

You can find the measures of central tendency of data displayed in a stem-and-leaf plot. The stem-and-leaf plot in the next example is a back-to-back stem-and-leaf plot. The stem is between the two bars, and the leaves are on each side. Leaves are in increasing order from the stems.

5 EXAMPLE Using a Stem-and-Leaf Plot

Find the mean of the city mileage and highway mileage for nine new cars.

New Car Mileage (mi/gal)		
City		Highway
9	1	
9 8 3 3 0	2	7 8
4 1 1	3	0 2 2 7 8 8
	4	1
means 20 mi/gal ← 0		2 7 → means 27 mi/gal

Mean City Mileage: $\frac{19 + 20 + 23 + 23 + 28 + 29 + 31 + 31 + 34}{9} = 26.\bar{4}$ mi/gal

Mean Highway Mileage: $\frac{27 + 28 + 30 + 32 + 32 + 37 + 38 + 38 + 41}{9} = 33.\bar{6}$ mi/gal



- 5 a. Find the median of the city mileage and of the highway mileage.
 b. Find the mode(s) of the city mileage and of the highway mileage.
 c. Find the range of the city mileage and of the highway mileage.

EXERCISES

For more exercises, see *Extra Skill and Word Problem Practice*.

Practice and Problem Solving

A Practice by Example

Example 1
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Find the mean, median, and mode. Which measure of central tendency best describes the data?

- | | |
|---|--|
| 1. weights of textbooks in ounces
12 10 9 15 16 10 | 2. ages of students on math team
14 14 15 15 16 15 15 16 |
| 3. time spent on Internet in min/day
75 38 43 120 65 48 52 | 4. weights of channel catfish in pounds
4.8 5 2.3 4.4 4.8 5.1 |

Example 2
(page 41)

Write and solve an equation to find the value of x .

- | | |
|--|------------------------------------|
| 5. $3.8, 4.2, 5.3, x$; mean 4.8 | 6. 99, 86, 76, 95, x ; mean 91 |
| 7. 100, 121, 105, 113, 108, x ; mean 112 | 8. 31.7, 42.8, 26.4, x ; mean 35 |

Example 3
(page 42)

Find the range.

- | | |
|-------------------------|--|
| 9. 12 15 17 28 30 | 10. 5.3 6.2 3.1 4.8 7.3 |
| 11. -12 -15 5 3 -2 0 -7 | 12. $2\frac{1}{2}$ $3\frac{1}{3}$ $-5\frac{3}{4}$ $\frac{3}{8}$ $3\frac{5}{8}$ |

13. For each list of data, find the range and the mean.

Use the range to compare the spread of the data.

- | | |
|----------------|----------------|
| List 1 | List 2 |
| 64 43 55 28 71 | 48 53 61 47 52 |

Example 4
(page 42)

Make a stem-and-leaf plot for each set of data.

14. 18 35 28 15 36 10 25 22 15 15. 18.6 18.4 17.6 15.7 15.3 17.5
 16. 785 776 788 761 768 768 785 17. 0.8 0.2 1.4 3.5 4.3 4.5 2.6 2.2

Example 5
(page 43)

Find the mean, median, mode, and range of each side of the stem-and-leaf plot.


18. **Time Spent on Homework (minutes/day)**
- | Class A | Class B |
|-------------|-----------------|
| 6 6 4 3 | 4 1 1 4 5 7 |
| 9 8 6 4 4 4 | 5 0 2 2 2 4 |
| 5 2 1 0 | 6 4 5 8 9 |
| 8 7 6 6 4 2 | 7 3 6 7 9 9 9 |
- means $43 \leftarrow 3 \mid 4 \mid 1 \rightarrow$ means 41
19. **Growth of Two Varieties of Tulip Plants (inches/day)**
- | Type A | Type B |
|---------|-----------|
| 6 3 3 | 2 |
| 3 2 1 1 | 3 1 1 2 |
| 1 | 4 3 5 8 |
| | 5 2 4 |
- means $0.33 \leftarrow 3 \mid 3 \mid 1 \rightarrow$ means 0.31

B Apply Your Skills

Find the mean, median, mode, and range.

