1) REVIEW

2) MEAN ABSOLUTE DEVIATION (M.A.D.)

https://www.loom.com/share/642157821f3840fd9cea270d2bcaf689

3/24/20

LIVE SESSION

Quick Review

Thoughts on this unit so far?

Answer in the chat:

A) I love data and statistics. I could do this stuff all day.

B) I am sooo done with histograms, dot plots, and box plots.

C) Neutral- Don't love don't hate it.

D) I am so lost in this unit. I need help!

To Review

Data sets can be compared using measures of center and variability.

Measures of Center (central tendency)

1. **Mean**: use to describe the data set when an outlier is NOT present (symmetric data)
2. **Median**: use when outliers are present (skewed data)

★ The mean and median are both measures intended to be a single number that best represents an entire data set.

Measures of Variability

1. **Interquartile Range** (IQR) = Q3-Q1. Used to describe the middle 50% of the data.
2. **Mean Absolute Deviation** (MAD): takes the average distance of the data points from the mean.

★ The IQR and MAD are both measures intended to summarize the variability of the data using one number.

Measures of Center (central tendency)

★ The mean and median are both measures intended to be a single number that best represents an entire data set.

Finding the Mean
1. Find the sum of the data values. 2. Divide the sum by the number of data points. This is the mean.

Finding the Median
1. First arrange the data from least to greatest. 2. Count the number of data points. If there is an even number of data points, the median is the average of the two middle-most values. If there is an odd number of data points, the median is the middle-most value.

Measures of Variability

★ The IQR and MAD are both measures intended to summarize the variability of the data using one number.

Finding the Interquartile Range

1. Arrange the data from least to greatest.
2. Find the median of the data set. The median divides the data into two halves: the lower half and the upper half.
3. Find the middle-most value between the min. value and the median. This is the first quartile, Q_1.
4. Find the middle-most value between the median and the max value. This is the third quartile, Q_3.
5. Calculate the difference between the two quartiles, $Q_3 - Q_1$.

Finding the Mean Absolute Deviation (M.A.D.)

1. Find the mean.
2. Calculate the absolute value of the difference between each data value and the mean.
3. Determine the average of the differences found in step 2. This average is the mean absolute deviation.

Mean Absolute Deviation

M.A.D.


Hey Patrick, Are you mad too?
Yeah!
Why are you mad?
I can't see my forehead!

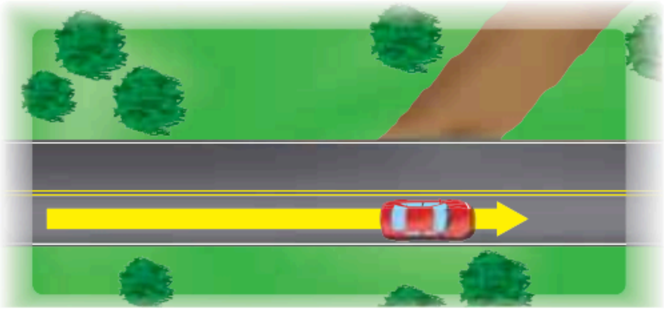
Learning Target

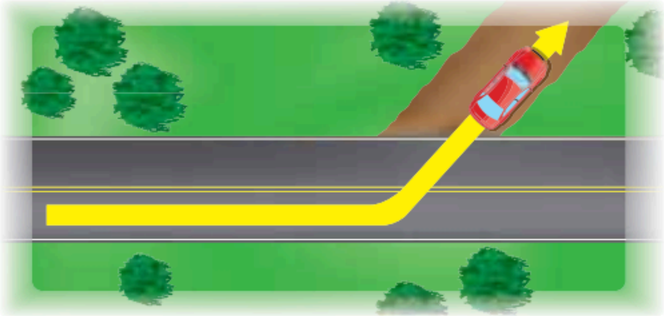
How can you use the distances between each data value and the mean of a data set to measure the spread of a data set?

Deviation?

The Meaning of a Word ● Deviate

When you **deviate** from something, you stray or depart from the normal course of action.





