

# Math Content by Strand

## Data

### Kindergarten

Identifying attributes and using them to sort and classify are essential to the study of mathematics, particularly data and geometry. Students think about attributes of math manipulatives (e.g., attribute blocks, GeoBlocks), objects (e.g., buttons), and students in their class, and use the attributes to sort. This work builds on students' natural interest in thinking about how things are the same and different, and it helps students see how two objects can be the same in some ways and different in others.



[ 5 shapes are circles. ]









[ 6 shapes are not circles. ]

In connection to students' work with Number, students collect data about the number of patterns blocks they can grab with one or two hands. They classify the data according to shape, count the number in each group, order the groups from least to determine the total amount most, and then.

Grab 2 handfuls of pattern blocks.

1 How many of each block did you grab?

Shape						
How Many?	2	2	2	1	1	4

2 Put the numbers in order:

1    1    2    2    2    4

3 How many did you grab in all? 12

[ Students grab two handfuls of pattern blocks and record their data. ]

Unlike materials such as attribute blocks and pattern blocks, which have a clearly defined set of attributes, data sets are often open-ended with less defined attributes. For example, when students collect data about their favorite lunch food, they must consider various attributes as they think about how to group and organize the data into categories.



Students gain experience with the many aspects of carrying out a data investigation—collecting, recording, representing, describing, and interpreting data. These experiences provide students with an opportunity to model real-world situations with mathematics. In the Classroom Routine Today’s Question, students respond to a survey question and then look at the data and think about what the data tells them about their group. They count and compare the number in each group and think about how the sum of these two quantities is related to the total number of students who responded to the survey, identifying a one-to-one correspondence between number of responses and number of people surveyed. They eventually use an equation to model this information. As students encounter different ways to record and represent data, they see and discuss which ones allow for easier counting and comparing.

### Are you the oldest child in your family?

<p>⑪</p> <p>Kyle Lisa Dennis Yiyo Mary Mia Rebecca Yoshio Jenny raul Shavonn</p> <p><b>YES</b></p>	<p>⑧</p> <p>Laquinta Tammy Emma Corey Ricardo Jae Carmen Manuel</p> <p><b>NO</b></p>
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19 students answered the survey.

[ An example of one class’s response to the survey question  
“Are you the oldest child in your family?” ]

Would you rather have a dog or a cat?

Mary	
Joe	
Ricardo	
Latoya	
Kiyō	
Mia	
Yoshio	Lisa
Tammy	Russell
Hugo	Lionel
Cindy	Rebecca
Dennis	Sarah
Brad	Victor
<b>Dog</b>	<b>Cat</b>

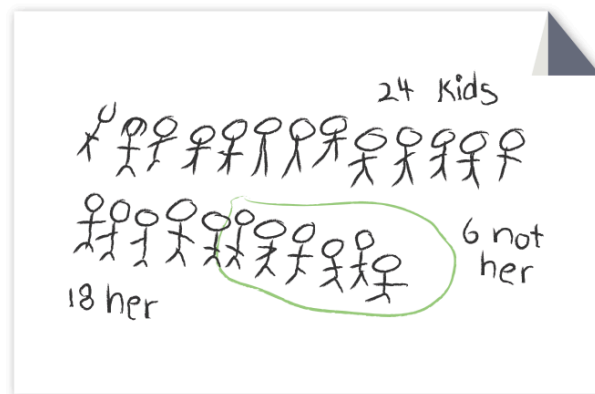
12 people would rather have a dog.

6 people would rather have a cat.

18 people answered Today's Question.

$$12 + 6 = 18$$

[ An example of one class's response to the survey question "Would you rather have a dog or a cat?" ]



[ An example of one student's work using attendance data to solve the problem "If 6 students are absent, how many are present?" ]

Students' experiences with data are further developed as they conduct their own survey, choosing and posing a yes/no question that is of interest to them, deciding how to record and keep track of information, and then making a representation of their data. They analyze the data as they count and compare responses and make statements about what they learned. They also use data to solve mathematical problems about their class, such as, "Do we have enough chairs for our class?" or "If 6 students are absent, how many are present?"

