The Biggest Number

TASK

The Phenomenon

People often try to make things bigger. You may have tried to make the biggest sandwich by piling pieces of meat, cheese, or vegetables on a slice of bread. You may have also tried to make the tallest tower out of blocks or Legos. Making the tallest tower is something people have been doing for more than 100 years.

Take a few minutes to watch a video about the tallest buildings ever made. As you watch the video, write down some things you notice and wonder about in the spaces below.

Things I **noticed**…	Things I **wonder** about…

The Task

The video you watched showed some of the tallest buildings ever made. People keep making taller and taller buildings. In 1900, the tallest building in the world was the City Hall building in Philadelphia, Pennsylvania. That building is almost 550 feet tall and is still used today. The current tallest building in the world is the Burj Khalifa, in the city of Dubai, United Arab Emirates. The Burj Khalifa stands 2,717 feet tall.

Some people have jobs where they try to make things bigger. Some work to make taller buildings. Others work to make bigger boats or ships. Still others have jobs where they think about and try to identify naturally occurring large things. Astronomers are people who study space. Many astronomers work to identify the largest planets and stars. Mathematicians are people who study mathematics. One thing many mathematicians investigate is the size of different numbers. This includes investigating very large

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TASK

numbers. Your goal in this investigation is to figure out what the biggest number is. The guiding question of this investigation is:

What is the biggest number?

Initial Ideas

Before you start this investigation, take a few minutes to think about numbers, including very big numbers. Then, in the space below, draw a picture that shows the difference between small and big numbers. When you draw your picture, be sure to include labels to help explain your thinking.

Some **ideas** that I have...

Now list some things you think will be important to learn more about during this investigation.

Some **things** that I want to know more about...

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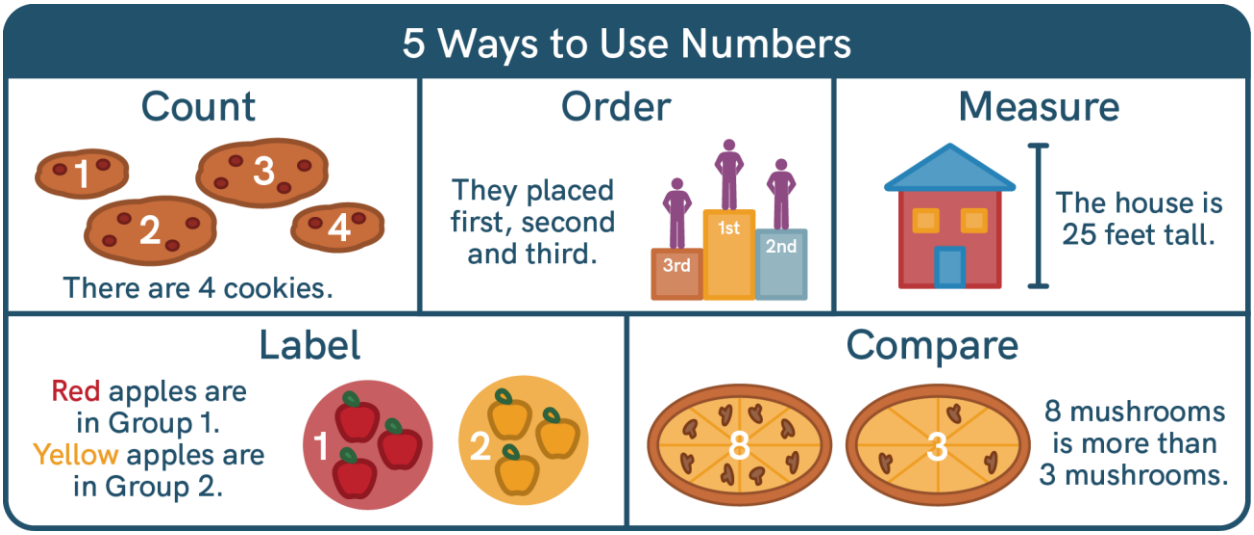
IDEAS

Some Ideas You Can Use: Numbers

Numbers are used to count, order, measure, compare, and label groups or objects. The image below shows the different ways people use numbers.



