

W1

Learning Area
Quarter

Mathematics
4th

Grade Level
Date

10

I. LESSON TITLE

ILLUSTRATION OF MEASURES OF POSITION

II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)

Illustrates the following measures of position: quartiles, deciles, and percentiles.
(M10SP – IVa – 1)

III. CONTENT/CORE CONTENT

Illustrating measures of position

IV. LEARNING PHASES AND LEARNING ACTIVITIES

A. Introduction (Time Frame: 20 minutes)

Learning Objectives

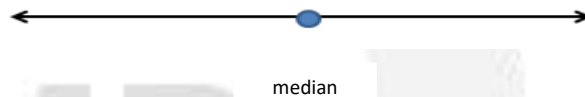
At the end of the lesson, you are expected to :

- define measures of position;
- illustrate measures of position; and
- appreciate the use of measures of position in real life situations.

Assume you are a tourist who wishes to visit Sampaloc Lake in San Pablo City. How will you find the lake's exact location?

GPS or Google Maps are the best ways to find it. These tools are used to identify locations. In statistics, there are also ways on how to locate a specific value in a data.

When you were in Grade 7, you encountered one of the measures of central tendency: the median. It is the middle number in a distribution. It can be illustrated by using a line shown below.



So, if you are given the following data: 2, 4, 5, 6, 7, the middlemost value is 5. Hence, it is the median of the data. It is important to note that the values in a data must be arranged in ascending order before looking for the median.

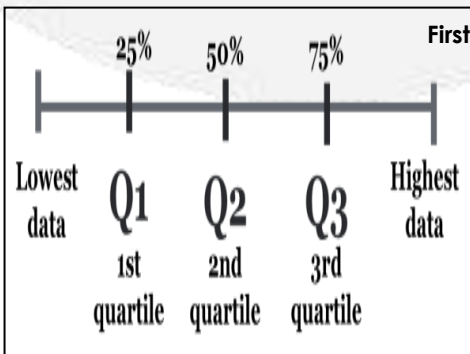
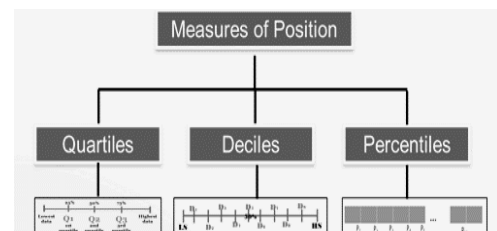
However, if there are two middlemost values in a data, then get the average of those numbers to get the median. For example, 2, 4, 6, 7, 8, 10, the two middlemost values in the given data are 6 and 7, so the median is $\frac{6+7}{2} = \frac{13}{2} = 6.5$.

Aside from median, there are other measures that indicate position. Study the text below.

B. Development (Time Frame: 60 minutes)

Measures of position shows where a certain data point or value falls in a sample or array of distribution. It can state whether a value is about the average, or whether it is unusually high or low compared to the data as a whole. There are a lot of measures of position, but the most common are the **quartiles**, **deciles**, and **percentiles**.

1) **Quartiles**- are points that divide the data into four equal parts.



First Quartile (Q₁) is a number such that at most one-fourth or 25 % of the data are smaller in value than Q₁ and at most three-fourths or 75% are larger than Q₁. It is also called as **lower quartile**.

Second Quartile (Q₂) is a number such that at most one-half or 50 % of the data are below and above in value than Q₂. Second Quartile is also known as **median**.

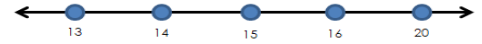
Third Quartile (Q₃) is a number such that at most three-fourths or 75 % of the data are smaller in value than Q₃ and at most one-fourth or 25% are larger than Q₃. It is also called as **upper quartile**.

Illustrative Example No. 1



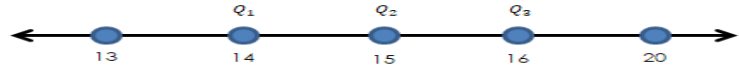
Mrs. Rivera, a math teacher, conducted her first quiz for the first quarter. The top 5 students got the following scores: 20, 13, 15, 16, 14. Illustrate Q_1 , Q_2 , and Q_3 of the given data.

First, arrange the numbers in ascending order in a line.

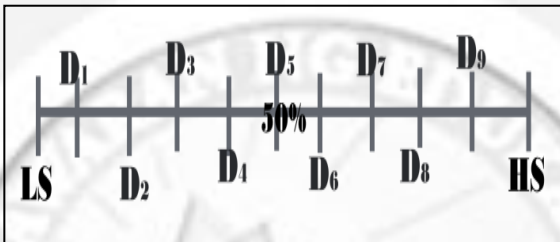


- The least value in the data is 13 and the greatest value in the data is 20.
- The middle value in the data is 15. It is the Q_2 .
- Q_1 or lower quartile is the middle value between the least value and Q_2 . In the example above, it is 14.
- Q_3 or upper quartile is the middle value between Q_2 and the greatest value in the data. In the example above, it is 16.

Therefore, Q_1 , Q_2 , and Q_3 can be illustrated as follow:



2) **Deciles** are the nine score points that divide the data into ten equal parts. $D_1, D_2, D_3, \dots, D_9$



Third Decile (D_3) is a number such that at most 30 % of the data are smaller in value than D_3 and at most 70% are larger than D_3 .

Fifth Decile (D_5) is a number such that at most one-half or 50 % of the data are below and above in value than D_5 . It is the *median of the set of data*. It is also the Q_2 .

Ninth Decile (D_9) is a number such that at most 90 % of the data are smaller in value than D_9 , and at most 10% are larger than D_9 .

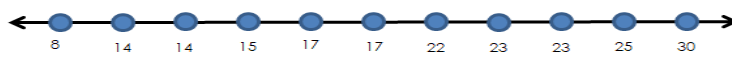
It is important to note that $D_{2.5}$ is equal to Q_1 and $D_{7.5}$ is equal to Q_3 .

Illustrative Example No. 2

The local government of San Pablo City informs the public on the daily number of CoViD-19 active cases and recoveries. It is posted in SPC Anti-Covid 19 Task Force Facebook Page. The number of recoveries from May 3, 2021 to May 13, 2021 is as follows:

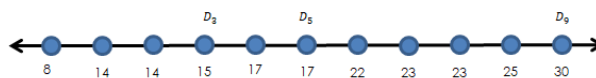
30, 14, 23, 23, 17, 8, 15, 25, 17, 14, 22. Illustrate D_3 , D_5 , and D_9 .

First, arrange the numbers in ascending order in a line.



- There are 11 values in the data.
- The 30% of 11 is $11(0.3) = 3.3 \approx 3$. (Note: \approx is used to show approximation or a value is being rounded off, up, or down.) Thus, the values 8, 14, 14 are the 30% of the data and $D_3 = 15$.
- D_5 is also the median of the data. Hence, $D_5 = 17$.
- The 90% of 11 is $11(0.9) = 9.9 \approx 10$. Therefore, the values 8, 14, 14, 15, 17, 17, 22, 23, 23, 25 are the 90% of the data and $D_9 = 30$.

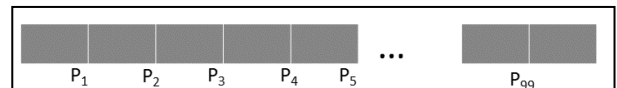
D_3 , D_5 , and D_9 can be illustrated as shown below.



3) **Percentiles** are score points that divides the data into 100 equal parts. $P_1, P_2, P_3, \dots, P_{99}$.

The n th percentile, P_n , separates the lowest $n\%$ from the other $(100-n)\%$.

Illustrating percentile is the same way of illustrating the decile.



IV. LEARNING PHASES AND LEARNING ACTIVITIES

***30th percentile (P_{30})** is a number such that at most 30 % of the data are smaller in value than P_{30} and at most 70% are larger than P_{30} .

***50th percentile (P_{50})** is a number such that at most one-half or 50 % of the data are below and above in value than P_{50} . It is the *median of the set of data*. It is also the Q_2 .

***85th percentile (P_{85})** is a number such that at most 85 % of the data are smaller in value than P_{85} and at most 15% are larger than P_{85} .

C. Engagement (Time Frame: 30 minutes)

Learning Task 1: Let us choose the BEST!

Choose the best answer from the choices provided in each item.

___ 1. Which the following measure of position illustrates the equivalent of 2nd quartile?

A.

	D ₂								
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C.

				P ₅₀					
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B.

						D ₈			
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D.

								P ₉₀	
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___ 2. Vince is the fourth tallest in the group of 10. It means that 60% of the students are shorter than him. Which of the following measures of position is being illustrated by the given situation?

- A. Second Quartile C. Sixth Decile
B. Fourth Decile D. Seventy-fifth Percentile

___ 3. The scores of the students in their Math Quiz were: 20, 28, 23, 15, 33, 40, 35, 28, and 18. Which of the following illustrate measures of position?

- A. $Q_1 = 28.5$ B. $Q_3 = 33.5$ C. $D_3 = 20$ D. $P_{45} = 25.5$

___ 4. Which of the following statements illustrate a decile?

- A. The value of a decile such as the 6th decile is obtained using $D_6 = \frac{6(n+1)}{100}$.
B. Deciles are the nine scores points that divides a distribution into ten equal parts.
C. The fifth decile is also the 5th percentile of a distribution.
D. 8th decile is also equal to 3rd quartile.