Example Together

Order	Dollar amount
1	21
2	15
3	22
4	26
5	24
6	21
7	17
8	22

A website captures information about each customer's order. The total dollar amounts of the last 8 orders are listed in the table to the ~~right~~. left

What is the mean absolute deviation of the data (M.A.D.)?

Example Together

Order	Dollar amount
1	21
2	15
3	22
4	26
5	24
6	21
7	17
8	22

Or use Desmos!

What is the mean absolute deviation of the data?

① Step 1: Find the mean.

- Find the sum of the data values, and divide the sum by the number of data values.

$$\frac{21+15+22+26+24+21+17+22}{8} = 21$$

Example Together

Order	Dollar amount
1	21
2	15
3	22
4	26
5	24
6	21
7	17
8	22

① Mean = 21

② $21 - 21 = 0$
$15 - 21 = |-6| = 6$
$22 - 21 = 1$
$26 - 21 = 5$
$24 - 21 = 3$
$21 - 21 = 0$
$17 - 21 = |-4| = 4$
$22 - 21 = 1$

What is the mean absolute deviation of the data?

② **FIND THE ABSOLUTE DEVIATION FROM THE MEAN**

a) Find the difference between each data value and the mean.

b) Take the absolute values of these differences.

DATA VALUE – MEAN = |ANSWER|

Example Together

Order	Dollar amount
1	21
2	15
3	22
4	26
5	24
6	21
7	17
8	22

1 Mean = 21

2
21 – 21 = 0
15 – 21 = | -6 | = 6
22 – 21 = 1
26 – 21 = 5
24 – 21 = 3
21 – 21 = 0
17 – 21 = | -4 | = 4
22 – 21 = 1

What is the mean absolute deviation of the data?

3 Find the sum of the absolute values of the differences.

0 + 6 + 1 + 5 + 3 + 0 + 4 + 1 = 20

4 FIND THE **MEAN** OF THE SUM OF THE **ABSOLUTE DEVIATIONS**

Divide the sum of the absolute values of the differences by the # of data values.

$$\frac{20}{8} = 2.5$$

Example Together

Order	Dollar amount
1	21
2	15
3	22
4	26
5	24
6	21
7	17
8	22

$\frac{20}{8} = 2.5$

- What is the mean absolute deviation of the data?

The mean absolute deviation of the dollar amounts of each order set is **2.5**.

This says that the average cost difference between the orders and the mean order is **$2.50**

Mean Absolute Deviation Is a measure of how far each data point, on average, strays away from the mean of the distribution. It is often written as the acronym "**MAD**."

Find the mean of the data → Find the difference between each value of the mean → Find the absolute value of each difference → Find the mean of these differences

1. Enter the heart rate data into `L1`.

2. For L2, calculate `L1 - mean(L1)`. This will give the difference between each data point and the mean of the data set.

