Content Overview

Important Words

mean or average

median

range

interval

quartiles

clusters

peaks

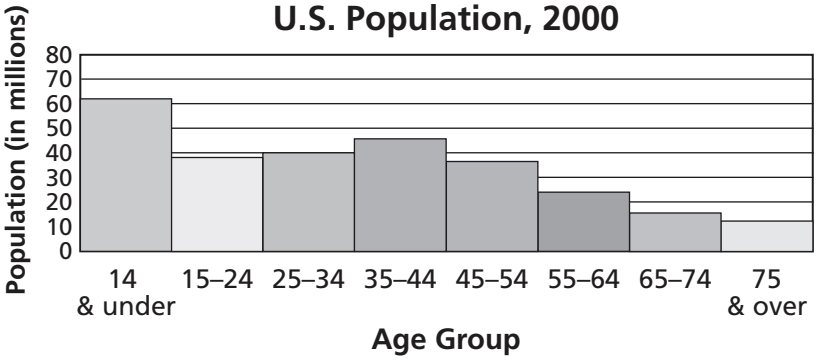
gaps

Dear Family,

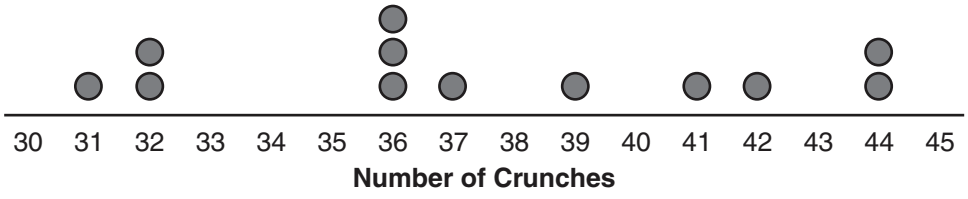
Your child will be learning about numbers throughout the school year. The math unit your child is beginning to study now involves numerical data in the form of statistics.

Some of the important words we will be working with in this unit are shown at the left. Some of the data displays we will be working with are shown below.

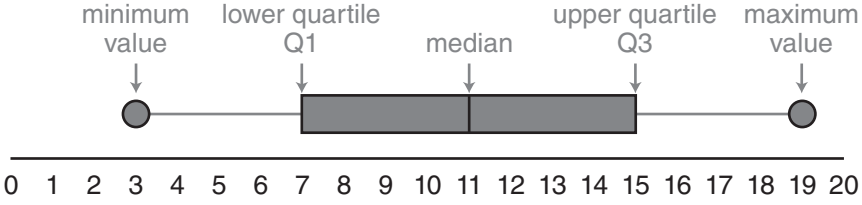
Histogram



Dot Plot



Box Plot



In addition to learning about ways to display data, your child will be learning about ways to analyze and summarize it. In other words, we will be exploring ways to make sense of data and statistics.

If you have any questions or comments, please call or write to me.

Sincerely,
Your child's teacher

CA CC

Unit 8 addresses the following standards from the *Common Core State Standards for Mathematics with California Additions*: **6.SP.1, 6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5, 6.SP.5a, 6.SP.5b, 6.SP.5c, 6.SP.5d,** and all Mathematical Practices.

Un vistazo general al contenido

Palabras importantes

media o promedio

mediana

rango

intervalo

cuartiles

agrupamientos

valores pico

brechas

Estimada familia,

Su hijo aprenderá diferentes conceptos relacionados con los números durante el año escolar. La unidad de matemáticas que estamos comenzando a estudiar trata de datos numéricos en forma de estadísticas.

Algunas de las palabras importantes que usaremos en esta unidad se muestran a la izquierda. Algunas de las representaciones de datos que estaremos usando se muestran debajo.

Histograma

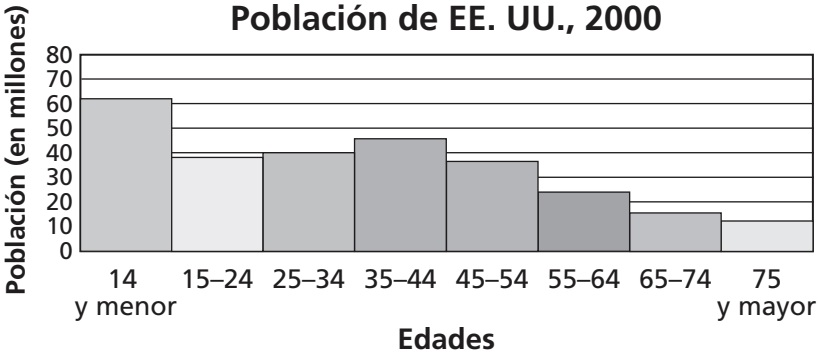


Diagrama de puntos

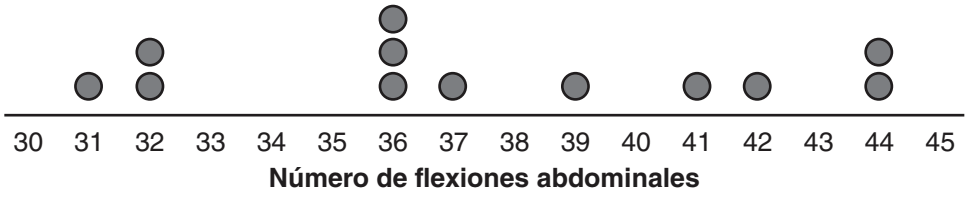
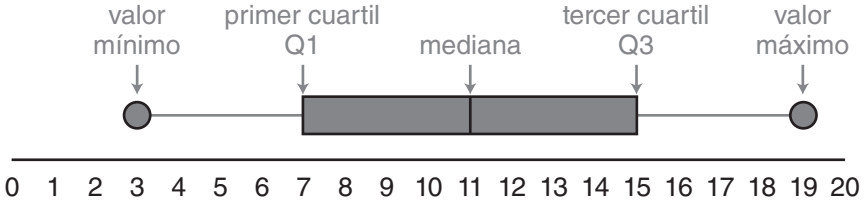


Diagrama de caja y brazos



Además de aprender acerca de diferentes maneras de representar datos, su hijo aprenderá cómo analizarlos y resumirlos. En otras palabras, explorará maneras de interpretar mejor los datos y las estadísticas.

Si tiene preguntas o comentarios, por favor comuníquese conmigo.

Atentamente,
El maestro de su hijo

CA CC

En la Unidad 8 se aplican los siguientes estándares auxiliares, contenidos en los *Estándares estatales comunes de matemáticas con adiciones para California*: **6.SP.1, 6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5, 6.SP.5a, 6.SP.5b, 6.SP.5c, 6.SP.5d,** y todos los de prácticas matemáticas.

CA CC Content Standards **6.SP.1, 6.SP.4, 6.SP.5, 6.SP.5a**
Mathematical Practices **MP.1, MP.3, MP.6, MP.8**

Vocabulary

numerical data

▶ Numerical Data Can Vary

Numerical data involve numbers and quantities. One example of numerical data is the number of students in your class. The answers to these questions involve numerical data: How many students are in your class? How does the number of students in your class compare to the number of students in other classes in your school, or in your city or state?

For each group of people named below, describe a kind of numerical data that could be collected. Then decide if you would expect all of the data to be the same or if you would expect it to vary. Explain why. Exercise 1 shows you an example.

1. For each student in your school:

   The length of time it takes each student to travel to school in the morning. These times will vary because students live different distances from school.

2. For each student in your class: _____

3. For each sixth grade student in your state: _____

4. For each teacher in your school: _____

5. Write your own example. _____

▶ Compare Numerical Data

Fitness testing sometimes involves the number of crunches that can be completed in a given length of time. (Crunches are sometimes called sit-ups.) The data below show how many crunches a group of sixth grade students from two classes were able to complete in 1 minute.

Ms. Jackson's Class

Student	Number of Crunches
Lucas	36
Ava	32
Tyler	44
Alexis	36
Jada	37
Chase	41
Sabrina	39

Mr. Ryan's Class

Student	Number of Crunches
Reyna	32
Julien	42
Lia	36
Omar	44
Jorge	31

Use the data from the tables.

