IM 9–12 MATH v.1

Unit 1
Sequences and Functions

ALGEBRA 1

Lesson 12

Standard Deviation

Illustrative Mathematics®

Kendall Hunt

Learning Goal

Let's learn about standard deviation, another measure of variability.

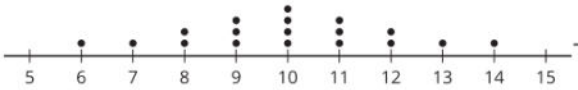
Algebra 1

Measuring Variability

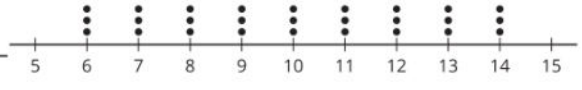
Warm-up: Notice and Wonder

What do you notice? What do you wonder?

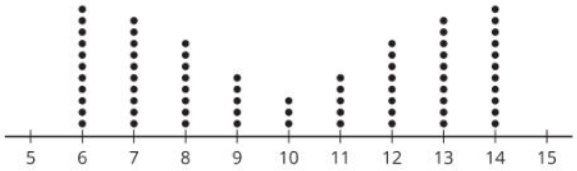
mean: 10, MAD: 1.56, standard deviation: 2



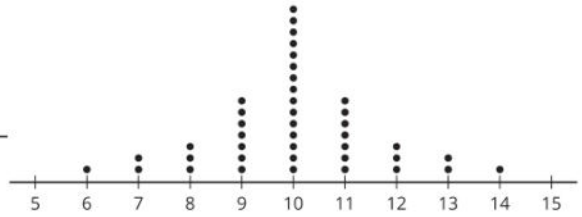
mean: 10, MAD: 2.22, standard deviation: 2.58



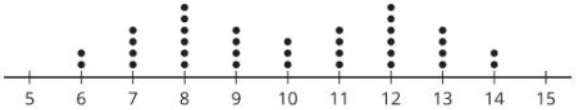
mean: 10, MAD: 2.68, standard deviation: 2.92



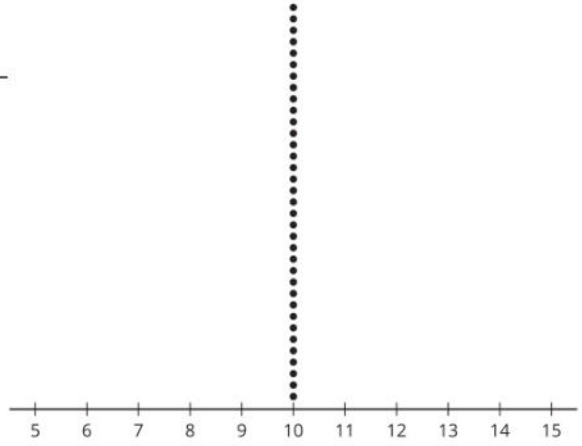
mean: 10, MAD: 1.12, standard deviation: 1.61



mean: 10, MAD: 2.06, standard deviation: 2.34



mean: 10, MAD: 0, standard deviation: 0



Investigating Standard Deviation

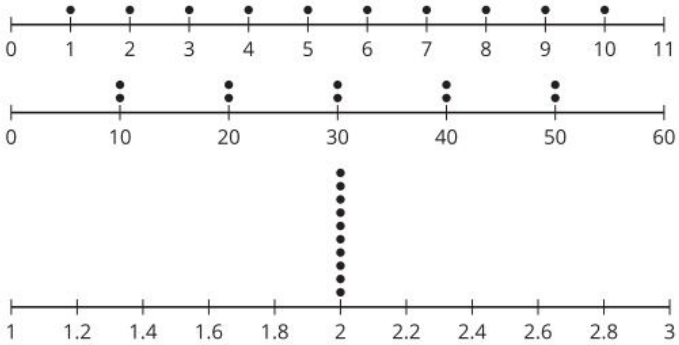
Use technology to find the mean and the standard deviation for the data in the dot plots.

