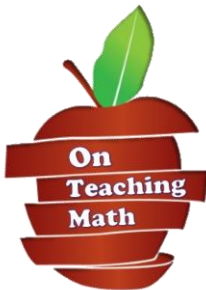


**Complete
Bundle**

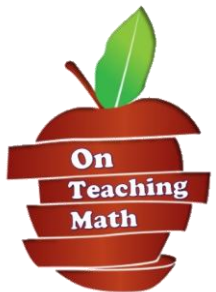
**IB
Math**

**4.3 Statistics
Central Tendencies**



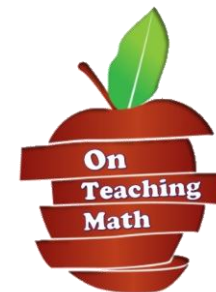
What's Covered?

- 1 IB Math SL AI Unit 4.3 – Central Tendencies
- 2 Using technology to find measures of central tendency
- 3 Changes in central tendency when adding or multiplying the data set by a value
- 4 Representing and interpreting the spread of data with graphs and images



What's Included?

- 1 PowerPoint Lesson on 4.3 – Part 1 – Measures of Central Tendency
- 2 PDF Guided Notes for 4.3 – Part 1
- 3 PowerPoint Lesson 4.3 – Part 2 – Transitions of Central Tendencies
- 4 PDF Guided Notes for 4.3 – Part 2
- 5 Student Reference Guide
- 6 2 Homework Assignments
- 7 2 Activities
- 7 Practice Test & Test



The Lesson – Part 1

It Looked Good, But Felt Bad



It all started with a math teacher (me) glancing over the test scores of two classes.

Both had the same average, 72%.

At first I thought, "Bruh, we nailed it. Consistency is a sign of healthy classes."

Lesson Objectives

Compute and interpret **mean, median, mode, range, IQR, and standard deviation (σ)** for small data sets.

Explain why equal means do **not** imply similar performance; use at least two measures of spread to justify claims.

➤ **Median:** The middle value of a data set when ordered from smallest to largest, representing the center of the data.

Class A had the following scores:

50, 52, 70, 95, 91, 72, 72

50, 52, 70, 72, 72, 91, 95

Median: 72

How do you manually find the median?

Class B had these scores:

71, 72, 70, 74, 71, 72, 74

How do you find the median on a Ti-Nspire?

Same steps as finding the mean. Then scroll down until you see: MedianX ...

So these two data sets have the same mean and median.

Are there significant differences between the groups?

What statistical measurement could be used to describe these differences?

Measures of Central Tendency

- **Mean:** The arithmetic average of all values in a data set, calculated by summing all values and dividing by the number of values.
- **Median:** The middle value of a data set when ordered from smallest to largest, representing the center of the data.
- **Mode:** The most frequent value in a data set, indicating the most common data point.
- **Range:** The difference between the highest and lowest values in a data set, providing a simple measure of spread.
- **Standard Deviation:** A measure of how spread out the data is from the mean, calculated as the average distance of each data point from the mean (σ for population).
- **Inner Quartile Range (IQR):** The range of the middle 50% of the data, calculated as the difference between the third quartile (Q3) and the first quartile (Q1).

➤ **Standard Deviation:** A measure of how spread out the data is from the mean, calculated as the average distance of each data point from the mean (σ for population).

Class A had the following scores:

50, 52, 70, 95, 91, 72, 72

15.9



On average, the scores in this class are 15.9 points from the mean.

Class B had these scores:

71, 72, 70, 74, 71, 72, 74

1.41



On average, the scores in this class are 1.41 points from the mean.

Meet the Players

Class A had the following scores:

50, 52, 70, 95, 91, 72, 72

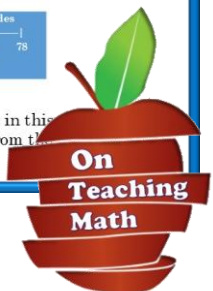
Class B had these scores:

71, 72, 70, 74, 71, 72, 74

Both classes had an average score of 72%.

What's up with this?