6. Consider the question "Which class did better in crunches?" Why is the question difficult to answer?

7. What are different ways you could display the two sets of data so the sets would be easier to compare?

8. Choose one of the ways you named in Exercise 7. Why would that way make the data easier to compare?

8–1
Class Activity

Vocabulary

dot plot

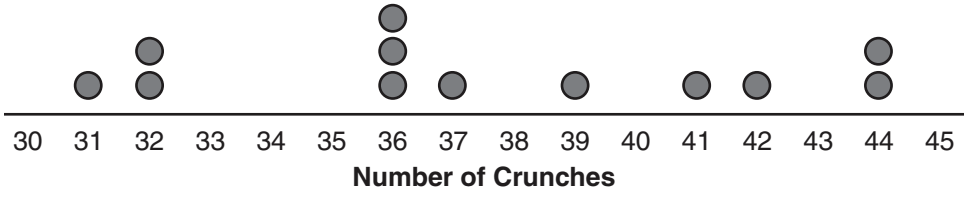
► Numerical Data and Dot Plots

Look again at the crunch data. The data are numerical.

Ms. Jackson's Class	
Student	**Number of Crunches**
Lucas	36
Ava	32
Tyler	44
Alexis	36
Jada	37
Chase	41
Sabrina	39

Mr. Ryan's Class	
Student	**Number of Crunches**
Reyna	32
Julien	42
Lia	36
Omar	44
Jorge	31

A **dot plot** displays the frequency of numerical data. It uses dots to show how often numbers occur.



9. The data tables show how many crunches various students completed. Is the number of students shown in the tables the same as the number of dots in the plot?

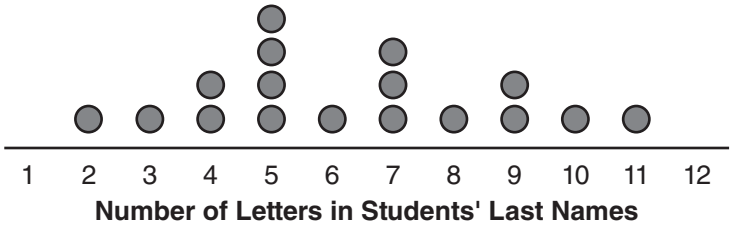
10. How does the dot plot represent the data in the tables?

11. In the dot plot, there are three dots above 36. Which three students do the dots represent? Explain how you know.

8–1
Class Activity

▶ Analyze a Dot Plot

Use the dot plot below for Exercises 12–15. The dot plot shows how many letters are in the last names of a group of students.



12. How many students does the dot plot represent? Explain how you know.

13. How many letters do most students have in their last name? Explain your answer.

14. Do more students have short last names or long last names? Explain your reasoning.

15. Write your own question about the dot plot. Exchange papers with a classmate and answer each other's questions.

8–2
Class Activity

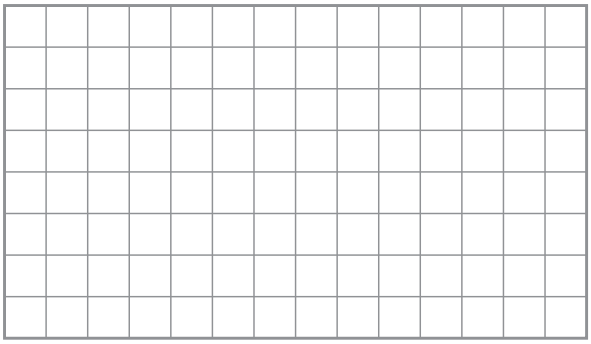
CA CC Content Standards **6.SP.1, 6.SP.4, 6.SP.5, 6.SP.5a** Mathematical Practices **MP.2, MP.3, MP.4, MP.5, MP.6, MP.8**

▶ Make a Dot Plot

The data below show the number of hours a group of students spent doing homework last week.

5, 4, 1, 6, 0, 5, 3, 3, 5, 6, 1, 3, 8, 5, 4

1. Draw a dot plot to represent the data. Title your display.



2. How many students does your dot plot represent? Explain how you know that number of students is correct.

3. **Analyze** Why are no dots shown at 2 and at 7?

4. **Analyze** Why do you think 5 hours is the most frequent number of hours? Explain.

5. **Predict** The data represent 15 students. Would the scale of the plot change if it included more students? Explain.

6. **Predict** Suppose the data represent sixth grade students. Would the data change if it represented high school students? Explain.

▶ What's the Error?

Dear Math Students,

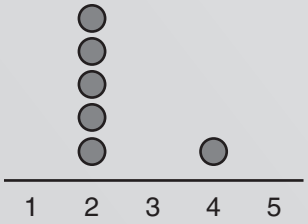
The dot plot at the right displays data about kites that were seen at the beach.

I interpreted the dot plot to show that 2 kites had tails with five bows on each tail, and 4 kites had tails with one bow on each tail.

Did I interpret the dot plot correctly? Explain.

Your friend,

Puzzled Penguin



7. Write a response to Puzzled Penguin.

Dear Math Students,

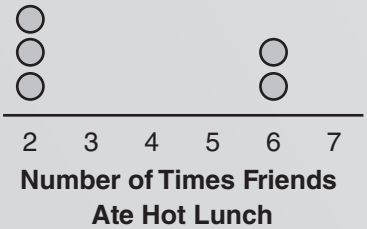
Five of my friends made a dot plot to show the number of times they ate hot lunch at school last month.

My three friends represented by the dots on the left side of the plot said that altogether they ate hot lunch more times than my two friends represented by the dots on the right side of the plot.

Can you help me decide if they are correct?

Your friend,

Puzzled Penguin



8. Write a response to Puzzled Penguin.

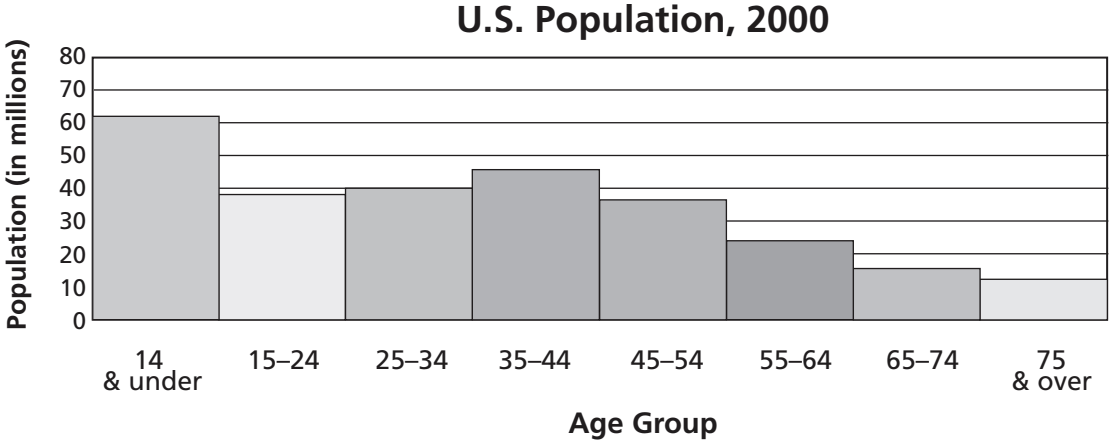
8–2
Class Activity

Vocabulary

histogram
interval

► Read a Histogram

A **histogram** is a frequency display that uses bars to show the distribution of data in a set. The data are presented in intervals. An **interval** is a range of numbers.



A histogram is used when we want to graphically display a large set of data. The intervals are usually the same size. The bars touch so all the data in the set are included.

Height and width are two important characteristics of the bars. The vertical height (*y*-axis) of a bar shows the frequency, or number of times a data value occurs. The horizontal width (*x*-axis) shows the intervals into which the data are grouped.

Use the histogram above for Exercises 9–13.

9. Which age group has the least number of people? _____

10. Which age groups have nearly the same numbers of people?

_____

11. What age group has about 15 million people? _____

12. About how many people are 14 & under or 75 & older?

_____

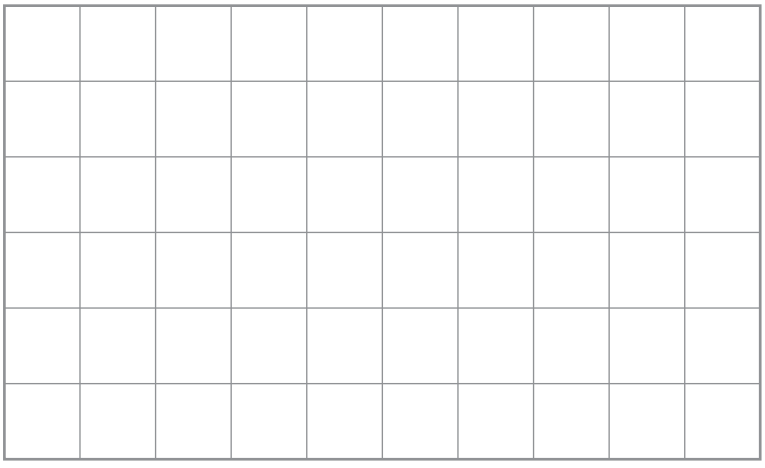
13. Discuss Where do you think a person that is $34\frac{1}{2}$ is included in the graph?