___ 5. Which of the following statements illustrate quartiles?

- A. The first quartile separates the bottom 75% from the top 25% of the data.
B. The second quartile is the same as the 25th percentile
C. Quartiles are the four score points that divide the distribution into four parts.
D. The upper quartile is the median of the data set.

Learning Task 2: Let's Illustrate!

During the month of February, Dr. Ortega recorded the number of CoViD-19 patients who came in of the hospital each day. The results are as follow: 15, 11, 13, 10, 18, 6, 9, 10, 15, 11, 12. Illustrate the following:

- 1) Q_1 3) D_4 5) P_{55}
2) Q_3 4) D_7

D. Assimilation (Time Frame: 30 minutes)

Learning Task 3: Let's Dig Deeper.

Albert has an assignment to ask at random 10 students in their school about their ages. The data are given in the table below.

Name	Age	Name	Age
Ana	10	Tony	11
Ira	13	Lito	14
Susan	14	Christian	13
Antonette	13	Michael	15
Gladys	15	Dennis	12

Illustrate the following: 1) Q_1

2) Q_3

3) D_2

4) D_6 .

5) P_{45} .

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 30 minutes)

The final exam scores of 18 students in their Math Test are 24, 58, 61, 67, 71, 73, 76, 79, 82, 83, 85, 87, 88, 88, 92, 93, 94, and 97. Illustrate the following:

- The lower quartile, Q_1
- The upper quartile, Q_3
- Thirteenth Percentile
- The median
- Sixth Decile

VI. REFLECTION (Time Frame: 5 minutes)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.

✓ - I was able to do/perform the task. It was quite challenging, but it still helped me in understanding the target content/lesson.

⚡ - I was not able to do/perform the task. It was extremely difficult. I need additional enrichment activities to be able to do/perform this task.

Learning Task 1	LP	Learning Task 2	LP	Learning Task 3	LP	Assessment	LP
Number 1		Number 1		Number 1		Q_1	
Number 2		Number 2		Number 2		Q_3	
Number 3		Number 3		Number 3		P_{13}	
Number 4		Number 4		Number 4		Median	
Number 5		Number 5		Number 5		D_6	

VII. REFERENCES

Mathematics Learners Module Grade 10, p. 362-367

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W2	Learning Area	Mathematics	Grade Level	10
	Quarter	Fourth	Date	

I. LESSON TITLE	FINDING MEASURES OF POSITION
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	The learner calculates a specified measure of position (e.g. 90 th percentile) of a set of data. (M10SP-IVb-1)
III. CONTENT/CORE CONTENT	Calculating a measure of position (grouped and ungrouped data)

IV. LEARNING PHASES AND LEARNING ACTIVITIES

A. Introduction (Time Frame: 20 minutes)

Learning Objectives: At the end of the lesson, you are able to:

- identify the procedures in calculating measures of position of ungrouped and grouped data;
- use the appropriate formula in finding measures of position of grouped data; and
- appreciate the usefulness of measures of position in real life situations.

In Grade 7 Mathematics, you encountered finding median of a set of values. Let us review your knowledge and skills on it. Study the text below.

In a 10-item Math quiz, 10 students got the following scores: 4, 8, 6, 3, 4, 5, 6, 7, 7, 10. Find the median of the scores.

Following are the steps in finding median:

STEPS	ILLUSTRATION
1. Arrange the values in ascending order. (Take note that you can also arrange it in descending order.)	3, 4, 4, 5, 6, 6, 7, 7, 8, 10
2. (a) If the number of values is odd, find the middle value. Then, that value is the median. (b) If the number of values is even, find the two middle values by using $\frac{n}{2}$. (n is the number of values.)	Since there are 10 values, $\frac{n}{2} = \frac{10}{2} = 5$. Get the 5 th and 6 th values in the set of values. These are the middle values. In the problem above, the middle values are both 6.
3. This step is applicable if the number of values is even. Find the mean of the two middle values. The resulting value is the median.	$\frac{6 + 6}{2} = \frac{12}{2} = 6$ Therefore, 6 is the median of the given set of values.

These steps are somehow similar with finding the measures of position of ungrouped data. Study the lesson below.

B. Development (Time Frame: 80 minutes)

I. MEASURES OF POSITION FOR UNGROUPED DATA

1. Quartiles – the score points which divide a distribution into four equal parts. (Figure 1)

- First Quartile** – the value where the twenty-five percent (25%) of the distribution are below it. It is denoted by Q_1 . It is also called as the **lower quartile**.
- Second Quartile** – the value where fifty percent (50%) or half of the distribution are below it. It is denoted by Q_2 and also the **median** of the distribution.
- Third Quartile** – the value where seventy-five percent (75%) of the distribution are below it. It is denoted by Q_3 . It is also called as the **upper quartile**.

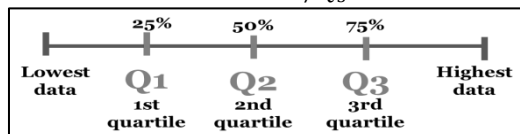


Figure 1

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Mendenhall and Sincich Method – a method that can be used in calculating quartiles.

Illustrative Example 1

Find Q_1 , Q_2 , and Q_3 of the following distribution: 3, 5, 2, 5, 4, 6, 8, 7, 4.

STEPS	ILLUSTRATION
1. Arrange the values in the distribution in ascending order.	2, 3, 4, 4, 5, 5, 6, 7, 8 $n = 9$
2. (a) Find the position of Q_1 by using $\frac{1}{4}(n + 1)$ where n is the number of values. The resulting value must be rounded to the nearest integer. However, if the resulting value falls halfway between two integers, round it up. (b) Find the position of Q_2 by finding the median. (c) Find the position of Q_3 by using $\frac{3}{4}(n + 1)$ where n is the number of values. The resulting value must be rounded to the nearest integer. However, if the resulting value falls halfway between two integers, round it down.	Position of $Q_1 = \frac{1}{4}(n + 1) = \frac{1}{4}(9 + 1) = \frac{1}{4}(10) = 2.5$. The resulting value 2.5 becomes 3 after rounding up . Therefore, in the distribution, the third value is 4 and that is Q_1 In the distribution, the middle value or the median is 5. Hence, $Q_2 = 5$. Position of $Q_3 = \frac{3}{4}(n + 1) = \frac{3}{4}(9 + 1) = \frac{3}{4}(10) = 7.5$. The resulting value 7.5 becomes 7 after rounding down .
3. Look at the arranged distribution. First Quartile or Q_1 : the value that falls under the computed position of Q_1 . Second Quartile or Q_2 : the value of the median Third Quartile or Q_3 : the value that falls under the computed position of Q_3 .	Based on the given distribution, $Q_1 = 4$, $Q_2 = 5$, and $Q_3 = 6$.

2. **Deciles** – the nine score points which divide a distribution into ten equal parts. They are denoted as $D_1, D_2, D_3, \dots, D_9$. (Figure 2)

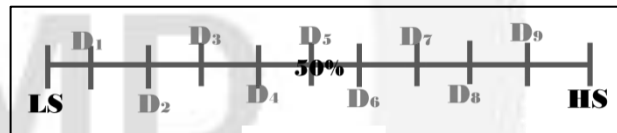


Figure 2

Finding deciles is similar to finding quartiles except to the formula being used in finding its positions.

Illustrative Example 2

Find the third decile (D_3) and the seventh decile (D_7) of the distribution: 3, 5, 2, 5, 4, 6, 8, 7, 4.

STEPS	ILLUSTRATION
1. Arrange the values in the distribution in ascending order.	2, 3, 4, 4, 5, 5, 6, 7, 8
2. (a) In finding the position of the third decile (D_3), use $\frac{3}{10}(n + 1)$ where n is the number of values. (b) In finding the position of the seventh decile (D_7), use $\frac{7}{10}(n + 1)$ where n is the number of values. Note: The fifth decile (D_5) is also the median of the distribution.	(a) Position of $D_3 = \frac{3}{10}(9 + 1) = \frac{3}{10}(10) = 3$ D_3 is the 3 rd data (b) Position of $D_7 = \frac{7}{10}(9 + 1) = \frac{7}{10}(10) = 7$ D_7 is the 7 th data

IV. LEARNING PHASES AND LEARNING ACTIVITIES

3. Look at the distribution.

Third Decile (D_3): the value in the distribution that falls under the computed position of D_3 .

Seventh Decile (D_7): the value in the distribution that falls under the computed position of D_7 .

Based on the distribution,

$$\begin{aligned} D_3 &= 4 \\ D_7 &= 6 \end{aligned}$$

3. **Percentiles** – the ninety-nine score points which divide a distribution into one hundred equal parts.

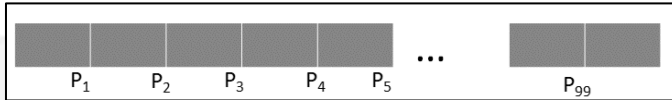


Figure 3

It can be used to determine the values for 1%, 2%, ..., and 99% of the distribution. P_{40} or 40th percentile of the distribution means 40% of the distribution have values less than or equal to P_{40} .

Finding percentiles is similar to finding quartiles and deciles except to the formula being used in finding its positions.

