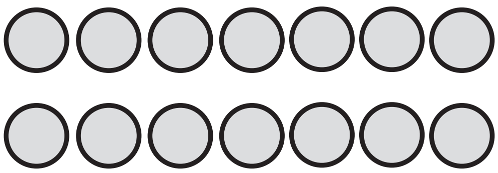
7 times 1 is 7

Can you see that both facts have the same answer? Let's try the next fact in the table. What is the missing number in the number bonds below?





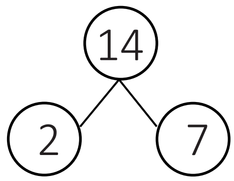
The first fact tells us there are two groups of seven.



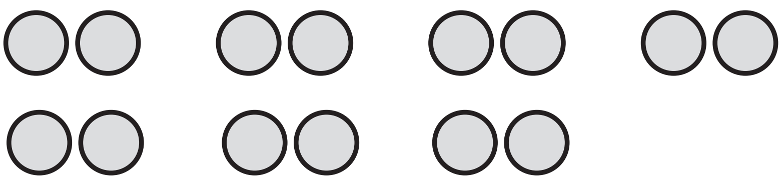
7 + 7 = 14

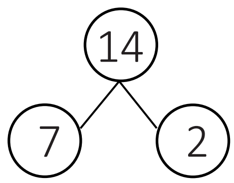
OR

2 times 7 is 14



The second fact tells us there are seven groups of two.



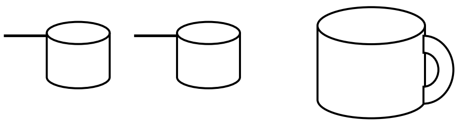


2 + 2 + 2 + 2 + 2 + 2 + 2 = 14 OR **7 times 2 is 14**

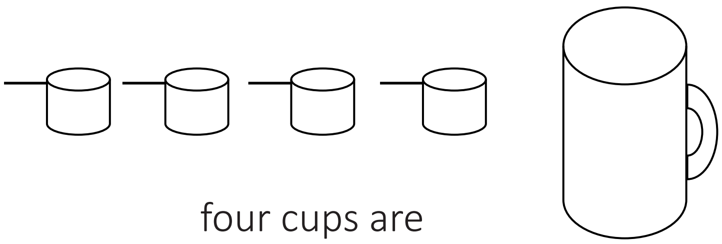
Fill in the number bonds for the rest of the multiplication facts for SEVEN.

In the last lesson you drew a picture about a **division story**. Division lets us break down a larger number into smaller equal parts. It lets us **divide** a number into parts.

Before that, you measured amounts of water to see how much liquid a container could hold. You were measuring the capacity of a pint-sized container, a quart-sized container, and a gallon-sized container. You saw how many cups and pints were contained in those containers.

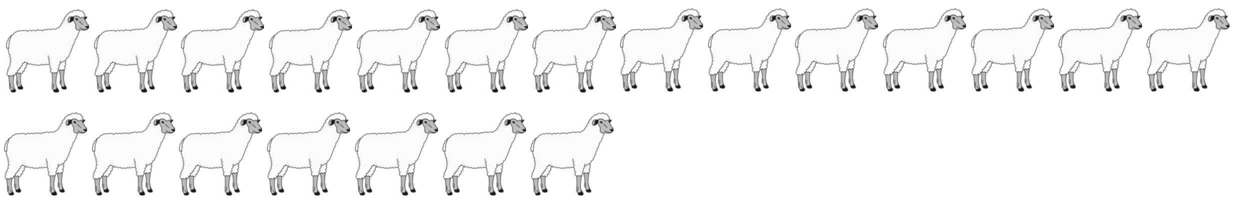


two cup are
contained in a pint



four cups are
contained in a quart

In the division story, you were asked questions about how many groups of a certain number were contained in a larger number. Do you remember how many sheep were in each flock when the twenty-one sheep were divided into three flocks of the same size?

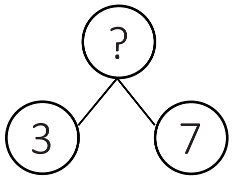


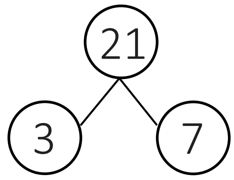
Yes, seven. We asked the question, “How many times is 3 contained in 21?” Draw circles around the sheep to “herd” them into the three groups of equal size (seven). Your circles show how many groups of three are contained in the number 21. We could say this another way. “How many times does 3 go into 21?”

When you drew the circles around the sheep, you **divided** the 21 sheep into 3 groups of the same size, with each group having 7 sheep.

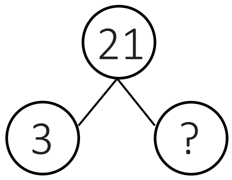
Now let’s ask this question: “How many is 3 times 7?” That’s a multiplication question, isn’t it? We’re asking how many is 3 groups of 7. Do you see how all these numbers are related?

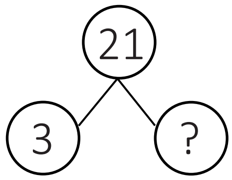
Looking at the number bond may help you see how they are connected. Look at the number bond for this multiplication fact of 3 times 7. What is the missing number?





If we were to use a number bond to show what you did when you drew the circles around the sheep to herd them into three groups of the same size, the number bond would look like this.





This time the question mark showing the missing number is on the bottom row instead of at the top. What is the missing number?

Yes, 7. Can you see how this number bond shows the same numbers as the one for multiplication above? The only difference is where the question mark is.

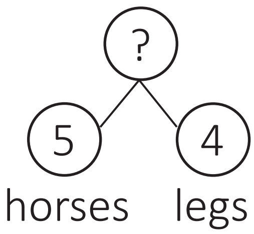
The multiplication number bond shows the fact: 3 times 7 is 21. This division number bond shows the fact: 3 is contained in 21 seven times. It shows that 3 goes into 21 seven times. It shows that 3 into 21 is 7.

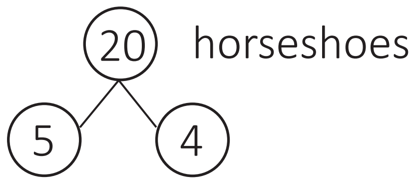
By now you should be able to see that multiplication and division are related. They are related in the same way that subtraction and addition are related.

Division is the reverse of multiplication. In multiplication, you multiply two numbers together to find a total. In division, you have the total and one of the numbers, and you want to find the other number. Do you remember the horses in our division story?

