



# Helping With Math

## Solving Measures of Variability



**GRADE 6**



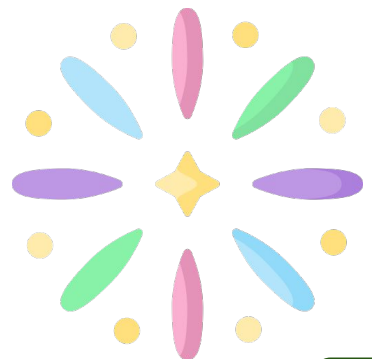
Measures of variability is the calculation of the amount of dispersion of the scores/values around the mean, median, or mode. Variability can also be mathematically associated with the terms spread, consistency, and scatter.

### The commonly used measures of variability are:

- Range (R)
- Interquartile range (IQR)
- Mean absolute deviation (MAD)

Can you calculate the value of R, IQR, and MAD from this given set of data?

*10, 12, 8, 9, 20, 16, 18, 21, 25, 30, 8*



# RANGE



## Range (R)

- It is the easiest and simplest measure of variation.
- To compute for the range, just simply get the difference between the highest value and the lowest value. In symbol,

$$R = HV - LV$$

## Example:

What is the range of this set of data:  
10, 12, 8, 9, 20, 16, 18, 21, 25, 30, 8 ?

## Solution:

1. Identify the highest and lowest value of the distribution.

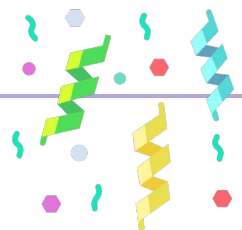
$$HV = 25 \quad LV = 8$$

2. Get the difference of HV and LV

$$R = HV - LV = 25 - 8$$

$$R = 17$$

The computed range of the distribution is 17.

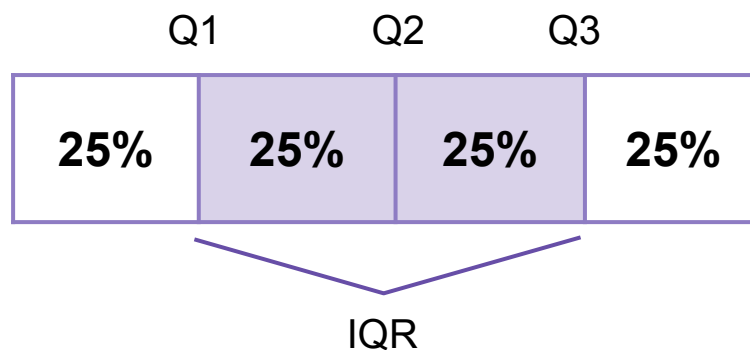




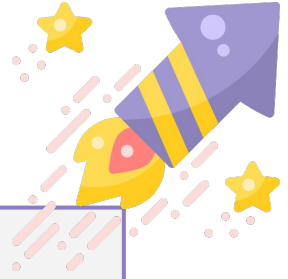
## Interquartile Range (IQR)

- It is the range of values of the variable in a statistical distribution that lies between the upper and lower quartiles.
- It is a measure of variability that is based on dividing a data set into quartiles.
  - **Quartiles** divide a rank-ordered data set into **four equal parts**. The values that divide each part are called the first, second, and third quartiles; and they are denoted by Q1, Q2, and Q3, respectively.
  - Q1 is the "middle" value in the first half of the rank-ordered data set.
  - Q2 is the median value in the set.
  - Q3 is the "middle" value in the second half of the rank-ordered data set.
- The interquartile range is equal to Q3 minus Q1. In symbols,

$$\text{IQR} = \text{Q3} - \text{Q1}$$



## INTERQUARTILE RANGE



### Example:

What is the IQR of this set of data:  
10, 12, 8, 9, 20, 16, 18, 21, 25, 30, 8 ?

### Solution:

1. Arrange the values in ascending order. (  $n = 11$  )

8    8    9    10    12    16    18    20    21    25    30

2. Locate Q1 and Q3

$$Q_1 = \left( \frac{n+1}{4} \right)^{th} \text{ Term}$$

$$Q_2 = \left( \frac{n+1}{2} \right)^{th} \text{ Term}$$

$$Q_3 = \left( \frac{3(n+1)}{4} \right)^{th} \text{ Term}$$

$$Q_1 = \frac{(11+1)}{4}$$

$$Q_3 = \frac{3(11+1)}{4}$$

$$Q_1 = \frac{(12)}{4}$$

$$Q_3 = \frac{3(12)}{4}$$

$$Q_1 = 3\text{rd term}$$

$$Q_3 = 9\text{th term}$$

$$Q_1 = 9$$

$$Q_3 = 21$$

3. Solve for IQR.

$$\text{IQR} = Q_3 - Q_1 = 21 - 9. \text{ Thus, IQR} = 12.$$



## MEAN ABSOLUTE DEVIATION

### Mean Absolute Deviation (MAD)

- It is the average distance of all scores/values away from the mean.
- It determines how scatter/spread out the values in a given set of data are.