Illustrative Example 3

Find the 30th percentile (P_{30}) of the distribution : 3, 5, 2, 5, 4, 6, 8, 7, 4.

STEPS	ILLUSTRATION
1. Arrange the values in the distribution in ascending order.	2, 3, 4, 4, 5, 5, 6, 7, 8
2. In finding the position of the 30 th percentile (P_{30}) of the distribution, use $\frac{30}{100}(n + 1)$ where n is the number of values. Note: 50 th percentile or P_{50} is also the median of the distribution.	(a) Position of $P_{30} = \frac{30}{100}(9 + 1) = \frac{30}{100}(10) = 3$ P_{30} is the 3 rd data.
3. Look at the distribution. 30 th Percentile (P_{30}): the value in the distribution that falls under the computed position of P_{30} .	Based on the distribution, $P_{30} = 4$

II. MEASURES OF POSITION FOR GROUPED DATA

1. Quartiles

In computing the quartiles of grouped data, use the formula below:

$$Q_k = LB + \left(\frac{\frac{kN}{4} - cf_b}{f_{Q_k}} \right) i$$

where: LB=lower boundary of the Q_k class

N=total frequency

cf_b =cumulative frequency of the class before the Q_k class

f_{Q_k} =frequency of the Q_k class

i =size of class interval

k = nth quartile, where $n=1, 2$, and 3

Illustrative Example 4

Calculate the Q_1 , Q_2 , and Q_3 of the distribution below.

Class Interval	Frequency
26-30	4
21-25	8
16-20	11
11-15	9
6-10	12
1-5	6

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Solution:

Class Interval	Frequency (f)	Lower Boundary (LB)	Less than Cumulative Frequency (<cf)
26-30	4	26-0.5=25.5	46+4=50
21-25	8	21-0.5=20.5	38+8=46
16-20	11	16-0.5=15.5	27+11=38
11-15	9	11-0.5=10.5	18+9=27
6-10	12	6-0.5=5.5	6+12=18
1-5	6	1-0.5=0.5	6

N=50

(28th-38th value) Q_3 class

(19th - 27th value) Q_2 class

(7th - 18th value) Q_1 class

*To get Lower Boundary (LB), subtract 0.5 from the lower limit.

*To get Less than Cumulative Frequency (<cf), add each frequency starting at the bottom.

For Q_1

STEPS	ILLUSTRATION
1. Find the position of the Q_1 class.	Position of the Q_1 class = $\frac{N}{4} = \frac{50}{4} = 12.5$.
2. Then, look for the class interval where 12.5 th value belongs.	12.5 th value belongs to 7 th - 18 th value. 6-10 is the Q_1 class.
3. LB is the lower boundary of the Q_1 class.	$LB = 5.5$
4. cf_b is the less than cumulative frequency below the Q_1 class.	$cf_b = 6$
5. f_{Q_1} is the frequency of the Q_1 class	$f_{Q_1} = 12$
6. i is the size of class interval. Count the values from a class interval.	$i = 5$
7. Substitute the values in the formula and get the final answer.	$Q_1 = LB + \left(\frac{\frac{kN}{4} - cf_b}{f_{Q_1}} \right) i$ $Q_1 = 5.5 + \left(\frac{\frac{1(50)}{4} - 6}{12} \right) 5$ $Q_1 = 5.5 + \left(\frac{12.5 - 6}{12} \right) 5$ $Q_1 = 5.5 + \left(\frac{6.5}{12} \right) 5$ $Q_1 = 5.5 + \left(\frac{6.5}{12} \right) 5$ $Q_1 \approx 8.21$ <p>*\approx is the symbol used to denote approximation. It is used in this example since Q_1 is approximated.</p>

For Q_2

STEPS	ILLUSTRATION
1. Find the position of the Q_2 class.	Position of the Q_2 class = $\frac{N}{2} = \frac{50}{2} = 25$.
2. Then, look for the class interval where 25 th value belongs.	25 th value belongs to 19 th - 27 th value. 11-15 is the Q_2 class.
3. LB is the lower boundary of the Q_2 class.	$LB = 10.5$
4. cf_b is the less than cumulative frequency below the Q_2 class.	$cf_b = 18$
5. f_{Q_2} is the frequency of the Q_2 class	$f_{Q_2} = 9$
6. i is the size of class interval. Count the values from a class interval.	$i = 5$

IV. LEARNING PHASES AND LEARNING ACTIVITIES

7. Substitute the values in the formula and get the final answer.

$$Q_2 = LB + \left(\frac{\frac{N}{2} - cf_b}{f_{Q_2}} \right) i$$

$$Q_2 = 10.5 + \left(\frac{\frac{50}{2} - 18}{9} \right) 5$$

$$Q_2 = 10.5 + \left(\frac{25 - 18}{9} \right) 5$$

$$Q_2 = 10.5 + \left(\frac{7}{9} \right) 5$$

$$Q_2 \approx 14.39$$

For Q_3

STEPS	ILLUSTRATION
1. Find the position of the Q_3 class.	Position of the Q_3 class = $\frac{3N}{4} = \frac{3(50)}{4} = 37.5$.
2. Then, look for the class interval where 37.5 th value belongs.	37.5 th value belongs to 28 th – 38 th value. 16-20 is the Q_3 class.
3. LB is the lower boundary of the Q_3 class.	$LB = 15.5$
4. cf_b is the less than cumulative frequency below the Q_3 class.	$cf_b = 27$
5. f_{Q_3} is the frequency of the Q_3 class	$f_{Q_3} = 11$
6. i is the size of class interval. Count the values from a class interval.	$i = 5$
7. Substitute the values in the formula and get the final answer.	$Q_3 = LB + \left(\frac{\frac{3N}{4} - cf_b}{f_{Q_3}} \right) i$ $Q_3 = 15.5 + \left(\frac{\frac{3(50)}{4} - 27}{11} \right) 5$ $Q_3 = 15.5 + \left(\frac{37.5 - 27}{11} \right) 5$ $Q_3 = 15.5 + \left(\frac{10.5}{11} \right) 5$ $Q_3 \approx 20.27$

2. Deciles

. In computing the deciles of grouped data, use the formula below:

$$D_k = LB + \left(\frac{\frac{kN}{10} - cf_b}{f_{D_k}} \right) i$$

where: LB=lower boundary of the D_k class

N=total frequency

cf_b =cumulative frequency of the class before the D_k class

f_{D_k} =frequency of the D_k class

i =size of class interval

k = nth decile, where $n=1, 2, 3, 4, 5, 6, 7, 8, 9$

Illustrative Example 5

Calculate the 7th decile of the distribution in Illustrative Example 4.

Solution:

Class Interval	Frequency (f)	Lower Boundary (LB)	Less than Cumulative Frequency (<cf)
26-30	4	26-0.5=25.5	46+4=50
21-25	8	21-0.5=20.5	38+8=46
16-20	11	16-0.5=15.5	27+11=38 ← (28 th -38 th value) D_7 class
11-15	9	11-0.5=10.5	18+9=27
6-10	12	6-0.5=5.5	6+12=18
1-5	6	1-0.5=0.5	6

N=50

IV. LEARNING PHASES AND LEARNING ACTIVITIES

STEPS	ILLUSTRATION
1. Find the position of the D_7 class.	Position of the D_7 class = $\frac{7N}{10} = \frac{7(50)}{10} = 35$.
2. Then, look for the class interval where 35 th value belongs.	35 th value belongs to 28 th – 38 th value. 16-20 is the Q_3 class.
3. LB is the lower boundary of the D_7 class.	$LB = 15.5$
4. cf_b is the less than cumulative frequency below the D_7 class.	$cf_b = 27$
5. f_{D_7} is the frequency of the D_7 class	$f_{D_7} = 11$
6. i is the size of class interval. Count the values from a class interval.	$i = 5$
7. Substitute the values in the formula and get the final answer.	$D_7 = LB + \left(\frac{\frac{7N}{10} - cf_b}{f_{D_7}} \right) i$ $D_7 = 15.5 + \left(\frac{\frac{7(50)}{10} - 27}{11} \right) 5$ $D_7 = 15.5 + \left(\frac{35 - 27}{11} \right) 5$ $D_7 = 15.5 + \left(\frac{8}{11} \right) 5$ $D_7 \approx 19.14$

3. Percentiles

In computing the percentiles of grouped data, use the formula below:

$$P_k = LB + \left(\frac{\frac{kN}{100} - cf_b}{f_{P_k}} \right) i$$

where: LB=lower boundary of the P_k class

N=total frequency

cf_b =cumulative frequency of the class before the P_k class

f_{P_k} =frequency of the P_k class

i =size of class interval

k =nth percentile, where $n=1, 2, 3, 4, 5, 6, 7, 8, 9, \dots, 99$

Illustrative Example 6

Calculate the 65th percentile of the distribution in Illustrative Example 4.