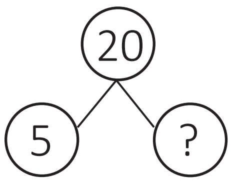
You multiplied the number of legs on each horses (four) times the number of horses (five). 4 times 5 is 20.   Draw a circle around each set of four legs. How many circles did you draw? Did you draw five circles so that each horse has a circle around it? Those circles show how many groups of four there are in twenty. They show how many fours are contained in the number twenty. They show 4 goes into 20 five times. They show 20 divided by 4 is 5.

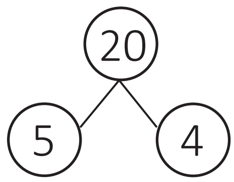
To show this using the number bonds, you show the number of legs and the number of horses to find the total.





To show the reverse operation of division, you know the total and one of the parts (that each horse has four legs). Four is contained in 20 five times.





DEFINITION:

Division is finding how many times one number is contained in another number.

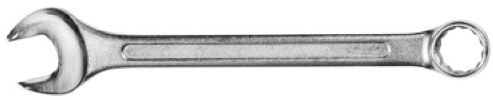
Have you ever watched someone work on a car's engine or some other machine? The person uses tools that fit the job that needs to be done. A person who works on machines is called a mechanic.

In arithmetic, you have learned about four tools that we use to work on numbers. The four tools are **addition**, **subtraction**, **multiplication**, and **division**. You will be learning the division fact families in the weeks ahead. For now, though, we want to make sure you understand that the arithmetic operations are very useful tools. And very necessary.

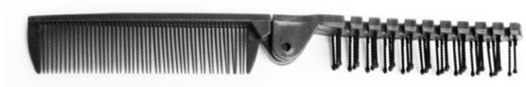
It would be hard for a mechanic to work without basic tools. It will be hard for you to work with numbers without your basic tools.

So far, you have been learning how to use the arithmetic operations on the counting numbers, specifically the numbers 1 through 10. The counting numbers (1 through 9 and up), along with the zero are called **whole numbers**. In other levels of this math program, you will learn how to use these same basic tools on different types of numbers. They are very useful tools.

You have learned that addition and subtraction are related. They are like two tools in one.

addition  subtraction

You have learned that multiplication and division are related. They are also like two tools in one, but they are a different set of tools.

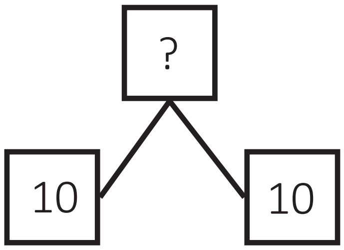
multiplication  division

All four math tools can be used to work on numbers. Let's look at the number twenty, (20). Count the number of screws.

Did you count tweny? Draw a circle around ten of them using a colored pencil. How many screws are left? Draw another circle around those ten screws. We can use one end of our combination tool to do addition on these screws. We can use the addition number bond to show the addition fact.

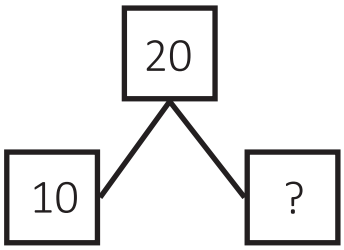
addition  **subtraction**

10 + 10 = **20**



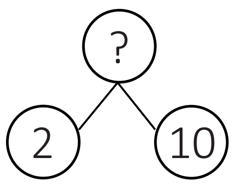
We can use the other end of our combination tool to do subtraction on these screws. Remember, subtraction is the reverse of addition. It's as if we used the other end of the combination tool to "undo" what we put together in addition.

20 – 10 = 10



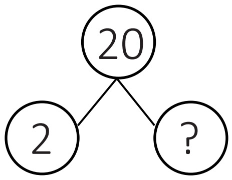
We can take those same circled screws and use the <u>other</u> combination tool on them, starting with multiplication. Of course, we will have to use a multiplication number bond to show the fact that we have two groups of ten.

2 x 10 = **20**



Then we can use the other end of the tool to do division on the screws and use a division number bond to show the fact. Remember, division is the reverse of multiplication, so it is as if we use the other end of this combination tool to "undo" what we put together in multiplication. If we have two groups of equal size, how many will be in each group?

20 divided by 2 is 10



What is amazing about the arithmetic operations is that these are just some of the ways we can work with the number 20!

Here's another picture of the same screws. This time, draw a circle around five of the screws. Keep drawing circles around five screws at a time until all the screws are circled. We can use the addition tool to "operate" on these numbers. 5 + 5 + 5 + 5 = **20**

If we wanted to, we could start with the twenty screws and keep subtracting five screws. **20** – 5 – 5 – 5 – 5 = 0. As you can see, the number 20 contains four groups of five.

Or we can use the other combination tool to do multiplication on these screws. Since multiplication is the same as repeated addition, we "group" the fives together to do the "operation." We write 4 x 5 = **20**.

Can you guess what operation we will do next? Yes, division. **5 goes into 20 four times.** We can say that 20 divided 5 is 4.

There's one more thing you need to see about division. In order to show it to you, we have to remind you of what you already know about how to use these operations.

- You already know that subtraction is the reverse of **addition**.
- You already know that **multiplication** is repeated **addition**.
- You already know that *division* is the reverse of **multiplication**.

So guess what? *Division* is the same as repeated subtraction!

Both subtraction and division start with the total and one part, the size of the group. In division, we take the total and keep breaking it down into groups of the same size. The group size is the number that is repeatedly subtracted. The subtraction number bond shows us that **20** – 5 – 5 – 5 – 5 = 0.

In both cases, we started with the total of 20. In subtraction, we used the number 5 four times. In division, we “grouped” the fives together to “operate” on the total number of 20 and found that there are four groups of five in 20. We see the same facts.

As you will see in the weeks ahead, the arithmetic operations let us get a lot of work done on numbers.

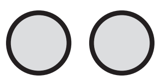
DIVISION FACT FAMILY – ONES

1 into 1 goes 1 time	
1 into 2 goes 2 times	2 into 2 goes 1 time
1 into 3 goes 3 times	3 into 3 goes 1 time
1 into 4 goes 4 times	4 into 4 goes 1 time
1 into 5 goes 5 times	5 into 5 goes 1 time
1 into 6 goes 6 times	6 into 6 goes 1 time
1 into 7 goes 7 times	7 into 7 goes 1 time
1 into 8 goes 8 times	8 into 8 goes 1 time
1 into 9 goes 9 times	9 into 9 goes 1 time
1 into 10 goes 10 times	10 into 10 goes 1 time

Now that you know that division is the reverse of multiplication and the same as repeated subtraction, let's look at the first fact family for division, the ONES. Read through the first column on the left. What pattern do you see? ONE goes into a given number that number of times.