19 Total Slides – Aligned with the Guided Notes



The Guided Notes – Part 1

4.3.1 Measures of Central Tendency & Dispersion GN

Name: _____

Lesson Objectives:

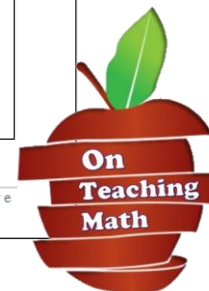
Big Idea:

Measures of Central Tendency

- **Mean:** The arithmetic average of all values in a data set, calculated by summing all values and dividing by the number of values.
- **Median:** The middle value of a data set when ordered from smallest to largest, representing the center of the data.
- **Mode:** The most frequent value in a data set, indicating the most common data point.
- **Range:** The difference between the highest and lowest values in a data set, providing a simple measure of spread.
- **Standard Deviation:** A measure of how spread out the data is from the mean, calculated as the average distance of each data point from the mean (σ for population).
- **Inner Quartile Range (IQR):** The range of the middle 50% of the data, calculated as the difference between the third quartile (Q3) and the first quartile (Q1).
- **Central Tendency:** A measure (mean, median, or mode) that describes the center or typical value of a data set.
- **Dispersion:** A measure (range, IQR, standard deviation) that describes the spread or variability of data points in a data set.
- **Population:** The entire group of data being analyzed, where standard deviation is denoted by σ .
- **Sample:** A subset of a population, where standard deviation is denoted by s_x .

Mean	
Class A had the following scores: 50, 52, 70, 95, 91, 72, 72	Class B had these scores: 71, 72, 70, 74, 71, 72, 74
Find the mean manually.	Find the mean with a TI-Nspire
How do you manually find the mean?	Steps for TI-Nspire
The notation for mean is:	
Median	
Find the median manually.	Find the median with your calculator.
Range	
Find the range manually.	Find the range with your calculator.
Standard Deviation	
Standard deviation is:	
Small SD:	
Large SD	
The units for SD are:	
The symbol for SD is:	
Population SD symbol:	Sample SD symbol:
Steps to find standard deviation on your calculator:	

Class A had the following scores: 50, 52, 70, 95, 91, 72, 72	Class B had these scores: 71, 72, 70, 74, 71, 72, 74
Standard deviation and meaning in this context:	Standard deviation and meaning in this context:
Class A's Distribution of Grades ----- ----- ----- ----- 50 60 70 80 90 100 + + + + + +	Class B's Distribution of Grades ----- ----- ----- ----- 68 70 72 74 76 78 + + + + + + + +
Variance:	
Inner Quartile Range (IQR)	
Create a labeled box-and-whisker graph for each data set in the space below.	
Analysis of the data:	



The Lesson – Part 2

Key Concepts

Adding/Subtracting a Constant

- Shifts the entire data set.
- Mean, median, and mode change by that constant.
- Spread measures (range, IQR, standard deviation) remain unchanged.

Multiplying/Dividing by a Constant

- Scales the entire data set.
- Mean, median, and mode are multiplied by the constant.
- Spread measures also scale by the absolute value of the constant.

Why It Matters

- Helps understand unit conversions (e.g., °C to °F).
- Explains grade scaling, tax adjustments, and price changes.

Key Insight: Adding a constant shifts the mean, median, and mode by the same amount (+0.50 here) but **does not change the spread** (range, IQR, standard deviation).

The prices of apples juice at 5 stores WERE:

\$1.50, \$1.75, \$2.00, \$2.25, \$2.50.

The price increased by \$0.50 at each store. Use your calculator to find the new measures of central tendency.

	BEFORE	AFTER
Mean:	\$2.00	\$2.50
Median:	\$2.00	\$2.50
Mode:	None	None
Range:	\$1.00	\$1.00
IQR:	\$0.75	\$0.75
Standard Deviation:	\$0.35	\$0.35

Did we add or multiply a value to all of the data points?

Transformation of Center and Spread

Transformation	Mean	Median	Mode	Range	IQR	Standard Deviation
Add/Subtract constant	Shifts (\pm)	Shifts (\pm)	Shifts (\pm)	No change	No change	No change
Multiply/Divide	Scales (\times)	Scales (\times)	Scales (\times)	Scales (\times)	Scales (\times)	Scales (\times)

Fill out the reference table using what you've learned today.



The prices of apples juice at 5 stores WERE:

\$1.50, \$1.75, \$2.00, \$2.25, \$2.50.