► Make a Histogram

The table below shows the lengths of various U.S. rivers.

Selected Rivers of the United States				
River	**Length (miles)**		**River**	**Length (miles)**
Connecticut	407		Savannah	314
Hudson	306		Illinois	273
Mobile	45		Roanoke	410
Potomac	287		Yazoo	169
Apalachicola	90		Saint Johns	285
Monongahela	129		Kanawha	97
Sacramento	374		Delaware	367

14. On the grid below, draw and label a histogram of the data.



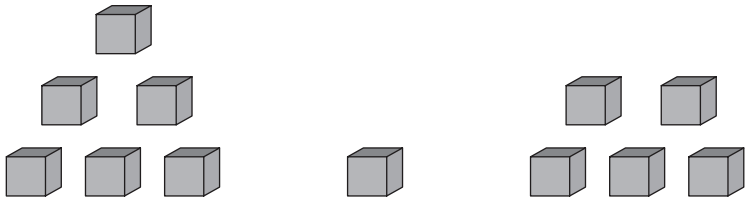
8–3
Class Activity

CA CC Content Standards **6.SP.2, 6.SP.3**
Mathematical Practices **MP.3, MP.4, MP.6, MP.8**

Vocabulary
mean

▶ Leveling Out and Fair Shares

The **mean** is a measure of the center for a set of numerical data. It summarizes all of its values with a single number. Use the three groups of cubes shown below for Exercises 1 and 2.



1. Suppose two cubes are moved from the left group to the center group, and two cubes are moved from the right group to the center group. Will the groups be leveled out and represent fair shares? Explain.

2. Explain how to level out the three groups so that each group represents a fair share. Use the words *add* and *subtract* in your answer. Then sketch the fair shares in the space at the right.

▶ Calculate the Mean

Eight students took a 10-question quiz. The number of correct answers each student scored is shown in the table at the right. Use the table for Exercises 3 and 4.

3. What is the quotient when the sum of the scores is divided by the number of scores? _____

4. What is the mean of the data? Explain.

Quiz Scores

Student	Score (Number Correct)
Blaise	6
Dani	7
Olivia	8
Jamaal	9
William	5
Shanika	8
Cora	6
Enrico	7

▶ What's the Error?

Dear Math Students,

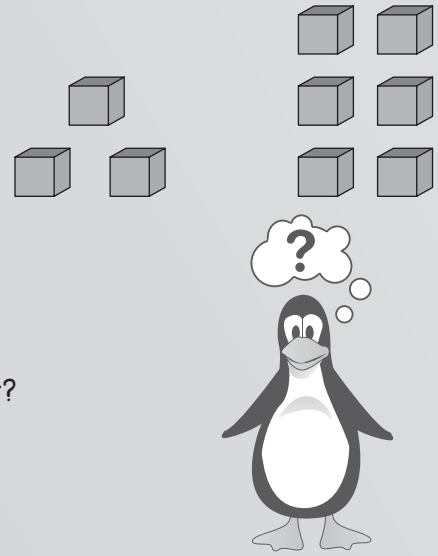
I was asked to find the mean of the numbers 3 and 6.

I know that finding the mean is the same as rearranging cubes so there are the same number of cubes in each group.

When I rearrange the cubes, there are too many cubes to make two groups of 4, and not enough cubes to make two groups of 5. So I don't think there is a mean for the numbers 3 and 6. Am I correct?

Your friend,

Puzzled Penguin



5. Write a response to Puzzled Penguin.

Dear Math Students,

I was asked to find the mean of the numbers 12, 1, and 2.

When I used addition and division to calculate the mean, my work produced an answer of 5, which didn't seem right because the set of numbers doesn't contain the number 5.

Then I calculated the mean a second time and again my answer was 5. Can you explain what I did wrong?

Your friend,

Puzzled Penguin

6. Write a response to Puzzled Penguin.

CA CC Content Standards **6.SP.2, 6.SP.3, 6.SP.5**
Mathematical Practices **MP.1, MP.2, MP.3, MP.6**

▶ Summarize Data

One way to summarize a set of data is to use the mean. If all the data values were the same, the common value would be the mean.

1. Hannah wants to tell her family about her homework scores, shown in the table at the right. Hannah believes it would be easier for her family to make sense of the mean score than it would be to make sense of the individual scores.

   Using words, explain how to find the mean score.

   _____

2. Calculate the mean score. _____

3. Write a sentence to explain what your answer to Exercise 2 represents. Include your answer to Exercise 2 in your sentence.

   _____

Homework Scores

Day	Score
Monday	90
Tuesday	84
Wednesday	93
Thursday	97
Friday	91

▶ Compare Sets of Data

One way to compare two sets of data is to compare the mean of one set to the mean of the other set.

4. The number of points two basketball players scored is shown in the table at the right. One player missed the first two games of the season.

   Which player made a greater contribution of points to the team on a game-by-game basis? Give a reason to support your answer.

   _____

   _____

   _____

   _____

Points Scored

Game	Player A	Player B
1	5	
2	8	
3	1	11
4	12	7
5	9	6
6	4	6
7	10	8
8	7	10

▶ Solve Real World Problems

Solve.

5. In Ms. Dixon's science class, the mean of four quiz scores and a final test score determine the quarterly grade. During the first quarter, Yunhee's four quiz scores were 95, 99, 86, and 94.

   a. What is the sum of Yunhee's four quiz scores?

   b. What must the sum of Yunhee's *five* scores be for her to average 90 or more on all four quizzes and the test? Explain your answer.

   c. What is the minimum score Yunhee must earn on the final test to have an average score of at least 90 for the quarter? Explain your answer.

6. The average age in years of the four people in Jorge's family is 25. Jorge is 12 years old, his mom is 38 years old, and his dad is 41 years old. How old is Jorge's sister?

7. The fuel economy of Jo's car is 32 miles per gallon on the highway and 26 miles per gallon in the city. For the two trips shown in the chart at the right combined, did Jo drive more often on the highway, or more often in the city? Give a reason to support your answer.

Jo's Trips

Miles Driven	Fuel Used (in gallons)
420	14
190	6

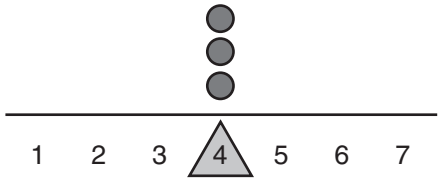
CA CC Content Standards **6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5c**
Mathematical Practices **MP.2, MP.3, MP.4, MP.6**

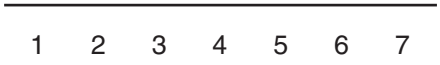
▶ Draw Models to Unlevel Data

In this lesson, the mean is shown as a balance point.

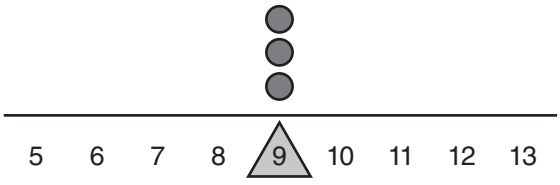
Draw a dot plot to show the new arrangement of dots.

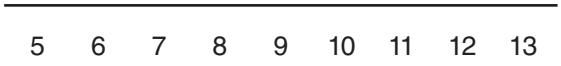
1. Move one dot to the left and move one dot to the right so the balance point remains the same.