We can also put numbers into groups based on **properties** of the numbers. For example, we put numbers into groups when we determine whether they are even or odd. An even number does not have a remainder, or anything left over, when we divide it by 2. The numbers 8, 74, and 1,336 are all even numbers, because when we divide them by 2, we do not have a remainder. The numbers 13, 77, and 495 are all odd numbers, because when we divide them by 2, we have a remainder.

Some things I **know** from what I read…

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IDEAS

Some Ideas You Can Use: Mathematical Operations

In mathematics, we can use two or more numbers to make new numbers. To make a new number, we need to perform an operation on the numbers. The most common operations are addition, subtraction, multiplication, and division. The image below shows how we can perform these four operations on the numbers 8 and 4.

Addition	Subtraction	Multiplication	Division
8 + 4 = 12	8 – 4 = 4	8 × 4 = 32	8 ÷ 4 = 2

We can also perform these operations on more than two numbers at a time. For example, we can add three numbers together. We can also multiply three numbers together. The image below shows addition and multiplication with groups of three, four, and five numbers.

Addition with 3 Numbers 7 + 274 + 39 = 320	**Multiplication with 3 Numbers** 8 × 343 × 47 = 128,968
Addition with 4 Numbers 11 + 103 + 2 + 53 = 166	**Multiplication with 4 Numbers** 5 × 17 × 286 × 31 = 753,610
Addition with 5 Numbers 19 + 75 + 463 + 284 + 4 = 845	**Multiplication with 5 Numbers** 3 × 7 × 311 × 22 × 74 = 10,632,468

Some things I **know** from what I read…

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IDEAS

Some Ideas You Can Use: Comparing Numbers Using Place Value

One question mathematicians ask about numbers is whether one number is bigger than another number. When comparing two very large numbers, we need some way to determine which number is bigger. To compare large numbers, we can use the idea of place value. **Place value** is the value represented by a digit based on its position in the number. The image below shows the different place values.

Millions			Thousands			Ones		
Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
100,000,000	10,000,000	1,000,000	100,000	10,000	1,000	100	10	1

When comparing very large numbers, we can use place value to help us. The steps below show the comparison between 136,423 and 133,578.

Example 1

Step 1: Write both numbers with each digit in the respective place it represents.

Millions			Thousands			Ones		
Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
			1	3	6	4	2	3
			1	3	3	5	7	8

Step 2: Starting with highest place value, compare the digits in each number.

Millions			Thousands			Ones		
Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
			1	3	6	4	2	3
			1	3	3	5	7	8

Step 3: Because the value in the hundred thousandths place is the same for each number, we keep comparing the digits in the next place until one of the digits is larger than the other.

Millions			Thousands			Ones		
Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
			1	3	6	4	2	3
			1	3	3	5	7	8

As the steps show, 136,423 is bigger than 133,578. We determine that both numbers have the same value in the hundred thousands place and in the ten thousands place. We then compare the thousands place and determine the number 136,423 is bigger in the thousands place than 133,578. So 136,423 is the bigger number.

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IDEAS

Finally, we can compare numbers that have different numbers of places. The steps below show how to compare numbers that have different numbers of places. In the steps below, we see that 1,284,557 is bigger than 498,326.

Example 2

Step 1: Write both numbers with each digit in the respective place it represents.

Millions			Thousands			Ones		
Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
		1	2	8	4	5	5	7
			4	9	8	3	2	6

Step 2: Because the second number does not have a value in the millions place, we can assume that the value is 0. We can even write a 0 in the box for the millions place to help us compare.

Millions			Thousands			Ones		
Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
		1	2	8	4	5	5	7
		0	4	9	8	3	2	6

Step 3: Starting with highest place value, compare the digits in each number. Because the value in the millions place is larger in the top number, we know it is the larger number. We do not need to compare the value in any other places.

Millions			Thousands			Ones		
Hundred Millions	Ten Millions	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
		1	2	8	4	5	5	7
		0	4	9	8	3	2	6

Some things I **know** from what I read…

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PLAN

Plan Your Investigation

Prepare a plan for your investigation by filling out the chart below.