### Example:

What is the MAD of this set of data:  
10, 12, 8, 9, 20, 16, 18, 21, 25, 30, 8 ?

### Solution:

1. Find the mean of the distribution.  
 $10 + 12 + 8 + 9 + 20 + 16 + 18 + 21 + 25 + 30 + 8 = 177$   
 $177 \div 11 = 16.09$ . Thus, the mean is 16.09.
2. Find the absolute deviations by getting the difference of the computed mean and each score/value.

$$|10 - 16.09| = 6.09$$

$$|18 - 16.09| = 2.09$$

$$|12 - 16.09| = 4.09$$

$$|21 - 16.09| = 4.91$$

$$|8 - 16.09| = 8.09$$

$$|25 - 16.09| = 8.91$$

$$|9 - 16.09| = 7.09$$

$$|30 - 16.09| = 13.91$$

$$|20 - 16.09| = 3.91$$

$$|8 - 16.09| = 8.09$$

$$|16 - 16.09| = 0.09$$



## MEAN ABSOLUTE DEVIATION

3. Find the mean of all the deviations.

$$6.09 + 2.09 + 4.09 + 4.91 + 8.09 + 8.91 \\ + 7.09 + 13.91 + 3.91 + 8.09 + 0.09$$

$$67.27 \div 11 = 6.11. \text{ Thus, the MAD is } 6.12.$$

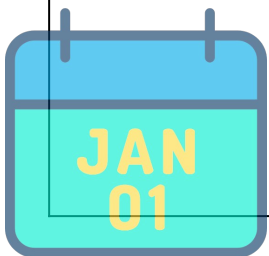
*This means that the average distance of all scores away from the mean is approximately 6.12 units.*

### Independent Practice:

Solve for the range, IQR, and MAD of this set of data:

25, 40, 30, 19, 21, 18, 30, 22, 15, 17

Range	IQR	MAD



# TABLE OF ACTIVITIES

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# NEW YEAR'S EVE THOUGHTS

Today is New Year's Eve but James has a lot of things in mind. Help him sort out his thoughts about measures of variability by answering the following questions below.

1. This measure of variation is the difference of the lowest value and highest value in the distribution.

2. It refers to the "middle" value in the second half of the rank-ordered data set.

3. It is the average distance of all scores/values away from the mean.

4. It is a measure of variability that is based on dividing a data set into quartiles.

Essay. Compare and contrast measures of central tendency and measures of variability.

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# NEW YEAR'S COUNTDOWN

Don't miss the chance to solve these problems about range once the New Year's countdown begins.



1. Clark tells you that the range of the distribution: 14, 19, 20, 18, 20, 17, 25, 10, 13 is 15. Is he correct? Justify your answer.

2. You are asked to compute for the range of the given distribution below. What must be your answer?

110 98 78 90 102 105 80 97 100 75

3. The range of a certain distribution is 24. 75. If the lowest value is 19.3, what is the highest value?

4. The range of a certain distribution is 15. What is the lowest value is the value of the highest score is 90?



# A MAGICAL CELEBRATION

A magical celebration of the upcoming new year is perfect with these questions about IQR. Don't forget to show your solutions!

1. Given below is the height, in cm, of ten randomly selected people who attended the year-end celebration. Compute for Q1, Q2, Q3, and IQR.

180 175 190 159 162 190 172 181 184 160

2. Compute for the IQR of these data collected from the 12 randomly selected people about their daily savings.

60 90 100 150 50 50 100 150 85 85 80 35



# CLASS REUNION

Because of the year-end holiday, class reunion is on our way! Help them recall their understanding of MAD by answering these problems.

1. Arrange the steps in solving MAD by writing numbers 1,2, and 3 on the box.

	Find the mean of the distribution.
	Get the sum of all the deviations.
	Find the absolute deviations.

