10

Mathematics

Quarter 4 - Week 1, Module :1
Illustrating Measures of Position: Quartiles, Deciles, and Percentiles

AIRs - LM

Mathematics 10
Quarter 4 - Week 1, Module 1: Illustrating measures of position: quartiles, deciles, and percentiles.

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Target

What do you do when you are lost? You use tools like a compass and GPS to figure out where you are and how to get where you are going. Well, in statistics there are ways to figure out where a data point or set falls. These are called measures of position. Once we know where a data set or model is, we can figure out what to do with it.

In this module, you will study about the measures of position. Remember to look for the answers to the following questions:

1. How would I know my position given the academic rank?
2. What are the ways to determine the measure of position in a set of data?

After going through this module, you are expected to illustrate the following measures of position: quartiles, deciles and percentiles.

Specifically, you should be able to define, identify and illustrate the following measures of position: quartiles, deciles and percentiles.

Before going on, find out how much you already know about this module.
Answer the pre-assessment below.

Pre-Assessment

Directions: Choose the letter of the correct answer and write it on a separate sheet of paper.

1. Which of the following refers to the score point that divides the distribution into two equal parts?

A. Decile B. Median C. Percentile D. Quartile

2. Which of the following is equal to the lower quartile?

A. 25^{th} percentile B. 50^{th} percentile

C. 2^{nd} decile D. 3^{rd} quartile

3. Which of the following refers to the score point that divides a distribution into hundred equal parts?

A. decile B. median C. percentile D. quartile

4. Which of the following is equal to the median?

A. 75^{th} percentile B. 5^{th} decile C. 3^{rd} decile D. 1^{st} quartile

5. Which of the following is equal to the third quartile?

A. 50^{th} percentile B. 75^{th} percentile C. 7^{th} decile D. 3^{rd} decile

6. Bamby got a score of 55 that is equivalent to 70^{th} percentile in a Math test. Which of the following is ***NOT*** true?

A. Her score is below the 5^{th} decile.

B. She scored above 70% of her classmates.

C. Thirty percent of the class got scores of 55 and above.

D. If the passing mark is the first quartile, she passed the test.

7. In the set of scores: 14, 17, 10, 22, 19, 24, 8, 12, and 19, what is the median score?

A. 12 B. 14 C. 17 D. 19

8. What is the highest value of the set of data? (refer to #7)

A. 24 B. 22 C. 19 D. 17

9. What is the value of the 3^{rd} quartile?

A. 17 B. 19 C. 22 D. 24

10. The 1^{st} quartile of the ages of 250 Grade 10 students is 16 years old. What does it imply?

A. Most of the students are below 16 years old.

B. Seventy-five percent of the students are 16 years old and above.

C. Twenty-five percent of the students are 16 years old.

D. One hundred fifty students are younger than 16 years.

11. Which of the following is the same as the median of a set of data?

A. 2^{nd} quartile B. 2^{nd} percentile C. 20^{th} percentile D. 2^{nd} decile

12. Which of the following data is arranged in ascending order?

A. 5, 8, 9, 10 B. 10, 9, 8, 5 C. 8, 9, 5, 10 D. 10, 5, 8, 9

13. In the set of scores: 14, 17, 10, 22, 19, 24, 8, 12; if the 3^{rd} decile is the 3^{rd} element, what is the value of D_3?

A. 8 B. 10 C. 12 D. 14

14. When a distribution is divided into ten equal parts, what is the denominator in finding its specified position?

A. 4 B. 10 C. 50 D. 100

15. Which of the following is equal to the 60th percentile?

A. 6th quartile B. 6th decile C. 60th decile D. 60th quartile

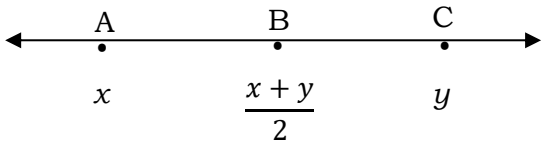
Now, let us look on the discussions below. This will help you in understanding the lesson.

Jumpstart

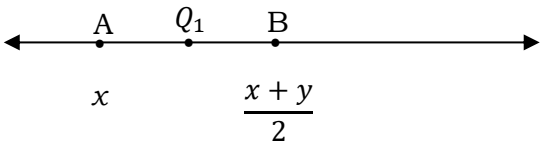
Let us start by first reviewing the concept of median, which is needed in the study of this module.

Activity 1: Find Your Center...