Do you remember that any number times ONE is always that same number? Since division is the reverse of multiplication, it makes sense that any number divided by ONE is still that number. When you divide by ONE, you are subtracting ONES over and over.

Let's use counters to look at some of these facts. Let's start with 1 into 2 since it will be easier to see the division fact. Put two counters in front of you.

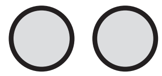


When we divide we want to know how many groups of a certain number are contained in a given number. It's like the number of cups contained in a pint or quart. So when we divide by ONE, we want to know how many "groups" of ONE are in that number.

In this case, how many ONES are in two? So start by moving ONE counter a little to the side. How many counters are left?

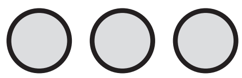
Yes, ONE. We can see that there are two groups of ONE contained in two. ONE into two goes 2 times. We could also say that two divided by ONE is two.

Now let's show the opposite fact from the second column, 2 goes into 2. We start with the two counters again.



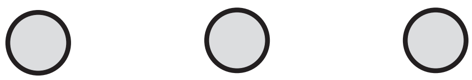
We want to know how many groups of twos are contained in these counters. We don't need to move any counters because we already have the ONE group of two that we can make. Two goes into 2 ONE time.

Now let's look at the next set of facts. Move three counters in front of you.



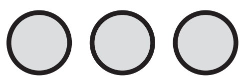
Since we want to know how many groups of ONE are contained in three, move ONE counter a little to the side. How many counters are left?

Yes, two. Can we get another group of ONE from the counters? Yes, so move ONE more counter over a bit. Now how many counters are left? Yes, ONE.



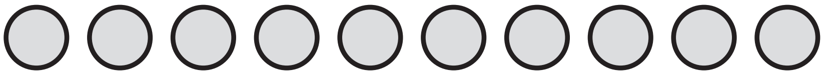
Now we can see that there are three groups of ONE in three. We can see that ONE goes into three 3 times. We can see that three divided by ONE is three.

To show the opposite fact, we start with the three counters again.



We want to know how many groups of three are contained in these three counters. We don't need to move any counters because we already have the ONE group of three that we can make. Three goes into 3 ONE time.

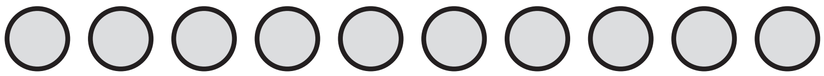
Let’s try the last fact in the list. Move ten counters in front of you.



To find how many groups of ONE are contained in ten, move ONE counter a little to the side. Keep moving ONE counter a little bit until there is only ONE counter left.

Now we can see that there are ten groups of ONE in ten. We can see that ONE goes into ten 10 times. We can see that ten divided by ONE is ten.

To show the opposite fact, we start with the ten counters again.



This time we want to know how many groups of ten are contained in these ten counters. We don’t need to move any counters because we already have the ONE group of ten that we can make. Ten goes into 10 ONE time.

- Can you see that ONE goes into any number that number of times?

- Can you see that any number divided by ONE is always that number?

If not, then use the counters to show all the facts in the list using the counters as we have done with here.

Today you will need your mechanic's hat again to work on some more story problems. As with the last lesson, you will need to use more than one tool to work the problem. Be sure to use the problem-solving steps to help you solve the problem. We will do a few problems together first.

> **1. Look to see what information you need to find out.**
> **2. Look to see what information you know.**
> **3. Look for clue words to help you decide what tool to use to find the answer.**
> **4. Write the information in number sentences and use models to help you see the information.**

Here's the first story: *Henry spends 32 cents for pears, at 4 cents apiece, and 20 cents for pears, at 5 cents apiece. How many pears does he buy?*

1. Look to see what information you need to find out. how many pears he bought in all

2. Look to see what information you know. he spent 32 cents and 20 cents

3. Look for clue words. the word *apiece* tells us the rate or cost for each pear, which tells us to divide; since two different prices were given, we need to divide twice to find out how many pears were bought; then we need to add to find the total he bought

4. Write the information in number sentences and use models. You can use the counters to help you see the problem.

The first time he bought pears, Henry spent 32 cents at 4 cents apiece. To divide, we start with the total and move counters into the groups. So put 32 counters in front of you and move them into groups of four. The number sentence looks like this: 32 ÷ 4 = ? What is the answer to that fact?

Yes, 8. Do you have 8 groups of four counters? So far we know that **Henry bought 8 pears.** Now let's find out how many he bought the second time. He spent 20 cents for pears at 5 cents apiece. So put 20 counters in front of you and move them into groups of 5. How would you write the number sentence for this problem?

Did you write: 20 ÷ 5 = ?   What is the answer to that fact?

Yes, 4. Do you have 4 groups of five counters? So now we know that Henry also **bought 4 pears**. What do we need to do to find the total number of pears Henry bought?

Yes, add. The number sentence looks like this: 8 + 4 = ? What is the answer to this fact?

Yes, 12. The final answer: **Henry bought 12 pears.**

Let's try another story: *Sarah spends 50 cents for lemons, at 5 cents apiece. She gives 6 of them to her sister. How many lemons does she have left?*

1. Look to see what information you need to find out. the number of lemons left

2. Look to see what information you know.   she spent 50 cents on lemons costing 5 cents each and gave 6 lemons away

3. Look for clue words.   the word *apiece* tells you the rate or cost for each lemon, which tells us to divide to find out how many lemons she bought; the word *gives* tells us to subtract to find the total (she gave away the lemons)

4. Write the information in number sentences and use models.   You can use the counters to help you see the problem.

Whenever you have a problem that seems more involved, don't let it throw you. Just work the problem step-by-step.

Start with the first part: Sarah spent 50 cents at 5 cents apiece. Since we need to divide, start with 50 counters in front of you and move them into groups of five. The number sentence looks like this: 50 ÷ 5 = ? What is the answer to that fact?

Yes, 10. Do you have 10 groups of five in front of you?

We now know that **Sarah bought 10 lemons**. What did she do next? She gave away six of them. So we need to subtract. How would you write the number sentence?

Did you write: 10 – 6 = ? What is the answer to that fact?

Yes, 4. The final answer is that **Sarah has 4 lemons left**.

Can you see that the story problem is not that hard? It is just a matter of breaking it down into smaller parts, finding the answer with the math facts that you already know for each part, and then using the math operations to find the final answer. Can you see how useful it is to know the math facts?

Here's another problem to fix. *Mary bought 7 cents worth of thread, and 10 cents worth of needles. She gave the clerk 25 cents. How much change did she get?*

Break the problem up into smaller parts using the problem-solving steps.