2. Explain the concept of MAD in your own words.

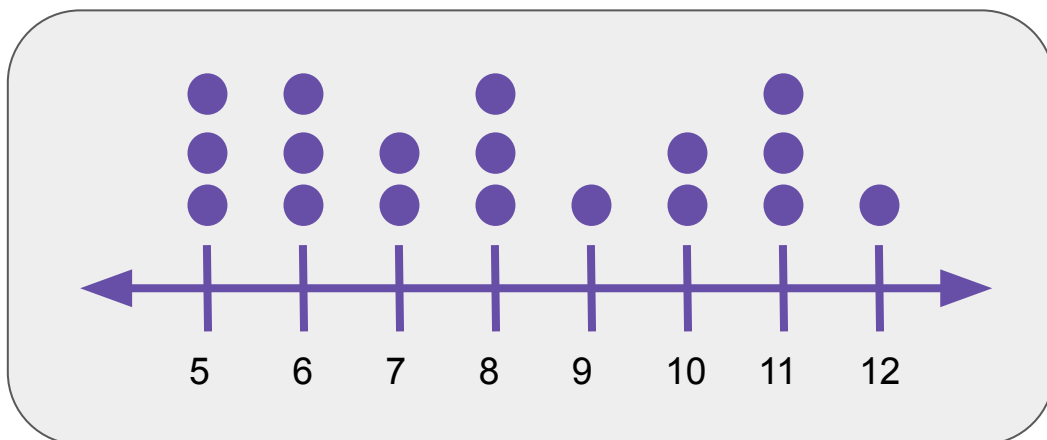
3. Find the MAD of the distribution: 38 45 50 51 39 50

4. Compute for the MAD: 18 13 15 19 20 21 22

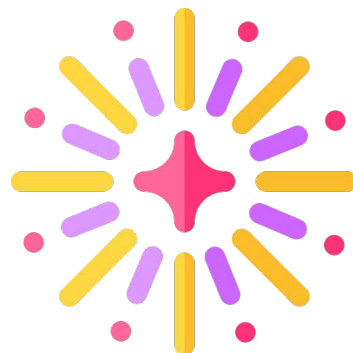


# FIREWORKS BOOM

Who are not fascinated with fireworks? Before enjoying the fireworks, solve the following measures of variation.



1. What is the range of the dot plot above?
2. What is the value of the mean of the distribution?
3. Compute for the Q1, Q2, Q3, and IQR.

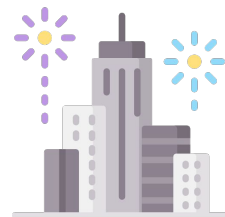


# CITY PYRO DISPLAY

An annual pyro display is about to start! Examine and answer the following questions then write the letter of your answer on the space provided before each number.

\_\_\_\_ 1. Calculate the interquartile range of the following data 17, 18, 18, 19, 20, 21, 21, 23, 25

Solution:



- A. 3                      B. 5                      C. 4                      D. 8

\_\_\_\_ 2. What is the Q3 of this data set? 37 42 48 51 52 53 54 54 55

Solution:



- A. 45                      B. 54                      C. 52                      D. 51

\_\_\_\_ 3. Ace bowled 7 games last weekend. His scores are: 155, 165, 138, 172, 127, 193, 142. What is the range of Acer's scores?

Solution:



- A. 193                      B. 127                      C. 60                      D. 55



# LAST DAY OF DECEMBER

Before the year ends, let's try to solve these word problems about measures of variation.

1. A distribution has the following scores:

11	13	9	15	20	21
13	10	19	19	23	20

Compute for its MAD.

2. Another set of data has the following scores:

40	38	29	35	38	40
36	39	34	40	41	42

Compute for its MAD.

3. Based on your answers from the two previous numbers, which distribution is more consistent? Why?



# HELLO JANUARY 1ST

Start our new year with some significant comparisons. Compare these two sets of data in terms of its measures of variation. Afterwards, answer the questions that follow.

Compute for the MAD of these two distributions.

Set A: 7 6 8 7 5 7 6 8 7 7

Set B: 9 10 13 15 9 11 15 19 22 30

MAD of Set A

MAD of Set B



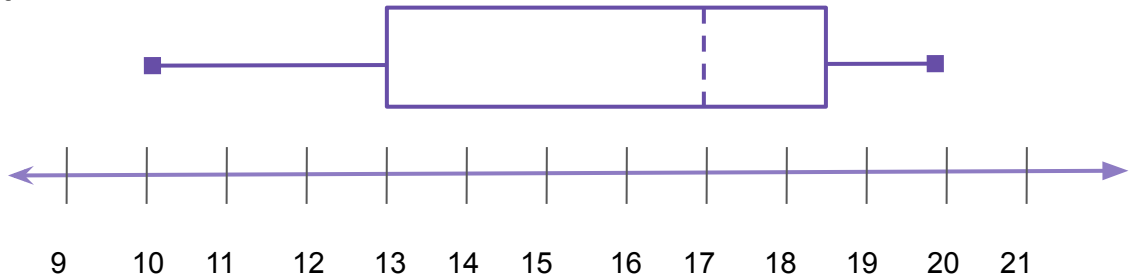
Examine the scores in each set. How will you describe the given scores of both sets? Compare their MAD. Formulate a conclusion regarding the relationship of the characteristics of the scores and the computed value of MAD.