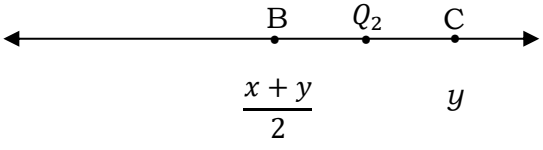
The midpoint between two numbers x and y on the real number line is $\frac{x+y}{2}$.



1. Find the coordinates of the midpoint (Q_1) of $\overline{AB}$ in terms of x and y.



2. Find the coordinates of the midpoint (Q_2) of $\overline{BC}$ in terms of x and y.



3. In the given example, $\overline{AC}$ represents a distribution. What does point B represent in the distribution?

- The median divides the distribution into two equal parts. It is a point in the distribution where one-half of the distribution lies below it and one-half above it. One-half of the distribution lies below *B* and one-half lies above it. Hence, *B* represents the median.

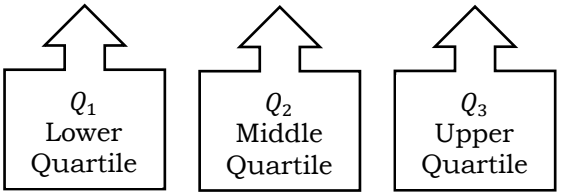
Activity 2: Watch This!

A group of students obtained the following scores in their Math quiz:

9, 3, 6, 5, 9, 6, 8, 2, 4, 7, 10

First, arrange the scores in ascending order:

2 3 <u>4</u> 5 6 <u>6</u> 7 8 <u>9</u> 9 10



Observe how the lower quartile (Q_1), middle quartile (Q_2), and upper quartile (Q_3) of the scores are obtained. Complete the statements below:

The first quartile 4 is obtained by _____
(observe the position of 4 from 2 to 6)

The second quartile 6 is obtained by _____
(observe the position of 6 from 2 to 10)

The third quartile 9 is obtained by _____
(observe the position of 9 from 7 to 10)

Discover

Measures of Position

The different measures of position are **quartiles**, **deciles**, and **percentiles**.

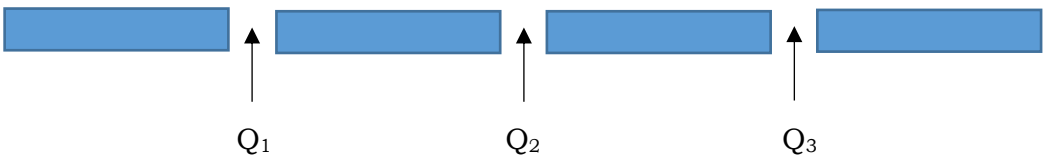
1. Quartiles

The quartiles are the score points that divide a distribution into four equal parts. Twenty-five percent (25%) of the distribution are below the first quartile, fifty percent (50%) are below the second quartile, and seventy-five percent (75%) are below the third quartile.

Q_1 is the lower quartile
Q_2 is the middle quartile or the median
Q_3 is the upper quartile

The difference between Q_3 and Q_1 is the **interquartile range**.

Since the second quartile is the median, the steps in the computation of median by identifying the median class is the same as the steps in identifying the Q_1 class and the Q_3 class.



a. 25% of the data has a value $\leq Q_1$
b. 50% of the data has a value $\leq \tilde{X}$ or Q_2
c. 75% of the data has a value $\leq Q_3$

Example 1: The scores of 7 students in a Mathematics seatwork are 7,4, 3, 6, 7, 4, 8

Steps: **Solution:**

1. Arrange the scores in ascending order. ⟶ 3, 4, 4, 6, 7, 7, 8
2. Identify the lowest score and highest score. ⟶ LS = 3, HS = 8
3. Find the middle score. Label it as Q_2. ⟶ $Q_2 = 6$
4. Identify the value between the middle score and the lowest score. Label it as Q_1. ⟶ $Q_1 = 4$

5. Identify the value between the middle score and the highest score. Label it as Q_3. ⟶ $Q_3 = 7$

Therefore, 3 $\underline{4}$ 4 $\underline{6}$ 7 $\underline{7}$ 8
Q_1 Q_2 Q_3

Example 2: Find the average of the lower quartile and the upper quartile of the data.