The price increased by \$0.50 at each store. Use calculator to find the new measures of central tendency.

	BEFORE	AFTER
Mean:	\$2.00	\$2.50
Median:	\$2.00	\$2.50
Mode:	None	None
Range:	\$1.00	\$1.00
IQR:	\$0.75	\$0.75
Standard Deviation:	\$0.35	\$0.35

Did we add or multiply a value to all of the data points?

What was the end result?

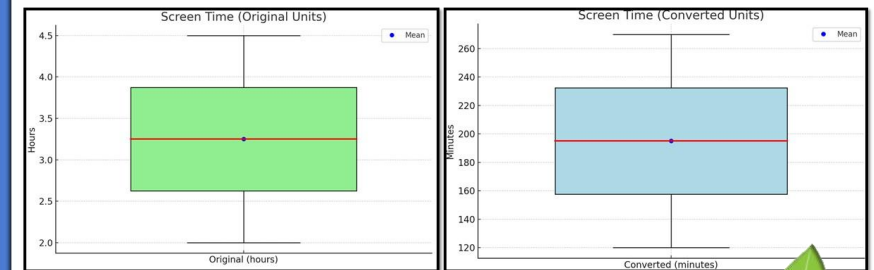


The student scores on a recent quiz were as follows:

7, 8, 10, 6, 9, 7, 10

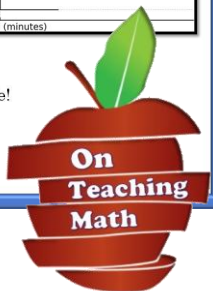
Now multiply each score by 1.5. Use your calculator to find the measures of central tendency.

	BEFORE
Mean:	8.14
Median:	8
Mode:	7
Range:	4
IQR:	3
Standard Deviation:	1.46



Just by glancing these look the same. But, look at the scale!

This is why labeling your graphs is KEY!



24 Total Slides – Aligned with the Guided Notes

The Guided Notes – Part 1

4.3.2 Transformation of Center and Spread Guided Notes

Name: _____

Lesson Objectives

Key Concepts

Juice Prices: The prices of apples juice at 5 stores are:

\$1.50, \$1.75, \$2.00, \$2.25, \$2.50.

Use your calculator to find the measures of central tendency.

The price increased by \$0.50 at each store.

Before	Mean	Median	Mode	Range	IQR	SD
After						

Did we add or multiply a value to all of the data points? Describe the result on the measures of central tendency.

Key Insight:

© On Teaching Math 2025

Lumber: The lengths of lumber in meters are as follows:

1.2, 1.5, 1.7, 1.8, 2.0

Use your calculator to find the measures of central tendency.

Convert the lengths to centimeters ($\times 100$).

Before	Mean	Median	Mode	Range	IQR	SD
After						

Did we add or multiply a value to all of the data points? Describe the result on the measures of central tendency.

Key Insight:

Test Scores: The student scores on a recent quiz were as follows:

7, 8, 10, 6, 9, 7, 10

Use your calculator to find the measures of central tendency.

Then, multiply each score by 1.5.

Before	Mean	Median	Mode	Range	IQR	SD
After						

Did we add or multiply a value to all of the data points? Describe the result on the measures of central tendency.

Key Insight:

© On Teaching Math 2025

2 | Page

Transformation of Center and Spread Reference Chart

Transformation	Mean	Median	Mode	Range	IQR	Standard Dev
Add/Subtract constant						
Multiply/Divide						

Daily Steps

4000, 5200, 6100, 7000, 8300
 Mean = 6120
 Median = 6100
 Mode = None
 Range = 4300
 IQR = 1800
 Standard Deviation ≈ 1474.31

Screen Time

A group of 6 students reported their daily screen time in hours:
 2.0, 2.5, 3.0, 3.5, 4.0, 4.5
 Original Data (hours)
 Mean = 3.25
 Median = 3.25
 Mode = None
 Range = 2.5
 IQR = 1.25
 Standard Deviation ≈ 0.85

© On Teaching Math 2025

3 |

You Try:			
Original Data	After	Original Data	After
A data set has: Mean = 45 Median = 46 Mode = 44 Range = 12 IQR = 6 Standard Deviation = 4		Mean = 3.25 Median = 3.25 Mode = None Range = 2.5 IQR = 1.25 Standard Deviation ≈ 0.85	
Add 5 to each point.		Multiply by 3.	

