# IN 9-12 M A T H

**Unit 1** One-variable Statistics

ALGEBRA 1

Lesson 1 Getting to Know You



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## Non-Curricular Task



## Unit 1 • Lesson 1

## Learning Goal

## Let's work together to collect data and explore statistical questions.









Warm-up: Which One Doesn't Belong?

Which one doesn't belong?

Question A: How many potato chips are in this bag of chips?

Question C: What type of chips are these?

Question B: What is the typical number of chips in a bag of chips?

Question D: What type of chips do students in this class prefer?







I will give a sheet of questions. Please choose one set to begin this activity.

- Write another question of your own that will require data collected from the class to answer.
- For each of the 4 questions, write a survey question that will help you collect data from the class that can be analyzed to answer the questions.
- <u>Create/Make-up responses to the 4 survey questions for 15</u> <u>classmates and record their responses to collect data</u>. (Notice the instructions changed.)

responder's	question 1	question 2	question 3	my question
name	response	response	response	response







## Representing Data About You and Your Classmates

- Set A 1. On average, how many letters are in the family (last) names for students in this class?
  - 2. Which month has the most birthdays from the class?
  - 3. How many periods (or blocks) have there been before this math class?
- Set B 1. On average, what is the furthest, in miles, that each student in this class has ever been from home?
  - 2. Would the class rather have a snow day or a field trip day?
  - 3. In what year was the 13th Amendment ratified?
- Set C 1. About how long did it take students in this class to get to school this morning?
  - 2. Which combination does the class prefer: peanut butter and banana or strawberry and banana?
  - 3. What is the lightest element from the periodic table?
- Set D 1. On average, how many movies in the theater did each student in the class watch this summer?
  - 2. Does the class prefer to write on paper with or without lines?
  - 3. How many seats are in the classroom?



Unit 1 • Lesson 1 • Activity 2

## Kendall Hunt

## Representing Data About You and Your Classmates

Set A 1. On average, how many letters are in the family (last) names for students in this class?

Set B 1. On average, what is the furthest, in miles, that each student in this class has ever been from home?

Set C 1. About how long did it take students in this class to get to school this morning?

Set D 1. On average, how many movies in the theater did each student in the class watch this summer?







## Representing Data About You and Your Classmates

Set A

2. Which month has the most birthdays from the class?

#### Set B

2. Would the class rather have a snow day or a field trip day?

#### Set C

2. Which combination does the class prefer: peanut butter and banana or strawberry and banana?

#### Set D

2. Does the class prefer to write on paper with or without lines?







#### Set A

	3.	How many periods (or blocks) have there been before this math class?
Set B		
	3.	In what year was the 13th Amendment ratified?
Set C		

3. What is the lightest element from the periodic table?

Set D

3. How many seats are in the classroom?







## **Getting to Know You**

- What makes a question statistical?
- What is an example of a non-statistical question?
- What is an example of a statistical question that we have not used in class?
- What type data is collected to answer the statistical question, "Would the class rather have pizza or donuts?"
- What is an example of a statistical question that results in numerical data?
- What are some different ways to represent data graphically?



Lesson Synthesis

Kendall Hunt

## **Getting to Know You**

#### **Student Lesson Summary**

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Statistics is about using data to solve problems or make decisions. There are two types of data:

- Numerical data are expressed using a number. For example, to answer the question "How tall are the students in this class?" you would measure the height of each student which would result in numerical data.
- **Categorical data** are expressed using characteristics. For example, to answer the question "What brand of phones do people use?" you
- would survey several people and their answers result in categorical data.

The question that you ask determines the type of data that you collect and whether or not there is variability in the data collected. In earlier grades, you learned that there is variability in a data set if not all of the values in the data set are the same. These are examples of **statistical questions** because they are answered by collecting data that has variability:

- "What is the average class size at this school?" would produce numerical data with some variability.
- "What are the favorite colors of students in this class?" would produce categorical data with some variability.

These are examples **non-statistical questions** because they are answered by collecting data that does not vary:

- "How many students are on the roster for this class?" would produce numerical data that does not vary. There is only one value in the data set, so there is no variability.
- "What color is this marker?" would produce categorical data that does not vary. There is only one value in the data set, so there is no variability.

#### Glossary

- categorical data
- non-statistical question
- numerical data
- statistical question

#### Lesson Synthesis



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## Unit 1 • Lesson 1

- I can tell statistical questions from nonstatistical questions and can explain the difference.
- I can tell the difference between numerical and categorical data.

## Learning Targets



**Kendall Hunt** 





# categorical data

Categorical data are data where the values are categories. For example, the breeds of 10 different dogs are categorical data. Another example is the colors of 100 different flowers.







