Warm-Up (Unit 5 Test Review) 4/16/18

14. Which function represents the relationship between x and y shown in the table to the right?

a. $f(x) = 3(11)^x$

b. $f(x) = 11(3)^x$

c. $f(x) = 11^x$

d. $f(x) = 3^x$

$y = a \cdot b^x$

a = y-int

b = constant ratio

$y = 3(11)^x$

x	y
0	3
1	33
2	363
3	3993

×11 ×11 ×11

15. The function f(x) represents the amount of air remaining in an exercise ball that originally had 4,500 cubic inches of air and is losing 6% of its air every minute, x. The function $g(x) = 4500(1 - 0.03)^x$ represents the amount of air remaining in a second exercise ball. Which of the following statements is true about the functions f(x) and g(x).

a. Function f(x) is losing air at a slower rate than function g(x).

b. Function g(x) is losing air at a slower rate than f(x).

c. Both functions are losing air at the same rate.

d. The rates of losing air cannot be determined.

$f(x) = 4500(1-0.06)^x$

0	4500
1	4230
2	3976

$g(x) = 4500(1-0.03)^x$

0	4500
1	4365
2	4230

16. A table of values is shown for f(x) and g(x):

x	f(x)
0	0
1	1
2	4
3	9
4	16
5	25

x	g(x)
0	−2
1	−1
2	1
3	5
4	13
5	29

Which statement compares the graphs of f(x) and g(x) over the interval [0, 5]?

a. The graph of f(x) always exceeds the graph of g(x).

b. The graph of g(x) always exceeds the graph of f(x).

c. The graph of g(x) exceeds the graph of f(x) on the interval between x = 0 and x = 4, the graphs intersect at a point somewhere between x = 4 and x = 5, and then the graph of f(x) exceeds the graph g(x).

d. The graph of f(x) exceeds the graph of g(x) on the interval between x = 0 and x = 4, the graphs intersect at a point somewhere between x = 4 and x = 5, and then the graph of g(x) exceeds the graph f(x).

x_1 x_2

17. Find the average rate of change on the interval **[2, 5]** for each of the functions below. **(12 points)**

a) $a(x) = 3x + 4$ b) $b(x) = x^2 - 2$ c) $c(x) = 2^x - 1$

$a(2) = 3(2)+4$

$a(2) = 10$ $(2, 10)$ x_1 y_1

$a(5) = 3(5)+4$

$a(5) = 19$ $(5, 19)$ x_2 y_2

$\frac{19-10}{5-2} = \frac{9}{3}$

3

Which function has the greatest average rate of change over the interval **x = 2** to **x = 5**?

18. Identify the function as linear, exponential, quadratic, or neither. Justify your answer. **(4 points)**

x	−3	−2	−1	0	1	2	3
y	1	0	−1	−2	−1	0	1

vertex

Quadratic

19. The graph below shows the function $g(x)$. The table shows several input- and output values of the function $f(x)$.

(8 points)

$g(x)$

x	$f(x)$
0	1
2	4
4	16
6	64
8	256

A. Identify each type of function, and explain how you know.

$g(x)$: _____

_____

$f(x)$: _____

_____

B. List the domain and range of each function.

$g(x)$: Domain _____

$g(x)$: Range _____

$f(x)$: Domain _____

$f(x)$: Range _____

Unit 6 4/16/18

Essential Question

How can we use measures of central tendency and spread to analyze data?

Unit 6: Describing Data

Standard for Today:
MGSE9-12.S.ID.2 Use statistics appropriate to the shape of the **data distribution** to compare **center** (median, mean) and **spread** (interquartile range, mean absolute deviation) of two or more different data sets.

Opening 4/16/18

- If you scored a 92%, 89%, 95% and a 35% on four tests this quarter what is your Mean (average)?
- Is this a good representation of what you know?
- What do we call the number 35%?

Notes 4/16/18

Day 1 - Calculating Measures of Central Tendency & Spread

In middle school, you learned how to calculate measures of central tendency (mean, median, mode). In this unit, we are going to use measures of central tendency, along with other statistical concepts to describe data spreads. Before we review measures of central tendency, it is important to understand the types of data we will be using.

Types of Data

There are several different classifications of data: univariate versus bivariate, categorical versus quantitative.

