

# Diagnostic Assessment #1 for Statistical Sleuths



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## Assessment Instructions

### **Diagnostic Assessment #1 - Constructed Response**

**Duration:** 30 minutes

**Standard(s) Assessed:**

MA.E.3.3.1.8.1, MA.E.3.3.1.8.3, MA.E.3.3.2.8.3, MA.E.1.3.1.8.2, MA.E.1.3.1.8.1, MA.E.1.3.2.8.1, MA.E.1.3.2.8.3, MA.E.3.3.2.8.4

**Description of Assessment Activity:**

Throughout the unit, students (a.k.a. detectives) make entries in their Detective Diaries about the clues they discover while collecting and analyzing different sets of data. At the onset of the unit, students are presented with a hypothesis, asked to formulate their own hypothesis, and design an experiment to test their hypothesis. Students are given data and based on this data, the student explains why the data does or does not support the original hypothesis. Students identify the type of sampling technique that was used to collect the data in the table and explain their answers. Next, students are introduced to test scores from thirty-one students. Using these scores, students create a box-and-whisker graph and find the mean, median, and mode of the data. Students also explain how a box-and-whisker graph is used to interpret measures of central tendency. Finally, students look at a histogram and are asked to read and to interpret the data.

\*Source: Adapted from open-response released items (1991-1990). Kentucky Instructional Results Information System. Kentucky Department of Education.

**Teacher Directions:**

Provide a copy of the first Detective Diary entry (diagnostic) for each student. Ask students if they have any questions about the activity.

1. Provide additional assistance if students appear to be having any difficulties; however, remember the purpose of this assessment is to acquire raw data of the students' prior knowledge.
2. Remind students that the first diary entry is for diagnostic assessment purposes only and will not be counted for a grade.
3. Once the diary entry is assessed, return the diary to students.

**Student Directions:**

1. Respond to each question completely.
2. Students turn in their Diagnostic Assessment #1 when they finish.

**Scoring Method & Criteria:**

See the Scoring Criteria for Diagnostic Assessment #1 and Long-Answer Question Rubric to determine students' prior knowledge.

Diagnostic assessments are designed to be challenging assessments to gauge what your students know or do not know about the topic. Make sure students understand this. Do not worry if students do not know the answers. If they know all the answers, then there is no reason to teach this unit. Do not allow your students to spend too much time agonizing over the answers if they do not know them.

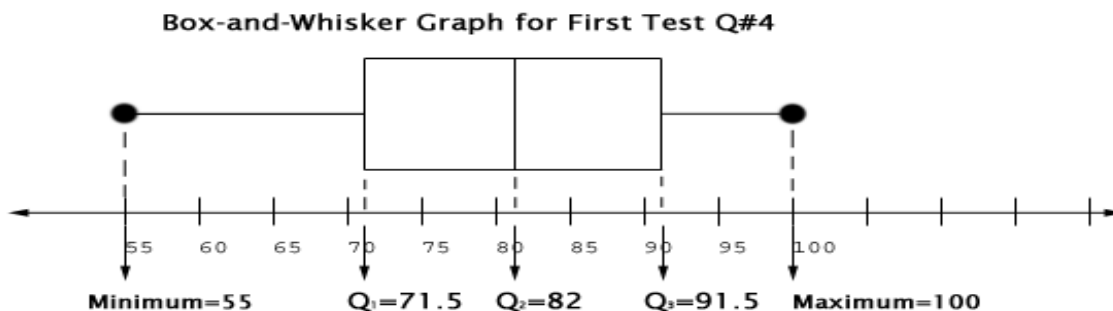
- ❖ Remember this assignment is a diagnostic assessment of each student's prior knowledge and should not be counted for a grade.
- ❖ Use the information acquired through these diagnostic assessments to determine what students need for further instruction. Diagnosing students' needs should drive all instruction.

## Scoring Criteria for Diagnostic Assessment #1

Use the Long-Answer Question Rubric to assess the thoroughness of each description.

1. The student's hypothesis should contain an assumption about how many hours of homework the average eighth grade student should complete per week to make better grades. The design of the experiment that the student plans to use to test the hypothesis should be reasonable (affordable, appropriate for an eighth grader to accomplish), clearly explained, and possible within the constraints of the scientific process. Did they use any of the techniques for formulating a hypothesis or designing an experiment described in Lesson Plan #1 Designing Detectives?
2. The best answer for this section is, **yes**, the data supports Marie's hypothesis. If you look at the table, you will see that a total of 130 students out of 390 students received a B average or higher when they did between 4-10 hours of math homework per week ( $60+70=130$ ). Whereas, only 6 students who did 0-3 hours of homework per week in math received a B average or higher for the year and only 40 students who did 11+ hours of homework per week received a B average. Based on these statistics, the data from the table supports Marie's hypothesis.
3. Letter **D** is the answer. The statistics that were collected from Mystery Falls Middle School are an example of results from a **Biased Sample** because the only group that is represented is from one location only. In order to be a more representative sample of the average 8<sup>th</sup> grade student, the sample would have to be of people from other areas of the country or from people other than the students at Mystery Falls Middle School only. If a random sample had been used, each individual would have been chosen entirely by chance (not from a selected school) and each member of the population would have an equal chance of being selected (every child in a population would not be selected). If the statistics represented every fifth, tenth, fifteenth,... (etc.) member of the population, then it would represent a systematic sample. A systematic sample is acquired by selecting one member of the population on a random basis and by choosing additional members at evenly spaced intervals until the desired number for the sample space has been collected. If a stratified sample had been used, the entire population would have been divided into meaningful subgroups (strata) and **then** each group would be **randomly** sampled (as described by random sample above).