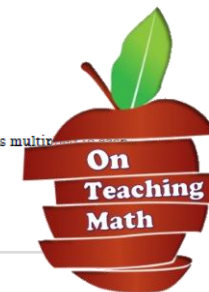
You Try:			
Original Data	After	Original Data	After
Mean = 100 Median = 98 Mode = 102 Range = 40 IQR = 18 Standard Deviation = 7		A data set has a mean of 65 and standard deviation of 0. What happens if you: a) Add 7 to each value? b) Multiply every value by 2?	
Double, then subtract 10.			

Reflection and Check for Understanding:

What happens to the measures of central tendency when:

- A constant is added to each data point?
- A constant is multiplied to each data point?
- A constant is added to each data point and another constant is multiplied to each data point?

© On Teaching Math 2025



Homework, Activities, Quiz

2.4.1 Measures of Central Tendency HW 1

Name: _____

1. Write a definition for each of the following:

- Standard Deviation:
- Population Standard Deviation:
- Sample Standard Deviation:

2. What is the difference between variance and standard deviation?

3. For the following data sets compute the a) mean, b) median, c) mode, d) range, e) standard deviation. Sketch (and label) a box-and-whisker plot for each data. Then, write a brief explanation of the differences between the two data sets, supporting your claims with the statistical evidence gathered.

Mean	70, 71, 72, 73, 73, 74	60, 65, 60, 6, 72, 68, 100
Median		
Mode		
Range		
Standard Deviation		

4.2.2 Transformation of Center and Spread HW 1

Name: _____

Part A - Applying Transformations (5 Questions)

For each question, the original measures are given. Calculate the new measures of central tendency and spread after the stated transformation.

- A data set has mean = 52, median = 54, mode = 50, range = 14, IQR = 5, SD = 5. Every value is increased by 7.
- A data set has mean = 20, median = 25, mode = 25, range = 20, IQR = 13, SD = 6. Every value is multiplied by 2.
- A data set has mean = 90, median = 85, mode = 92, range = 10, IQR = 5, SD = 3. Every value is decreased by 4.
- A data set has mean = 65, median = 63, mode = 60, range = 20, IQR = 15, SD = 7. Every value is multiplied by -2.
- A data set has mean = 20, median = 19, mode = 21, range = 5, IQR = 4, SD = 2. Every value is increased by 15.
- A data set has mean = 110, median = 108, mode = 115, range = 25, IQR = 10, SD = 5. Every value is multiplied by 0.5.
- A data set has mean = 64, median = 66, mode = 67, range = 16, IQR = 6, SD = 4. Every value is increased by 3 and then doubled.
- A data set has mean = 72, median = 70, mode = 74, range = 12, IQR = 7, SD = 3. Every value is multiplied by 5 and then decreased by 10.

Part B - Raw Data and Graphing (3 Questions)

9. Histogram

The daily study hours of 8 students are:

1, 2, 2, 4, 4, 5, 6

- Find the mean, median, mode, range, IQR, and SD.
- Then add 2 hours to each value. Recalculate the measures.
- Create a histogram for the original data and the shifted data (use bin widths of 1 hour).

10. Box and Whisker Plot (Addition)

The quiz scores of 10 students are:

12, 15, 17, 15, 19, 20, 21, 22, 24, 25

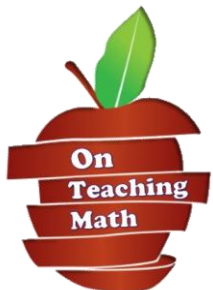
- Find all measures of central tendency and spread.
- Then increase all scores by 5 points. Recalculate the measures.
- Create side-by-side box and whisker plots of the original and shifted data.

11. Box and Whisker Plot (Multiplication)

The weights (kg) of 7 puppies are:

4, 5, 5, 5, 7, 5, 9

- Find all measures of central tendency and spread.
- Then convert the weights into pounds (multiply by 2.2). Recalculate the measures.
- Create side-by-side box and whisker plots of the original and converted data.