Solution:

Class Interval	Frequency (f)	Lower Boundary (LB)	Less than Cumulative Frequency (<cf)
26-30	4	26-0.5=25.5	46+4=50
21-25	8	21-0.5=20.5	38+8=46
16-20	11	16-0.5=15.5	27+11=38
11-15	9	11-0.5=10.5	18+9=27
6-10	12	6-0.5=5.5	6+12=18
1-5	6	1-0.5=0.5	6

N=50

(28th-38th value) P_{65} class

STEPS	ILLUSTRATION
1. Find the position of the P_{65} class.	Position of the P_{65} class = $\frac{65N}{100} = \frac{65(50)}{100} = 32.5$.
2. Then, look for the class interval where 32.5 th value belongs.	32.5 th value belongs to 28 th – 38 th value. 16-20 is the Q_3 class.
3. LB is the lower boundary of the P_{65} class.	$LB = 15.5$
4. cf_b is the less than cumulative frequency below the P_{65} class.	$cf_b = 27$
5. $f_{P_{65}}$ is the frequency of the P_{65} class	$f_{P_{65}} = 11$

IV. LEARNING PHASES AND LEARNING ACTIVITIES

6. i is the size of class interval. Count the values from a class interval.

$$i = 5$$

7. Substitute the values in the formula and get the final answer.

$$P_{65} = LB + \left(\frac{\frac{65N}{100} - cf_b}{f_{P_{65}}} \right) i$$

$$P_{65} = 15.5 + \left(\frac{\frac{65(50)}{100} - 27}{11} \right) 5$$

$$P_{65} = 15.5 + \left(\frac{32.5 - 27}{11} \right) 5$$

$$P_{65} = 15.5 + \left(\frac{5.5}{11} \right) 5$$

$$P_{65} = 18$$

C. Engagement (Time Frame: 30 minutes)

Learning Task 1

Solve the following problem.

The weights of the students in a class are the following: 69, 70, 75, 66, 83, 88, 66, 63, 61, 68, 73, 57, 52, 58, and 77. Calculate the following:

1. Q_1
2. Q_3
3. D_6
4. P_{45}
5. P_{80}

Learning Task 2

Given the frequency distribution, compute for the third quartile, fourth decile, and 65th percentile.

Class Interval	f	<cf
81-90	7	60
71-80	10	53
61-70	15	43
51-60	4	28
41-50	12	24
31-40	6	12
21-30	3	6
11-20	2	3
1-10	1	1

D. Assimilation (Time Frame: 30 minutes)

Learning Task 3A

Consider the situation below and solve the following problem.

Mr. Mel Santiago is the sales manager of JERRY'S Bookstore. He has 40 sales staff members who visit college professors all over the Philippines. Each Saturday morning, he requires his sales staff to send him a report. This report includes, among other things, the number of professors visited during the previous week. Listed below, ordered from smallest to largest, are the number of professors visited last week.

38 40 41 45 48 48 50 50 51 51 52 52 53 54 55 55 55 56 56 57 59 59 59 62 62 62 63 64 65 66 66 67 67 69 69 71 77 78 79 79

Determine the following:

- a. 3rd quartile
- b. 9th decile
- c. 35th percentile

Learning Task 3B

The following is a distribution for the number of employees in 45 companies belonging to a certain industry. Calculate the third quartile, 85th percentile, and 4th decile of the number of employees given the number of companies.

Number of Employees	Number of Companies
41-45	11
36-40	6
31-35	9
26-30	7
21-25	8
16-20	4

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 30 minutes)

Solve the following problems.

1. Find Q_3 , D_8 , and P_{60} of this set of data: 23, 42, 37, 26, 23, 38, 47, 29, 33, 38, 41, 36, 47, 29, 34.

2. Find Q_1 , D_4 , and P_{20} of the data below.

Class	Frequency
31-35	6
26-30	8
21-25	3
16-20	7
11-15	6

VI. REFLECTION (Time Frame: 5 minutes)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.

✓ - I was able to do/perform the task. It was quite challenging, but it still helped me in understanding the target content/lesson.

? - I was not able to do/perform the task. It was extremely difficult. I need additional enrichment activities to be able to do/perform this task.

Learning Task 1	LP	Learning Task 2	LP	Learning Task 3A	LP	Learning Task 3B	LP	Assessment	LP
Number 1		Third quartile		a		Third quartile		Number 1	
Number 2		Fourth decile		b		85th percentile		Number 2	
Number 3		65th percentile		c		4th decile			
Number 4									
Number 5									

VII. REFERENCES

Mathematics Learners Module Grade 10, p. 362-395

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W3	Learning Area	Mathematics	Grade Level	10
	Quarter	Fourth	Date	

I. LESSON TITLE	INTERPRETING MEASURES OF POSITION
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	The learner interprets measures of position. (M10SP-IVc-1)
III. CONTENT/CORE CONTENT	Interpreting a measure of position

IV. LEARNING PHASES AND LEARNING ACTIVITIES	
<p>A. Introduction (Time Frame: 20 minutes)</p> <p>Learning Objectives: At the end of the lesson, you are able to:</p> <ol style="list-style-type: none"> recognize the connection between the definition of a measure of position and its interpretation in a given distribution ; interpret a particular measure of position in a distribution; and appreciate the importance of interpretation of measure of position in real life situations. <p>Consider the situation below.</p> <p>Mrs. Rosales gave a 10-item Math quiz to her advisory class. Based on the result, 4 is the median of the scores. What does it mean?</p> <p>Explanation: It means that 50% of the students got scores less than or equal to 4. In addition, the other 50% of the class got scores greater than 4. It comes from the definition of median as the middlemost value in a set of data.</p> <p>Since median has its equivalents in measures of position, namely, in quartiles, in deciles, and in percentiles, then measures of position can also be interpreted the same way the median is interpreted.</p> <p>Study the text that follows.</p>	

B. Development (Time Frame: 40 minutes)

INTERPRETATION OF MEASURES OF POSITION		
Quartiles	Deciles	Percentiles
<ul style="list-style-type: none"> 25% of the distribution has a value less than or equal to the first quartile (Q_1). 50% or one-half of the distribution has a value less than or equal to the second quartile (Q_2). 75% of the distribution has a value less than or equal to the third quartile (Q_3). 	<ul style="list-style-type: none"> 10% of the distribution has a value less than or equal to the first decile (D_1). 20% of the distribution has a value less than or equal to the second decile (D_2). 30% of the distribution has a value less than or equal to the third decile (D_3). <p>NOTE: The connection between deciles and percentiles is that the first decile D_1 is the 10th percentile; the second decile is the 20th percentile; the third decile is the 30th percentile, and so on.</p>	<ul style="list-style-type: none"> 1% of the distribution has a value less than or equal to the first percentile (P_1). 2% of the distribution has a value less than or equal to the second percentile (P_2). 3% of the distribution has a value less than or equal to the third percentile (P_3). <p>NOTE: The percentile position is also the percentage of the values in a distribution less than or equal to that particular percentile.</p>

Look at the following examples and study how each measure is being interpreted.

Illustrative Example 1

In preparation for Palarong Pambansa, Mr. Borja, as CALABARZON athletics team coach, asked his 10 players to run 100 meters. Anthony, one of the players, ran completely in 9 minutes which is 4th decile of the recorded time. What does it mean?

Explanation: Since 4th decile is equal to P_{40} then this means that 40% of the players ran less than or equal to 9 minutes. In other words, $10 \times 40\% = 4$ players ran less than or equal to 9 minutes. Furthermore, 60% of the players or 6 players ran greater than 9 minutes.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Illustrative Example 2

Based on the survey conducted by the Barangay Health Office of Barangay San Jose, the third quartile (Q_3) of the ages of 200 Grade 10 students of that barangay is 16 years old. What does it mean?

Explanation: This means that 75% of the Grade 10 students in Barangay San Jose is 16 years old or younger than 16 years old. In other words, $200 \times 75\% = 150$ Grade 10 students of Barangay San Jose are 16 years old or younger than 16 years old. In addition, 25% or 50 Grade students are older than 16 years old.

Illustrative Example 3

The score of Grace in the Third Quarterly Examination in Mathematics is in the 8th decile (D_8) and the passing score is in the 65th percentile (P_{65}). Did she pass the test? (Assume that the values of D_8 and P_{65} are different.)

Explanation: $D_8 = P_{80}$. Since it is assumed that D_8 and P_{65} have different values, then it can be said that Grace's score is greater than P_{65} . Therefore, she passed the examination.

C. Engagement (Time Frame: 30 minutes)

Learning Task 1

Consider the situation below and answer the questions that follow.

Teacher Liza, the health coordinator of San Jose National High School, recorded the height of 40 students in a Grade 10 class for computing Body Mass Index (BMI). Based on her report, Nadine's height is in the 60th percentile (P_{60}). (Assume that the height of each student is different to each other.)

- How many students are shorter than Nadine?
- How many students are taller than Nadine?
- If Kathryn's height is in the 3rd quartile (Q_3), how can you compare it with Nadine's height?
- If Maymay's height is in the 4th decile (D_4), how can you compare it with Nadine's height?
- If Maymay's height is in the 4th decile (D_4), how can you compare it with Kathryn's height?

Learning Task 2

Read the situation below and answer the questions that follow.

Mr. Aguilar is applying as a staff worker of a shoe factory in Nagcarlan, Laguna. During the interview, he asked the manager about the salary he would get once he is hired. The manager told him that it is in the 4.5th decile.

- What does the manager's answer to Mr. Aguilar mean?
- If Mr. Aguilar's friend is also a staff worker in that shoe factory and receives a salary which is in the 2nd quartile, which of them has a higher salary? Explain. (Assume that Mr. Aguilar is hired in the factory.)
- If the manager told Mr. Aguilar that starting next month he will receive a salary which is in the 3rd quartile, should he be glad with that? Explain.

