6th Basic

7th Advanced

Helping With Math

USA GRADES

Measures of Variability

Suitable for students **aged 10-12**

This pack is suitable for learners aged 10-12 years old or 6th to 7th graders (USA). The content covers fact files and relevant basic and advanced activities involving measures of variability.

- 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.

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

The commonly used measures of variability are:

- Range (R)
- Interquartile range (IQR)
- Mean absolute deviation (MAD)
- Standard Deviation (SD)
- Variance (V)

THE DIFFERENT MEASURES OF VARIABILITY

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 LV = 8

2. Get the difference of HV and LV

   R = HV - LV = 25 -8

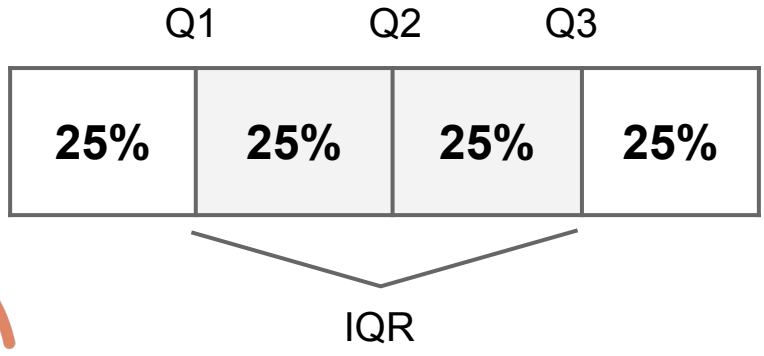
   R = 17

   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,

$$IQR = Q3 - Q1$$



THE DIFFERENT MEASURES OF VARIABILITY

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

$$Q_1 = \left(\frac{n+1}{4}\right)^{th} Term \qquad Q_2 = \left(\frac{n+1}{2}\right)^{th} Term \qquad Q_3 = \left(\frac{3(n+1)}{4}\right)^{th} Term$$

$$Q1 = \frac{(11 + 1)}{4} \qquad Q3 = \frac{3(11 + 1)}{4}$$

$$Q1 = \frac{(12)}{4} \qquad Q3 = \frac{3\ (12)}{4}$$

Q1 = 3rd term Q3 = 9th term

Q1 = 9 Q3 = 21

3. Solve for IQR.

   IQR = Q3 - Q1 = 21 - 9. Thus, IQR = 12.

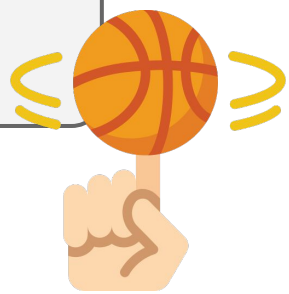
THE DIFFERENT MEASURES OF VARIABILITY

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.

$\lvert 10 - 16.09 \rvert = 6.09$	$\lvert 18 - 16.09 \rvert = 2.09$
$\lvert 12 - 16.09 \rvert = 4.09$	$\lvert 21 - 16.09 \rvert = 4.91$
$\lvert 8 - 16.09 \rvert = 8.09$	$\lvert 25 - 16.09 \rvert = 8.91$
$\lvert 9 - 16.09 \rvert = 7.09$	$\lvert 30 - 16.09 \rvert = 13.91$
$\lvert 20 - 16.09 \rvert = 3.91$	$\lvert 8 - 16.09 \rvert = 8.09$
$\lvert 16 - 16.09 \rvert = 0.09$	

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 ÷ 11 = 6.11. 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

THE DIFFERENT MEASURES OF VARIABILITY

Standard Deviation

Standard Deviation is the most important measure of variability. It differentiates the scores with equal averages.

Variance

Variance is the measure of how widely spread the data is.

We compute the standard deviation and variance to know how far from the mean or from the “normal value” the values are. To compute for the standard deviation and variance, we have these steps to follow:

1. First, we compute for the mean score of each data. Mean score is simply the average value of the numbers or data given.
2. Next, we subtract the numbers in each score from the computed mean.
3. We square each value obtained from step 2.
4. After getting the squared value of each number, we now find the mean or average of these numbers. The value we get from here is the variance.
5. To get the standard deviation, we simply get the square root of the variance.