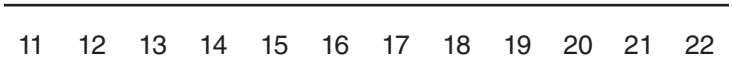


2. Move all of the dots so the balance point remains the same.

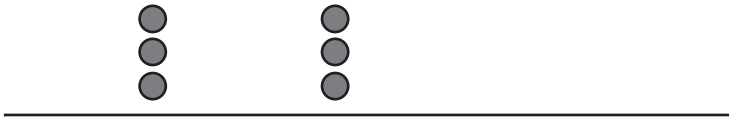




3. Move all of the dots so that the balance point changes to a different whole number. Draw the new balance point.



4. Move all of the dots so that the balance point is 6.



8–5
Class Activity

▶ Predict the Mean

Plot the given data. Draw a balance point to predict where you think the mean will be located. Then calculate the mean to check your prediction.

5. 10, 17, 9, 18, 11

8 9 10 11 12 13 14 15 16 17 18

mean: _____

6. 8, 10, 7, 5, 10, 2

1 2 3 4 5 6 7 8 9 10

mean: _____

▶ What's the Error?

Dear Math Students;

I was asked to decide if the balance point of the dot plot at the right was correct.

The numbers to the left of the balance point are 4, 4, and 5, which add to 13. The numbers to the right of the balance point are 8 and 9, which add to 17.

I decided the balance point is not correct because the total on one side of the balance point is not the same as the total on the other side.

Can you help correct my thinking?

Your friend,

Puzzled Penguin

7. Write a response to Puzzled Penguin.

_____

_____

_____

_____

8–6
Class Activity

CA CC Content Standards **6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5, 6.SP.5c, 6.SP.5d** Mathematical Practices **MP.1, MP.3, MP.6, MP.7, MP.8**

Vocabulary

median

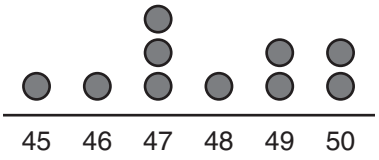
▶ Find the Median

The **median** is a single number that summarizes the center of a set of numerical data. The median is the middle number, or the mean of the two middle numbers, when the data are arranged from least to greatest or greatest to least.

1. The numbers at the right are ordered from least to greatest. Find the median.

10 21 22 37 46

2. The dot plot at the right displays 10 data values. Find the median of the data.



3. Some animals can move very fast for short distances. The table at the right shows the top speeds at which some animals can move. Find the median speed.

Animal	Speed (mph)
Giraffe	32
Rabbit	35
Squirrel	12
Wildebeest	50
Elephant	25
Gray Fox	42
Zebra	40
Wart Hog	30

A set of data may have an odd number of values or an even number of values.

4. Using words, describe the median of a numerical set of data when there are an odd number of values in the set.

5. Using words, describe the median of a numerical set of data when there are an even number of values in the set.

8–6
Class Activity

▶ What's the Error?

Dear Math Students,

I was asked to find the median of the set of numbers at the right.

7 4 5 1 6 8 9

By counting, I discovered that there are three numbers to the left of 1 and three numbers to the right of 1. So I decided that 1 is the median because it is the middle number.

Can you tell me what I did wrong?

Your friend,

Puzzled Penguin

6. Write a response to Puzzled Penguin.

Dear Math Students,

I wrote the two sets of numbers shown at the right to help a friend understand how to find the median of a set of numbers.

205 142 110

56 40

I explained that the median of the top set of numbers was 142 because 142 was the number in the middle.

Then I explained that the bottom set of numbers had no median because there was no number in the middle.

Did I provide my friend with correct advice?

Your friend,

Puzzled Penguin

7. Write a response to Puzzled Penguin.

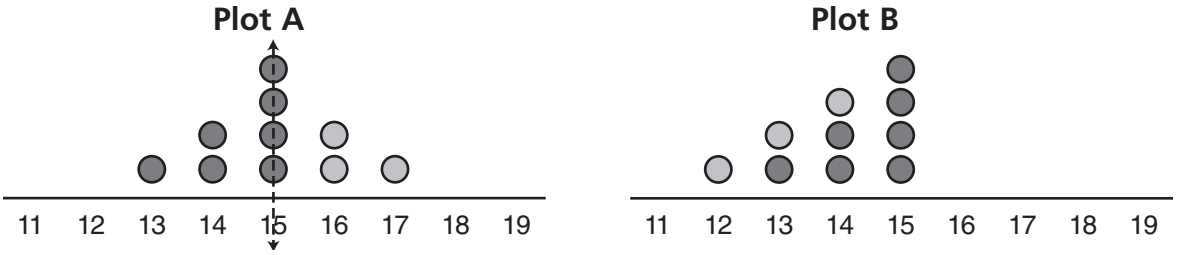
8–6
Class Activity

Vocabulary

symmetric

► Same Mean and Median

Compare the dot plots below. Plot A has a line of symmetry. The data in Plot A are **symmetric** because the shape of the data on one side of the line of symmetry is the same as the shape of the data on the other side of the line. Plot B has the same number of data values as Plot A, but when compared to Plot A, some values in Plot B have been shifted to the left.



8. Calculate the mean and the median of Plot A.

Plot A mean: ____ Plot A median: ____

9. Plot A is a symmetric dot plot. How is the line of symmetry related to the mean and the median of the data?

_____

_____

10. Using words, predict how the mean and the median of Plot B may be different than the mean and the median of Plot A.

_____

_____

11. Calculate the mean and the median of Plot B. Was the prediction you made in Exercise 10 correct?

_____

_____

12. Why do you think the shift of dots to the left as is shown in Plot B decreased the mean and median of Plot A?

_____

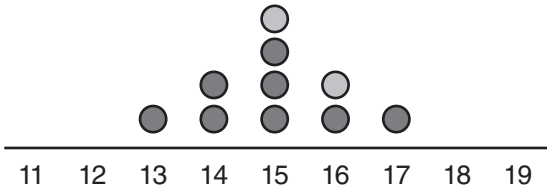
_____

8–6
Class Activity

► Same Median, Different Mean

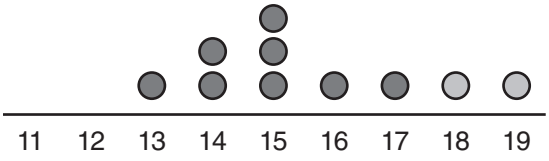
Compare these two dot plots. Two data values in symmetric Plot A have been shifted to the right.

Plot A



mean: 15 median: 15

Plot C



mean: ____ median: ____

13. Calculate the mean and median of Plot C.

14. How did the shift of dots to the right as is shown in Plot C affect the mean and median of Plot A?

_____

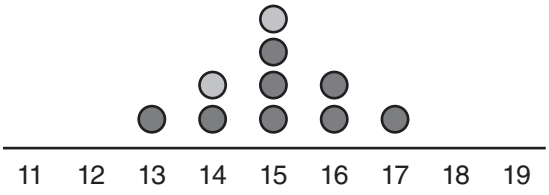
15. Why does a shift to the right increase the mean?

_____

_____

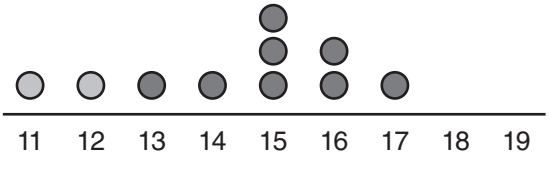
Compare these two dot plots. Two data values in symmetric Plot A have been shifted to the left.

Plot A



mean: 15 median: 15

Plot D



mean: ____ median: ____

16. Calculate the mean and median of Plot D.

17. How did the shift of the dots to the left as is shown in Plot D affect the mean and median of Plot A?

_____

18. Why does a shift to the left decrease the mean?

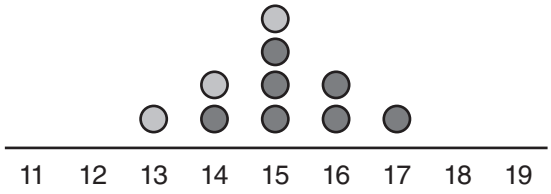
_____

8–6
Class Activity

► Different Mean and Median

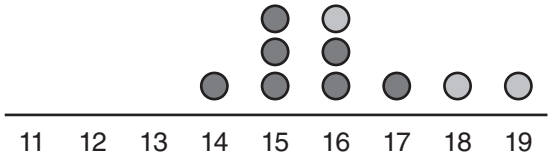
Compare these two dot plots. Three data values in symmetric Plot A have been shifted to the right.