1. Look to see what information you need to find out. how much change she gets

2. Look to see what information you know. she spent 7 cents and 10 cents, and gave the clerk 25 cents

3. Look for clue words. the word *and* means we need to add the amount of money Mary spent both times; the word *change* means she got money back from the clerk so we need to subtract what she spent from the amount she gave the clerk.

4. Write the information in number sentences and use models. You can use the counters to help you see the problem.

To see how much money Mary gave the clerk, put 7 counters in front of you and then 10 more counters. How would you write that number sentence?

Did you write: 7 + 10 = ? What is the answer to that fact?

Yes, 17. Do you have 17 counters in front of you? Now we know that the amount of money **Mary spent was 17 cents**. How much money did she give the clerk?

Yes, 25 cents. In subtraction, we start with the total, so put 25 counters in front of you. Then take away 17 cents. So how would you write that number sentence?

Did you write: 25 – 17 = ? What is the answer to that fact? How many counters do you have left in front of you?

Yes, 8. The answer is that **Mary got 8 cents back in change**.

Can you see how important it is to look for clue words? They tell you what math tool to use and how to operate on the numbers.

Here's another problem to work on: *I bought 4 pencils at 3 cents each. I gave the clerk three nickels. How many cents should I get back in change?*

1. Look to see what information you need to find out. how much change I should get

2. Look to see what information you know. I bought 4 pencils at 3 cents each; I gave the clerk 3 nickels.

3. Look for clue words. The word *each* means we need to multiply to find out how much all the pencils cost. Since we need the answer in cents, we also need to multiply the number of cents in a nickel to find how much I gave the clerk. The word *change* means I get money back, so we need to subtract.

4. Write the information in number sentences and use models. You can use the counters to help you see the problem.

This problem is even more involved, isn't it? But that's alright because you know how to break the problem down into smaller parts to make it easier to work on.

Start with the first part of the problem, the total cost of the pencils. When we multiply, we start with the size of the group (three cents) and then keep adding that many groups until we reach the number of times we need. In this case, we need four groups to show the 4 pencils. How do we write that number sentence?

Did you write: 4 x 3 = ? Or did you write 3 x 4 = ? Remember, it doesn't really matter because in multiplication the order of the numbers doesn't matter. The answer is the same to both facts.

So whether you make four groups of three counters or three groups of four counters, you still end up with the same number of counters: 12. So now you know that **the pencils cost me 12 cents**. Now we can go to the next part of the problem. How many nickels did I give the clerk?

Yes, three. How many cents is each nickel worth?

Yes, 5 cents. So write the number sentence to show this problem.

Did you write: 3 x 5 = ? What is the answer to that fact?

Yes, 15. So now you know **I gave the clerk 15 cents**.

Since the amount of money I gave the clerk is more than the cost of the pencils, we need to subtract to find the amount of money I should get back. In subtraction, we start with the total, so put 15 counters in front of you. Now take away 12 of them. How would you write that number sentence?

Did you write: 15 – 12 = ? What is the answer?

Yes, 3. So the final answer is that **I should get back 3 cents in change**.

Practice

Here are some problems to fix on your own. Read through the story first. Use the problem-solving steps to break them down into smaller parts. You will need to do more than one operation on each problem. Use the counters, too.

(1) Lucy spends 36 cents for apples at 6 cents apiece. She gave 2 apples to Elizabeth. How many apples does Lucy have left?

(2) Shane spends 63 cents for large marbles, at 7 cents each. He also spent 40 cents for small marbles, at 5 cents each. How many marbles did Shane buy altogether?

(3) Owen buys 2 books that cost 8 cents apiece. He gives the clerk two dimes. How much change should he get back?

(4) Kali spends 9 cents on gum and 6 cents on candy. She gives the clerk 20 cents. How much change should she get back?

(5) Jack bought 2 apples at 5 cents apiece and 4 plums at 6 cents apiece. How much money did he spend?

Challenge Question:

(6) Anna bought 3 pieces of satin cloth for 18 dollars. She also bought 2 pieces of cotton cloth for 5 dollars apiece. How much did Anna pay for the cotton cloth? How much more did Anna spend for the satin cloth than for all the cotton cloth?

(6) Gary bought 4 flags at 10 cents each, and 3 flags at 3 cents each. How many flags did he buy, and how much did they cost?

(7) Stephanie had 40 dollars given to her for Christmas. She spent 10 dollars for a shirt and 6 dollars for a book. How much did she have left?

Challenge Questions:

(8) Max is 4 years old. His father is 32 years old. In how many years will Max be as old has his father is now?

(9) A farmer bought 8 yards of cloth, at 3 dollars a yard. He paid for it with flour at 4 dollars a barrel. How many barrels did it take?

UNIT FOUR-COUNTING TO 1000 **LESSON 121 – ADDING TO THE HUNDRED CHART**

As a math detective, you used the counters and the Hundred Chart to solve math mysteries with larger numbers.

Just when we thought we were done, we have found another mystery that needs solving: *Francine has 96 cents. Her mother gave her a nickel. How much money does Francine have now?*

How many cents is a nickel worth?

Yes, five cents. So we need to add 5 to 96. Look at the Hundred Chart your teacher gives you. Find the box with the numeral 96 in it and add five more. What happens? You run out of boxes and numerals, don't you?

So far you have only learned the counting numbers from 1 to 100, and the numeral zero. The Hundred Chart shows the pattern of tens we use in our number system, starting with the numerals 1 through 9, then the teens, twenties, thirties, forties, fifties, sixties, seventies, eighties, and nineties. The chart ends at 100.

Do you remember what 10 times 10 is?

Yes, 100. The Hundred Chart shows the first ten groups of ten in our number system all on one page.

But now we have a mystery on our hands to solve. How are we going to find the answer? What is amazing about our number system is that we can easily make more numbers using the same pattern of tens.

Look at the first row of the Hundred Chart that shows the counting numerals that keep being repeated.

1	2	3	4	5	6	7	8	9	10

The last box uses the zero and a 1 to show that it marks the end of the first group of ten. Each next row in the chart uses these same numerals with another numeral to show which group of ten it shows. 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100.

Now look at the last row of the chart.

91	92	93	94	95	96	97	98	99	100

The last box uses the zero and a 10 to mark the end of the tenth group of ten. **10 x 10 = 100**.

Being the good math detective that you are, can you guess what we can do to keep adding on numbers? If you said we can use the same pattern of numerals, then let out a whoop—but NOT if you have a baby brother or sister who is sleeping!

We can use another chart to show more numbers. The charts are just another way we can picture the numbers. The rows on the chart help us keep the numbers in order while showing them on one page rather than a very long line of numbers.

Here's what the next row in a chart would look like.