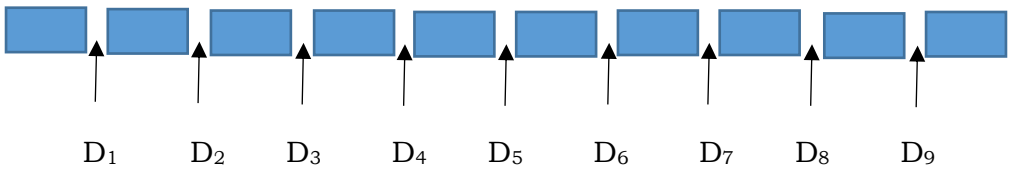
Grade Level	**No. of Learners**
Grade 7	204
Grade 8	194
Grade 9	177
Grade 10	163
Grade 11	135

Solution:

- In increasing order, the data are 135, 163, 177, 194, 204.
- The least value of the data is 135 and the greatest value is 204.
- The middle value (Q_2) of the data is 177.
- The lower quartile (Q_1) of the data is 163.
- The upper quartile (Q_3) of the data is 194.
- The average of the lower quartile and the upper quartile is 178.5

2. Deciles

The deciles are the nine score points that divide a distribution into ten equal parts. They are denoted as D_1, D_2, D_3,..., D_9. They are computed in the same way that the quartiles are calculated.



Example:

Rimar is a secretary in one big company in La Union. His salary is in the 7th decile. Should Rimar be glad about his salary or not? Explain your answer.

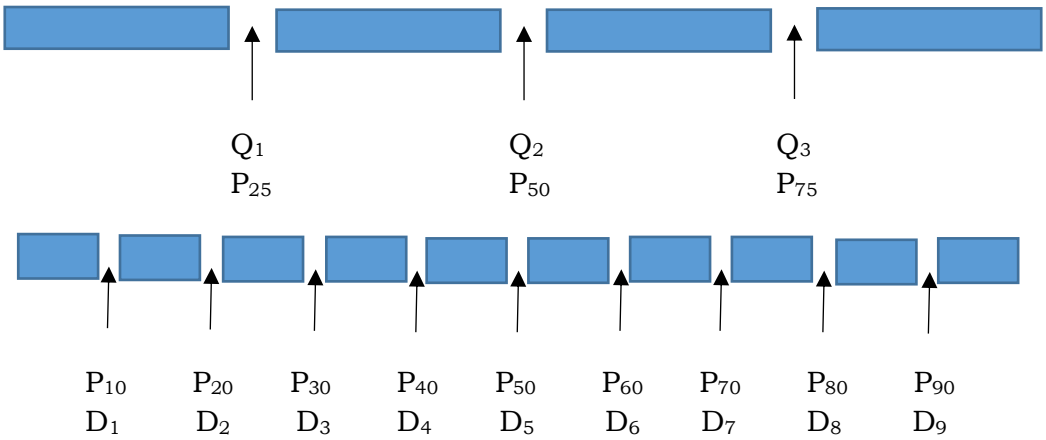
Solution:

70% of the employees receive a salary that is less than or equal to his salary and 30% of the employees receive a salary that is greater than his salary. Therefore, Rimar should be pleased with his salary.

3. Percentiles

The percentiles are the ninety-nine score points that divide a distribution into one hundred equal parts, so that each part represents the data set. It is used to characterize values according to the percentage below them.

For example, the first percentile (P_1) separates the lowest 1% from the other 99%, the second percentile (P_2) separates the lowest 2% from the other 98%, and so on.



- The percentiles determine the value for 1%, 2%,..., and 99% of the data. P_{30} or 30^{th} percentile of the data means 30% of the data have values less than or equal to P_{30}.

- The 1^{st} decile (D_1) is the 10^{th} percentile (P_{10}). It means 10% of the data is less than or equal to the value of P_{10} or D_1, and so on.

Example 1:

You are the fourth tallest person in a group of 20.

Solution:

- 80% of the people are shorter than you

https://www.google.com/search?q=percentile+image&rlz=1C1CHBF_enPH914PH914&tbm

- That means you are at the **80th percentile**.

- If your height is 1.85m then "1.85m" is the 80th percentile height in that group.

Example 2:

If your score is in the 25th percentile, then 25% of test takers are below your score.

Example 3:

A person with an IQ of 120 is at the 91st percentile, which indicates that their IQ is higher than 91 percent of other scores.

For you to understand the lesson well, do the following activities.
Have fun and good luck!

Explore

Activity 1: Find Me

Find the first quartile (Q_1), second quartile (Q_2), and the third quartile (Q_3), given the scores of 11 students in their Mathematics class.

5, 10, 8, 15, 11, 9, 13, 16, 7, 12, 9

Activity 2: Go, Investigate!