4. Part A- Using the data set (for the first test of the year) from Ms. Rodriguez's third period pre-algebra class, here is a sketch of the box-and-whisker graph:



Part B- **Mean= 81.03125**

**Median= 82**

**Mode= 70, 75, and 80**

Part C- A box-and-whisker graph shows the median, quartiles, and range of the data set. By looking at the spread of the data, a box-and-whisker graph helps summarize large amounts of data into an easily read diagram. However, unlike a stem-and-leaf plot, the mean and mode cannot be determined in the diagram.

5. Part A- Since the question asks for the **approximate** answer, there are several possible answers. The actual answer is 61 students. An answer between 56-66 would be acceptable.

Part B- Most of the students at Mystery Falls Middle School spent between six to seven hours on homework per week. This interval is also the **mode** of the data because most of the data falls into this interval.

Part C- The statistics that were collected from Mystery Falls Middle School are an example of results from a **Biased Sample** because the only group that is represented is from a single location. In order to be a more representative sample of the average eighth grade student, the sample would have to be of people from other areas of the country or from people other than the students at Mystery Falls Middle School only.

(Diagnostic Assessment #1)

### Long - Answer Question Rubric

	4	3	2	1	0
<b>Answering the Problem</b>	You arrive at a correct answer. You show that you understand the concepts and the procedures necessary to solve the problem.	You arrive at a correct answer, but minor errors in your response indicate that you have some misunderstanding of the concepts and procedures.	You may arrive at a correct answer, but the errors in your response reveal that there are essential parts of the concepts and procedures that you do not understand.	You arrive at an incomplete answer. The errors in your response reveal many flaws in your understanding of the concepts and procedures.	Your answer was incorrect or not given at all.
<b>Showing your Work</b>	You follow the given directions to show how the problem was solved. All steps are provided, and they show correct math procedures.	You follow the given directions to show how the problem was solved. Steps are provided, but careless errors are shown in the math procedures.	You follow the given directions in an attempt to show how the problem was solved. Some of the steps provided show incorrect math procedures.	You attempt to show how the problem was solved. Some of the steps are addressed, but you fail to arrive at a complete answer.	You make no attempt to show how the problem was solved, or the procedures shown are all incorrect.
<b>Explaining and Interpreting Your Answer</b>	You explain how to solve the problem so clearly and completely that someone else can find the answer in a new situation. The interpretations you give can be inferred from the information.	You explain how to solve the problem so that someone else can find the answer. The interpretations you give can be supported by the information.	You may begin to explain how to solve the problem, but you do not clearly show how to find the answer. The interpretations you give are not always supported by the information.	Your explanation of how to solve the problem is incomplete or flawed. The interpretations you give can not be supported by the information.	Your explanations and interpretations are not correct, understood, or given.
<b>What each point value means...</b>	<i>Your work shows a <b>complete</b> understanding of the concepts and procedures.</i>	<i>Your work shows an <b>essential</b> understanding of the concepts and procedures.</i>	<i>Your work shows a <b>partial</b> understanding of the concepts and procedures.</i>	<i>Your work shows a <b>limited</b> understanding of the concepts and procedures. <b>If a student is at this level, re-teaching is necessary.</b></i>	<i>Your work shows <b>no</b> understanding of the concepts and procedures. <b>If a student is at this level, re-teaching is necessary.</b></i>

Developed by Kristy Rousseau

## Diagnostic Assessment #1

**Directions:** Read the information below.

Marie believes that students who do between four and ten hours of homework per week in mathematics make better grades than students who do not do homework *or* who do more than 10 hours of homework per week. To test her hypothesis, she is designing an experiment that she will give the mathematics students at her school. Marie will then evaluate all eighth grade students' year averages in mathematics to determine if her hypothesis is valid.

Adapted from open-response released items (1991-1990). Kentucky Instructional Results Information System. Kentucky Department of Education.

### Detective Diary Entry #1

1. Formulate your own hypothesis about how much homework average eighth grade students should do in order to make better grades in mathematics. Tell me how you would design an experiment to test this hypothesis.

2. Consider Marie's hypothesis: She believes that students who do between four and ten hours of homework per week in mathematics make better grades (a B average or higher) than students who do less than four hours or more than ten hours. Does the data from the table below adequately support Marie's hypothesis?