1. What do you notice about the mean and standard deviation you and your partner found for the three dot plots?
2. Invent some data that fits the conditions. Be prepared to share your data set and reasoning for choice of values.

Investigating Standard Deviation

Partner 1

Dot plots:

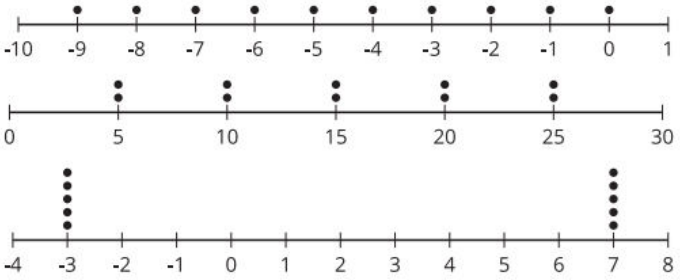


Conditions:

- 10 numbers with a standard deviation equal to the standard deviation of your first dot plot with a mean of 6.
- 10 numbers with a standard deviation three times greater than the data in the first row.
- 10 different numbers with a standard deviation as close to 2 as you can get in 1 minute.

Partner 2

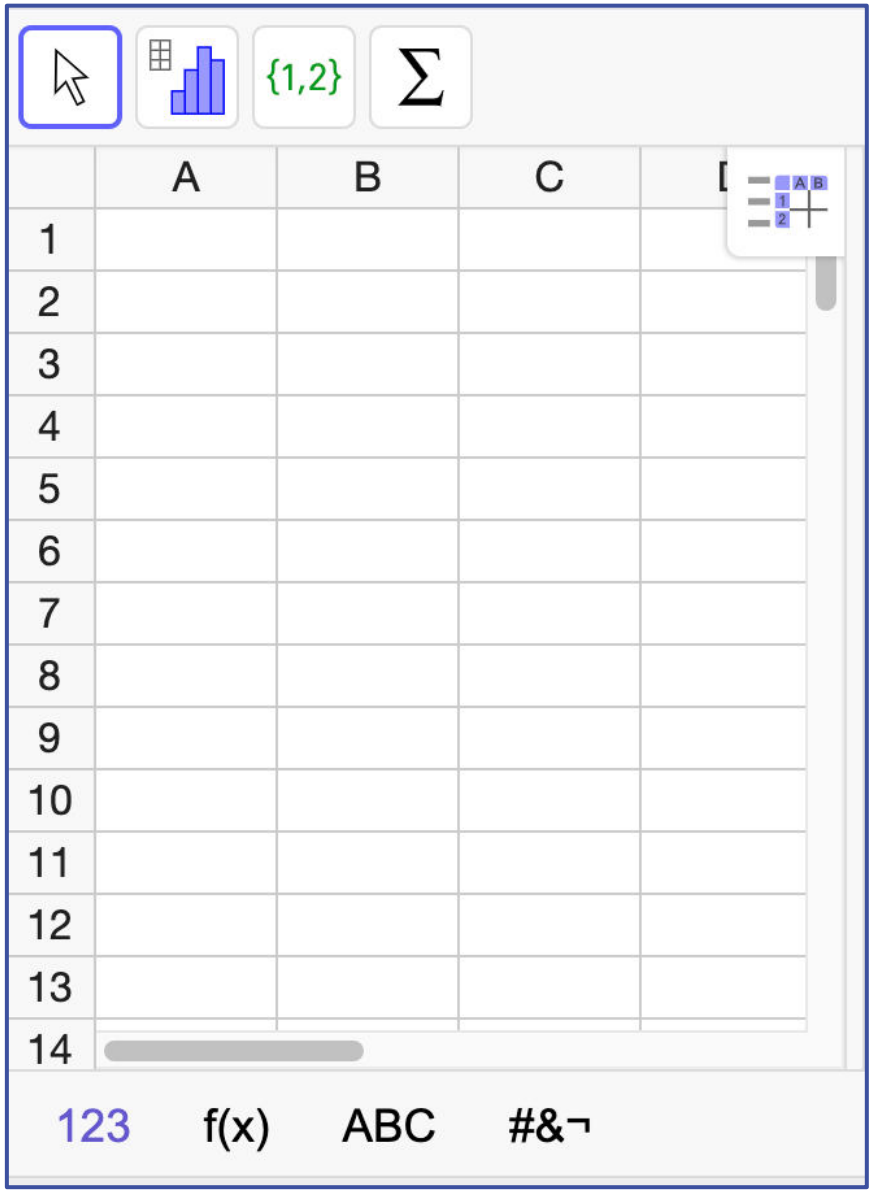
Dot plots:



Conditions:

- 10 numbers with a standard deviation equal to the standard deviation of your first dot plot with a mean of 12.
- 10 numbers with a standard deviation four times greater than the data in the first row.
- 10 different numbers with a standard deviation as close to 2 as you can get in 1 minute.

Investigating Standard Deviation



Investigating Standard Deviation

- What do you think that standard deviation measures? Why do you think that?
- Why is the standard deviation the same for {1,2,3,4,5} and {-2,-1,0,1,2}?
- Why is the standard deviation different for {-4, -2, 0, 2, 4} and {-4, -3, -2, -1, 0}?
- When is the standard deviation equal to zero?
- Was your mean the same as your partner's mean in the fifth match?
- How did using technology help or hinder your mathematical thinking about standard deviation and mean?

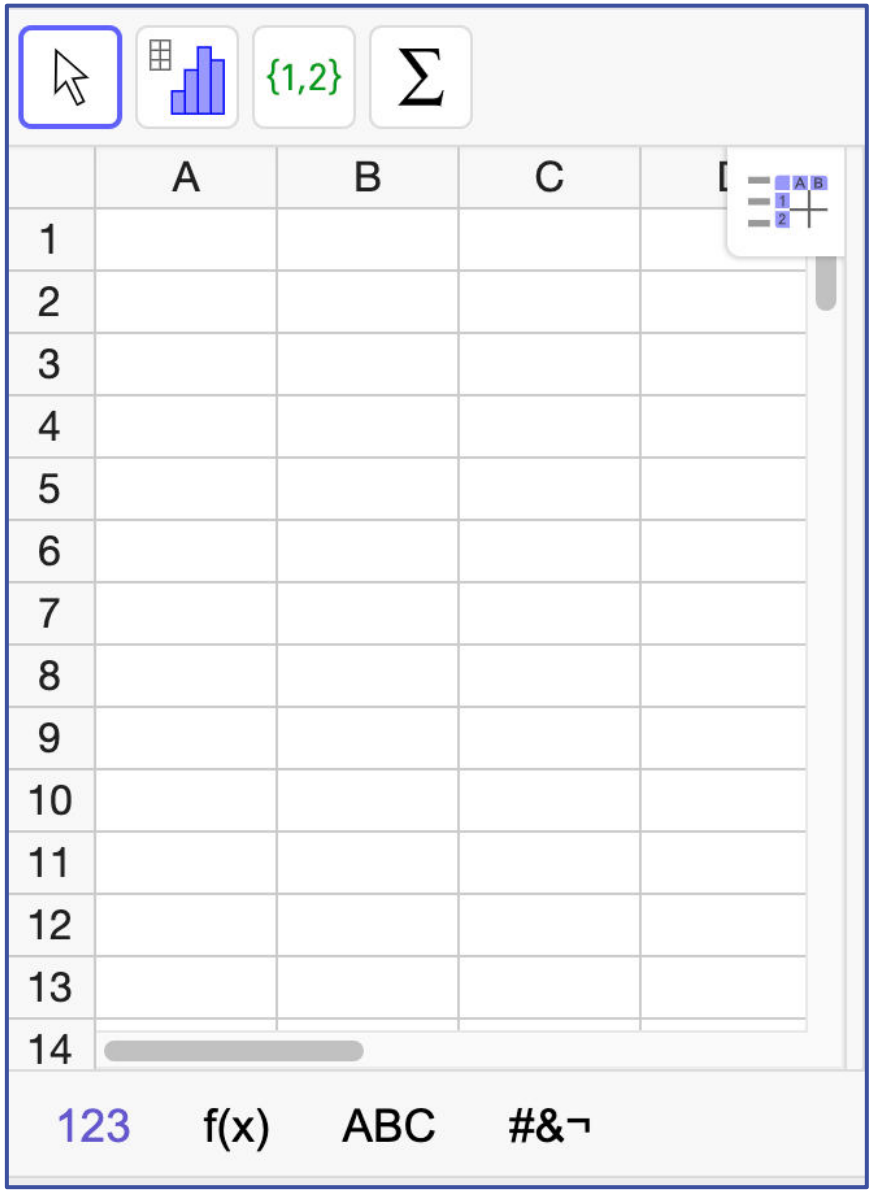
Investigating Variability