Plot A



mean: 15 median: 15

Plot E



mean: ____ median: ____

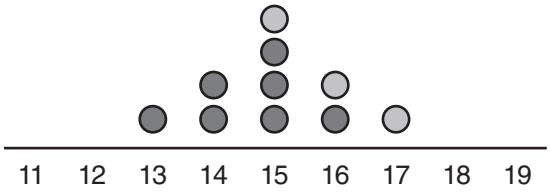
19. Calculate the mean and median of Plot E.

20. How did the shift of the dots to the right as is shown in Plot E affect the mean and median of Plot A?

21. Why did the shift increase the mean and the median?

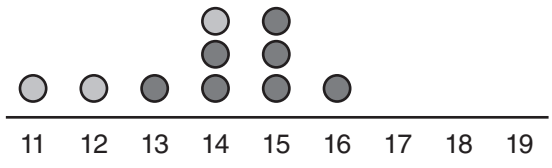
Compare these two dot plots. Three data values in symmetric Plot A have been shifted to the left.

Plot A



mean: 15 median: 15

Plot F



mean: ____ median: ____

22. Calculate the mean and median of Plot F.

23. How did the shift of the dots to the left as is shown in Plot F affect the mean and median of Plot A?

24. Why did the shift decrease the mean and the median?

▶ Choose the Best Measure

Solve.

Estimates of the populations of seven cities in Colorado are shown in the table at the right. The populations have been rounded to the nearest thousand.

City	Population
Durango	17,000
Montrose	18,000
Windsor	17,000
Loveland	66,000
Erie	17,000
Canon City	16,000
Golden	17,000

25. Calculate the mean of the data. _____

26. Find the median of the data. _____

27. How could you summarize the populations of all seven cities using only one number? Would you choose the mean, or the median, to summarize the populations? Give a reason to support your answer.

_____

_____

_____

Rachel has a new part-time summer job. She works 3 days per week. Her earnings for the first two weeks are shown in the table at the right.

Earnings	
Week 1	**Week 2**
$20	$40
$40	$10
$30	$40

28. Calculate the mean earnings per day for each week.

Week 1: _____ Week 2: _____

29. Calculate the median earnings per day for each week.

Week 1: _____ Week 2: _____

30. Suppose Rachel wants to summarize her earnings for the first two weeks using only one number. Should Rachel choose a mean or a median to summarize her earnings? Give a reason to support your answer.

_____

_____

_____

8–7
Class Activity

CA CC Content Standards **6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5c**
Mathematical Practices **MP.1, MP.3, MP.4, MP.6**

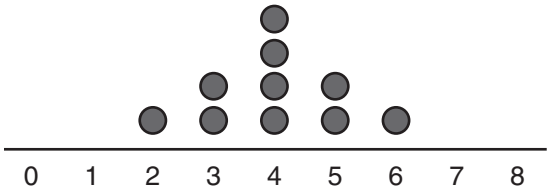
Vocabulary

range

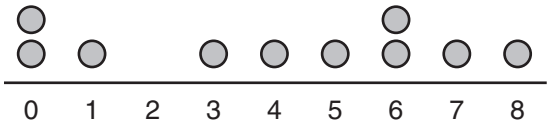
▶ Calculate Range

Jayla and Sophie are members of a sixth grade basketball team. The dot plots below show the number of points scored by each player during the first 10 games of the season.

Jayla
Points per Game



Sophie
Points per Game



The range is a single number that summarizes the variability of a set of data. You can calculate the **range** of a set of numbers by subtracting the least number from the greatest number in the set.

1. Calculate the range of each dot plot.

   Jayla: range _____ Sophie: range _____

2. Calculate the mean and the median number of points per game for Jayla and for Sophie.

   Jayla: mean _____ median _____

   Sophie: mean _____ median _____

3. Suppose you calculated the mean and the median for each of the other players on the team. Would your answers be the same as the mean and median for Jayla and Sophie, or would your answers be different? Explain.

4. All three measures—mean, median, and range—describe the data in some way. What does the range tell you about the data?

8–7
Class Activity

Vocabulary

quartiles
first quartile
third quartile

▶ What are Quartiles?

A set of numerical data is shown below. The median is the mean or average of the two middle numbers.

1 2 3 4 5 6 7 8 9 10 11 12

median = 6.5

5. Into how many equal parts does the median divide the data? _____

Quartiles are the values of the points that separate a set of data into four equal parts. The **first quartile** separates the lower half of the data into two equal parts. The **third quartile** separates the upper half of the data into two equal parts.

Look below at the numbers to the *left* of the median. The first quartile is the mean or average of the two middle numbers.

1 2 3 4 5 6 7 8 9 10 11 12

first quartile median

6. Into how many equal parts does the first quartile divide the data to the left of the median? _____

7. What number represents the first quartile? _____

Look below at the numbers to the *right* of the median. The third quartile is the mean or average of the two middle numbers.

1 2 3 4 5 6 7 8 9 10 11 12

first quartile median third quartile

8. Into how many equal parts does the third quartile divide the data to the right of the median? _____

9. What number represents the third quartile? _____

▶ Find Quartiles

Look at Set A. When a set of data has an odd number of values, the median is a value in the set.

Set A

101
first quartile → 133
137
median → 210
212
third quartile → 275
284

10. What number is the median, or middle number, of the set? _____

11. Explain why 133 is the first quartile of the set and 275 is the third quartile.

_____

_____

Look at Set B. When a set of data has an even number of values, the median is not a value in the set.

Set B

26
first quartile → 28
median → 51
55
third quartile → 64
87

12. Explain how to calculate the median, or middle number, of the set. Then calculate the median.

_____

_____

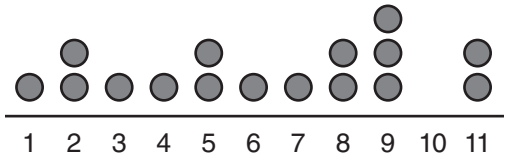
13. Explain why 28 is the first quartile of the set and 64 is the third quartile.

_____

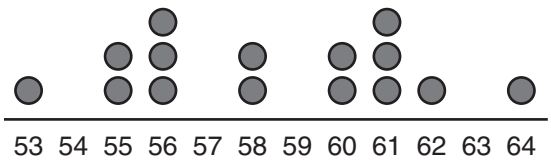
_____

Find the median, first quartile, and third quartile of the data on each dot plot.

Plot A



Plot B



14. Plot A: median: _____

first quartile: _____

third quartile: _____

15. Plot B: median: _____

first quartile: _____

third quartile: _____

8–7
Class Activity

▶ What's the Error?

Dear Math Students,

I can use mental math to calculate the range and the median of the numbers at the right.

The range is 60 because $70 - 10 = 60$. And the median is 30 because $60 \div 2 = 30$. Is this correct?

Your friend,

Puzzled Penguin

10
30
40
50
70

16. Write a response to Puzzled Penguin.

Dear Math Students,

I was asked to calculate the first quartile of the set of data that is shown at the right.

2, 2, 3, 4, 4, 6, 8, 8, 8, 10

To calculate the first quartile, I divided the range by 4, like this:

$$\text{First Quartile} = \text{Range} \div 4$$
$$\text{First Quartile} = (10 - 2) \div 4$$
$$\text{First Quartile} = 8 \div 4$$
$$\text{First Quartile} = 2$$

So I decided that the first quartile is 2. Can you explain what I did wrong, and explain how I can correctly calculate the first quartile?

Your friend,

Puzzled Penguin

17. Write a response to Puzzled Penguin.

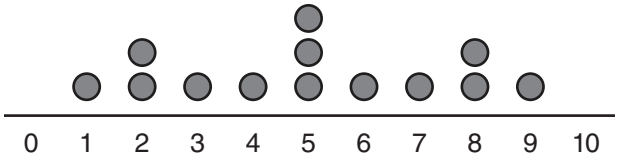
CA CC Content Standards **6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5c, 6.SP.5d**
Mathematical Practices **MP.1, MP.3, MP.4, MP.5, MP.6, MP.7, MP.8**

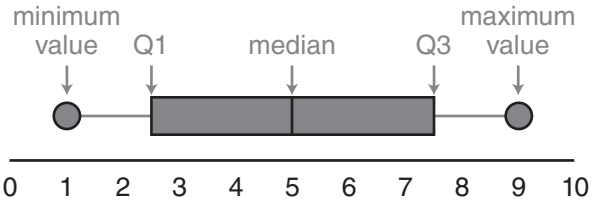
Vocabulary

box plot

► Compare a Dot Plot and a Box Plot

The dot plot and box plot below represent the same set of data. A **box plot** is a graphic summary that shows the median, quartiles, and minimum and maximum values of a set of data.