Math Year Average Totals for All 8<sup>th</sup> Grade Students at Mystery Falls Middle School

Number of hours spent on homework per week in mathematics ↓	Number of students with an A	Number of students with a B	Number of students with a C	Number of students with a D	Number of students with an F	Total number of students
<b>0-3 hours</b>	2	4	5	38	37	=86
<b>4-10 hours</b>	60	70	100	12	1	=243
<b>11+hours</b>	15	25	21	0	0	=61
<b>Total number of students</b>	77	99	126	50	38	=390

Explain why the data does or does not support the hypothesis.

THINK  
SOLVE  
EXPLAIN

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(Diagnostic Assessment #1)

(Diagnostic Assessment #1)

3. Looking at Math Year Average Totals for All Eighth Grade Students at Mystery Falls Middle School in the chart from question #2, what kind of sampling technique did Marie use to verify her hypothesis? In the space provided, briefly describe why you believe this sampling technique was used.

- A** Random sampling \_\_\_\_\_
- B** Systematic sampling \_\_\_\_\_
- C** Stratified sampling \_\_\_\_\_
- D** Biased sampling \_\_\_\_\_

4. The following data set represents math scores from the first test in Ms. Rodriguez's third period pre-algebra class:

100	99	98	96	95	94	93	92	91	90	89
88	87	85	83	82	82	81	80	78	75	75
74	73	70	70	68	65	64	62	59	55	

- a. Using the test scores in the data set above, sketch a box-and-whisker graph of the data.
- b. Find the mean, median, and mode of the test scores.  
**Mean=** \_\_\_\_\_ **Median=** \_\_\_\_\_ **Mode=** \_\_\_\_\_
- c. Explain why a box-and-whisker graph helps when interpreting data.

THINK  
SOLVE  
EXPLAIN

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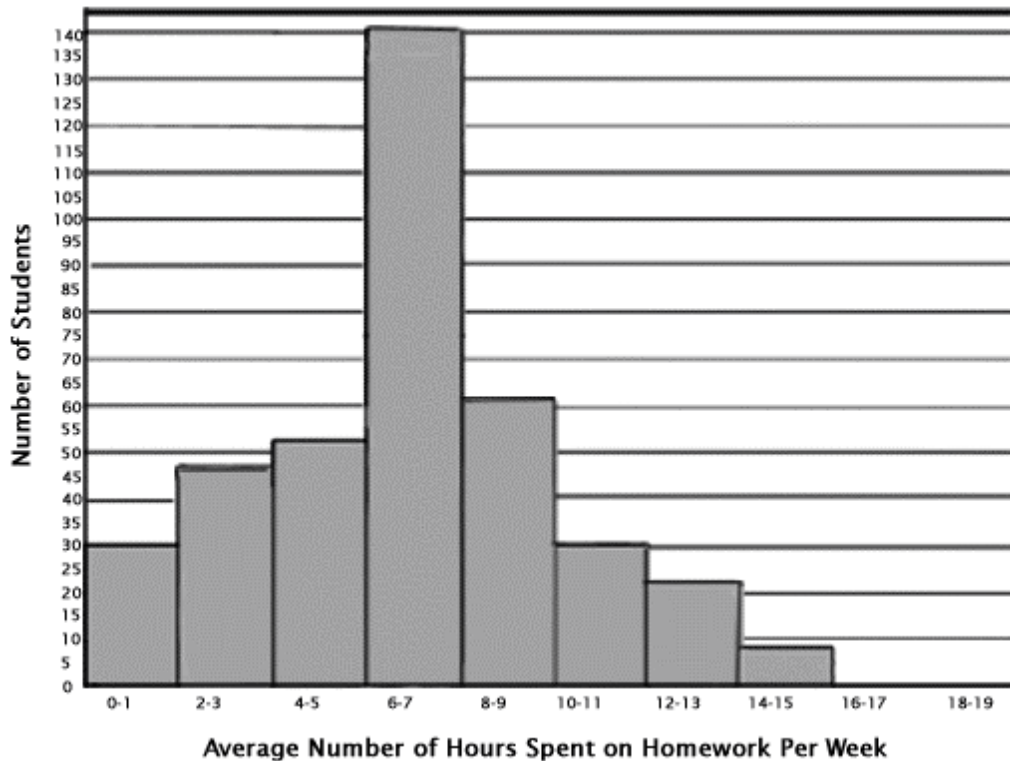


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(Diagnostic Assessment #1)

5. Marie conducted a survey of 390 eighth grade math students at Mystery Falls Middle School (M.S.) at the end of the school year. She asked them what the average number of hours each had spent on math homework per week. Here are the results:

**Eighth Grade Math Students at Mystery Falls M.S.**



- a. Approximately how many students completed ten or more hours of homework per week?  
\_\_\_\_\_
- b. How many hours did the most number of students spend on homework (which interval)? **Also**, which measure of central tendency does this interval represent?  
\_\_\_\_\_
- c. Explain how these results are an example of a biased sample.

THINK  
SOLVE  
EXPLAIN

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