Homework, Activities, Quiz

Practice Test – Unit 4.1 to 4.3 (Student Version)

Covers: Data Collection & Types of Data, Presentation of Data, Measures of Central Tendency & Dispersion

Section A: Knowledge & Skills

- Which of the following represents the population?
 - 200 selected students
 - All students in the district
 - Students who prefer print books
 - Teachers using the digital textbooks
- Classify each as discrete or continuous:
 - Height
 - Number correct
 - Time Spent
- Which is best displayed with a bar graph:

Favorite sport, Heights of students, Test times
- Find the mean, median, mode, range for data: 5, 7, 9, 7, 6.
- True/False: Increasing sample size always guarantees reliability.

Section B: Applications

- A frequency table shows test score intervals. Estimate the **mean**. State the modal class.

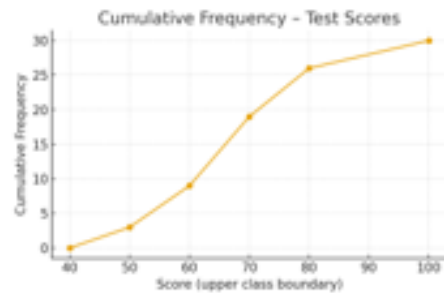
Interval (Score)	Frequency
$40 \leq x < 50$	3
$50 \leq x < 60$	6
$60 \leq x < 70$	10
$70 \leq x < 80$	7
$80 \leq x < 100$	4

- Data: 5.3, 6.4, 6.8, 7.0, 7.2, 7.4, 7.5, 7.6, 7.7, 7.9, 8.1, 8.4, 8.9, 9.2, 10.5. Find IQR, and identify any outliers.
- A dataset has a **mean** of 64, **SD**=6. Add 5 to each. New **mean**? New **SD**?
- A district samples every 50th student alphabetically. What sampling method is this?

Section C: IE-Style Questions

- Use cumulative frequency graph below to answer the following questions.
 - What is the **median**?

- What is the modal class?
- What is the **IQR**?
- How many **students** scored more than 50?
- How many **students** scored between 50 and 70?



- Use the frequency density diagram below to fill out the table below. Total number of students: $N = 20$



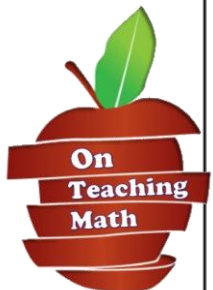
Complete the table below.

Interval (Score)	Class width	Frequency density (height)	Frequency (area)
$40 \leq x < 50$	10	0.3	
$50 \leq x < 60$	10		
$60 \leq x < 70$	10		
$70 \leq x < 80$	10		
$80 \leq x < 100$	20		

Estimate the **mean**.

What is the modal class?

- Grab quiz #1. What material on that quiz did you mess up? How can you make sure you don't make those same mistakes?



Homework, Activities, Quiz

Consistency in Experiments — Student Handout

Learning Targets:

- Compute and interpret mean, median, range, IQR, and standard deviation (σ).
- Choose appropriate displays (histogram for numerical data; bar graphs for categorical).
- Write a comparison using claim-evidence-reasoning with at least two spread measures.

Directions: For each station,

- 1) Make a histogram using the given bin widths.
- 2) Draw a box-and-whisker plot (five-number summary).
- 3) Compute mean, range, IQR, σ . Use units.
- 4) Write a 3–5 sentence comparison answering the station question and justifying with statistics.

Station 1 — Reaction Time (keyboard vs. screen tap)

Question: Which method gives more consistent reaction times?

Method K (keyboard, s): 0.41, 0.45, 0.46, 0.47, 0.48, 0.49, 0.5, 0.51, 0.52, 0.46, 0.47, 0.49

Method S (screen tap, s): 0.29, 0.35, 0.35, 0.42, 0.45, 0.45, 0.45, 0.4, 0.5, 0.55, 0.64

Suggested bins: 0.25–0.65 by 0.05

Task: Histogram • Box plot • Mean • Range • IQR • σ

Station 2 — Paper Helicopter Flight Time (Design A vs. B)

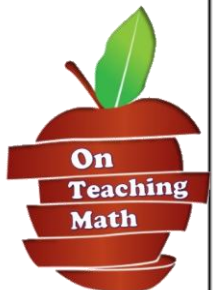
Question: Which rotor design produces more stable flight times?