20. 9.8 7.2 6.3 8.7 5.8 9.4 5.1 6.2
 21. 3 -12 -1 -7 -2 0 -5 -1 -4 -2
 22. 42.1 46.4 58.2 67.3 49.1 40.2 22.3 46.6


23. **Critical Thinking** The mean of a set of data is 7.8, the mode is 6.6, and the median is 6.8. What is the least possible number of data values? Explain.

 24. **Wildlife Management** A wildlife manager working at the Everglades National Park in Florida measured and tagged adult male crocodiles. The data he collected are at the right.

Crocodile Lengths (meters)

2.4	2.5	2.5	2.3
2.8	2.4	2.3	2.4
2.1	2.2	2.5	2.7

- a. What are the mean and median lengths of the crocodiles?
 b. The wildlife manager captured another crocodile. Its length was 3.3 m. What is the mean with this new piece of data? What is the median? Round to the nearest tenth.

 25. **Manufacturing** Two manufacturing plants create sheets of steel for medical instruments. The back-to-back stem-and-leaf plot at the right shows data collected from the two plants.

Width of Steel (millimeters)


Manufacturing Plant A	Manufacturing Plant B
-----------------------	-----------------------


	4 3 5 9
8 7 4 4 2	5 2 7
4 3 1	6 3 4
	7 2

- a. Find the mean, median, mode, and range of each set of data.
 b. Which measure of central tendency best describes each set of data? Explain.
 c. **Reasoning** Which plant has the better quality control? Explain.

means $6.1 \leftarrow 1 \mid 6 \mid 3 \rightarrow$ means 6.3

26. **Open-Ended** Give an example of a set of data for which the mode best represents the data. Explain.

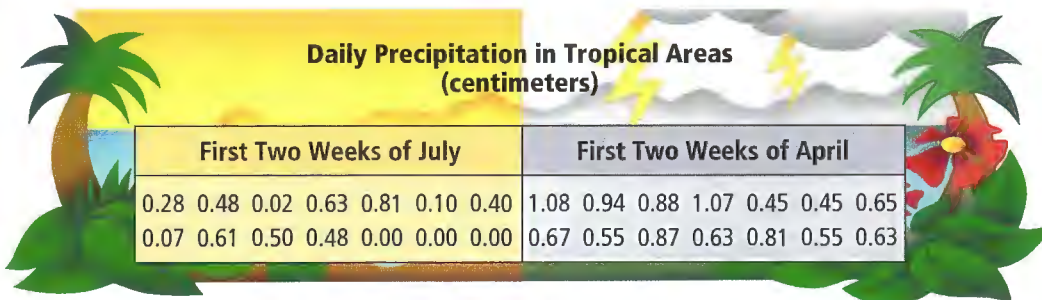
 27. **Sports** The median height of the 21 players on a girls' soccer team is 5 ft 7 in. What is the greatest possible number of girls who are less than 5 ft 7 in. tall?

 28. **Writing** How does an outlier affect the mean of a set of data?

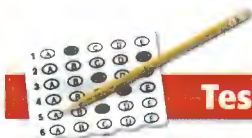


C Challenge

29. Make a back-to-back stem-and-leaf plot of the data below.



30. **Data Collection** Record the high and low temperatures in your town for one week. Make a back-to-back stem-and-leaf plot with the data you collect.
31. During the first 6 hours of a trip, you average 44 mi/h. During the last 4 hours of your trip, you average 50 mi/h. What is your average speed for the whole trip? (*Hint:* First find the total number of miles traveled.)