Univariate data	Bivariate data
Involves a single variable	Involves two variables
Does not deal with causes and relationships	Deals with causes and relationships
Purpose is to describe data	Purpose is to explain data
Types of data calculations: mean, median, mode, range, mean absolute deviation, quartiles, bar graphs, histograms, box plots, dot plots	Types of calculations: correlations, comparisons, relationships, cause and effect, independent/dependent variables,
Example: Travel time (minutes): 15, 29, 8, 42, 35, 21, 18, 42, 26	Example: An ice cream shop keep tracks of how much ice cream they sell versus the temperature on that day.
Example Question: How many of the students in the freshman class are female?	Example Question: Is there a relationship between the number of females in computer programming and their scores in mathematics?

Categorical – Places an individual into one of several groups or categories (gender, hair color, eye color, etc)

Quantitative – Numerical values (test scores, age, grade point average, etc)

Classify: Classify the following as either categorical or quantitative data:

a. Marital status Categorical

b. A person's height Quantitative

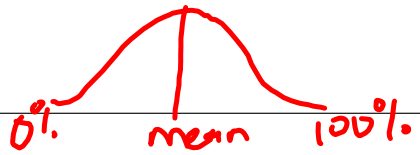
c. Hair Color Categorical

d. # of Children in a Family Quantitative

Measures of Central Tendency

Measures of Central Tendency are used to generalize data sets and identify common values.

Mean	**Definition:** Average of a numerical data set, denoted as $\bar{x}$ **Calculation:** Add up all the data values and divide by the number of data values **Useful When:** - Data values do not vary greatly - No outliers ? - Distribution is symmetric



Example: Find the mean of the following numbers.

a. 76 77 79 80 82 88 90 92 95

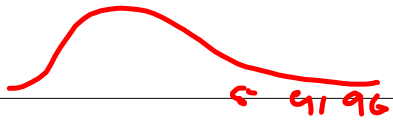
$(76+77+79+80+82+88+90+92+95) \div 9$

$\bar{X} = 84.3$

b. 15, 10, 12, 18, 10, 22

$X = 14.5$

Median	**Definition:** The middle number when the values are written in numerical order **Calculation:** Rewrite your data values in numerical order to find the middle number. ○ If your data set is **ODD**, then the median will be the number that falls directly in the middle. ○ If your data set is **EVEN**, then the median is the average of the two middle numbers. **Useful When:** - Distribution is skewed - Data values contain an outlier



Example: Find the median of the following numbers.

a. 76 77 79 80 82 88 90 92 95

Median = 82

b. 15, 10, 12, 18, 10, 22

10, 10, 12, 15, 18, 22

$$\text{Median} = \frac{12+15}{2} = \frac{27}{2} = 13.5$$

First and Third Quartiles	**Definition:** Quartiles are values that divide a list of numbers into quarters • **First (Q1) Quartile:** Median of the lower half of a data set ○ **Calculation:** Find the middle number of the values to the left of the median • **Third (Q3) Quartile:** Median of the upper half of a data set ○ **Calculation:** Find the middle number of the values to the right of the median

Example: Find the lower and upper quartiles of the following numbers.

a. 76 77 79 80 82 88 90 92 95

LQ UQ

$Q1 = \frac{77+79}{2}$ $Q3 = \frac{90+92}{2}$

$Q1 = 78$ $Q3 = 91$

b. 15, 10, 12, 18, 10, 22

10, 10, 12, 15, 18, 22

LQ UQ

$Q1 = 10$ $Q3 = 18$

Mode	**Definition:** Value that occurs most frequently. There can be no, one, or several modes **Calculation:** Find the numbers that are repeated ○ *NO MODE* (No numbers repeat) ▪ Say "no mode" ○ *ONE MODE* (One number repeats) ▪ State the number that repeats ○ *MORE THAN ONE MODE* (Several numbers repeat the same amount of times) ▪ State the numbers that repeat. **Useful When:** - Data set contains categorical data

Example: Find the mode of the following numbers.

a. 76 77 79 80 82 88 90 92 95

No mode

b. 15, 10, 12, 18, 10, 22

Mode: 10

Outliers 	Data value that is much greater than or much less than the rest of the data in a data set If an outlier is present, you would use the median to describe the data, NOT the mean!

Example: Identify any outliers in the data set. Then determine if the median or mean best represents the data sets.

a. 15, 10, 12, 18, 10, 22

None

b. 128, 152, 170, 41, 161

outlier = 41

Measures of Spread

Measures of Spread describe the "diversity" of the values in a data set. Measures of spread are used to help explain whether data values are very similar or very different.