Begin with the data:

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20

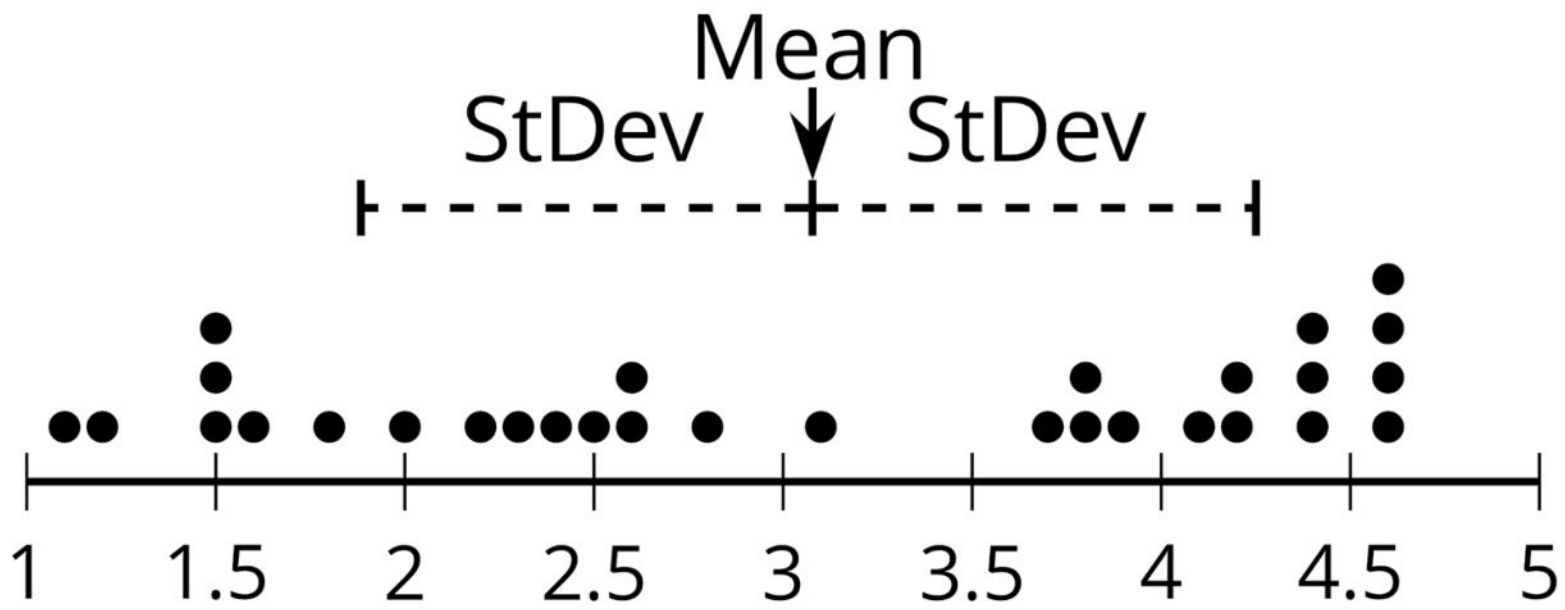
1. Use technology to find the mean, standard deviation, median, and interquartile range.
2. How do the standard deviation and mean change when you remove the greatest value from the data set? How do they change if you add a value to the data set that is twice the greatest value?
3. What do you predict will happen to the standard deviation and mean when you remove the least value from the data set? Check to see if your prediction was correct.
4. What happens to the standard deviation and mean when you add a value to the data set equal to the mean? Add a second value equal to the mean. What happens?
5. Add, change, and remove values from the data set to answer the question: What appears to change more easily, the standard deviation or the interquartile range? Explain your reasoning.