101	102	103	104	105	106	107	108	109	110

Can you see how the numerals 1 to 9 and the zero are repeated? This time the last box uses the zero and an 11 to mark the eleventh group of ten.

The numbers add on to that last box in the Hundred Chart, the one with the numeral 100. So we start with that name. The name of the first numeral is ONE HUNDRED ONE.

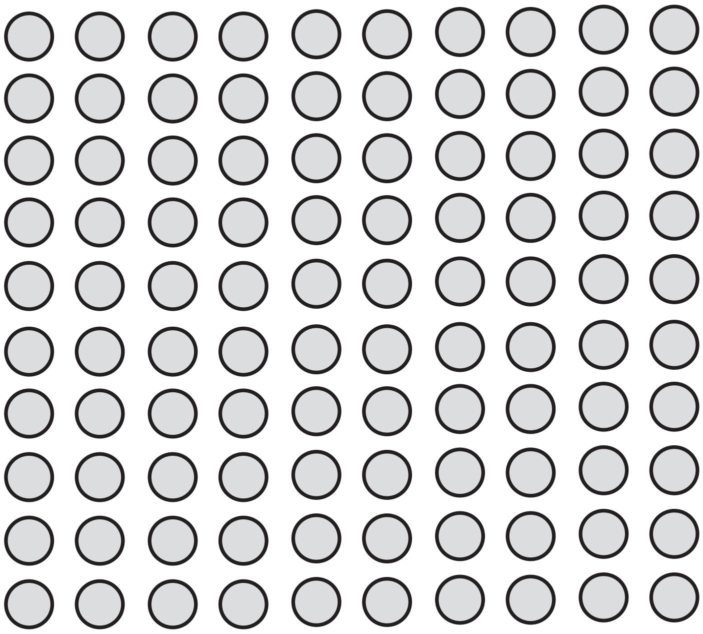
Here are the names of these new numbers:

one hundred one
one hundred two
one hundred three
one hundred four
one hundred five
one hundred six
one hundred seven
one hundred eight
one hundred nine
one hundred ten

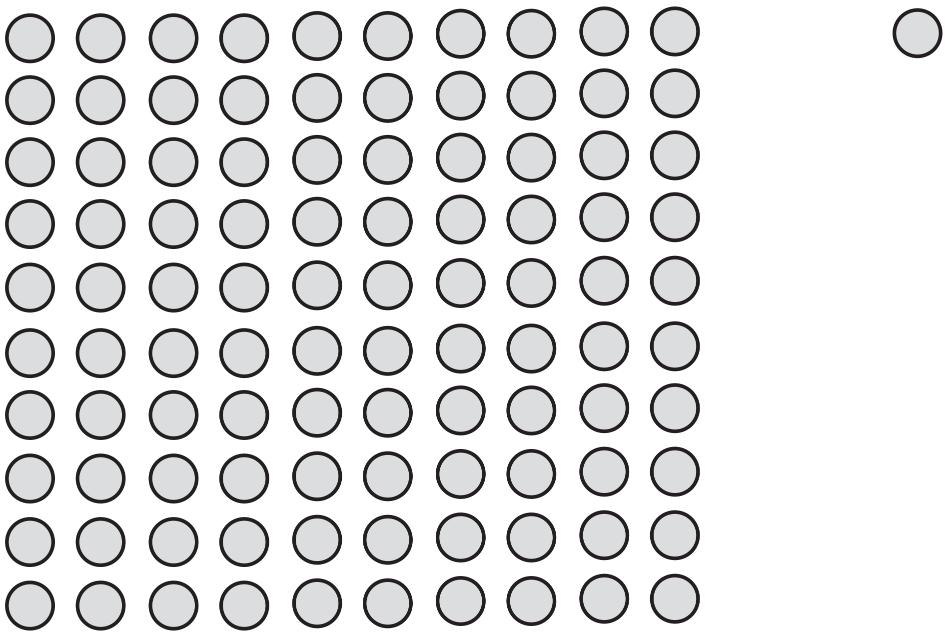
Do you see the pattern? We say the names of the first ten numerals along with the words ONE HUNDRED to show that we are starting to count on from one hundred.

Now it's time to see what these numbers stand for.

We use numbers to count objects. So start with the number you already know well, 100. Put 100 counters in front of you. To make it easier to keep track of how many counters you have, put them in rows of ten. When you are done, you should have ten rows of ten counters each.

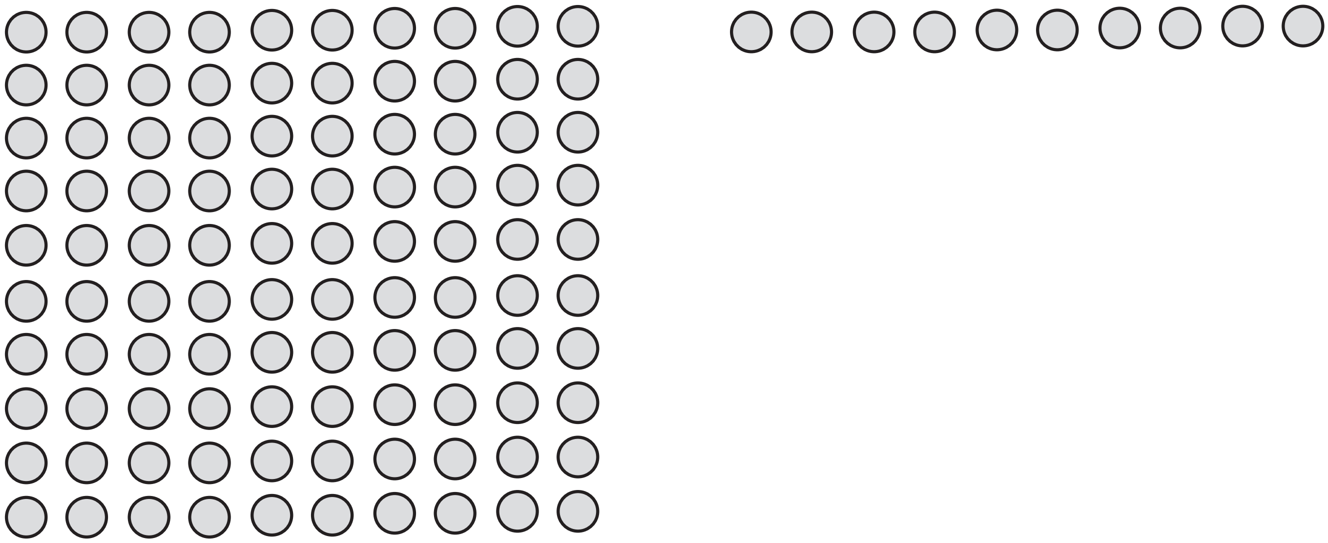


Can you see how your collection of counters matches the Hundred Chart? Ten rows of ten. **10 x 10 = 100**. Now put one counter on the same line as the top row of your counters, but move it over a bit to the side.