I am trying to answer the following **question**...

I **have** the following information...

I **need** to find or calculate...

The **operations** I will need to use...

I approve of this investigation plan

Teacher's Signature

Date

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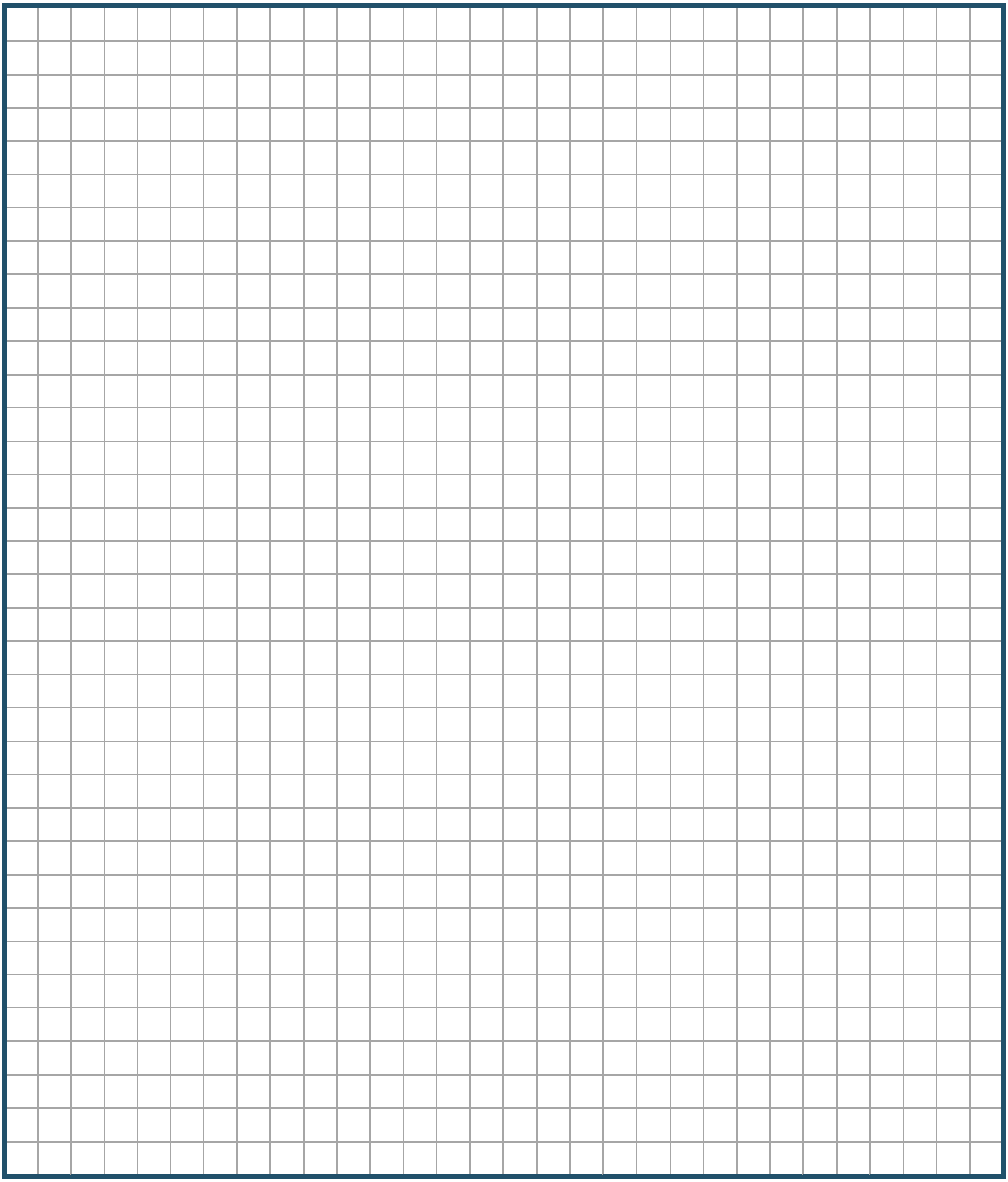
DO

Discuss and Solve the Task

Use the space below to perform the calculations that you need or create any tables or graphs that will help you make sense of the phenomenon and complete the task.