## MAIN MATH IDEAS

- Sorting and classifying
- Collecting, representing, describing, and interpreting data
- Comparing and ordering quantities
- Counting and representing quantities

## BENCHMARKS

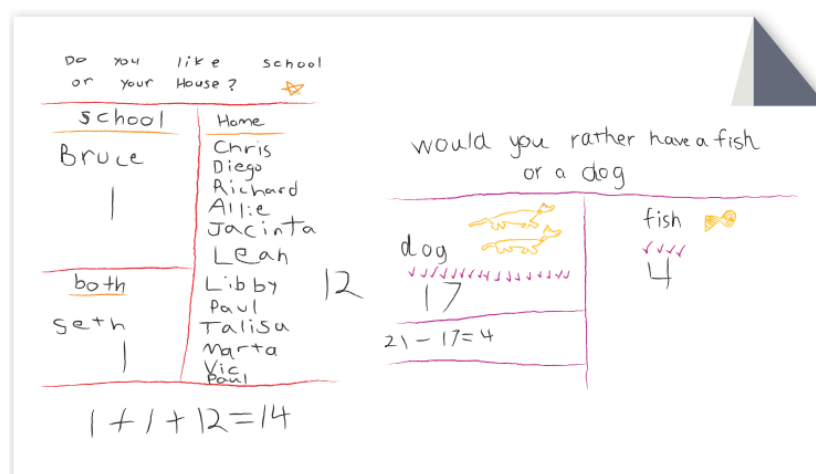
- Sort a set of objects by a given attribute and order the groups based on the number in each. (Unit 7)
- Using data to represent and solve a real-world problem. (Unit 7)

## Grade 1

Data investigations engage students in modeling with mathematics. Students collect, represent, describe, and interpret categorical data with up to three categories. As they create representations, students work on keeping track of the data and on finding ways to represent the data that help others see what the data show.

As part of this work, students are introduced to several standard forms of representation, including picture graphs and horizontal and vertical tables. Guided by the question “What do these data tell us about [our class]?”, students discuss and compare representations—and consider what features of a representation help communicate a clear description of the data, an important aspect of mathematical modeling. In the context of this overall question, their descriptions focus on quantitative characteristics of the data such as, “How many are in each group?”; and “Which category has more data? How many more?” Students also determine the total number of responses in all categories and think about the relationship of that total to the total number of people who responded.

Students carry out their own data investigation. They develop a question, collect the data, represent it, and describe and interpret it, which may, in turn, bring up more questions. Once data is collected, they are represented, examined, and analyzed to find out what information the data provides about the original question. By carrying out their own investigations, students encounter the real and challenging issues that are involved in data collection and analysis.