How many counters do you have now?

Yes, 101. One hundred one. Keep adding one more counter, one-by-one. As you do, say how many counters you have each time. Stop when you have the new row of ten counters in place. It should look something like this.



How many counters do you have in all?

Yes, **110. One hundred ten.**

Now you can solve the mystery. *Francine has 96 cents. Her mother gave her a nickel. How much money does Francine have now?*

Before you begin, take away the new row of counters you just added. From the bottom row of the 100 counters you started with, take away 4 counters. Why do you need to do this? So that you have 96 counters that show the 96 cents. That's how many cents Francine had to begin with. Now we can solve the mystery.

How many cents (counters) do we need to add to these?

Yes, 5 because a nickel is worth five cents. Start adding counters, one-by-one so that you finish off the last row of ten. How many counters have you used so far? Yes, 4. How many do you need to add all together? Yes, 5. So put one more counter on the same line as the top row, but move it over a bit. How many counters do you have now? If you said "one hundred one," then clap your hands.

Can you see how useful it is to add more numbers? That way we can add, subtract, multiply, and divide larger numbers.

DEFINITIONS:

A **number** is the amount that is counted.

A **numeral** is the symbol or figure used to write that number or amount.

A **digit** is one of the counting numbers of 1, 2, 3, 4, 5, 6, 7, 8, 9, or zero that is used to write the numeral. A numeral may have 1 or more digits. The numeral 4 has one digit. The numeral 74 has two digits. The numeral 104 had three digits.

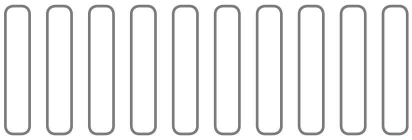
UNIT FOUR-COUNTING TO 1000 **LESSON 122 – NUMBERS 111 TO 130**

Can you guess what we're going to do today? Yes, add on more numbers. We are going to add on to the Hundred Chart. In fact, we are going to start a new chart so that we can keep adding on more numbers.

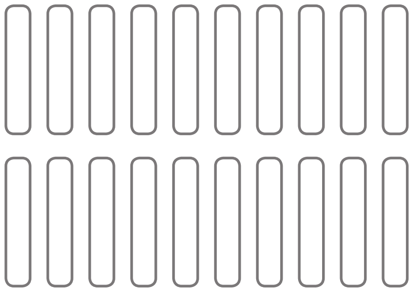
In the last lesson, you learned another group of ten numbers, from one hundred one (101) to one hundred ten (110). Can you see those numbers on the new chart your teacher gives you? The top row of this chart shows the eleventh group of tens. We will call this the Two Hundred Chart. You will see why shortly.

Since we are adding on to the Hundred Chart, we need to begin with 100 counters. It is a lot of work to count out all one hundred counters and put them in 10 rows of 10, isn't it? To make it easier, we are going to use craft sticks instead. For this lesson, you will count them out as you did the counters. As you can imagine, this is going to take up a lot of room, so you will probably want to work on the floor unless you have a large table that you can use.

Your teacher will hand you ten loose sticks. Lay these down one-by-one, counting them as you go (one through ten). Place them side-by-side so that they are "standing up" like this:

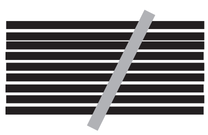


Your teacher will keep handing you ten loose sticks. Keep laying them out and counting as you go—eleven through twenty, twenty-one through thirty, and so on until you have one hundred sticks laid out in a very large column. Here's what the sticks should look like after you have counted to twenty.



When you are done, you should have ten rows of ten sticks. Go ahead and lay out the sticks.

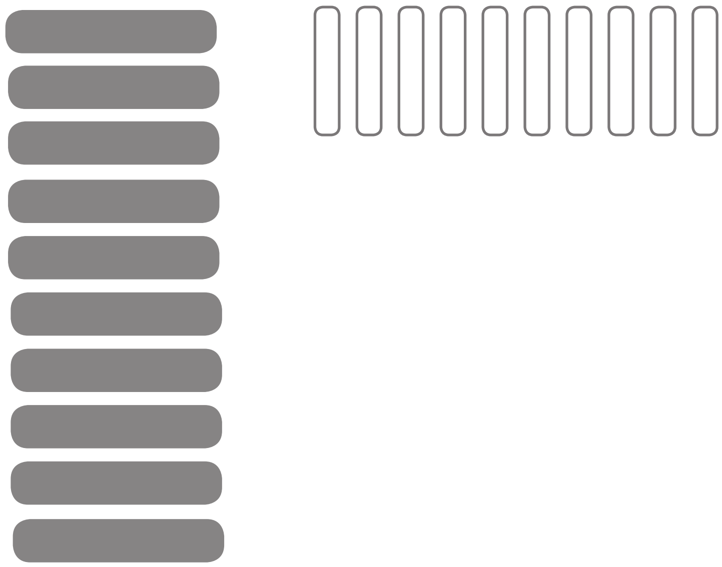
Ten times ten is what? 10 x 10 = 100. That's a lot of sticks, isn't it? And they take up a lot of room. It will be a lot of work if you have to lay out all one hundred sticks for each lesson. So let's use a short-cut. Your teacher will show you how to bundle each group of ten sticks together. When you have a bundle made, lay it on its side so that you can see the edge of all ten sticks in the bundle. It should look something like this (the gray line across the "sticks" is the rubber band that holds the sticks in place):



Do this will all one hundred sticks.

When you are done, you should have ten bundles of ten sticks. Place them in one column. Do the sticks take up less room now? They should. They should also be easier to work with and move around. From now on, all you will have to do is lay out bundles of sticks to start each lesson. Aren't you glad?

Now that you have **ten bundles of ten**, showing **one hundred** sticks, you can add on from there. Do you remember the numbers you learned in the last lesson? Your teacher will give you another group of ten loose sticks. Put these in a row next to the bundles. Your sticks should look something like this. To show the bundles of ten, we will use a different shape: 



Place them on the same line as the top bundle. Lay these down one-by-one, counting as you go. You should have the column of ten bundles and then ten loose sticks "standing up" next to the top bundle. How many sticks to you have altogether?

Yes, **110**. Can you see how the ten loose sticks show the numbers in the top row of the Two Hundred Chart your teacher gave you?

Now we're ready to add on some more numbers. Let's do the next group of tens. Each new group of numbers will use the same pattern that we have been using all along. It is the same pattern seen in the Hundred Chart, using the numerals 1 through 9 and zero.