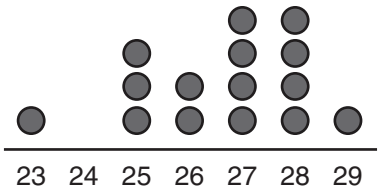
1. In which display, the dot plot or the box plot, is it easier to identify the median and quartiles of the data? Give a reason to support your answer.

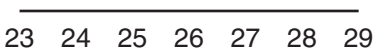
2. Use the box plot to name the median, the quartiles, and the minimum and maximum values of the data. Explain how you know.

3. In which display, the dot plot or the box plot, is it easier to identify the range into which one half the data can be found? Explain your answer.

► Make a Box Plot

4. Make a box plot to represent the dot plot data.

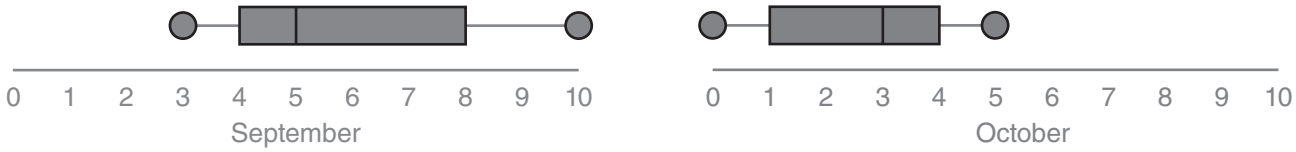




8–8
Class Activity

► Interpret a Box Plot

Compare the box plots shown below. The box plot at the left shows the number of times the students in Mr. Rayburn's class wore shorts during September. The box plot at the right shows the number of times the students wore shorts during October.



Use the box plots for Exercises 5 and 6.

5. How do the median and quartiles for September compare to the median and quartiles for October?

6. What does your answer for Exercise 5 suggest about the September and October temperatures? Explain your answer.

Three summaries of data displayed by a box plot are shown at the right. Use the summaries for Exercises 7 and 8.

Q1 = 13.5
median = 16.02
Q3 = 44

7. Suppose 37.79 is a value in the set of data. Where in the set is 37.79? Explain your answer.

8. How does the range from the median to Q1 compare to the range from the median to Q3, and what does this suggest about the spread of the data?

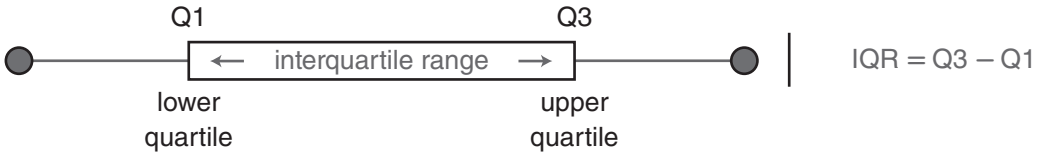
8–8
Class Activity

Vocabulary

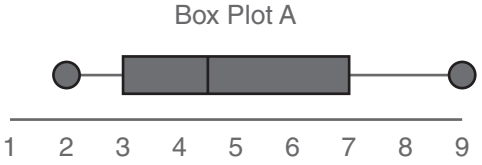
interquartile range

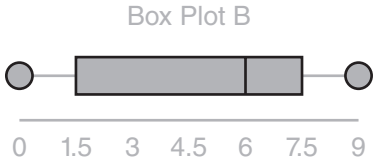
► Introduce Interquartile Range

In a box plot, Q1 is often called the lower quartile and Q3 is often called the upper quartile. The **interquartile range** (or IQR) is the difference between the upper and lower quartiles, and it is a way to describe the spread of data in a set.



Use the box plots below for Exercises 9–11.





9. Calculate the IQR of Box Plot A.

10. Calculate the IQR of Box Plot B.

11. Compare the IQR of Box Plot A to the IQR of Box Plot B. What does the comparison suggest about the spread of data in Plot A when compared to the spread of data in Plot B?

The data at the right summarize the quiz scores for two math classes. The quiz was the same for each class, and each class has the same number of students.

Morning Class	Afternoon Class
Q1 = 74	Q1 = 81
median = 87	median = 87
Q3 = 89	Q3 = 95

12. Suppose a score of 90 or more earns a grade of A. Which class earned more A's? Give a reason to support your answer.

8–8
Class Activity

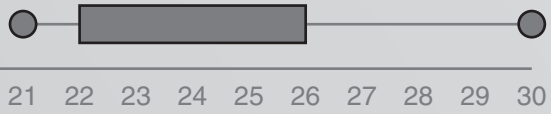
▶ What's the Error?

Dear Math Students,

I was given the set of data shown below.

21 21 22 23 24 25 26 26 26 29 30

Here is the box plot I made to represent the data. Can you help me understand what I did wrong?



Your friend,

Puzzled Penguin

13. Write a response to Puzzled Penguin.

Dear Math Students,

I was asked to draw a box plot to display the set of data at the right. The box plot I made is shown below. Can you help me understand what I did wrong?

203 204 205 206 207 208 209

Your friend,

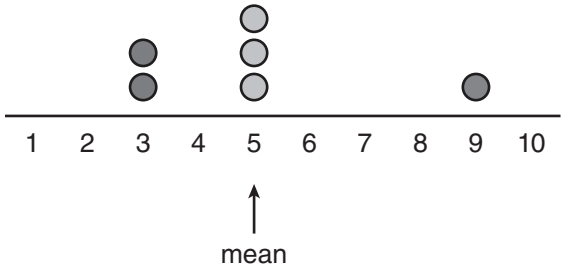
Puzzled Penguin

14. Write a response to Puzzled Penguin.

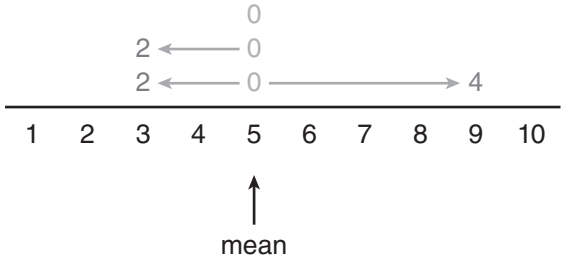
CA CC Content Standards **6.SP.5, 6.SP.5c**
Mathematical Practices **MP.1, MP.2, MP.3, MP.6**

▶ Determine Distance from the Mean

This dot plot shows six values. The mean of the values is 5.



The numbers below represent each dot's distance from the mean.

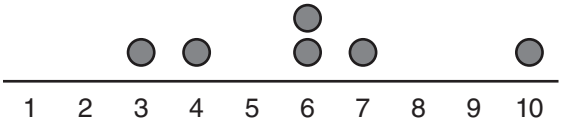


1. Why is 5 the mean?

2. What subtraction is used to calculate distance from the mean to each blue dot?

3. What subtraction is used to calculate distance from the mean to the green dot?

4. Calculate the mean of the dot plot below and label it. Then in the space at the right, write a number for each dot that represents the dot's distance from the mean.



8–9 Class Activity

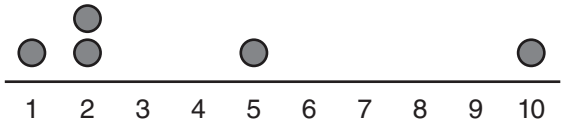
Vocabulary

mean absolute deviation

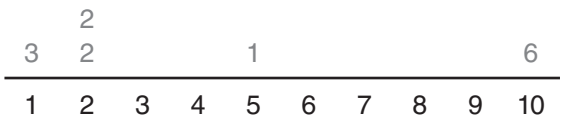
► Find the Mean Absolute Deviation

Each display below represents the same set of data. The display at the right shows a number in green to indicate each dot's distance from the mean. Use the displays for Exercises 5–7.

The Mean of These Values is 4



Distance from the Mean



5. Find the sum of the distances from the mean. _____

6. Divide the sum of the distances from the mean by the number of values. _____

7. What does the answer to Exercise 6 represent?

_____

_____

In a set of data, the **mean absolute deviation** is the mean or average distance each data value is from the mean. The mean absolute deviation is a measure of the variability or spread of data in a set.

Follow the steps below to calculate the mean absolute deviation of the set of data shown at the right.

