S.ID.A.3 Outliers/Extreme Data Points

GRAPHS AND STATISTICS
S.ID.A.3 Outliers/Extreme Data Points

A. Summarize, represent, and interpret data on a single count or measurement variable

3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

Overview of Lesson
- activate prior knowledge and review learning objectives (see above)
- explain vocabulary and/or big ideas associated with the lesson
- connect assessment practices with curriculum
- model an assessment problem and solution strategy
- facilitate guided discussion of student activity
- facilitate guided practice of student activity
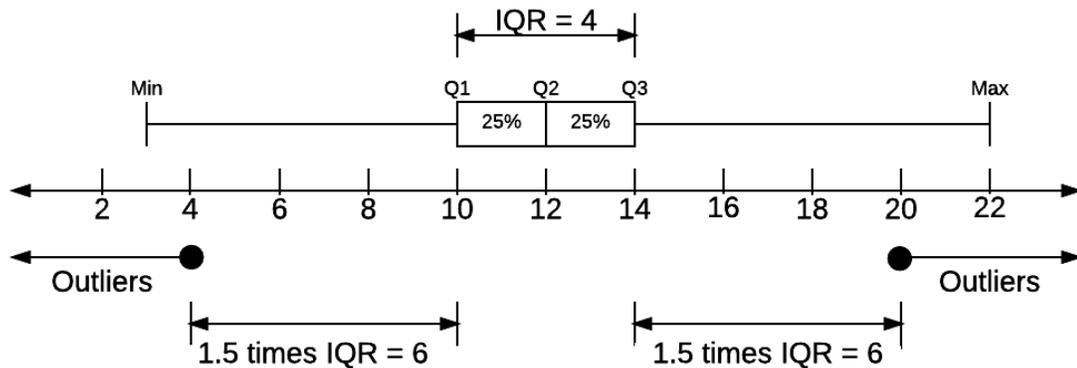   **Selected problem set(s)**
- facilitate a summary and share out of student work
        Homework – Write the Math Assignment

Vocabulary

Outlier   An observed value that is distant from other observations. Outliers in a distribution are 1.5 interquartile ranges (IQRs) or more below the first quartile or above the third quartile.

Example:

In the above example, outliers would be any observed values less than or equal to 4 and/or any observed values greater than or equal to 20.

Big Idea

An **outlier** can significantly influence the measures of central tendency and/or spread in a data set. (For additional information, see also S.ID.A.2 Central Tendency and Dispersion.)

REGENTS PROBLEM TYPICAL OF THIS STANDARD

1. The table below shows the annual salaries for the 24 members of a professional sports team in terms of millions of dollars.

0.5	0.5	0.6	0.7	0.75	0.8
1.0	1.0	1.1	1.25	1.3	1.4
1.4	1.8	2.5	3.7	3.8	4
4.2	4.6	5.1	6	6.3	7.2

The team signs an additional player to a contract worth 10 million dollars per year. Which statement about the median and mean is true?

a. Both will increase.
c. Only the mean will increase.
b. Only the median will increase.
d. Neither will change.

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Answer Section

1. ANS: C
   Median remains at 1.4.

   Strategy:
   Compare the current median and mean to the new median and mean:

   STEP 1. Compare the medians:
   The data are already in ascending order, so the median is the middle number. In this case, the data set contains 24 elements - an even number of elements. This means there are two middle numbers, both of which are 1.4. When the data set contains an even number of elements, the median is the average of the two middle numbers, which in this case is $\dfrac{1.4 + 1.4}{2} = 1.4$

   The new data set will contain 10 as an additional element, which brings the total number of elements to 25. The new median will be the 13th element, which is 1.4.

   The current median and the new median are the same, so we can eliminate answer choices a and b.

   STEP 2. Compare the means:
   The mean will increase because the additional element (10) is bigger than any current element. It is not necessary to do the calculations. We can eliminate answer choice d.