You measured how large each balloon you inflated before giving it to all your friends who attended your birthday party. You found out that their sizes are 6, 7, 6, 9, 8 and 7 meters each. Find the standard deviation and the variance of the balloons.

TABLE OF ACTIVITIES

BASKETBALL JERSEY

G6 Basic

Basketball jersey serves as team identification. Given the description below, identify each given.

1. These are statistical procedures to describe how spread out the data is.

2. It is used to calculate the average deviation from the mean value of the given data set.

3. It is the difference between the highest value and the lowest value is found.

4. It is the expected value of the squared variation from its mean value.

5. It is the square root of the variance.

6. It is the value you will get if there is no variation.

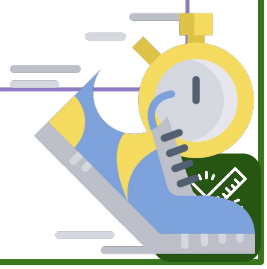
BASKETBALL SPRINT

G6 Basic

Read and analyze each statement below. Write T if the statement is correct otherwise replace the underlined word to correct it. In every valid statement, Michael has to make a 5-meter sprint.

1. Measures of variability is also called the measures of dispersion.
2. Range, standard deviation and variance are the measures of variability.
3. The range of the data set 18, 24, 15, 25, 21, 16 and 25 is 41.
4. The first step to find the mean deviation is to find the mean.
5. A low standard deviation means that the numbers are more spread out.
6. A standard deviation of 1.5 indicates a more consistent scores than the a standard deviation of 2.5.

1.	2.
3.	4.
5.	6.



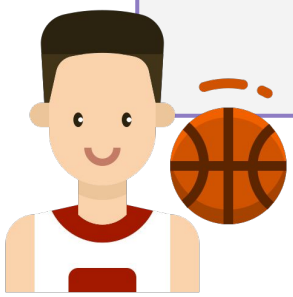
LARRY'S HOMEWORK

G6
Basic

Larry is the ace player of your school's basketball team. Help him on his homework. Explain your answer briefly but comprehensively.

1. Differentiate measures of central tendency from measures of variability.

2. Differentiate the range, mean deviation, variance and standard deviation from each other.



SUPERSTARS' RANGE

G6 Basic

Find the range of the scores of each NBA player in 7 finals games.

Name	G1	G2	G3	G4	G5	G6	G7
Lebron James	25	27	23	34	30	27	35
Kobe Bryant	60	45	38	45	56	48	39
Stephen Curry	30	28	30	32	39	35	29
Kevin Durant	28	35	37	25	26	30	28
Kyrie Irving	27	25	30	28	31	30	25
Klay Thompson	37	40	35	25	28	32	38

1.	2.
3.	4.
5.	6.

BASKETBALL BUCKS

G6 Basic

Find the mean average deviation of each set of data about the salaries of some basketball players. Round off to the nearest tenths.

The tables below are the top ten salaries and the bottom ten salaries for the 2020 Boston Red Sox players. Salaries are in million dollars.

Top Ten Salaries				
38.25	35.00	34.80	33.20	32.10
31.50	28.00	27.50	25.00	23.10

Bottom Ten Salaries				
2.50	2.30	2.00	1.50	1.10
1.00	0.80	0.75	0.60	0.58

TURNOVERS PER GAME

G7
Advanced

Refer to the given scenario below. Use your understanding of this lesson to solve each item.

The number of turnovers of the 3 basketball teams during the finals game are listed below. Calculate the range and standard deviation and interpret compare the obtained values.

Green Flashers 23, 19, 22, 21, 20

Range _____
Standard Deviation _____

Net Ninjas 24, 23, 20, 24, 18

Range _____
Standard Deviation _____

Centerline Commandos 20, 21, 24, 23, 25

Range _____
Standard Deviation _____

Interpretation

MILWAUKEE BUCKS TEAM

G7 Advanced

Find the variance and standard deviation of the heights (in inches) of the top ten basketball players of Milwaukee Bucks in history.