The numbers 101 through 110 show the eleventh group of ten. Can you guess what the next group of numbers will show? Yes, the twelfth group of ten. It will be the second row in the new chart.

101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120

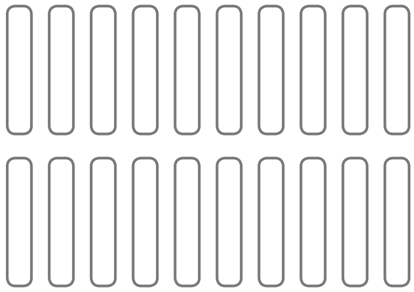
Compare these two rows with the first two rows on the Hundred Chart. How are they alike? How are they different? Here are the names of this next group of ten:

one hundred eleven
one hundred twelve
one hundred thirteen
one hundred fourteen
one hundred fifteen
one hundred sixteen
one hundred seventeen
one hundred eighteen
one hundred nineteen
one hundred twenty

Can you see how the names use the "teens" along with ONE HUNDRED, except for the last one? It tells us that we need to start another group of ten.

Let's see what these numbers look like using the number sticks. You already have the ten bundles of ten to show ONE HUNDRED. And you have the row of sticks showing ONE HUNDRED ONE (101) through ONE HUNDRED TEN (110). Your teacher will give you another group of loose sticks. Start a second row of loose sticks under the sticks you already have.

Lay down each of these sticks one-by-one in a row under the others, counting as you go, from 111 through 120. You should have the column of ten bundled sticks and then two rows of loose sticks lined up next to the column. Your column of loose sticks should look something like this:



Now that you've seen what these numbers look like, write them in the boxes on the TWO HUNDRED CHART. They will go in the second row.

Let's do one more group of ten. It will be the thirteenth group of ten, and it will be the third row on the TWO HUNDRED CHART.

101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130

Compare these three rows with the top three rows on the Hundred Chart. How are they alike? How are they different? Can you guess the names of these new numbers?

one hundred twenty-one
one hundred twenty-two
one hundred twenty-three
one hundred twenty-four
one hundred twenty-five
one hundred twenty-six
one hundred twenty-seven
one hundred twenty-eight
one hundred twenty-nine
one hundred thirty

Can you see how the names use the “twenties” along with ONE HUNDRED, except for the last one? It tells us that we need to start another group of ten.

Let’s see what these numbers look like using the number sticks. You already have the ten bundles of ten to show ONE HUNDRED and the two rows of ten showing 101 through 110 and 111 through 120. Your teacher will give you another group of ten loose sticks.

Lay down each of these sticks one-by-one in a row under the others, counting as you go, from 121 through 130. You should have the column of ten bundled sticks and then three rows of loose sticks lined up next to the column when you are done.

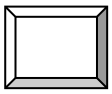
Now that you’ve seen what these numbers look like, write them in the boxes on the TWO HUNDRED CHART. They will go in the third row.

You can put each row of loose sticks into bundles of ten now, too. Be sure to put them away in the storage box so you can use them again in the next lesson.

It's time to put your explorer's hat on again because we are going to head into new places. In the last lesson you learned that the ONES, TENS, and HUNDREDS each have a special **place** in our number system. Today we are going to explore the place of the ONES and the HUNDREDS.

Have you ever seen a train go by that has container cars? The containers are used to ship goods all across the country. This picture shows flat train cars with containers stacked on them. The containers keep the goods separated and in one place.

We can use pictures of container boxes to help us see the places that the ONES and TENS hold in our number system.



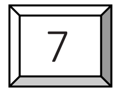
Think back to how you laid out the sticks to show the numbers from 1 through 1000. Sometimes you used bigger bundles of 100, sometimes you used smaller bundles of 10, and sometimes you used the sticks one-by-one. You used three ways of grouping the sticks: hundreds, tens, and ones.

To show those different groupings, we use separate "box cars." The ONES box car only holds ONES. The TENS box car only holds TENS. When we want to show a number, we can move the numerals into place to show how many are in each box.

Let's explore how this works. Your teacher will give you some sticks. Each stick shows us how many? Yes, ONE. Put the sticks down in front of you, counting them out one-by-one. How many do you have? Yes, seven. The seven sticks show that you have seven ONES.

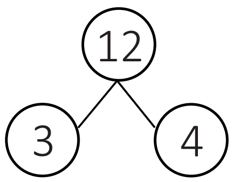
We can use a picture of the container box to show these ONES and “keep” them together in one **place**.

Can you see that the seven ONES are in the ONES place?



When you see a single numeral by itself, such as the numeral 7, it is actually showing you that there are seven ONES. The only difference is that we don’t bother to draw the container box around it. We are using the boxes to help us see the “place” that the ONES hold in our number system.

The idea is the same as when we used the number bonds to show the multiplication and division facts. We used the number bonds at first to help you see how the numbers are “connected” to one another. After a while, we didn’t have to draw the circles and lines. We used the short-cut of numerals and signs instead.



$3 \times 4 = 12$

$12 \div 4 = 3$

As we are exploring the “places” that the numbers hold in our number system, we will use the “box car” shapes to help you see the places and how the numbers can be hooked together in a “train” of numerals. We call each of the numerals used to write a number a **digit**.

To show the number twelve, for example, we can use the numeral symbol 12. We write the digit **1** and the digit **2** to form the numeral that symbolizes twelve objects.

Let’s try another bunch of sticks. Put the sticks your teacher gives you down in front of you, counting them out one-by-one. How many do you have?

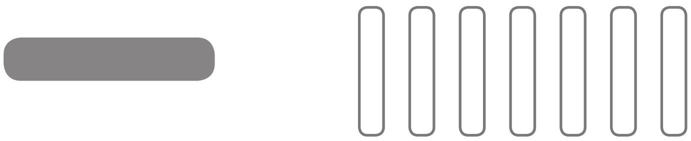
Yes, seventeen. The seventeen sticks show that you have seventeen ONES.

Our number system that is based on our ten fingers uses **multiples of ten** to make it easier to work with larger numbers as you saw in the last unit. What can we do to make it easier to work with these seventeen sticks?

If you said put them into as many bundles of ten as we can make, then pat yourself on the shoulder for having the right answer. How many bundles of TEN can you make? 

Yes, one bundle of TEN. Go ahead and put the ten sticks on top of each other and put a rubber band around the bundle of TEN. Put the bundle to the left of the single sticks. Do you have enough single sticks left to make another bundle of TEN?

No, the seven sticks are left over. Using the shapes we used to show the new numbers you learned in the last unit, the sticks should now look something like this:



Can you see that you have one bundle of TEN and seven ONES?

We can now use the box car pictures to show how many ONES and TENS we have. Remember, each way we put the sticks together has to have their one place. We can only put the ONES in the ONES box car and the TENS in the TENS box car.