D. Assimilation (Time Frame: 20 minutes)

Learning Task 3

Answer the following questions.

- The first quartile (Q_1) of the ages of the 120 employees of Tropicana Fruit Factory is 30 years old. What does it imply?
- Mrs. Santos' advisory class has 35 students. She made a report on the weight of each student as part of the feeding program of the school. Roger, one of the students, has a weight which is in the 7th decile. How many students have weight greater than him? (Each of them has unique weight.)
- Rodelyn's score is the 30th percentile in the Second Summative Test in Mathematics. If the passing score is D_4 , did she pass the test? Explain. (The values of P_{30} and D_4 are not equal.)

V. ASSESSMENT (Time Frame: 20 minutes)

Answer the following questions. Choose the letter that corresponds to the correct answer.

- Theodoro took the entrance examination in San Pablo City Science Integrated High School. His score is in the 7th decile and the passing score is the 75th percentile. Suppose that D_7 and P_{75} are not equal, can Theodoro enroll in that school?
 - Yes, because his score is greater than the passing score.
 - Yes, because his score is equal to the passing score.
 - No, because his score is equal to the passing score.
 - No, because his score is below the passing score.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

2. During the flag raising ceremony, Miss Nicole asked her advisory class with 45 students to form a line according to height from the shortest to the tallest. One of the students, Tony, has a height that is in the 40th percentile. Assuming that none of the students has the same height, how many students are taller than Tony?
A. 18 B. 24 C. 27 D. 30
3. Jason got a score of 90 which is the 88th percentile in First Summative Test in Mathematics. Which of the following is TRUE?
A. He passed the test if the passing score is the 9th decile.
B. Eighty-eight percent of the class got scores less than or equal to 90.
C. Twelve percent of the class got scores less than or equal to 90.
D. He scored above 90% of his classmates.
4. The second quartile (Q_2) of the ages of the 50 Grade 7-Rutherford students of San Jose National High School is 12 years old. Which of the following is TRUE?
A. Most of the students are aging 12 years old.
B. All of the students are aging 12 years old.
C. There are 12 students aging 12 years old.
D. There are 25 students that the ages are less than or equal to 12 years old.
5. A certain government scholarship is offered to incoming Grade 11 students in Laguna. The policy is that a student who will pass the qualifying examination will be accepted as scholar. Given that the passing score is in the 60th percentile, which of the following scores will make a student accepted as scholar?
A. Q_1 B. Q_3 C. D_4 D. P_{50}

VI. REFLECTION (Time Frame: 5 minutes)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.

✓ - I was able to do/perform the task. It was quite challenging, but it still helped me in understanding the target content/lesson.

⚡ - I was not able to do/perform the task. It was extremely difficult. I need additional enrichment activities to be able to do/perform this task.

Learning Task 1	LP	Learning Task 2	LP	Learning Task 3	LP	Assessment	LP
a		a		Number 1		Number 1	
b		b		Number 2		Number 2	
c		c		Number 3		Number 3	
d							
e							

VII. REFERENCES

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W4	Learning Area	Mathematics	Grade Level	10
	Quarter	Fourth	Date	

I. LESSON TITLE	PROBLEMS INVOLVING MEASURES OF POSITION
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	The learner solves problems involving measures of position. (M10SP-IVd-e-1)
III. CONTENT/CORE CONTENT	Solving problems involving measures of position

IV. LEARNING PHASES AND LEARNING ACTIVITIES

A. Introduction (Time Frame: 10 minutes)

Learning Objectives: At the end of the lesson, you are able to:

- analyze problems involving measures of position;
- use the appropriate procedure in solving problems involving measures of position and
- appreciates the importance of measures of position in real life situations.

In solving a word problem, it is important to analyze it carefully to easily identify the proper solution.

Considering problems involving measures of position, the following questions should be answered correctly to come up with the right answer:

- What is the data being presented in the problem? Is it ungrouped or grouped data?
- What measure of position is being asked? Is it quartile? decile? percentile?
- What is the procedure to perform and the formula to use?

B. Development (Time Frame: 80 minutes)

Try to study the illustrative examples below.

Illustrative Example 1

San Pablo City is well-known to its delicacies made of coconut. One of them is the buko pie. According to Mang Carlos, an online seller of buko pie, his sales has increased due to the demand of online services due to pandemic. The following data is the number of buko pie boxes being sold for the past ten days: 35, 42, 37, 47, 38, 38, 43, 46, 35, 32. Find Q_3 .

Solution:

Answering the guide questions above,

- The data is ungrouped.
- The measure of position being asked is Q_3 .

STEPS	ILLUSTRATION
1. Arrange the values in the distribution in ascending order.	32, 35, 35, 37, 38, 38, 42, 43, 46, 47
2. Find the position of Q_3 by using $\frac{3}{4}(n + 1)$ where n is the number of values. The resulting value must be rounded to the nearest integer. However, if the resulting value falls halfway between two integers, round it down.	$n = 10$ Position of $Q_3 = \frac{3}{4}(n + 1) = \frac{3}{4}(10 + 1) = \frac{3}{4}(11) = 8.25$. The resulting value 8.25 becomes 8 after rounding it off to the nearest integer. Hence Q_3 is the 8 th value.
3. Look at the arranged distribution. Third Quartile or Q_3 : the value that falls under the computed position of Q_3 .	Based on the given distribution, $Q_3 = 43$.

Therefore, it can be said that 75% of the number of buko pie boxes being sold for the past ten days is less than or equal to 43.

Illustrative Example 2

Coconut oil is one of the benefits of coconut tree to human lives. It contains natural saturated fats that increase good cholesterol levels in human bodies. In TLE we learned about these saturated and unsaturated fats. One of the factories manufacturing the product is Tropicana Food Products, Inc. (TFPI) which was founded in 1975 at the heart of "Coconut City" – San Pablo City, Laguna. TFPI has been the manufacturer of coconut products such as **pioneering Virgin Coconut Oil (VCO) production** in 1985. It has been a major supplier of many VCO brands both locally and internationally. Supposed it has 50 employees with the age data shown below:

Age	Frequency
51-55	3
46-50	7
41-45	12
36-40	8
31-35	9
26-30	11

Find P_{60} .

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Solution:

Answering the guide questions in solving the word problem.

- The data is grouped.
- The problem is asking for P_{60} .
- Formula:

$$P_k = LB + \left(\frac{\frac{kN}{100} - cf_b}{f_{Pk}} \right) i$$

where: LB=lower boundary of the P_k class

N=total frequency

cf_b =cumulative frequency of the class before the P_k class

f_{Pk} =frequency of the P_k class

i =size of class interval

k = nth percentile, where $n=1, 2, 3, 4, 5, 6, 7, 8, 9, \dots, 99$

Age	Frequency (f)	Lower Boundary (LB)	Less than Cumulative Frequency (<cf)
51-55	3	51-0.5=50.5	47+3=50
46-50	7	46-0.5=45.5	40+7=47
41-45	12	41-0.5=40.5	28+12=40
36-40	8	36-0.5=35.5	20+8=28
31-35	9	31-0.5=30.5	11+9=20
26-30	11	26-0.5=25.5	11

(29th-40th value) P_{60} class

N=50

STEPS	ILLUSTRATION
1. Find the position of the P_{60} class.	Position of the P_{60} class = $\frac{60N}{100} = \frac{60(50)}{100} = 30$.
2. Then, look for the class interval where 30 th value belongs.	30 th value belongs to 29 th – 40 th value. 41-45 is the P_{60} class.
3. LB is the lower boundary of the P_{60} class.	$LB = 40.5$
4. cf_b is the less than cumulative frequency below the P_{60} class.	$cf_b = 28$
5. $f_{P_{60}}$ is the frequency of the P_{60} class	$f_{P_{60}} = 12$
6. i is the size of class interval. Count the values from a class interval.	$i = 5$
7. Substitute the values in the formula and get the final answer.	$P_{60} = LB + \left(\frac{\frac{60N}{100} - cf_b}{f_{P_{60}}} \right) i$ $P_{60} = 40.5 + \left(\frac{\frac{60(50)}{100} - 28}{12} \right) 5$ $P_{60} = 40.5 + \left(\frac{30 - 28}{12} \right) 5$ $P_{60} = 40.5 + \left(\frac{2}{12} \right) 5$ $P_{60} \approx 41.33$

Interpretation: 60% of the employees of Tropicana Food Products, Inc. have ages of less than or equal to 41.33.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

C. Engagement (Time Frame: 40 minutes)

Learning Task 1

Solve the following problem.

Mrs. Marasigan is a veterinarian. The Veterinarian is VET, in short, a person who is qualified to treat sick or injured animals such as cats or dogs. *Beterinaryo in Filipino, manggagamot ng hayop na may karamdaman o sakit.* The average salary for a Veterinarian in our country per year is ₱ 286,802. One morning, Vet Marasigan asked her secretary to record the service time she rendered for 15 customers.

The following are service times in minutes: 20, 35, 55, 28, 46, 32, 25, 56, 55, 28, 37, 60, 47, 52, 17.

Find the values of Q_1 , D_7 , and P_{30} . Interpret each measure of position.

Learning Task 2

Grade 10 students are required to take the National Career Assessment Examination (NCAE). It helps students to identify which strands they should take in Senior High School and courses in college. The students in the moving-up class 10-Hera of San Jose National High School obtained the following scores in the NCAE.