Kareem Abdul-Jabbar	86
Sidney Moncrief	75
Giannis Antetokounmpo	83
Bob Dandridge	78
Michael Redd	78
Ray Allen	77
Paul Pressey	77
Jon McGlocklin	77
Terry Cummings	81

Write your solutions here.

LEBRON JAMES' STAT

G7 Advanced

Lebron James is one of the NBA greatest. Use your learnings about measures of variability to complete the task below.

In 2020, Lebron James scored 23, 15, 10, 15, 22, 25, 26, 18, 52, 20, 30, and 32 points in his first 12 games.

1. Find:
    a. Range
    b. Mean average deviation
    c. Variance
    d. Standard deviation

2. What can you say about the standard deviation? Is there any value which affect the standard deviation?

NBA FINALS SCENARIO

G7 Advanced

Find the range, mean average deviation, variance, and standard deviation. Identify who performed more consistently during the finals games.

The scores of the top three basketball players during the six finals games are given below.

Chris Paul 25, 30, 30, 18, 25, 23

Range_____

Mean Average Deviation _____

Variance _____

Standard Deviation _____

Cameron Payne 17, 15, 10, 18, 19, 16

Range_____

Mean Average Deviation _____

Variance _____

Standard Deviation _____

Jevon Carter 10, 11, 13, 9, 10, 12

Range_____

Mean Average Deviation _____

Variance _____

Standard Deviation _____

Who performed more consistently during the finals games? Why?

STAT AND BASKETBALL

G7 Advanced

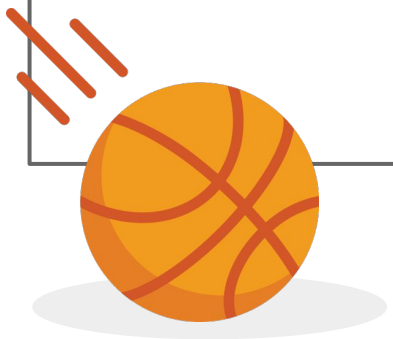
On this activity, you are going to relate measures of variability to basketball. Answer the following questions briefly but comprehensively.

1. When is it applicable to use range, mean deviation, and standard deviation?

2. Without calculating, tell and explain which of the two sets of data will have a lower value of standard deviation.

   A 85, 90, 92, 89, 93, 91, 90, 45, 89, 88

   B 75, 76, 78, 75, 77, 78, 75, 79, 78, 74



ANSWER GUIDE

Activity 1

1.) Measures of Variability
2.) Mean Average Deviation
3.) Range
4.) Variance
5.) Standard Deviation
6.) 0 / zero

Activity 2

1.) True
2.) True
3.) 9
4.) True
5.) high
6.) True

Activity 3

1.) Measures of central tendency tells us where most of the data points lie while measures of variability tells how far apart your points from each other.

2.) Range is the difference between the highest value and the lowest value. Mean average deviation is the average of all deviations. Variance is a measure of how far a set of data are spread out from their mean value and standard deviation is the square root of the variance.

Activity 4

1.) 12
2.) 22
3.) 11
4.) 12
5.) 6
6.) 15

Activity 5

Top Ten Salaries: 3.9
Bottom Ten Salaries: 0.6

ANSWER GUIDE

Activity 6

Green Flashers	Net Ninjas	Centerline Commandos
Range: 4	Range: 6	Range: 4
SD: 1.58	SD: 2.68	SD: 2.07

Interpretation: Answers may vary

Activity 7

Variance: 12.36 Standard Deviation: 3.52

Activity 8

1.) Range: 42 Mean Average Deviation: 7.5
Variance: 118.56 Standard Deviation: 10.89
2.) Answers may vary.

Activity 9

Chris Paul	Cameron Payne	Jevon Carter
Range: 12	Range: 9	Range: 4
MAD: 3.22	MAD: 2.22	MAD: 1.17
Variance: 20.56	Variance: 10.17	Variance: 2.17
SD: 4.54	SD: 3.19	SD: 1.47

Jevon Carter performed better. He has the lowest variability.

Activity 10

1.) Answers may vary.
2.) B, because A has an extreme value and affects the rest.

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