Range	**Definition:** Difference between the greatest and least values in the set **Calculation:** Subtract the smallest data value from the biggest data value Range = Biggest # - Smallest #

Example: Find the range of the following numbers.

a. 76 77 79 80 82 88 90 92 95

Range: 95 − 76
= 19

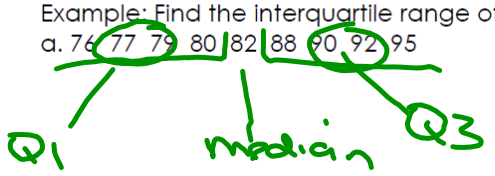
b. 15, 10, 12, 18, 10, 22

Range : 22 − 10 = 12

Interquartile Range (IQR)	**Definition:** The difference between the third and first quartiles ($Q_3 - Q_1$). It finds the distance between two data values that represent the middle 50% of the data. **Calculation:** Subtract the first quartile value from the third quartile value ($Q_3 - Q_1$).

Example: Find the interquartile range of the following numbers.

a. 76, 77, 79, 80, 82, 88, 90, 92, 95



$Q_3 - Q_1 = 91 - 76$

$IQR = 13$

b. 15, 10, 12, 18, 10, 22

$IQR = 18 - 10$

$= 8$

Mean Absolute Deviation M.A.D.	**Definition:** Average absolute value of the difference between each data point and the mean. It essentially takes the average distance of the data points from the mean. A data set with a smaller mean absolute deviation has data values that are closer to the mean than a data set with a great mean absolute deviation. The greater the mean absolute deviation, the more the data is spread out. The formula for mean absolute deviation is: $\frac{\sum_{i=1}^{N} \left\| x_i - \bar{x} \right\|}{N}$ X_1 = data value $\bar{x}$ = mean $\sum$ = sum N = number of data values **Calculation:** - Find the mean of the set of numbers - Subtract each number in the set by the mean and take the absolute value of each new number (new number will be positive) - Find the sum of the new numbers and divide by the number of data values

Example: Find the MAD of the following numbers.

a. 76 77 79 80 82 88 90 92 95 $\bar{X} = 84.3$

$8.3 + 7.3 + 4.3 + 5.3 + 2.3$
$+ 3.7 + 5.7 + 7.7 + 10.7$

Total $= \frac{55.3}{9}$

M.A.D. $= 6.14$

b. 15, 10, 12, 18, 10, 22

$\bar{X} = 14.5$

$X_1 - \bar{X}$
0.5
4.5
2.5
3.5
4.5
7.5
23 — 6

MAD = 3.8

Putting Measures of Center and Spread Together

Use the data set below to answer the following questions:

5, 2, 9, 10, 3, 7, 2, 18, 12, 15, 1, 6, 9, 5, 2, 7

1, 2, 2, 2, 3, 5, 5, 6, 7, 7, 9, 9, 10, 12, 15, 18

1.) Find the mean.	2.) Find the median(Q2).	3.) Find the mode.
$\bar{X} = 7.0625$ $\simeq 7.1$	$Q2 = 6.5$	Mode = 2

Use the data set below to answer the following questions:

5, 2, 9, 10, 3, 7, 2, 18, 12, 15, 1, 6, 9, 5, 2, 7

4.) Find the range.	5.) Find Q1.	6.) Find Q3.
Max - Min 18 − 1 = 17	Q1 = 2.5	Q3 = 9.5

Use the data set below to answer the following questions:

5, 2, 9, 10, 3, 7, 2, 18, 12, 15, 1, 6, 9, 5, 2, 7 $\bar{x} = 7.1$

7.) Find the IQR.

$Q3 - Q1$

$9.5 - 2.5$

$= 7$

8.) Find the MAD.

x_i	$\lvert x - \bar{x} \rvert$	x	$\lvert x_i - \bar{x} \rvert$
5	2.1	12	4.9
2	5.1	15	7.9
9	1.9	1	6.9
10	2.9	6	1.1
3	4.1	9	1.9
7	0.1	5	2.1
2	5.1	2	5.1
18	10.9	7	0.1

$\sum \lvert x - \bar{x} \rvert = 62.2$

MAD $= \frac{62.2}{16}$

$= 3.887$

≈ 3.9

Home Work - 4/16/18

1. Day 1: Measures of Central Tendency & Spread # 1 - 8c Due tomorrow - Tuesday 4/17/18