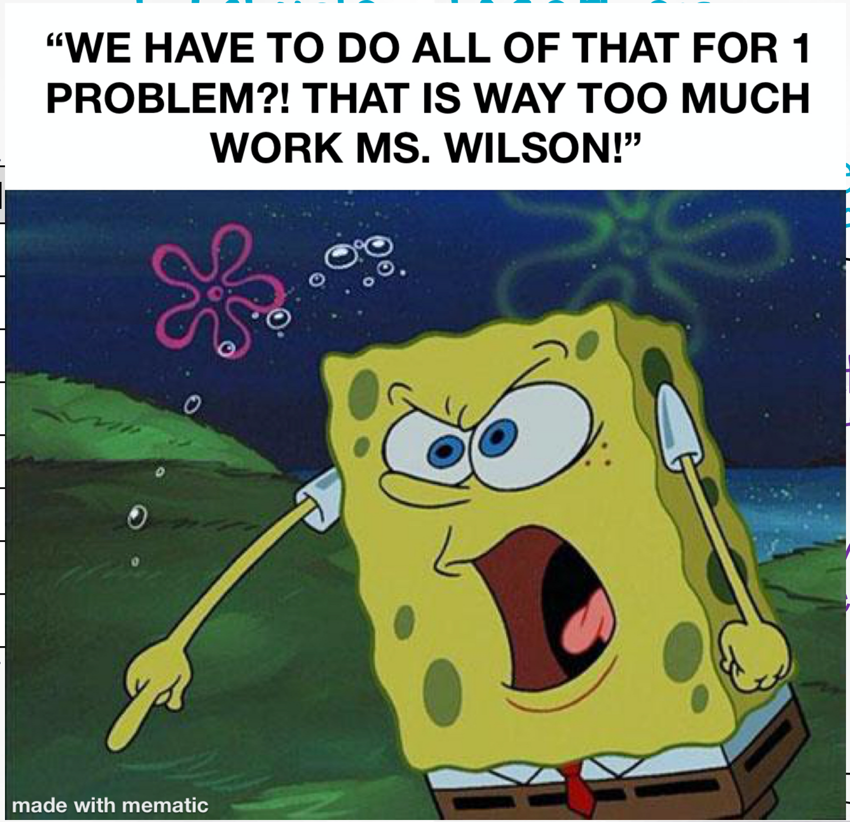
3. For L3, calculate `abs(L2)`. This will give the absolute value of each difference in `L2`.

4. From the main calculator screen, calculate `mean(L3)`. This will give the mean absolute deviation for the data set.

WHAT DO YOU THINK?

- A) You M.A.D. bro?
- B) This is M.A.D. easy!

Order	Dol
1	
2	
3	
4	
5	
6	
7	
8	



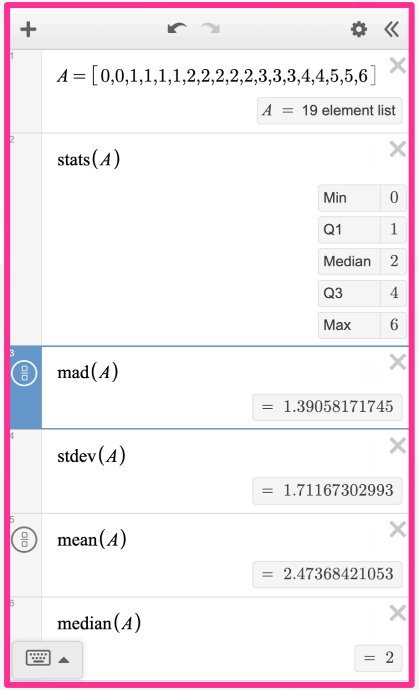
e mean absolute
f the data?

te deviation of the
f each order set

ne average cost
en the orders and
is **$2.50**

Example Together

Order	Dollar amount
1	21
2	15
3	22
4	26
5	24
6	21
7	17
8	22



What is the mean absolute deviation of the data?

OR.............

Desmos

To Summarize

So what's the point of all this?

We use measures of variability, such as range, IQR, and the mean absolute deviation to help us describe the SPREAD of data.

SMALLER VARIABILITY	LARGER VARIABILITY

To Summarize

So what's the point of all this?

We use measures of variability, such as range, IQR, and the mean absolute deviation to help us describe the SPREAD of data.

SMALLER VARIABILITY	LARGER VARIABILITY
IQR and/or M.A.D. are smaller → Data is considered **closer together**	IQR and/or M.A.D. are larger → Data is considered **more spread out**

To Summarize

Exam Scores			
Ben	89	Mike	95
Emma	86	Hong	96
Jeremy	80	Rob	92
Pete	80	Amy	90
Ryan	96	Sue	76
Dan	94	Kim	84
Lucy	89	Heather	85

a. What is the mean exam score?

b. Make a dot plot of the data. Place an "X" on the number line to represent the mean.

c. Is the number of exam scores that are greater than the mean equal to the number of exam scores that are less than the mean? Explain.

d. Which exam score *deviates* the most from the mean? Which exam score *deviates* the least from the mean? Explain how you found your answers.

e. Overall, do you think the exam scores are *close* to the mean or *far away* from the mean? Explain your reasoning.