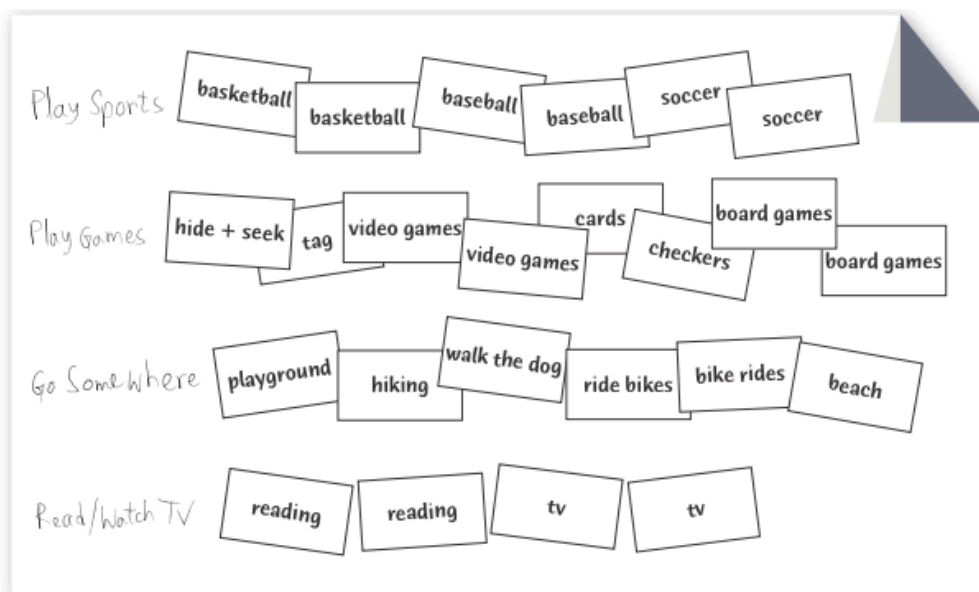
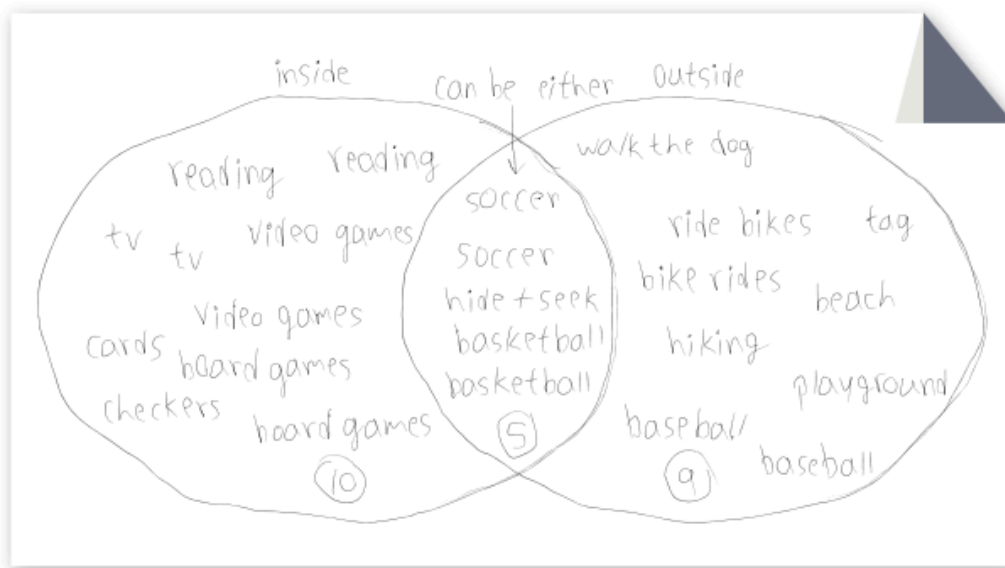


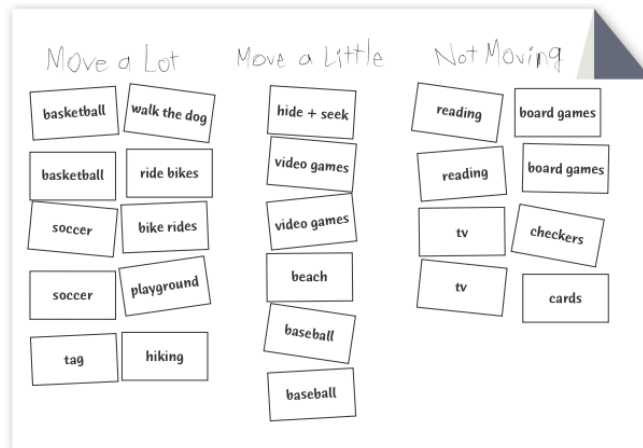
[ Students represent and analyze the data from their own surveys. ]



## Grade 2

Students' study of data begins with sorting and classifying people and objects based on visible attributes. These activities provide experience noticing the similarities and differences among individuals and objects in a group—and deciding which attributes to attend to. This leads to work sorting and classifying data having many different values and considering how to group the data into different categories. For example, answers to the question “What is your favorite weekend activity?” can be classified in a variety of ways (outdoor and indoor activities; or things you do by yourself, things you do with one friend, and things you do with a group). By grouping the data in different ways, students can use the same data to draw different conclusions.