Investigating Variability



Investigating Variability

- Standard deviation: A measure of variability often used with mean that describes the spread of the data. It is a more mathematically useful measure of variability than MAD.
- The MAD already included in the example display is approximately 1.09 and the standard deviation is 1.194.



Investigating Variability

- What does the standard deviation measure? How do you know?
- The standard deviation is calculated using the mean, do you think it is more appropriate to use with symmetric or skewed data sets?

Standard Deviation

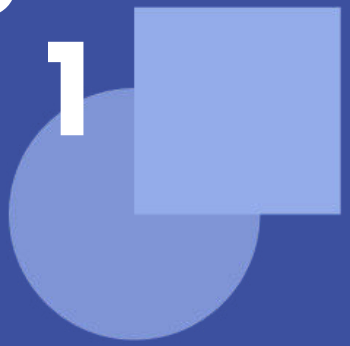
Lesson Synthesis

- How does standard deviation compare and contrast with MAD and IQR?
- One data set has a standard deviation of 5 and another data set has a standard deviation of 10. What does this tell you about the distribution of each data set?

- I can describe standard deviation as a measure of variability.
- I can use technology to compute standard deviation.

Learning Targets

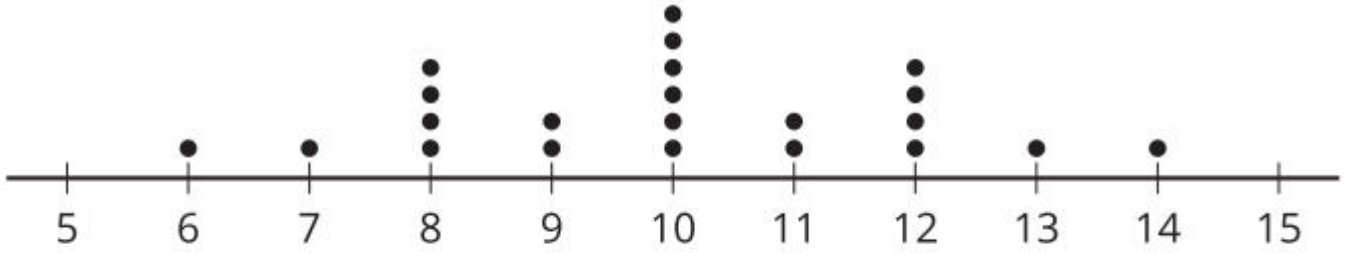
Algebra 1



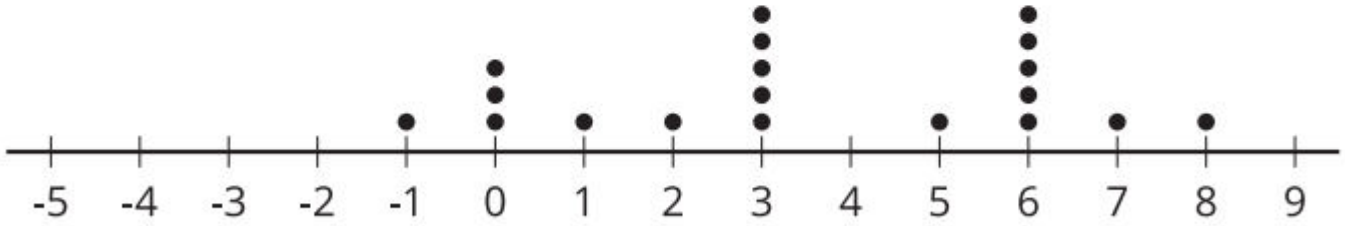
True or False: Reasoning with Standard Deviation