Design A (s): 2.3, 2.4, 2.4, 2.4, 2.5, 2.4, 2.3, 2.4, 2.5, 2.4, 2.5, 2.4, 2.5, 2.3, 2.3

Design B (s): 1.9, 2.0, 2.1, 2.2, 2.4, 2.4, 2.5, 2.9, 2.7, 2.3, 2.5, 2.4, 2.0, 2.9, 2.1

Suggested bins: 1.5–3.0 by 0.2

Task: Histogram • Box plot • Mean • Range • IQR • σ



Homework, Activities, Quiz

Station 3 — Screw Lengths (Factory A vs. B)

Question: Which factory's process is better controlled?

Factory A (mm): 50.0, 50.1, 50.0, 49.9, 50.2, 50.1, 49.8, 49.9, 50.0, 50.1, 49.9, 50.0

Factory B (mm): 49.5, 49.2, 50.5, 51.5, 47.9, 51.4, 49.3, 50.1, 51.9, 45.5, 50.3, 49.7

Suggested bins: 47.5–52.0 by 0.2

Tasks: Histogram • Box plot • Mean • Range • 3σ • σ

Classroom Experiment: Sampling the Sound – What Makes a Song “Wordy”?

Objective

Students will investigate how different sampling methods influence statistical conclusions by analyzing word lengths in a song. Each group will use a different sampling method, collect data, and create visual and statistical summaries.

Materials Needed

- Printed lyrics of one song (2–4 verses, chorus, bridge)
- Copies cut into 50–100 numbered phrases or lines
- Rulers, highlighters, calculators (optional)
- Tally sheet or data table (provided below)

Setup

1. Select and print the lyrics of a song.
2. Cut the lyrics into numbered lines or phrases (about 50–100).
3. Divide students into 3 groups and assign each group a sampling method:
 - Single Random Sampling
 - Systematic Sampling
 - Convenience Sampling
 - Quota Sampling (equal number of lines from verse and chorus)
 - Stratified Sampling (random samples from each song section: verse, chorus, bridge)

Student Task – Part 1: Data Collection

Each group will:

1. Use their assigned sampling method to select 20 lines.
2. Count the number of letters in each word in their lines.
3. Record all word lengths in the data table.

Student Task – Part 2: Data Analysis

Each group will:

- Calculate the mean, median, and mode of their word lengths.
- Identify any outliers.
- Create a box-and-whisker plot.

Student Task – Part 3: Report & Reflection

Create a mini-poster or digital slide that includes:

- Sampling method used
- Summary statistics (mean, median, mode, range)
- Box plot (hand-drawn or digital)
- A short reflection: Was this method effective? What were the strengths and weaknesses?

Class Debrief

Discuss the results as a class:

- Were there major differences between the samples?

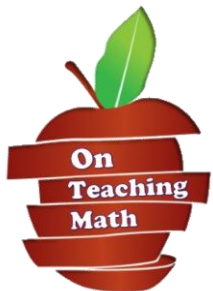
- Which method produced the most consistent or believable results?

- What are the implications of using one sampling method over another in real-world data collection?

Optional Extension

Try this activity with different songs, articles, or speeches across classes and compare the results.

Or use technology (Desmos, Google Sheets) to graph your box plots and share electronically.



Homework, Activities, Quiz

The snow gloves white on the mountain tonight
Not a footprint to be seen
A kingdom of isolation
And it looks like I'm the queen

The wind is howling like this swirling storm inside
Couldn't keep it in, heaven knows I tried
Don't let them in, don't let them see
Be the good girl you always have to be
Conceal, don't feel, don't let them know
Well, now they know

Let it go, let it go
Can't hold it back anymore
Let it go, let it go
Turn away and slam the door
I don't care what they're going to say
Let the storm rage on
The cold never bothered me anyway

It's funny how some distance makes everything seem small
And the fears that once controlled me can't get to me at all
It's time to see what I can do
To test the limits and break through
No right, no wrong, no rules for me
I'm free

Let it go, let it go
I am one with the wind and sky
Let it go, let it go
You'll never see me cry
Here I stand and here I stay
Let the storm rage on

My power flurries through the air into the ground
My soul is spiraling in frozen fractals all around
And one thought crystallizes like an icy blast
I'm never going back, the past is in the past

Let it go, let it go
And I'll rise like the break of dawn
Let it go, let it go
That perfect girl is gone
Here I stand in the light of day
Let the storm rage on
The cold never bothered me anyway

Data Table Template

Use the table below to record your data.