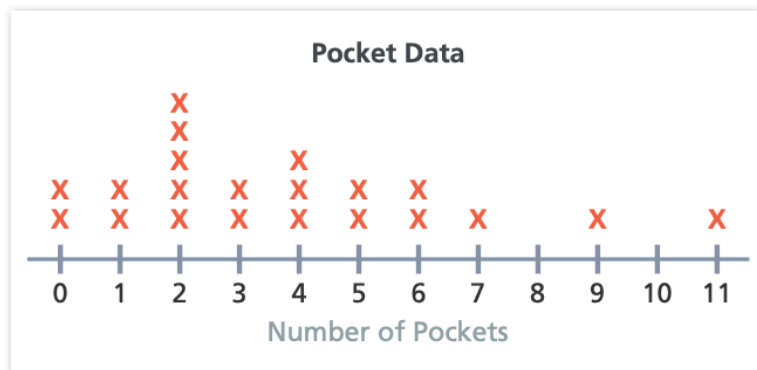




[ Students find different ways to classify data about favorite weekend activities. ]

Data investigations engage students in modeling with mathematics. By making predictions and then collecting their own data, students see how data are used to answer a real-world question or to give evidence about an issue. They use a variety of representations including picture graphs, Venn diagrams, bar graphs, cube towers, and line plots, as well as their own unique representations, to show the data that they collect. In comparing a variety of representations of the same data, students learn how different representations can make different aspects of the data set more visible. The goal is a representation that communicates a clear description of the data, an important aspect of mathematical modeling.

Students create line plots from data collected in response to questions with numerical answers such as, “How many teeth have you lost?” “How many pockets are you wearing?” and “What is the length of your longest jump?” In creating this kind of representation, students must think through two ways numbers are used: to indicate the value of a piece of data (I have 6 pockets); or to indicate how often a particular data value occurs (2 students have 6 pockets).



[ Students represent Pocket Data on a line plot. ]

Once data are classified, ordered, and represented, students describe and interpret them. They think about the counts at each value and consider the trends that these counts, considered together, reveal. Students are encouraged to make connections between the numerical information and the context, and to make observations about the data set as a whole, thinking about questions such as, “What do these data (or this model) tell us about the people in our class (or the group surveyed)?” Learning something about the context being modeled is the purpose of mathematical modeling.

By participating in an entire data investigation from start to finish, students encounter many of the same issues encountered by statisticians as they decide how to collect, keep track of, organize, represent, describe, and interpret their data.

## MAIN MATH IDEAS

- Sorting and classifying
- Collecting and representing data
- Describing and interpreting data

## BENCHMARKS

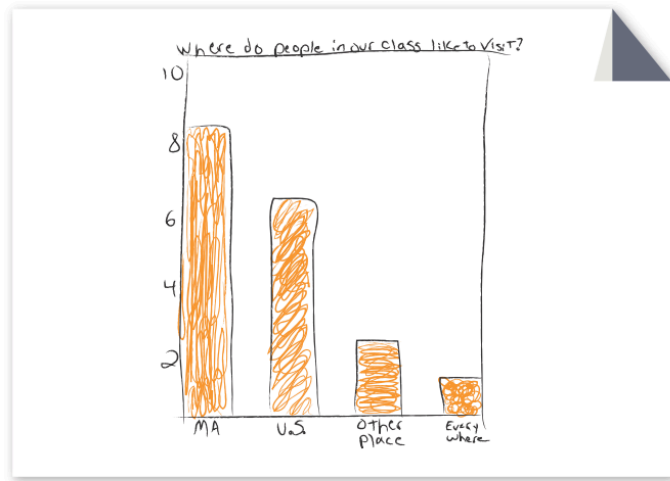
- Organize a set of data into up to four categories. (Unit 4)
- Create, describe, and interpret a variety of data representations, including picture graphs and bar graphs. (Unit 4)
- Order, represent, and describe a set of numerical data. (Unit 4)
- Represent measurement data on a line plot. (Unit 6)