Cool-down

The low temperature in degrees Celsius for some cities on the same days in March are recorded in the dot plots.



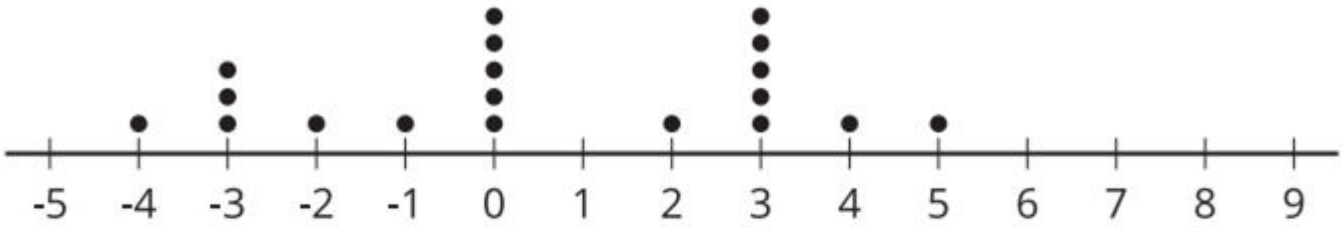
Christchurch, NZ low temperatures (°C)



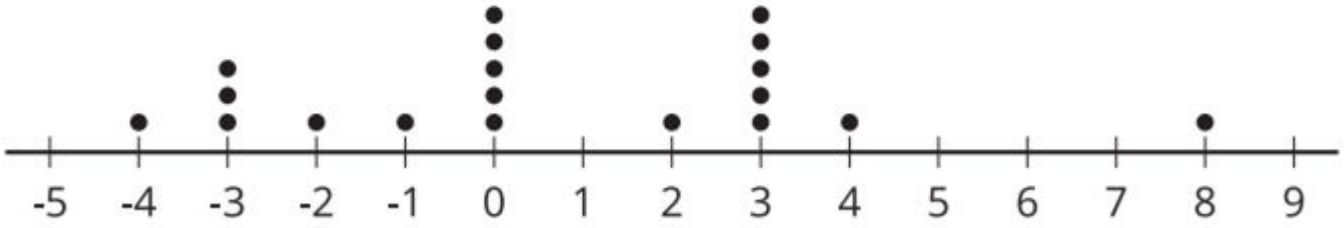
St. Louis, MO low temperatures (°C)

True or False: Reasoning with Standard Deviation

Cool-down



Chicago, IL low temperatures (°C)



London, UK low temperatures (°C)

Decide if each statement is true or false. Explain your reasoning.

1. The standard deviation of Christchurch's temperatures is zero because the data is symmetric.
2. The standard deviation of St. Louis's temperatures is equal to the standard deviation of Chicago's temperatures.
3. The standard deviation of Chicago's temperatures is less than the standard deviation of London's temperatures.

standard deviation

A measure of the variability, or spread, of a distribution, calculated by a method similar to the method for calculating the MAD (mean absolute deviation). The exact method is studied in more advanced courses.

statistic

A quantity that is calculated from sample data, such as mean, median, or MAD (mean absolute deviation).