1	1	3	5	9	9	10	10

8. Find the mean of the data. _____

9. Find the distance each value is from the mean.

_____

_____

10. Write the sum of the distances. _____

11. Calculate the mean absolute deviation by dividing the sum of the distances by the number of values. _____

12. Which set has data that are more spread out from the mean?

_____

_____

▶ Compare Mean Absolute Deviations

A basketball team consists of two groups of players with five players in each group. The tables at the right show the number of points the players have scored so far this season.

Group A	Points Scored
Nick	10
Kurtis	31
Raul	68
Cory	26
Hector	45

Group B	Points Scored
Casey	29
Pedro	43
Zack	32
Andre	45
Tommy	31

13. Calculate the mean number of points scored by the players in each group.

Group A mean: _____

Group B mean: _____

14. Calculate each player's distance from the mean number of points scored and write the distances in the table at the right.

Group A	Distance from Mean
Nick	
Kurtis	
Raul	
Cory	
Hector	

Group B	Distance from Mean
Casey	
Pedro	
Zack	
Andre	
Tommy	

15. Calculate the mean absolute deviation of each group. What does your calculation suggest?

Group A mean absolute deviation: _____ Group B mean absolute deviation: _____

16. Which player in each group has the greatest deviation from the mean?

Group A player: _____ Group B player: _____

17. What does the greatest deviation from the mean suggest about the two players you named in Exercise 16?

8–9
Class Activity

▶ What's the Error?

Dear Math Students,

On the last day of school, the students in a sixth grade class were asked how many days they were absent that year.

The table shows the data that were collected.

I calculated the mean absolute deviation for each set of data.

I concluded that the data for the girls showed more variability than the data for the boys.

I was told my conclusion was wrong. Can you tell me why?

Your friend,

Puzzled Penguin

Number of Days Absent	
Boys	Girls
2	0
0	3.5
8	1
5	3
0	4
3	0
0	4.5
9	3
0	5
1	2

18. Write a response to Puzzled Penguin.

Number of Days Absent	
Distance from the mean	Distance from the mean
Boys	Girls

8–10 Class Activity

CA CC Content Standards **6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5, 6.SP.5a, 6.SP.5c, 6.SP.5d** Mathematical Practices **MP.2, MP.3, MP.4, MP.6, MP.8**

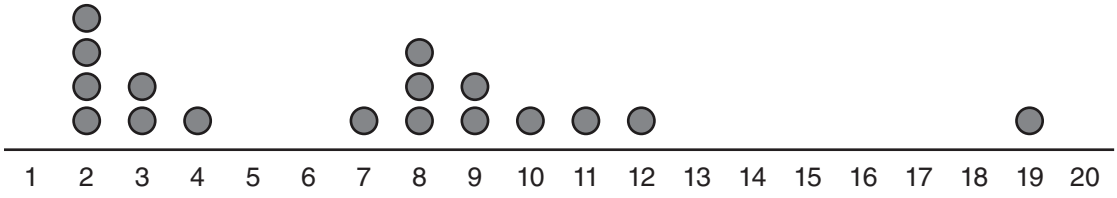
Vocabulary

cluster
peak
gap
outlier

► Analyze the Shape of Data

A set of data can be described by its shape. A **cluster** is a group of data values. A **peak** is the value that appears most often. A **gap** is an interval with no data. An **outlier** is an extreme or distant value.

Use the dot plot below for Exercises 1–4.



1. Describe the shape of the data. Use the words *clusters*, *peaks*, *gaps*, and *outliers* in your answer.

2. The median of the data is 8. Would the median change if it was calculated a second time without including the value at 19? Explain why or why not.

3. The mean of the data is 7. Would the mean change if it was calculated a second time without including the value at 19? Explain why or why not.

4. Which measure, mean or median, best describes the set of data? Give a reason to support your answer.

▶ Display and Summarize Data

Twenty-five sixth graders were surveyed and asked "In the morning, how long does it take you to get ready for school?" Their answers are shown in the table at the right.

Number of Minutes
30
60
45
60
25
90
55
60
50
60
30
60
10
45
25
45
30
60
50
60
45
90
60
30
50

Use the table for Exercises 5–7.

5. In the space below make a display of the data that enables you to see its overall shape.

6. Describe the shape of the data. Use the words *clusters*, *peaks*, *gaps*, and *outliers* in your answer.

7. Which measure—mean, median, range, interquartile range, or mean absolute deviation—best describes the data? Include a reason to support your answer.

8–11
Class Activity

CA CC Content Standards **6.SP.1, 6.SP.2, 6.SP.5, 6.SP.5a, 6.SP.5b, 6.SP.5d**
Mathematical Practices **MP.3, MP.5, MP.6, MP.8**

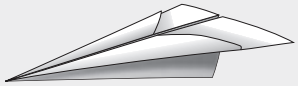
▶ Collect and Record Data

1. **Investigate** Write the question you are investigating.

2. **Predict** How far do you think a paper airplane can fly? Record your prediction.

3. Perform the steps shown at the right.

4. **Compare** Look at the prediction you made in Exercise 2 and compare it to the data that were collected during the investigation. Was your prediction reasonable? Explain your answer.



Investigation Steps

- Review the question to be answered.
- Use the steps on Student Book page 354 or use your own design to make a paper airplane.
- Measure the distance the paper airplane flies.
- Record the data you collect.
- With your classmates, make a graphic display of the data.
- Analyze the data.
- Form a conclusion.

5. **Summary** Look at the data that were collected during the investigation. Write a summary of the data. Include the distance a paper airplane can fly in your summary.

6. **Choose a Measure** Which statistical measure of the data would you use to best describe the distance a paper airplane can fly? Explain your reasoning.

8–11
Class Activity

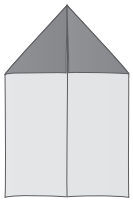
► Make a Paper Airplane

You are going to make a paper airplane to answer the question "How far will a paper airplane fly?"

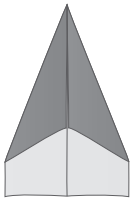
If you know how to make a paper airplane, make one of your own design. Or, make the paper airplane shown below.

Step 1 Fold a sheet of paper in half.

Step 2 Open it. Fold in two corners.

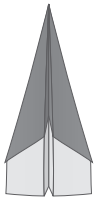


Step 3 Fold in two sides.



Step 4 Fold in half.

Step 5 Fold both sides in half.



Step 6 Write your name on the airplane.

8–12
Class Activity

CA CC Content Standards **6.SP.1, 6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5**
Mathematical Practices **MP.2, MP.3, MP.6, MP.8**

► Math and Handprints

If you've ever traced an outline of your hand, you may have traced it with your fingers spread apart.

In today's activity, you will estimate the area of your hand with your fingers together.

1. **Predict** What do you think the area of your hand might be? Record your prediction in square centimeters.

2. **Predict** Do you think the data collected by your class will vary? Give a reason to support your answer.

3. Perform the steps shown at the right.

4. **Compare** Look at the data collected by your class. Was your prediction in Exercise 1 reasonable? Explain.

5. **Choose a Measure** Which statistical measure of the data best describes the area of a typical sixth grader's hand? Explain your reasoning.

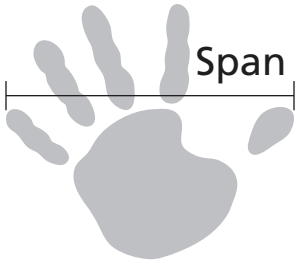
Investigation Steps

- Review the goal of the activity.
- Trace your hand.
- Estimate by counting.
- Record the data you collect.
- With your classmates, make a graphic display of the data.
- Analyze the data.
- Form a conclusion.

8–12
Class Activity

► Informal Measurement Tools and Units

Before the invention of formal measuring tools and standard units of measure, ancient civilizations used informal tools and units, such as spans.



An example of a *span* is the distance across your hand, from the tip of the thumb to the tip of the little finger, with your fingers spread apart as far as possible.

Solve.

6. **Estimate** What is a reasonable estimate in inches of one span of your hand?

_____

7. **Compare** Measure your hand span in inches. Was the estimate you made in Exercise 6 reasonable? Explain.

_____

_____

8. **Predict** What is a reasonable estimate in hand spans of the length and the width of your classroom?

_____

_____

9. **Measure** Using hand spans, measure and record the length and width of your classroom. Were the predictions you made in Exercise 8 reasonable? Explain.

_____

_____

10. **Decide** Do you think using a hand span is a precise way to measure? Explain why or why not.