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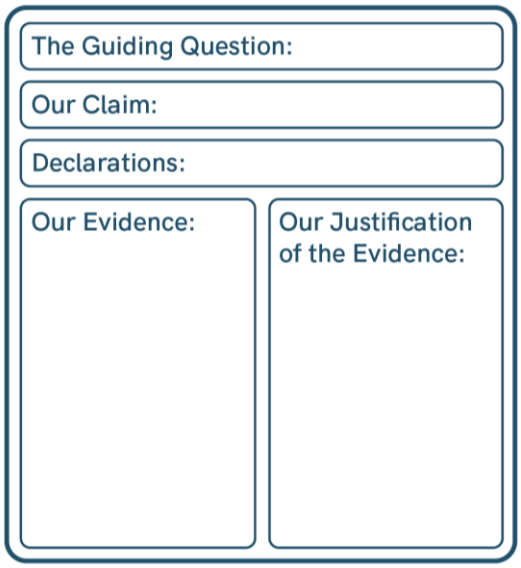
SHARE

Draft Argument

Develop an argument on a whiteboard. It should include:

1. A *claim*: Your answer to the guiding question.
2. *Declarations*: Any definitions, formulas, variables, or symbols you used.
3. *Evidence*: Tables, graphs, equations, computations, cases, examples and counterexamples, or thought processes necessary to support your claim.
4. A *justification of the evidence*: Why your group used certain mathematics concepts over others or why you decided to use one strategy over another. Be sure to include any assumptions you made.



Argumentation Session

Share your argument with your classmates. Be sure to ask them how to make your draft argument better. Keep track of their suggestions in the space below.

Some possible ways to **improve** our argument…

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REFLECT

Reflective Discussion

You can keep track of any ideas from the discussion that you think are important or will be useful in the future in the space below.

Some important **ideas**...

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REPORT

Draft Report

Prepare a *report* to share what you figured out during your investigations

Introduction

We have been studying _____ In class. Before we started this investigation, we explored _____

_____

_____

We noticed _____

_____

_____

Our goal for this investigation was to figure out _____

_____

_____

The guiding question was _____

_____

Method

To answer this question, _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

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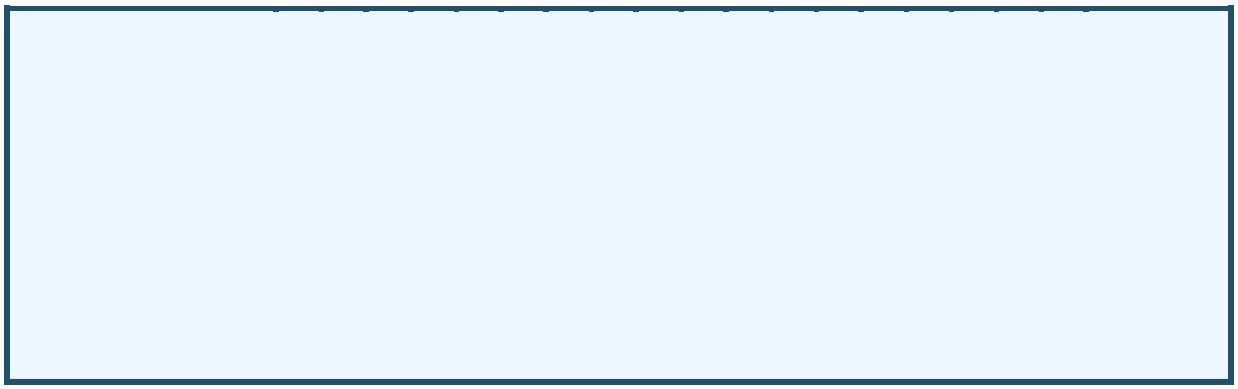
REPORT

Declarations

Argument

We figured out _____

The _____ below includes information about _____



This analysis suggests _____

This evidence is based on several important ideas. The first one is _____

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