Class Interval	F
46-50	4
41-45	5
36-40	7
31-35	11
26-30	13

Find the 3rd quartile, the 62nd percentile, and the 8th decile of the set of data. Interpret each measure of position.

D. Assimilation (Time Frame: 40 minutes)

Learning Task 3A

Consider the situation below and solve the following problem.

Teacher Marites conducted a pretest in Mathematics for the First Quarter to 10 students of her advisory section. The following is the result of the test: 23 38 28 46 22 20 18 34 36 35.

Determine and interpret the following:

- 3rd quartile
- 6th decile
- 55th percentile

Learning Task 3B

As part of the mini-research paper in Mathematics of Grade 10-Demeter, they conducted a survey on the number of minutes the students of Grade 10-Hermes spend in studying their lessons at home. The result of the survey is as follows:

Number of Minutes	Number of Students
101-115	15
86-100	5
71-85	9
56-70	10
41-55	6
26-40	5

Find and interpret the following:

- first quartile
- third decile
- 90th percentile

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 30 minutes)

Solve the following problems.

1. San Jose National High School – Mathematics Department conducted a quiz bee with selected Grade 10 students as participants. This was part of the Festival of Talents for the Second Grading Period. The twenty contestants had the following scores: 24, 37, 25, 25, 39, 42, 28, 25, 31, 37, 32, 45, 33, 21, 30, 43, 42, 46, 33, 40. Find Q_3 , D_2 , and P_{40} . Interpret each measure.

2. Baekhyun conducted a survey on the daily allowances of his classmates as part of his requirement in Mathematics 10. The survey result is shown below:

Allowance	Frequency
71-80	8
61-70	6
51-60	9
41-50	13
31-40	4

Find Q_1 , D_9 , and P_{80} . Interpret each measure.

VI. REFLECTION (Time Frame: 5 minutes)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.

✓ - I was able to do/perform the task. It was quite challenging, but it still helped me in understanding the target content/lesson.

? - I was not able to do/perform the task. It was extremely difficult. I need additional enrichment activities to be able to do/perform this task.

Learning Task 1	LP	Learning Task 2	LP	Learning Task 3A	LP	Learning Task 3B	LP	Assessment	LP
Q_1		Q_3		a		a		Number 1	
D_7		P_{62}		b		b		Number 2	
P_{30}		D_8		c		c			

VII. REFERENCES

Mathematics Learners Module Grade 10, p. 362-395

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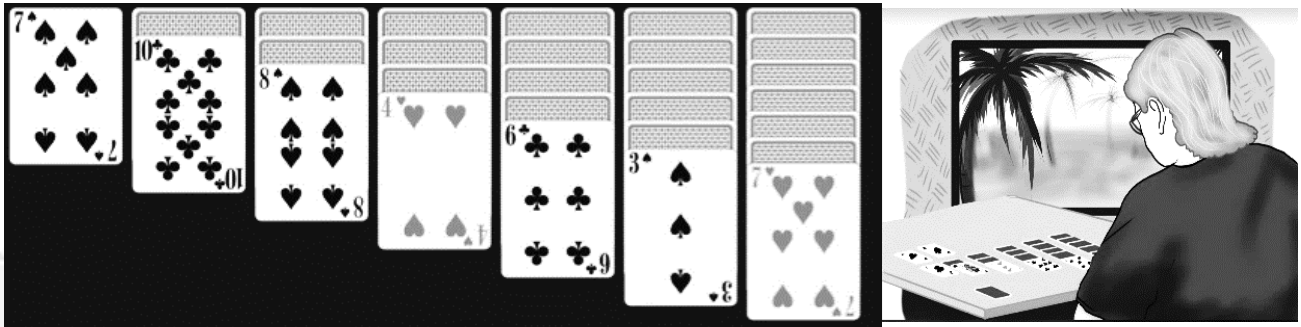
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W5-6	Learning Area	Mathematics	Grade Level	10
	Quarter	4 th Quarter	Date	
I. LESSON TITLE		CONDUCTING A STATISTICAL MINI -RESEARCH		
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)		<ul style="list-style-type: none">Identifies sampling techniques, measures of central tendency and variability. (EC-M10SP-IVf-g1)Formulates statistical mini – research. -M10SP-IVf-g-1		
III. CONTENT/CORE CONTENT				
IV. LEARNING PHASES AND LEARNING ACTIVITIES				
<p>I. Introduction (Time Frame: <u>20 minutes</u>)</p> <p>At the end of this lesson you are expected to :</p> <ol style="list-style-type: none">organize the knowledge about sampling techniques, measures of central tendency and variability;recall the gained knowledge about measures of positions or the quantiles; andconduct statistical mini-research and apply the statistical methods. <p><i>From the previous lessons you have already learned and identified the measures of position and the process of computing.</i></p> <p>Now that you have a deeper understanding of these concepts, in this lesson, you are going to apply the concepts you learned in formulating statistical mini-research. But before we proceed, let us check our previous knowledge about sampling techniques, measures of central tendency, and variability.</p> <p>Let us recall the following :</p> <p>Population- the set of all possible values of a variable.</p> <p>Sample – consists of one or more data drawn from a population.</p> <p>Sampling – method of choosing a representative from a population.</p> <p>Probability Sampling involves random selection, allowing you to make strong statistical inferences about the whole group.</p> <p>Non- probability involves non-random selection based on convenience or other criteria, allowing you to collect data easily.</p> <p>Measures of Central Tendency – are sometimes called <i>measures of central location</i>.</p> <p>A measure of central tendency is a single value that attempts to describe a set of data by identifying the central position within that set of data</p> <p>Mean -often called the average; it is equal to the sum of all the values in the data set divided by the number of values in the data set.</p> <p>Median -the middle score for a set of data that has been arranged in order of magnitude.</p> <p>Range – the difference between the highest and the lowest values in a given set of data.</p> <p>Interquartile Range - the middle half of the data that is in between the upper and lower quartiles.</p> <p>Variance is the average squared difference of the values from the mean.</p> <p>Standard Deviation is the standard or typical difference between each data point and the mean.</p> <p>Since you are going to conduct a statistical mini-research, the aforementioned terminologies are important, and applications also of the computational knowledge you gained are significant.</p>				

Let us have a review.

Illustrative Example 1 .

Look at the pictures below, does it illustrate something ?What can you say about it ?



Let us make a Concept Map about the measures of central tendency and use the numbers shown from the cards to identify the mean, median , mode, range, and interquartile range.

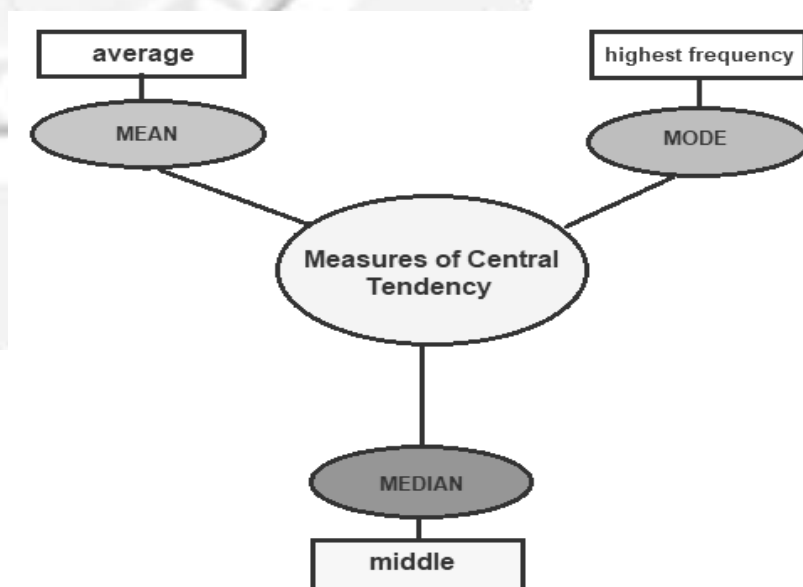
Solution :

The picture above illustrates the tabletop game using cards. This game is called **Solitaire** (**Solitaryo** in tagalog ay larong nagsasanay ng utak) and can be played by one person. This is popular among people even in the old times, particularly in a remote area. In San Pablo City, we can observe our grandparents playing these tabletop game cards solely while resting after a hard time working from the farm. **Solitaire** is an excellent way to diffuse any tension in one's mind or body and helps the person enjoys the day or get to sleep better at night; enough sleep keeps the body healthy. It gives the mind something to focus on, particularly in times of low action when the opportunity to fret is high.

Let us use the number in each card in reviewing the concepts about the measures of central tendency and variability . These numbers are : 7, 10, 8, 4, 6, 3, 7

By Concept Mapping you can easily organize your knowledge learned from the previous lessons you had when you were in grade 8 .

CONCEPT MAP



IV. LEARNING PHASES AND LEARNING ACTIVITIES

Using the number revealed in each card in the tabletop game Solitaire we will compute for the following :

- a. Mean b. Median c. Mode d. Range e. Interquartile Range

Computation :

a. Mean : $\frac{7 + 10 + 8 + 4 + 6 + 3 + 7}{7} = \frac{45}{7} = 6.42$

b. Median : (To identify the median, we need to put the data in an array from lowest to greatest.)