_____

_____

_____

Unit 8
Review / Test

1. Is the question a statistical question? Select Yes or No for each question.

   a. How many pets do you have in your home? ○ Yes ○ No

   b. How tall are basketball players? ○ Yes ○ No

   c. Who is the tallest 6th grade student? ○ Yes ○ No

   d. How many minutes long is a lunch period in a school? ○ Yes ○ No

   e. How much time do 6th grade students spend doing homework every night? ○ Yes ○ No

2. Choose one number from each column to show the mean and the median of the data set

8, 16, 4, 8, 5, 10, 12, 12, 10, 12, 13

Mean	Median
○ 5	○ 5
○ 8	○ 8
○ 10	○ 10
○ 11.5	○ 11.5
○ 12	○ 12
○ 12.5	○ 12.5

3. Suppose the data in one dot plot are symmetric and the data in a related dot plot are not symmetric. Explain how the dot plots would look different.

4. Why do the quartiles of a set of data divide the data into four equal parts?

Name _____ Date _____

5. Explain why you can think of finding a mean as unleveling and leveling data.

6. Norberto collected the data shown.

21	16	10	6	12	4

a. Calculate the mean. _____

b. Calculate the median. _____

7. Trina's final math grade is the average of five scores—four quarterly tests and a final exam. Her quarterly test scores were 72, 80, 84, and 76. What is the lowest score she can earn on her final exam if her goal is to have an average score of 80?

Choose the correct answer.

a. ○ 80

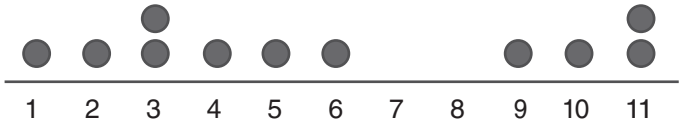
b. ○ 84

c. ○ 88

d. ○ 92

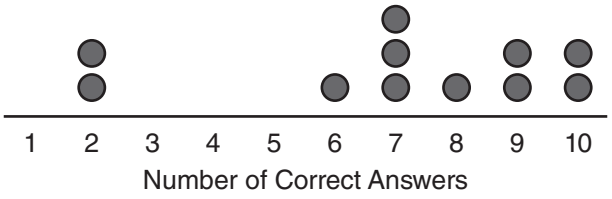
8. Choose a number from the number tiles to show the median, first quartile (Q1) and third quartile (Q3) of the data on the dot plot.

2	3	4	5
6	9	10	11



Median: ☐ Q1: ☐ Q2: ☐

9. The dot plot below shows the number of correct answers a group of students scored on a quiz.



a. Calculate the mean absolute deviation of the data.

b. Consider the shape of the data in the dot plot above. Does the dot plot display a *cluster or clusters* of data? Explain.

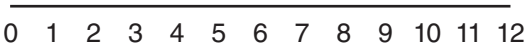
10. Using the dot plot from Problem 9, categorize each data value as a peak or a gap. Not every data value will be used.

1	2	3	4	5	6	7	8	9	10

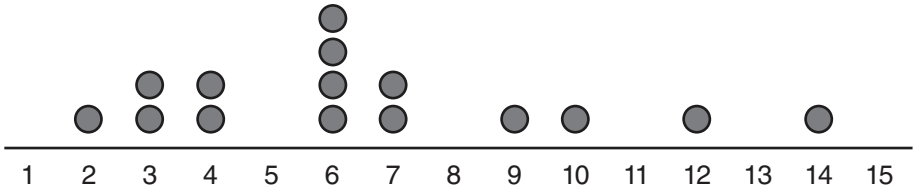
GAP	PEAK

11. Are any of the data values outliers? Explain why or why not.

12. Look back at Problem 9. In the space below, make a box plot display of the data.



13. Calculate the range and interquartile range of the dot plot data.

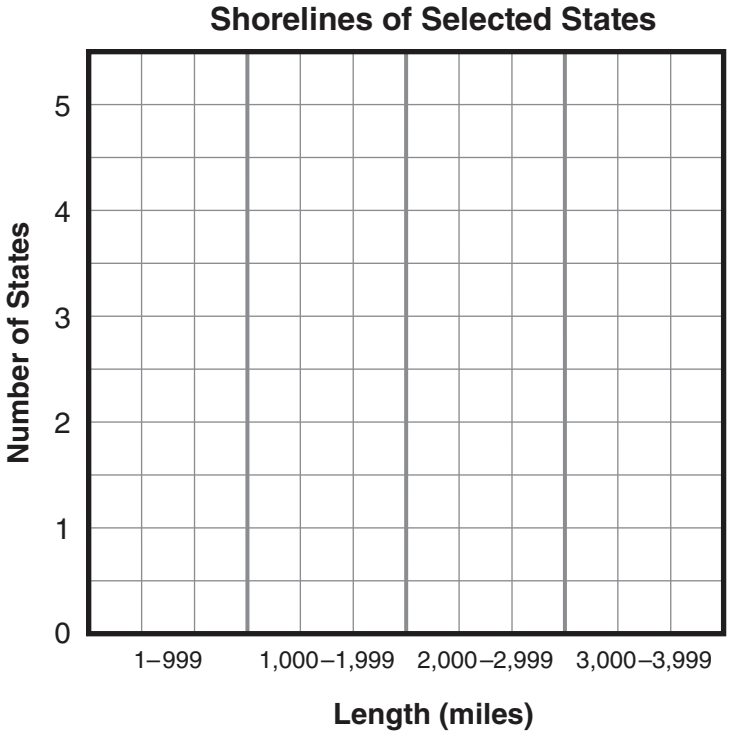


Range: _____ Interquartile range: _____

14. The table below shows the length of the shorelines of various states.

a. On the grid, draw a histogram of the data.

Shorelines of Selected States	
State	**Length (miles)**
Texas	3,359
Rhode Island	384
Georgia	2,344
California	3,427
Hawaii	1,052
Alabama	607
New Jersey	1,792
Maine	3,478
Oregon	1,410
South Carolina	2,876
Connecticut	618
Massachusetts	1,519
Washington	3,026
New York	1,850

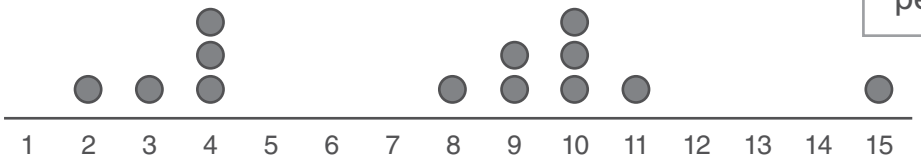


14b. In your histogram for Problem 14a, which length interval has the greatest number of states?

- ○ 1 – 999
- ○ 1,000 – 1,999
- ○ 2,000 – 2,999
- ○ 3,000 – 3,999

15. In the box plot below, the data value at 15 represents a(n) _____.

cluster
gap
outlier
peak



16. Suppose you wanted to investigate the size of a typical sixth grader's foot.

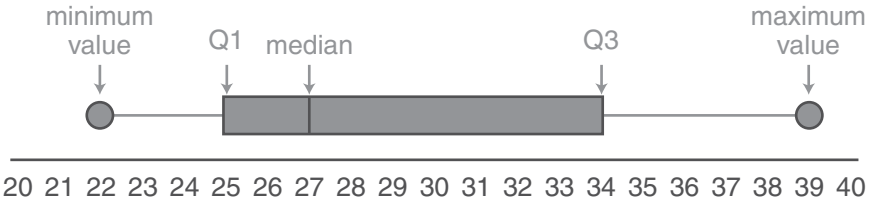
a. What unit of measure would you use?

_____

b. How would you do the measuring?

_____

17. Calculate the range and interquartile range for the data displayed in the box plot.



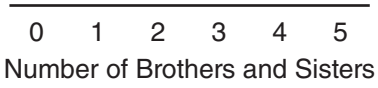
Range: _____ Interquartile range: _____

18. The set of data below shows the number of brothers and sisters each student in a sixth grade class has.

2	0	3	1	5	2	0	4	0	3	2	3	2	1	2

Part A

Make a dot plot to to display the data.



Part B

Interpret the dot plot data.

- How many students does the dot plot represent?

_____

- What does the data value 0 represent?

_____

Part C

Dena calculated these measures for the data:

Mean: 6 Median: 2 Range: 4

Are her calculations correct? If not, calculate the correct measures and explain her error.