   DIMS? Does it make sense that the answer is choice c?
   Yes. The median will stay and 1.4 and only the mean will increase.

   PTS: 2   REF: 061520ai   NAT: S.ID.A.3   TOP: Central Tendency and Dispersion

Homework - Write the Math Assignment

START   Write your name, date, topic of lesson, and class on your paper.

NAME:	Mohammed Chen
DATE:	December 18, 2015
LESSON:	Missing Number in the Average
CLASS:	Z

PART 1a.   Copy **the problem** from the lesson and underline/highlight key words.
PART 1b.   State your understanding of **what the problem is asking**.
PART 1c.   **Answer** the problem.
PART 1d.   Explanation of **strategy** with all work shown.

PART 2a.   Create **a new problem** that addresses the same math idea.
PART 2b.   State your understanding of **what the new problem is asking**.
PART 2c.   **Answer** the new problem.
PART 2d.   Explanation of **strategy** used in solving the new problem with all work shown.

Clearly label each of the eight parts.

Grading Rubric
Each homework writing assignment is graded using a four point rubric, as follows:

Part 1. The Original Problem	**Up to 2** points will be awarded for: a) correctly restating the original problem; b) explicitly stating what the original problem is asking; c) answering the original problem correctly; and d) explaining the math.
Part 2. My New Problem	**Up to 2** points will be awarded for: a) creating a new problem similar to the original problem; b) explicitly stating what the new problem is asking; c) answering the new problem correctly; and d) explaining the math.

This assignment/activity is designed to incorporate elements of [Polya's four step universal algorithm](#) for problem solving with the idea that writing is thinking. Polya's four steps for solving any problem are:

1. Read and understand the problem.
2. Develop a strategy for solving the problem.
3. Execute the strategy.
4. Check the answer for reasonableness.

EXEMPLAR OF A WRITING THE MATH ASSIGNMENT

Part 1a. **The Problem**
TOP Electronics is a small business with five employees. The mean (average) weekly salary for the five employees is $360. If the weekly salaries of four of the employees are $340, $340, $345, and $425, what is the salary of the fifth employee?

Part 1b. **What is the problem asking?**
Find the salary of the fifth employee.

Part 1c. **Answer**
The salary of the fifth employee is $350 per week.

Part 1d. **Explanation of Strategy**
The arithmetic mean or average can be represented algebraically as:
$$\overline{X} = \frac{x_1 + x_2 + \ldots + x_n}{n}$$

I put information from the problem into the formula. The problem says there are 5 employees, so $n = 5$. The problem also gives the mean (average) salary and the salaries of 4 of the employees. These numbers can be substituted into the formula as follows:

$$360 = \frac{340 + 340 + 345 + 425 + x_5}{5}$$
$$1800 = 340 + 340 + 345 + 425 + x_5$$
$$1800 = 1450 + x_5$$
$$1800 - 1450 = x_5$$
$$350 = x_5$$

Check: $360 = \dfrac{340 + 340 + 345 + 425 + 350}{5} = \dfrac{1800}{5} = 360$

Part 2a. **A New Problem**
Joseph took five math exams this grading period and his average score on all of the exams is 88. He remembers that he received test scores of 78, 87, 94, and 96 on four of the examinations, but he has lost one examination and cannot remember what he scored on it. What was Joseph's score on the missing exam?

Part 2b **What is the new problem asking?**
Find Joseph's score on the missing exam.

Part 2c. **Answer to New Problem**
Joseph received a score of 85 on the missing examination.

Part 2d. **Explanation of Strategy**
I substitute information from the problem into the formula for the arithmetic mean, as follows:

$$88 = \frac{78 + 87 + 94 + 96 + x_5}{5}$$
$$440 = 355 + x_5$$
$$85 = x_5$$

$$88 = \frac{78 + 87 + 94 + 96 + 85}{5} = \frac{440}{5} = 88$$
The answer makes sense.