Test Prep

Multiple Choice

32. You have a mean score of 84 after taking five 100-point tests. What do you need to score on the sixth 100-point test to have a mean score of 85?
A. 85 **B.** 89 **C.** 90 **D.** 92

33. The average speeds of the winners of the Daytona 500 from 1999 to 2004 are listed at the right. What is the mean of the given speeds, rounded to the nearest tenth?
F. 158.6 mi/h **G.** 153.4 mi/h
H. 156.1 mi/h **J.** 151.9 mi/h

Daytona 500

Year	Average Speed
1999	161.6 mi/h
2000	155.9 mi/h
2001	161.7 mi/h
2002	142.0 mi/h
2003	133.9 mi/h
2004	156.3 mi/h

SOURCE: 2005 Sports Almanac

34. Find the sum of the mean, the median, and the mode of the following data:
 22, 18, 17, 18, 25, 24, 24, 18, 29, 23.
A. 58.75 **C.** 60.25
B. 59.5 **D.** 62.3

35. The average low temperature for a 4-day period in January for the city of Orlando, Florida, was 58°F. After the fifth day, the 5-day average was 59°F. What was the low temperature on the fifth day?
F. 59°F **G.** 60°F **H.** 61.5°F **J.** 63°F

Mixed Review



Lesson 1-6

Find the mean, median, mode, and range for each set of data.

36. 1.1, 1.4, 2.2, 1.3, 2.5 37. 73, 68, 79, 86, 98, 92

Lesson 1-2

Evaluate each expression. Use $a = 4$, $b = 2$, and $c = 1$.

38. $3a^2 + (b - c)$ 39. $-\frac{4a + b}{2}$

Measures of Central Tendency and Linear Transformations

FOR USE WITH LESSON 1-6

When you add, subtract, multiply, or divide each data item of a data set by the same amount, the mean, median, and mode are changed by the same magnitude.

Day	1	2	3	4	5	6	7
Minutes	20	20	20	30	41	50	50



A.S.16

Recognize how linear transformations of one-variable data affect the data's mean, median, mode, and range.

EXAMPLE

During the first week of training, an athlete records the time spent on a treadmill each day. The results are shown in the table above.

- a. Find the mean, median, and mode of the data.

$$\text{mean} = \frac{20 + 20 + 20 + 30 + 41 + 50 + 50}{7} = 33 \quad \text{median} = 30 \quad \text{mode} = 20$$

- b. The athlete spends 15 minutes more each day during the second week of training. Find the mean, median, and mode for the second week.

$$\text{mean} = 33 + 15 = 48$$

$$\text{median} = 30 + 15 = 45 \quad \text{Add 15 to each measure of central tendency.}$$

$$\text{mode} = 20 + 15 = 35$$

- c. During the third week of training, the athlete doubles the amount of time spent each day of the first week. Find the mean, median, and mode for the third week.

$$\text{mean} = 33(2) = 66$$

$$\text{median} = 30(2) = 60 \quad \text{Multiply each measure of central tendency by 2.}$$

$$\text{mode} = 20(2) = 40$$

EXERCISES

For Exercises 1–5, find the mean, median, and mode of each data set.

- A pump operator controls the flow of water as indicated in the table.
- Each data value in the table is increased by 7 gallons per minute.
- Each data value in the table is decreased by 5 gallons per minute.
- Each data value in the table is tripled.
- Each data value in the table is divided by two.
- Critical Thinking** Examine the effect of linear transformations on the *range* of a data set. How are addition and subtraction different from multiplication and division?
- Writing in Math** Explain how to use linear transformations to predict the mean, median, mode, and range of the heights of your classmates. Suppose each person in your class grows 2 inches in the next year.
- Data Collection** Survey 10 people to find the mean, median, mode, and range of the number of pencils they have in class. Suppose each person has twice as many pencils tomorrow. Use linear transformations to find the same measures.

Pipe Flow Data

Time	Gallons per Minute
12:00–12:15	20
12:15–12:30	25
12:30–12:45	25
12:45–1:00	45
1:00–1:15	55
1:15–1:30	30
1:30–1:45	10