## Grade 3

Students collect, represent, describe, and interpret both categorical and numerical data. They consider how to examine a data set as a whole and make statements about the whole group. Students also solve “How many more?” and “How many less?” questions about the data.

To make sensible statements about a categorical data set that has many different values, students group the data into categories that help them see the data as a whole. They represent sets of categorical data using bar graphs and pictographs. This work includes bar graphs in which the scales have intervals greater than 1 and pictographs in which each picture represents more than one piece of data. When students organize and represent the data in different ways, they are creating different models of the data and can learn different things about the data set.

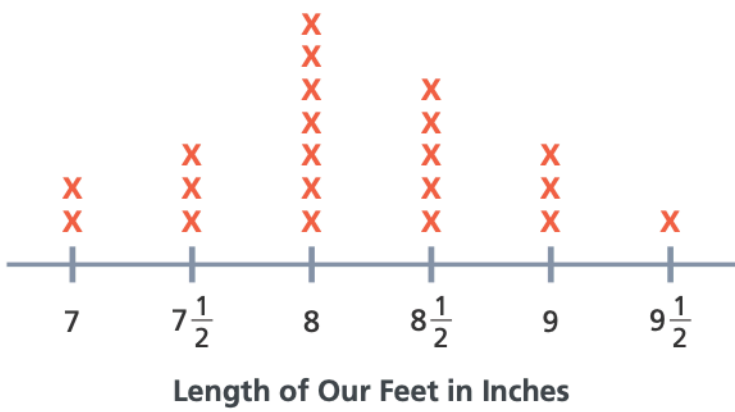




Paper Airplanes Made by Students	
Dart	
Delta Wing	
Fighter	
Glider	
Flying Wing	

Each  = 2 planes

Students use line plots to order numerical data by value so that they can see the shape of the data—where the data are concentrated and where they are spread out; which intervals have many pieces of data, and which have very few. They describe what values would be typical or atypical based on the data, and they compare data sets to develop a sense of how data can be useful in describing and comparing characteristics of a group. Students interpret line plots and create their own line plots to represent numerical data, including measurement data in inches and half inches.



## MAIN MATH IDEAS

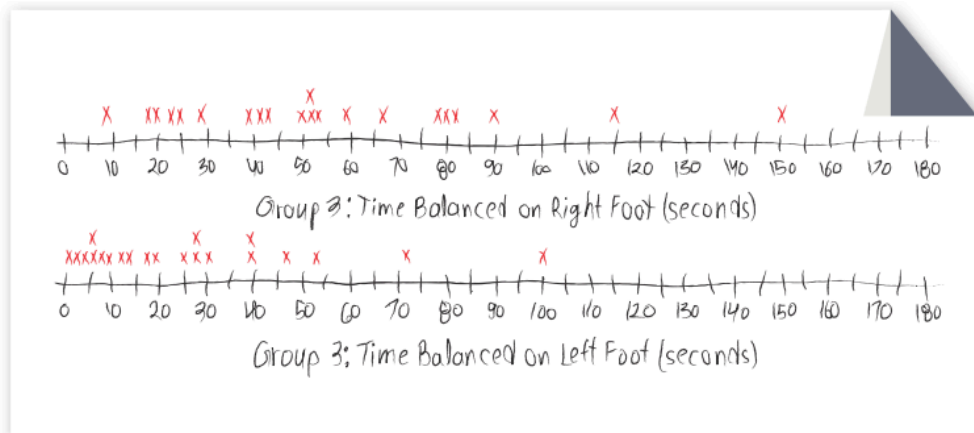
- Describing, summarizing, and comparing data
- Representing data
- Generating measurement data