If Anna got a score of 30 in a Math test and her score is in the 3rd decile. Does Anna pass the test? Yes or No? Why?

Activity 3: How Tall Are You?

If a learner is taller than or as tall as 79% of his classmates. What does this mean?

Did you enjoy answering the activities?
Now, let us go deeper for you to apply what you have learned about measures of position.

Deepen

Activity 1: How old are you?

Christian has an assignment to ask at random twenty (20) grade 10 learners in their school about their ages. The data are given below:

Name	Age	Name	Age
Sarah	15	Nhestle	14
Jubilee	14	Randy	17
Alyssa	15	Jean Leo	14
Shalae	15	Russel	16
Maegan	15	John Mark	15
Nathaniel	15	Shien Grace	15
Klien	16	Jesalyn	14
Jimuel	16	Rhenel	16
Nyl	16	Joana	15
Krishner	14	Quinelyn	16

Questions:

1. What is Q_1, Q_2, and Q_3 of their ages?
2. How many grade 10 learners belong to Q_1, Q_2, and Q_3 in terms of their ages?

Reflection:

Have you realized the process of finding quartiles while doing the activity?

Activity 2: Shopping Time!

A total of 8000 people visited a shopping mall over 12 hours.

Time (hours)	People
2	450
4	1500
6	2300
8	5700
10	6850
12	8000

1. Estimate the fifth decile (D_5) (when 50% of the visitors had arrived).

2. Estimate the 75^{th} percentile (when 75% of the visitors had arrived).

Gauge

Directions: Choose the letter of the correct answer and write it on a separate paper.

1. What measures of position divides the distribution into 10 equal parts?
   A. deciles B. median C. percentiles D. quartiles

2. Which of the following refers to the score points that divide a distribution into hundred equal parts?
   A. deciles B. median C. percentiles D. quartiles

3. Which of the following is equivalent to the median?
   A. the middle quartile (Q_2) B. the 50^{th} percentile (P_{50})
   C. the fifth decile (D_5) D. all of these

4. Which of the following is equal to the lower quartile?
   A. 25^{th} percentile B. 50^{th} percentile
   C. 2^{nd} decil D. 3^{rd} quartile

5. How many percent corresponds to D_6 if you will interpret it?
   A. 20% B. 40% C. 60% D. 80%

6. How many percent corresponds to Q_1 if you will interpret it?
   A. 25% B. 50% C. 75% D. 100%

7. In the set of scores: 14, 17, 10, 22, 19, 24, 8, 12, and 19, which of the following is the median score?
   A. 19 B. 17 C. 14 D. 12

8. In a 70-item test, Karen got a score of 50, which is the third quartile. What does this mean?
   A. she got the highest score
   B. her score is higher than 25% of her classmates
   C. she surpassed 75% of her classmates
   D. seventy-five percent of the class did not pass the test

9. Shiela scored at the 99^{th} percentile on a Math test. How should we interpret this information?
   A. Shiela scored better than 99% of people who took the test.
   B. Shiela got 99% of the questions on the test right.
   C. Shiela scored worse than 99% of people who took the test.

D. Shiela got 99% of questions on the test wrong.

10. Aira and her brother are both 62 inches tall. Aira is in the 85th percentile for height for her age and her little brother is in the 90th percentile. Who is taller for their age?

A. Anna
B. Anna's brother
C. They are the same, both 62 inches.
D. Cannot be determined

For numbers 11 to 15, consider the score distribution of 15 students below:

83, 77, 79, 72, 80, 82, 87, 73, 79, 79, 86, 74, 82, 81, 74

11. What is Q_1?

12. How many students scored lower than the median?

13. How many students scored higher than Q_3?

14. What is the 5th decile?

15. What is the 75th percentile?

Good job! I hope you have understood the lessons in this module. You are now ready for the next module.

References

BOOKS

- Mathematics Grade 10 Learner's Module, First Edition 2015

INTERNET

- Clark, John. Measures of Position Explained. Descriptive Statistics, Probability Distributions, May 11, 2018

LINKS

- https://www.slideshare.net/topengpogi/measures-of-position-72009187
- https://www.coursehero.com/file/48307058/Review-Test-in-Measures-of-positiondocx/
- https://quizizz.com/admin/quiz/5ca4292b80077f001a4f86c6/measure-of-position-ungrouped-data
- https://www.mathsisfun.com/data/percentiles.html
- https://www.statisticshowto.com/probability-and-statistics/percentiles-rank-range/
- https://magoosh.com/statistics/measures-of-position-explained/