A non-statistical question is a question which can be answered by a specific measurement or procedure where no variability is anticipated, for example:

- How high is that building?
- If I run at 2 meters per second, how long will it take me to run 100 meters?



Kendall Hunt



# numerical data

Numerical data, also called measurement or quantitative data, are data where the values are numbers, measurements, or quantities. For example, the weights of 10 different dogs are numerical data.







**Kendall Hunt** 

# statistical question

A statistical question is a question that can only be answered by using data and where we expect the data to have variability, for example:

- Who is the most popular musical artist at your school?
- When do students in your class typically eat dinner?
- Which classroom in your school has the most books?





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#### Lesson 1: Getting to Know You

#### Goals

- Describe (orally and in writing) the difference between statistical and non-statistical questions.
- Describe (orally and in writing) the distinctions between numerical and categorical data.

#### **Learning Targets**

- I can tell statistical questions from non-statistical questions and can explain the difference.
- I can tell the difference between numerical and categorical data.

#### Lesson Narrative

<u>In this lesson, you'll learn how to tell if a question is statistical and how to classify the data you collect</u> <u>as either numerical or categorical.</u>

We'll start by making charts and graphs to show numerical data and talk about what those numbers mean. Later on, we'll learn how to create and understand two-way tables using categorical data.

You'll also learn how to recognize statistical questions, which are questions where you expect to get different answers from different people (this is called variability). In today's lesson, you'll review what variability means and figure out which questions are statistical and which aren't while collecting survey data from your classmates. (We'll use this data in future lessons, so make sure to save it in a spreadsheet or folder!)

As you sort through the questions and data, you'll classify the questions as either statistical or nonstatistical and decide whether the data you collect is numerical or categorical.

By identifying whether data is numerical or categorical, you're practicing how to make sense of information (Math Practice 2, or MP2). Plus, you'll start using more precise language (Math Practice 6, or MP6) for the terms we'll use throughout this unit.

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#### 1.1 Which One Doesn't Belong?: Types of Data

#### Warm Up: 5 minutes

"Today, we're going to do our first 'Which One Doesn't Belong' activity of the course. Here's how it works: I'm going to show you four different figures, diagrams, graphs, or expressions, and your job is to decide which one doesn't belong.

Now, here's the twist—each of the four options usually doesn't belong for a different reason. The similarities and differences between them are all mathematically important, so pay attention to the details.

I want you to think carefully about why one option might not belong and be ready to explain your reasoning. We'll also take some time to refine and make your explanations more precise.

For today's warm-up, we're going to compare four survey questions. This will give you a chance to use mathematical language more precisely, and it'll also give me the opportunity to hear how you're thinking about and discussing the characteristics of these questions.

Let's dive in and see which one doesn't belong!"

#### Launch

I'm going to display some survey questions for you all to see. First, I want you to take a minute to think about the questions quietly on your own. After that, you'll share your thoughts with your group.

In your small groups, each of you will need to explain why you think a certain item doesn't belong. Work together to come up with at least one reason for why each item might not belong.

#### Student Task Statement

Which one doesn't belong?

Question A: How many potato chips are in this bag of chips?

Question B: What is the typical number of chips in a bag of chips?

Question C: What type of chips are these?

Question D: What type of chips do students in this class prefer?



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#### Student Response

Sample responses:

Question A doesn't belong because:

• There is only one right answer to the question, and it is numerical.

Question B doesn't belong because:

- This is a statistical question and would require numerical data to answer it.
- You would need to collect data and find a measure of center to answer this question.

Question C doesn't belong because:

- This is not a statistical question and would require categorical data to answer it.
- There is only one right answer that is non-numerical.

Question D doesn't belong because:

- This is a statistical question and would require categorical data to answer it.
- This question could be answered by looking at the answer that is repeated most often in the data.

#### Activity Synthesis

"Alright, everyone, let's wrap up by hearing from each group.

First, I want each group to share one reason why you think a particular item doesn't belong. Be ready to explain your thinking clearly.

As you share, I would like another member of the group to write down and display each group's response so everyone can see the different ideas. After each group speaks, I'll ask the class if you agree or disagree with what was said. Remember, there's no single right answer here, so focus on understanding and discussing the explanations behind each choice.

As we go through this, I want you to be able to explain any terms you use, like *numerical data, categorical data,* or *average*. If someone uses a term and you're not sure what it means, feel free to ask for clarification. It's important that we're all on the same page with these concepts.

Also, if you make a claim, be ready to support it with good reasoning. Let's get started! Which group would like to go first?"



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#### **1.2 Representing Data About You and Your Classmates**

#### 25 minutes

Now, we're diving into an activity where you'll get to explore different types of questions and the data they generate.