# NEW YEAR'S EVE ERRANDS

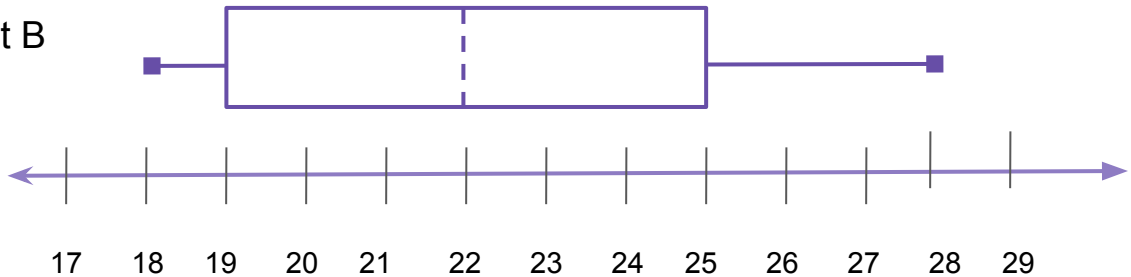
Help John complete his errands by accomplishing these tasks correctly using box plots.

Set A



1. Compute for the Range, Q1, Q2, Q3 and IQR.

Set B



1. Compute for the Range, Q1, Q2, Q3 and IQR.





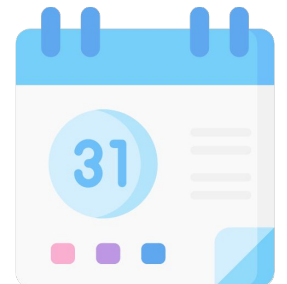
# NEW YEAR'S RESOLUTION

Elijah's new year's resolution is to perfect all his quizzes for this year. Help him to achieve his goal!

100 95 90 89 96 79 90 91 88 80 89 100  
96 95 95 95 90 90 90 93 92 91 85 90

Range	IQR	MAD

In terms of the computed value of MAD, is the distribution scattered or not? Why?



# ANSWER GUIDE

## Activity 1

1. Range
2. 3rd quartile/Q3
3. Mean absolute deviation
4. Interquartile Range

Essay: Possible answer: measures of central tendency aims to get the center value of the distribution while measures of variation aims to know how spread/scatter a distribution is.

## Activity 2

1. Yes, Clark is correct because the lowest value is 10 while the highest value is 25.  $R = 25 - 10 = 15$ .
2.  $R = 110 - 75 = 35$
3.  $R = HV - LV$                        $24.75 = HV - 19.3$   
 $HV = 24.75 + 19.3$                        $HV = 44.05$
4.  $R = HV - LV$                        $15 = 90 - LV$   
 $LV = 90 - 15 = 75$

## Activity 3

1.  $Q1 = 162$                        $Q2 = 177.5$                        $Q3 = 184$                        $IQR = 22$
2.  $IQR = Q3 - Q1$                        $IQR = 184 - 139 = 45$

## Activity 4

1. 1, 3, 2
2. Possible answer: the average of scores' distance from the mean
3.  $MAD = 4.83$
4.  $MAD = 2.54$



# ANSWER GUIDE

## Activity 5

1.  $R = 12 - 5 = 7$

2. Mean = 8.06

3.  $Q1 = 6, Q2 = 8, Q3 = 10, IQR = 4$

## Activity 6

1. C

2. B

3. D

## Activity 7

1. MAD = 4.25

2. MAD = 2.77

3. Based on the answers, the more consistent distribution is the second set because it has a lesser value.

## Activity 8

1. MAD = 0.68

2. MAD = 5.02

3. The scores of set A are not too far away from each other unlike in Set B where 30 and 9 are too far from each other. If the scores are more scattered, the MAD is larger.

## Activity 9

1.  $Q1 = 13, Q2 = 17, Q3 = 18.5, IQR = 18.5 - 13 = 5.5$

2.  $R = 28 - 18 = 10, Q1 = 19, Q2 = 22, Q3 = 25, IQR = 25 - 19 = 6$

## Activity 10

1.  $R = 100 - 79 = 21$

$IQR = 5.5$

$MAD = 3.74$

2. The distribution is not that scattered at all since the MAD is just 3.74.



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