Line #: _____
Words: _____
Word Lengths: _____

Mean: _____ Median: _____ Mode: _____
Outliers: _____

4.1 Central Tendencies & Spread Quiz #1

Name: _____

Questions

1. The data set is: 12, 14, 15, 20, 22

- Find the mean, median, and range.

2. A class has test scores: 72, 75, 80, 85, 85

- Find the standard deviation.

3. True or False: If 5 is added to every value in a data set, the mean and median increase by 5 but the standard deviation remains the same.

4. A data set has mean = 40 and standard deviation = 7. Every value is multiplied by 2.

- What are the new mean and standard deviation?

5. The quiz scores of a group of students are: 9, 10, 10, 7, 5, 10

- Calculate the mean, mode, range, and interquartile range (IQR).

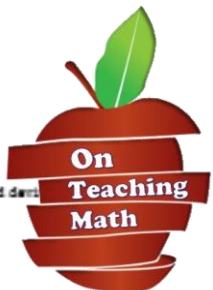
6. Consider two classes with the following scores:

- Class A: 50, 52, 70, 85, 91, 12, 72

- Class B: 71, 72, 70, 74, 71, 72, 74

Both have mean = 72.

- Which class has greater variability? Justify with range and standard deviation.



Homework, Activities, Quiz

7. A data set has mean = 64 and standard deviation = 5. New data: 69, 71, 75, 75, 80.
- Explain whether the new data was created by adding or multiplying a constant to the original values.

8. Two data sets are given:
- Set X: 3, 6, 9, 12
- Set Y: 6, 9, 12, 15
- Describe the transformation from X to Y. How do the **mean** and standard deviation change?

9. A student's daily step counts (in thousands) are: 5, 7, 9, 6, 8.
- Find the mean and standard deviation.
- If every value is reported in meters instead of kilometers (multiply by 1000), what happens to the mean and standard deviation?

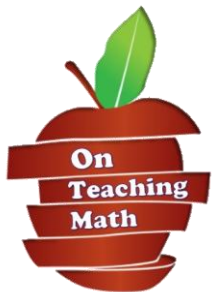
10. A data set has mean = 25 and standard deviation = 0.
- What does this tell you about the data?
- If you add 5 to every value, what happens to the mean and standard deviation?

11. A researcher wants to estimate the average screen time of high school students. She stands outside the school library and surveys the first 20 students who walk out.
- Which data collection method is this: systematic, random, quota, stratified, or convenience?

12. A school wants to survey 100 students about cafeteria food. The student body is 50% juniors and 40% seniors. The researchers select 60 juniors and 40 seniors randomly from each group.
- Which data collection method is this: systematic, random, quota, stratified, or convenience?

13. A researcher records the shoe sizes of 100 students.
- Is this data continuous or discrete? Explain.

14. A sports scientist measures the sprint times (in seconds) of athletes running 100m.
- Is this data continuous or discrete? Explain.



Responses from Students

7

MAY 2025 - MATHEMATICS APPLICATIONS AND I SL
MAY 2025 - THEORY KNOWL TK in ENGLISH

EE/TOK points:	2
Total Points:	34
Result:	Diploma awarded

Too easy 🤔👍

P

Phillip Brown

Dude!!!! That's awesome. Congratulations! [redacted]

[redacted]

to me ▾

Thanks bru!

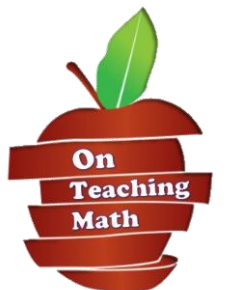
[redacted] and [redacted] got 7's too 🤔 You gotta keep the streak going next year 🙌

wait we're goats



This is a screenshot of an email I received from a student after they received their IB results.

The student guides give kids access to the content and the support they need to make sense of it!



**These resources are a
real time-saver for you
and valuable learning
experience for students.**