<u>Here's how it's going to work: Each group of four will be assigned three specific questions. One of</u> <u>these questions is non-statistical, meaning it has only one possible answer. Another question will</u> <u>generate numerical data, where the answers are numbers. The third question will generate</u> <u>categorical data, where the answers are words or categories.</u>

But that's not all—you'll also come up with a fourth question of your own. This question should be something you can answer with data collected from your classmates.

Here's what you'll do step by step:

- 1. <u>Create Your Survey: As a group, come up with four survey questions—your three assigned</u> <u>questions and the one you create yourselves. These questions should be designed to gather</u> <u>data from your classmates.</u>
- 2. <u>Collect the Data: Once your survey questions are ready, go around and ask your classmates to</u> <u>answer them. Make sure you're collecting this data in a way that's easy to track and record,</u> <u>whether it's in your workbook or another method that works for you.</u>
- 3. <u>Summarize Your Results: After you've collected all your data, your group will summarize the</u> <u>results to answer the four questions you focused on. As you do this, think about how the</u> <u>different types of questions led to different kinds of data and results.</u>

<u>Remember, in a future lesson, we'll be representing the distribution of the data you collect today using</u> graphs, so it's important that you keep your data organized and easy to retrieve.

Alright, let's get started! I'm excited to see the questions you come up with and the data you collect



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#### Launch

Arrange students in groups of 4. Assign each group one of the following sets of three questions. Set A

- 1. On average, how many letters are in the family (last) names for students in this class?
- 2. Which month has the most birthdays from the class?
- 3. How many periods (or blocks) have there been before this math class?

#### Set B

- 1. On average, what is the furthest, in miles, that each student in this class has ever been from home?
- 2. Would the class rather have a snow day or a field trip day?
- 3. In what year was the 13th Amendment ratified
- 4. ?

#### Set C

- 1. About how long did it take students in this class to get to school this morning?
- 2. Which combination does the class prefer: peanut butter and banana or strawberry and banana?
- 3. What is the lightest element from the periodic table?

#### Set D

- 1. On average, how many movies in the theater did each student in the class watch this summer?
- 2. Does the class prefer to write on paper with or without lines?
- 3. How many seats are in the classroom?

Alright everyone, I want you to take the next 2 minutes to come up with your own question that could be answered using data from our class. Think about the kinds of things we've been talking about, and try to create a question that you'd actually be interested in finding out the answer to.

Once the 2 minutes are up, I'll give you some time to discuss your question with your group. You'll get to hear each other's ideas and maybe even help each other improve your questions.

Let me give you an example of the type of question I'm talking about. Imagine you're trying to find out, 'Which month has the most birthdays in our class?' To get the data you need, you might ask your classmates, 'In what month is your birthday?'

That's the kind of question I'm looking for—something simple that can be answered by gathering data from everyone in the class.

Okay, your 2 minutes start now. Let's see what you come up with!



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#### **Anticipated Misconceptions**

Students may confuse statistical questions with survey questions. Explain that the set of three questions are statistical questions that can be answered using the survey questions. For example, students may think they should ask each of their classmates for the average distance they have traveled from home. However, students can ask each classmate "What is the furthest distance you have traveled from home?" and colletively use the answers to this survey question to answer the statistical question about the average distance their classmates have travelled from home.

#### Student Task Statement

I will assign you a set of 3 questions.

- Write another question of your own that will require data collected from the class to answer.
- For each of the 4 questions, write a survey question that will help you collect data from the class that can be analyzed to answer the question.
- Create/Make-up responses to the 4 survey questions for 15 classmates and record their responses to collect data.
- After collecting the data return to your group.
- 1. What is the question of your own that will require data collected from the class to answer?
- 2. What are the 4 survey questions you will ask your classmates?
- 3. Summarize the data for each question in a sentence or two and share the results with your group.
- 4. With your group, decide what the responses for question number 1 have in common. Then do the same for questions numbered 2 and 3.
- 5. Does the question you wrote fit best with the questions from number 1, 2, or 3? Explain your reasoning.



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6.

responder's name question 1 response question 2 response question 3 response my question response

responder's name	question 1 response	question 2 response	question 3 response	my question response



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#### Student Response

Sample responses:

- 1. What is the most popular favorite color for students in this class?
- 2. How many letters are in your family name? In what month were you born? How many periods came before this class? What is your favorite color?
- 3. The students in this class tend to have about five or six letters in their family name. February is the most popular birth month for students in this class. There have been two periods before this class. Red is the most popular favorite color for the class.
- 4. Questions from group 1 are answered with numbers and may have different answers from different people. Questions from group 2 are answered with words or phrases and may have different answers from different people. Questions from group 3 have a single right answer (although most people did not know the answers).
- 5. The question, "What is the most popular favorite color for students in this class?" fits best with group 2 questions since there are a variety of
- 6. answers that can be put into categories but are not connected to numbers.