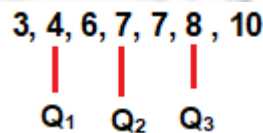
3, 4, 6, 7, 7, 8, 10

We can see that the middle is **7**, therefore, the median is **7**.

c. Mode : The mode is 7 because it is the number that occurs the most frequently.

d. Range : Highest data – Lowest data = 10 – 3 = 7, thus the range is 7.

e. Interquartile Range: The interquartile range includes the 50% of data points that fall between Q_1 and Q_3 .



$IQR = Q_3 - Q_1 = 8 - 4 = 4$, thus the interquartile range is 4.

Now that you have reviewed the concepts about measures of central tendency and variability; and you have already learned and identified measures of position and the process of computing and interpreting results. All these concepts are significant as you learn the lesson on how to conduct a statistical mini-research and be able to answer the guide question: **"How can the position of data be described and used in solving problems?"**

D. Development (Time Frame: 20 minutes)

Mini - research Making

Now, let us have an example of how to conduct **statistical mini-research**. When we say **"research"**, **it is a scientific investigation and study of something in order to establish facts and reach new conclusions.**

Illustrative Example 2.

Supposed you want to know the level of performance of MDL students in Mathematics for the third quarter, thus, you are prompted to conduct a statistical mini research.

Mini- research Title:

The Performance of Students in Mathematics of Grade 10 MDL Students in San Jose National High School of 3rd Quarter S.Y. 2020-2021

I. Background of Study:

For some reason, Mathematics is one of the unloved subjects. Many students have low grades and lack interest in the subjects. Thus, teachers need to know who among the students are experiencing difficulties with and make an intervention that will help them to overcome these.

II. Statement of the Problem:

This mini-research will help the researcher determine the performance of Grade 10 MDL Section L Students in Mathematics at San Jose National High School for the 3rd quarter of S.Y. 2020-2021.

III. Significance of the Study

The research can be able to identify those students who need help and intervention on the subject. This will reveal if the students in MDL class are struggling with mathematics or not.

IV. Methodology

A. Research Design

This is quantitative research. Documentary analysis and purposive sampling was used in conducting this mini-research.

B. Participants/ Respondents

Grade 10 MDL Students Section L at San Jose NHS.

C. Data Gathering (This is most important part of statistics, data should be collected accurately and convenient to use.)

The data were taken from the teacher's class record.

D. Statistical Treatment :

Mean = Average

Percentile : P_{15}

Percentile Rank

The first thing you should do is to create a **frequency table**

A **frequency table** is a table that list items and shows the number of times the items occur. We represent the frequency by the English alphabet "f"

Then, we have now the final table.

Class Interval	f	LB	<cf	Xm	fXm
94 - 97	4	93.5	45	95.5	382
90 - 93	5	89.5	41	91.5	457.5
86 - 89	10	85.5	36	87.5	875
82 - 85	9	81.5	26	83.5	751.5
78 - 81	9	77.5	17	79.5	715.5
74 - 77	5	73.5	8	75.5	377.5
70 - 73	3	69.5	3	71.5	214.5
$i = 4$	$N = 45$			$\sum fXm = 3,791.5$	

Computation :

$$\begin{aligned}\text{Mean} &= (\sum fXm) / N \\ &= \frac{3,791.5}{45} \\ &= 84.26\%\end{aligned}$$

Percentile : P_{15}

$$\begin{aligned}P_{15} &= LB + \left[\frac{\frac{K_{15}}{100} - <cf_b}{f_{p_k}} \right] i \\ P_{15} &= 73.5 + \left[\frac{\frac{15(45)}{100} - 3}{8} \right] 4\end{aligned}$$

$$P_{15} = 73.5 + \left[\frac{6.75 - 3}{8} \right] 4$$

$$P_{15} = 73.5 + (0.46875)(4)$$

$$P_{15} = 73.5 + 1.875$$

$$P_{15} = 75.375 = 75$$

Therefore, 15% of the N has grade of ≤ 75

Percentile Rank

Using Percentile Rank , we are going to determine how many students got the grade below 80. Thus, we are going to get the Percentile Rank of 79 which is between 78-81 class interval ; it is in the 3rd class.

$$PR = \left[\frac{100}{N} \right] \left[\frac{(P - LB)f_p}{i} + cf_p \right]$$

$$PR = (2.22)(3.375 + 8)$$

$$PR = (2.22)(11.375)$$

$$PR = 25.25 = 25$$

$$PR = \left[\frac{100}{45} \right] \left[\frac{(79 - 77.5)9}{4} + 8 \right]$$

$$PR = \left[2.22 \right] \left[\frac{13.5}{4} + 8 \right]$$

Therefore 25% of the class got the grade of ≤ 79 .

IV. Results and Findings (Evaluation)

The class has an average of 84.26% or 84%.

15% of the MDL Class Section L has a grade of which is equal or less than 75.

85% of the MDL Class Section L has a grade of which is equal or greater than 75.

25% of the MDL Class Section L has a grade of which is equal or less than 79.

75% of the MDL Class Section L has a grade of which is equal or greater than 79.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. Conclusion and Recommendation

Based on the results, the MDL Class Section L got a high mastery level of performance for the third quarter in Mathematics. There are only a few students who will be given an intervention.

The Math Teachers of MDL Grade, 10 section L, must prepare intervention materials for that 25% of the class who failed to reach above 75% of the grade.

VI. References

Here , you list down the books, journals, links , etc. that helps you in conducting this mini-research.

To summarize, let us consider the following Five Steps in conducting statistical mini-research :

STEP 1- State the problem, concern, or issues you need to solve (You can formulate hypothesis.)

STEP 2- Design the Research (You can make the outline to have a meaningful result.)

STEP 3- Gather data (You can gather from records, websites, survey checklist/questionnaire, interview.)

STEP 4- Use Statistical Treatment (You can apply formulas you learned in Statistics.)

STEP 5- Formulate conclusions and recommendation (This answers the hypothesis.)

After doing the steps you can now write the final draft of your Mini- research.

E. Engagement (Time Frame: 30 minutes)

Learning Task 1 : Am I a Scholar

Dennis and Christine scored 32 and 23, respectively, in the National Career Assessment Examination (NCAE). The determining factor for a college scholarship is that a student's score should be in the top 10% of the scores of his/her graduating class. The students in the graduating class obtained the following scores in the NCAE.

1. Complete the table by filling in the values of LB (lower boundaries) and <cf (less than cumulative frequency). Explain how you arrived at your answers.

2. Find the 3rd quartile, 72nd percentile, and the 8th decile of the set of data.

3. What is the percentile rank of Dennis and Christine?

4. Based on their percentile and percentile ranks, will Dennis and Christine receive a scholarship? Explain your answer.

NCAE Scores	f	LB	<cf	Xm	fXm
39 - 41	6				
36 - 38	7				
33 - 35	9				
30 - 32	13				
27 - 29	22				
24 - 26	10				
21 - 23	9				
18 - 20	7				
15 - 17	8				
12 - 14	4				
9 - 11	2				
6 - 8	1				
3 - 5	1				

IV. LEARNING PHASES AND LEARNING ACTIVITIES

A. Assimilation (Time Frame: 60 minutes)

Learning Task 2 : Based on Research

Conduct a mini-research on students' performance in their third quarter summative test in Mathematics. Apply the knowledge and skills you have learned in this lesson based on the test results and make/formulate meaningful decisions based on the results to resolve the identified problem, concern, or issue.

V. ASSESSMENT (Time Frame: 60 minutes)

Learning Task 3 : Be a Researcher

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. A high BMI can be an indicator of high body fatness. BMI can be used to screen for weight categories that may lead to health problems. The TLE and MAPEH teachers usually have a record of this.

Make a mini-research about the nutritional status of Grade 7 students of your school. Apply the knowledge and skills you learned in this lesson. Like for instance, you will identify the percentile of severely wasted Grade 7 students and what recommendation you can give based on your findings.

Follow the STEPS 1-5, until you do the final draft of your statistical mini-research.

VI. REFLECTION (Time Frame: 10 minutes)

Journal Writing

Write an entry in your journal describing how much you have learned about quantiles, and how these can be applied to real life. Add also the parts of the lesson that you still find confusing, if any. Work on these difficulties with your teacher.

VII. REFERENCES

Mathematics Learner's Module Grade 10 , pages 396-400

<https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php>

<https://statisticsbyjim.com/basics/variability-range-interquartile-variance-standard-deviation/>

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W7-8

Learning Area Mathematics
Quarter 4th Quarter

Grade Level 10
Date

I. LESSON TITLE

ANALYZING AND INTERPRETING DATA

II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)

Uses appropriate measures of position and other statistical methods in analyzing and interpreting research data. **M10SP-IVh-j-1**

III. CONTENT/CORE CONTENT

IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: 20 minutes)

Learning objectives:

- recall the different formulas about measures of position and the conduct of statistical mini-research;
- apply appropriate measures of position that can describe the given data; and
- employ statistical methods in analyzing and interpreting research data.

In your previous lessons, you could solve problems involving measures of position such as quartile, decile, and percentile. Can you still remember those formulae?

Let us recall. Below are the formulas that we can use to solve position that measure both in ungroup or group data.