TENS ONES

How many ONES do we have? They are shown by the single sticks. Yes, 7. So let's put those seven ONES in their place.

TENS ONES

How many bundles of TENS do we have? Yes, 1. So let's put that one bundle of TEN in the TENS place.

1	7
TENS	ONES

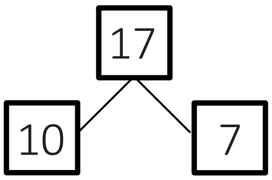
Now we can hook our two box cars together to show how many sticks we have altogether.

1	7
TENS	ONES

With the numerals in place, we can see that we have one bundle of TEN, which is equal to 10, and we have seven ONES left over, which equals 7. 10 + 7 = **17**. How many sticks did you have when you first counted them one-by-one? Yes, **17**.

Can you see how all these pictures show us the same number? They help us see the number **seventeen** in a different way?

1	7
TENS	ONES



10 + 7 = 17
17 – 10 = 7

17

The first picture with the box cars helps us see the number as part of our number system. It shows how many TENS and ONES there are in seventeen. The numeral 1 in the TENS box shows us the "value" of the TENS. It shows us how many TENS there are. The numeral 7 in the ONES box shows us the "value" of the ONES. It shows how many ONES there are.

The idea is the same as a nickel showing you the amount of cents you have. The nickel has a "value" of five cents, which is written as 5¢.

The second picture shows us one of the addition bonds for the number seventeen. It shows us that 10 + 7 = 17. It also shows us one of the subtraction bonds for the number seventeen. It shows us 17 – 10 = 7. We used the number bonds to show you how the numbers are connected to one another. Once you understood how addition and subtraction worked, you found it easier to work with the short-cut of the number sentences.

The last picture is not really a picture at all. It is a symbol. It is the numeral we write to show the number seventeen. To write that number we use two digits: the digit 1 and the digit 7. It's easier to write the numeral than the box car picture. So why are we bothering with the box cars?

Because they show you exactly what the numeral symbol stands for. The digit 7 on the right shows the value of the ONES. It stands for the seven single sticks you had left over. It shows you that there weren't enough single sticks left to make another bundle of TEN.

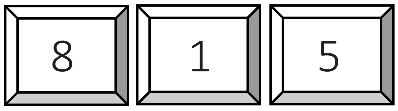
1**7**

The digit 1 on the left shows the value of the TENS. It stands for the one bundle of TEN that you were able to make.

17

So now when you see the symbol that stands for seventeen objects, the numeral 17, you can picture the value of each digit in the number: one bundle of TENS and seven ONES. Can you see how the numerals you have been using all along, in this case **17**, show the "values" of each digit in the number seventeen?

Have you noticed that the digits in the number train that shows a given number are the same digits used to write the numeral? Let's look at the number train that shows **eight hundred fifteen**.



numeral: **815**

8 x 100 = 800
1 x 10 = 10
5 x 1 = 5
800 + 10 + 5 = **815**

We have been using the box cars to help you separate the digits so you could find the value that place holds in the number. Connecting the box cars into number trains helped you see the place value connections in the same way that the number bonds helped you see how the numbers in the addition, subtraction, multiplication, and division facts were connected.

In this lesson, you are going to use the number sentences again to show the place values for each digit and how those values go together to show what the number stands for. Only this time we won't be using the number cars. The steps are exactly the same as in the last lesson. Let's do some together.

Find the value of **three hundred twenty-seven**.

- ✓ Write the numeral for the number: **327**.
- ✓ Find the value of the HUNDREDS: 3 x 100 = 300.
- ✓ Find the value of the TENS: 2 x 10 = 20.
- ✓ Find the value of the ONES: 7 x 1 = 7
- ✓ Add the values of each place together: 300 + 20 + 7 = **327**.

Find the value of **six hundred forty**.

- ✓ Write the numeral for the number: **640**.
- ✓ Find the value of the HUNDREDS: 6 x 100 = 600.
- ✓ Find the value of the TENS: 4 x 10 = 40.
- ✓ Find the value of the ONES: 0 x 1 = 0
- ✓ Add the values of each place together: 600 + 40 + 0 = **640**.

Find the value of **seventy-nine**.

- ✓ Write the numeral for the number: **79**.
- ✓ Find the value of the HUNDREDS: there are none so go to the next step
- ✓ Find the value of the TENS: 7 x 10 = 70.
- ✓ Find the value of the ONES: 9 x 1 = 9
- ✓ Add the values of each place together: 70 + 9 = **79**.

Practice

Now it's up to you to find the value of these numbers.

Remember to:

(a) write the numeral first;

(b) write a number sentence for each place value; and then

(c) add the values of each place value together to find the total value as we did in the examples.

(1) One hundred ninety-four numeral ___________

(number sentences)

____

____

____

____

(2) Seven hundred nineteen numeral ___________
(number sentences)

____

____

____

____

(3) Five hundred thirty-eight numeral ___________
(number sentences)

____

____

____

____

(4) Eighty-two numeral ___________
(number sentences)

____

____

____

(5) Nine hundred seven (number sentences)

numeral ___________

____

____

____

____

(6) Four (number sentences)

numeral ___________

____

(7) Two hundred fifty-six (number sentences)

numeral ___________

____

____

____

____

GLOSSARY OF DEFINITIONS, VOCABULARY, & PRINCIPLES

LEVEL 1

Counting is finding out how many there are. We count a single object or unit at a time.

Numbers count how many we have. They tell us the amount.

PRINCIPLE: Each number is one more than the number before it. Each number counts one more.

Numeration is being able to read the numbers.

Addition is uniting or putting together two or more numbers.

Subtraction is finding the difference between two numbers.

A **fraction** is one or more equal parts of a single (one) whole.

LEVEL 2

Multiplication is adding a number to itself as many times as shown by another number.

Division is finding how many times one number is contained in another number.

A **fraction** is one or more equal parts of a single (one) whole. It is written with two numbers separated by a line. The bottom number tells how many parts the whole is divided into. The top number tells how many parts are being described.

A **number** is the amount that is counted.

A **numeral** is the symbol or figure used to show that number or amount.

A **digit** is one of the counting numbers of 1, 2, 3, 4, 5, 6, 7, 8, 9, or zero that are used to write the numeral. A numeral may have 1 or more digits.

Place shows the order of the digits. It is the position (place) it holds in the numeral.

Place value is the amount that digit shows in that position.

PRINCIPLE:

- A digit in the ONES place has a value of that number times 1.
- A digit in the TENS place has a value of that number times 10.
- A digit in the HUNDREDS place has a value of that number times 100.