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#### Activity Synthesis

Alright, let's go over the questions you've been working on. First, I want to hear all of the questions that were numbered 1 from each group. After you've shared, take a moment to think about what the answers to these questions might have in common. Typically, to answer these, you'd collect responses that are numbers.

Now, let's do the same for the questions numbered 2. As you listen, think about how these answers might be different from the first set. For these, you'd likely collect responses that are descriptive words or characteristics.

Finally, let's talk about the questions numbered 3. These are a bit different because they only have one possible answer, with no variability in the responses.

So, here's the key takeaway:

- The data you collect for questions in number 1 is called numerical data.
- The data for questions in number 2 is called categorical data.
- The questions in number 3 are non-statistical questions because there's no variability in the answers.

Questions from number 1 and 2 are statistical questions because they require collecting data, and we expect to see different responses or variability. Keep this in mind as we move forward—it's going to be important for everything we do next!"

#### Lesson Synthesis

To promote student understanding of the differences between statistical and non-statistical questions and classifying data as numerical or categorical, ask:

- <u>"What makes a question statistical?" (There is variability in the data collected.)</u>
- <u>"What is an example of a non-statistical question?" (What value for x makes the equation x + 5 = 7 true?)</u>
- *"What is an example of a statistical question that we have not used in class?" (On average, how many people eat breakfast every day?)*
- <u>"What type data is collected to answer the statistical question, 'Would the class rather have</u> pizza or donuts?" (Categorical)
- "What is an example of a statistical question that results in numerical data?" (What is the typical surface area of styrofoam pellets?)

To help prepare students for the next lesson, ask:

• "What are some different ways to represent data graphically?" (Bar graphs, dot plots, box plots, pie charts, and histograms.)



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#### **1.3 Categorizing Questions**

#### **Cool Down: 5 minutes**

#### **Student Task Statement**

Categorize each of these questions as one of these types, then explain your reasoning for putting the question in that category.

- Statistical question requiring numerical data to answer it
- Statistical question requiring categorical data to answer it
- Non-statistical question
- 1. On average, how many books does each person in the United States read each year?
- 2. How many acts are in the play *Romeo and Juliet*?
- 3. Which book was read most by students in the class this summer?
- 4. How many books are in the classroom right now?

#### **Student Response**

- 1. Statistical question requiring numerical data to answer it. The data will be numbers and will have some variability.
- 2. Non-statistical question since there is one right answer to the question.
- 3. Statistical question requiring categorical data to answer it. The data will be words or phrases and will have some variability.
- 4. Non-statistical question since there is one right answer to the question.

#### **Student Lesson Summary**

Statistics is about using data to solve problems or make decisions. There are two types of data:

- **Numerical data** are expressed using a number. For example, to answer the question "How tall are the students in this class?" you would measure the height of each student which would result in numerical data.
- **Categorical data** are expressed using characteristics. For example, to answer the question "What brand of phones do people use?" you



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• would survey several people and their answers result in categorical data.

The question that you ask determines the type of data that you collect and whether or not there is *variability* in the data collected. In earlier grades, you learned that there is variability in a data set if not all of the values in the data set are the same. These are examples of **statistical questions** because they are answered by collecting data that has variability:

- "What is the average class size at this school?" would produce numerical data with some variability.
- "What are the favorite colors of students in this class?" would produce categorical data with some variability.

These are examples **non-statistical questions** because they are answered by collecting data that does not vary:

- "How many students are on the roster for this class?" would produce numerical data that does not vary. There is only one value in the data set, so there is no variability.
- "What color is this marker?" would produce categorical data that does not vary. There is only one value in the data set, so there is no variability.

#### Glossary

- categorical data
- non-statistical question
- numerical data
- statistical question



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#### **Lesson 1 Practice Problems**

#### 1. Problem 1 Statement

Write a survey question for which you would expect to collect numerical data.

#### Solution

Sample response: How many steps do I typically walk in a day?

#### 2. Problem 2 Statement

Write a survey question for which you would expect to collect categorical data.

#### Solution

Sample response: What are the most popular sports teams for people in ninth grade at my school?

#### 3. Problem 3 Statement

Select **all** the statistical questions.

- a. What is the typical amount of rainfall for the month of June in the Galapagos Islands?
- b. How much did it rain yesterday at the Mexico City International Airport?
- c. Why do you like to listen to music?
- d. How many songs does the class usually listen to each day?
- e. How many songs did you listen to today?
- f. What is the capital of Canada?
- g. How long does it typically take for 2nd graders to walk a lap around the track?

#### **Solution** ["A", "D", "G"]