## BENCHMARKS

- Organize, represent, and describe categorical data, choosing categories that help make sense of the data. (Unit 2)
- Make and interpret a bar graph and a pictograph, including use of scales greater than 1. (Unit 2)
- Make a line plot for a set of measurement data, with a scale that includes inches and half inches. (Unit 2)
- Describe and summarize a set of data, describing concentrations of data and what those concentrations mean in terms of the situation the data represents. (Unit 2)
- Generate measurement data by measuring lengths to half inch. (Unit 2)
- Measure to the nearest fourth inch and represent measurement data to the nearest fourth inch on a line plot. (Unit 6)

## Grade 4

Students model real-world situations with mathematics as they collect, represent, describe, and analyze data in order to compare two groups. They generate measurement data about two groups that include fractions and represent the two data sets. Students first choose their own way to represent the data sets, and then they use line plots.



Based on their representations, students describe and summarize the data—choosing the most important features that characterize a data set—and compare how the two sets are similar or different. They return to the context from which the data were taken to draw conclusions about the phenomenon and refer to the data to defend their claims.

Philadelphia is hotter because in Philadelphia they have 13 days  $90^\circ$  or above. In Boston they have 3 in  $90^\circ$  or above. Also the high in Philadelphia is 95 and in Boston is 93.

## MAIN MATH IDEAS

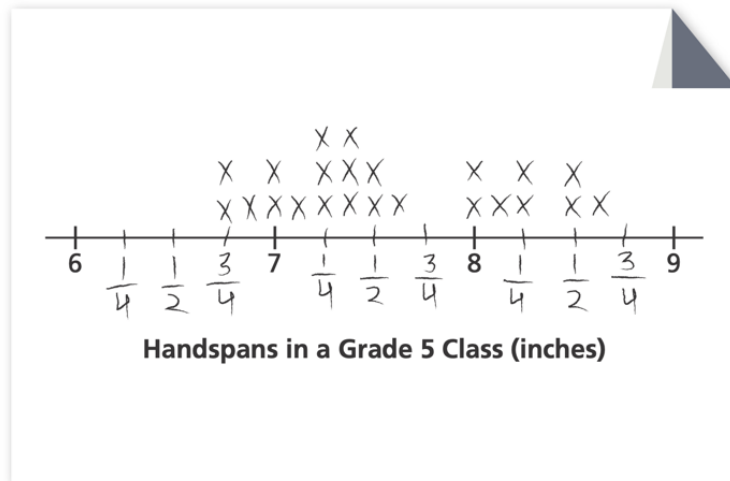
- Representing data
- Describing, summarizing, and comparing data
- Analyzing and interpreting data
- Generating measurement data

## BENCHMARKS

- Use a line plot to organize, represent, and analyze measurement data about two groups in order to compare the two groups. (Unit 2)
- Design a data question that involves measurement to compare two groups. (Unit 2)
- Use a line plot to represent measurement data that includes fractions. (Unit 2)
- Represent data on a line plot including fourths and eighths. (Unit 6)

## Grade 5

In the context of their work with multiplication and division, students apply what they have learned about multiplying and dividing rational numbers to convert measurements within a given measurement system, including solving multi-step word problems. Building on measurement ideas from earlier grades, students recognize that converting a larger unit of measure to a smaller unit of measure (e.g., meters to centimeters, yards to feet) results in more of the smaller units; and converting from a smaller unit of measure to a larger unit of measure (e.g., grams to kilograms, quarts to gallons) results in fewer of the larger units.



Students measure lengths to the nearest  $\frac{1}{4}$  inch and display their data on a line plot. They solve problems about these lengths.

### BENCHMARK

- Represent data including fractions on a line plot and solve addition and subtraction problems about the data. **(Unit 3)**