Measure of Position	Ungrouped (Position)	Grouped Data
Quartile	$Q_k = \frac{k(n+1)}{4}$	$Q_K = LB + \left(\frac{\frac{kN}{4} - cf_b}{f_{Q_k}} \right) i$
Decile	$D_k = \frac{k(n+1)}{10}$	$D_K = LB + \left(\frac{\frac{kN}{10} - cf_b}{f_{D_k}} \right) i$
Percentile	$P_k = \frac{k(n+1)}{100}$	$P_K = LB + \left(\frac{\frac{kN}{100} - cf_b}{f_{P_k}} \right) i$
Percentile rank	-----	$P_{PR} = \frac{100}{N} \left[\frac{(P-LB)f_p}{i} + cf_p \right]$

Before you proceed, let us answer the following by identification:

- It is a scientific investigation and study of something to establish facts and reach new conclusions. _____
- Data should be collected accurately in a manner convenient to use.
Would you be able to answer the two questions?

Let's check your answer!

"Research" is the answer in number 1

"Data gathering" is the answer in number 2

You learned from the previous two weeks about conducting mini-research.

"Research" is a careful and detailed study that uses a scientific method to solve the concern, problem, and issues, and **"Data gathering"** is the most important part, and it should be done in a manner that accurate and can be used conveniently.

Let us recall the 5 STEPS again in conducting statistical mini-research.

STEP 1- State the problem, concern, or issues you need to solve.

STEP 2- Design the Research

STEP 3- Gather data

STEP 4- Use Statistical Treatment

STEP 5- Formulate conclusion and recommendation.

In conducting mini-research, analyzing and interpreting data is very important. **Analyzing data** is the **heart** of the research; it transforms the data gathered into meaningful information. On the other hand, **interpreting data** is reviewing data, such as taking data analysis, assigning some meaning, and using them to arrive at a relevant conclusion. We can do this by using appropriate measures of position and other statistical methods. A researcher does this under STEP 4 and STEP 5 in conducting statistical mini-research.

You learned that the measures of position reveal to you the location of the score corresponding to a bunch of information. You learned that quartiles, deciles, and percentiles are otherwise called **quantiles**.

Quantiles refer to measures of position that divide a distribution into four, ten, and hundred equal parts.

Quartiles are a powerful method to figure out where the information fall. You can undoubtedly recognize differences, the focuses that are unreasonably high or low. Deciles are used more often in real life than in the classroom. For example, a researcher uses deciles to report drought data. Then again, percentiles are standard measures of position. There are the ideal approaches to communicate measures of position for the enormous arrangements of information. For example, numerous public appraisals, such as BMI, NAT, and NCAE scores, utilize percentiles to pass on where explicit scores fall and maybe effectively interpret them.

Illustrative Example 1.

a. Suppose in a 100-item test; the passing mark is the 3rd quartile. What does it imply?

Answer: The students should answer at least 75 items correctly to pass the test.

b. Francine is a secretary in a major organization in San Pablo, Laguna. If she wants to know if her salary belongs to the upper 20% and lower 80% of the data set, what should she use?

Answer: Francine can use percentile in order to determine the upper 20% and lower 80%.

c. What measure of position should be used to get the rank of a particular examinee in the BAR exam?

Answer: Percentile

To understand more about analyzing and interpreting research data using the measures of position and other statistical methods, let us have the following illustrative examples.

D. Development (Time Frame: 20 minutes)

Illustrative Example 2.

Teacher Ana is an Occupational Therapist-Teacher. She was conducting Case Study research on the academic standing of her SPED student, Roy, who is mainstreamed into a regular classroom in one of the schools in San Pablo City. As part of her study, she coordinated with Roy's teacher, and she got scores of the whole class in a 50-item test in English. She found out that Roy's score was 35 points.

She organized the gathered data as shown in the table below:

Scores	f	LB	<cf
44-47	6	43.5	50
40-43	3	39.5	44
36-39	4	35.5	41
32-35	9	31.5	37
28-31	6	27.5	28
24-27	5	23.5	22
20-23	12	19.5	17
16-19	5	15.5	5

To get the standing of Roy in English test she used the Percentile Rank.

Solution:

1. Let's compute using the Percentile Rank formula:

$$PR = \left[\frac{100}{N} \right] \left[\frac{(P - LB)f_p}{i} + cf_p \right]$$

$$PR = \left[\frac{100}{50} \right] \left[\frac{(35 - 31.5)9}{4} + 28 \right]$$

$$PR = \left[2 \right] \left[\frac{(3.5)9}{4} + 28 \right]$$

$$PR = \left[2 \right] \left[\frac{31.5}{4} + 28 \right]$$

$$PR = \left[2 \right] \left[7.86 + 28 \right]$$

$$PR = (2)(35.86)$$

$$PR = 71.72 = 72$$

2. Let us analyze and interpret the data.

By using the statistical treatment, which is Percentile Rank, Teacher Ana was able to get the academic standing of Roy in his English Subject. The value of the percentile rank is 72%. This means that 72% of the class got a score of less than 35 points, and 28% of the class got a higher score than 35 points. Therefore, Teacher Ana can conclude that Roy has a good academic standing in his English class because the percentile rank revealed that his score was above 72% of the whole class.

Illustrative Example 3.

A Mini-Research on a third grading grade of Grade 9 students was made. A survey of 60 students from San Pablo City Integrated High School about their grades in mathematics was conducted. The researcher would like to find out the status of Grade 9 by getting the mean and the first quartile. The researcher organized the data and were presented in a table:

Scores	f	LB	<cf	Class mark	fM
95-99	7	94.5	60	97	679
90-94	16	89.5	53	92	1472
85-89	17	84.5	37	87	1479
80-84	16	79.5	20	82	1312
75-79	4	74.5	4	77	308

1. Let us find the mean

$$\text{Mean} = (\sum fX_m) / N = 5250 / 60 = 87.5$$

Data analysis and interpretation:

Hence, the average grade in Math of 60 students is 87.5 %

Based on the result computed, it is shown that Grade 9 students have a satisfying grade in Math.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

2. Let us compute the first quartile, Q_1

$$Q_K = LB + \left(\frac{\frac{kN}{4} - cf_b}{f_{Q_k}} \right)$$

$$Q_1 = 79.5 + \left(\frac{\frac{60-4}{4}}{16} \right)$$

$$Q_1 = 79.5 + \left(\frac{15-4}{16} \right)$$

$$Q_1 = 79.5 + \left(\frac{1}{16} \right)$$

$$Q_1 = 79.5 + 0.0625$$

$$Q_1 = 79.5625 = 80$$

Data analysis and interpretation:

Therefore, 25% of the students had a grade of less than or equal to 80%. This means that 15 students needed remediation or intervention in their Math class because they had a grade of 80% or below.

Hence, you know now that data analysis occurs after a statistical treatment has been applied to a collection of data that has been compiled, arranged, and presented and may use the predictive treatment findings to draw conclusions.

E. Engagement (Time Frame: 60 minutes)

Learning Tasks 1: Show me the Proof

Ask your classmates about their Science, English, and Mathematics grades. Gather all the data from your classmates by listing. Then, construct a frequency distribution of a grouped data. (use $i = 5$).

1. Calculate the following:

- 1st quartile
- 4th decile
- 60th percentile
- percentile rank of 75

2. Interpret each result

A. Assimilation (Time Frame: 10 minutes)

Learning Tasks 2: Let's choose the BEST!

- Which measure of position should be used in order to get the rank of a particular student in the NCAE?
 - Fractiles
 - Quantiles
 - Quartile
 - Percentile
- What measure of position are you going to use if you are to determine whether an observation from a set of data falls in the upper 20% or the lower 80% of the ordered data set?
 - 20th percentile
 - 80th percentile
 - 5th decile
 - 2nd quartile
- If you are to determine whether an observation from a set of data falls in the upper 50% or the lower 50% of the ordered set, what is the most appropriate tool to use?
 - 1st Quartile
 - 2nd Decile
 - 3rd Quartile
 - Median
- Jasmine will determine the score that divides a set of data into the upper 75% or lower 25%. What measures of the position must she use?
 - 3rd Quartile
 - Median
 - 6th Decile
 - 70th Percentile
- Roentgen conducted a study that analyzes the performance of the Grade 10 students in the Third Periodical Test in English, the average score is 30, and its percentile rank is 60%. What does it imply?
 - 30% of the students are above the average score of 60
 - 40% of the students are below the average score of 30
 - 60% of the students are above the average score of 30
 - 60% of the students are below the average score of 30

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 120 minutes)

Learning Tasks 3: Make a Research.

1. Determine the number of active cases of covid-19 in 5 cities in Laguna province over the last 4 weeks. Then do the following:
 - a. Formulate a research TITLE.
 - b. Write the Background of the Study.
 - c. Analyze and Interpret the data that you gathered applying measures of position.

VI. REFLECTION (Time Frame: 5 minutes)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.

✓ - I was able to do/perform the task. It was quite challenging, but it still helped me in understanding the target content/lesson.

? - I was not able to do/perform the task. It was extremely difficult. I need additional enrichment activities to be able to do/perform this task.

Learning Task 1	LP	Learning Task 2	LP	Learning Task 3	LP
Number 1		Number 1		Number 1 (a)	
Number 2		Number 2		(b)	
		Number 3		(c)	
		Number 4			
		Number 5			

VII. REFERENCES

Mathematics Learner's Module Grade 10 , pages 396-400
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