

# Summary Sheet of Instruction for The Guise of a Graph Gumshoe

## **Things to instruct in this lesson plan to ensure alignment:**

- Instruct on how to construct and interpret displays of data (including circle, line, bar, and box-and-whisker graph) and explain how different displays of data can lead to different interpretations (MAE13182). (Specifically bar, circle, and box-and-whisker graphs)
- Instruct on how to find the median of a set of data (MAE13281).

## **Things to review with students based on prior knowledge:**

- How to read and interpret data displayed in a table (MAE13181).

## **Things students need to practice:**

- Construct and interpret displays of data (including circle, bar, and box-and-whisker graphs) and explain how different displays of data can lead to different interpretations (MAE13182).

## **Parts of the standard(s) that will not be covered in this lesson:**

- The student will not read and interpret data displayed in variety of ways. They will only read and interpret data displayed in a table (MAE13181).
- The student will not construct and interpret a line graph nor will they explain how different displays of data can lead to different interpretations. The student will however construct a bar, circle, and box-and-whisker graph (MAE13182).
- The student will find the median of a set of data, however they will not find the mean and mode in this lesson.

## **Formative assessment for this lesson:**

### **Students will know and be able to...**

MA.E.1.3.1.8.1 Read and interpret data displayed in a variety of forms including histograms. (Not a variety, only in a table).

MA.E.1.3.1.8.2 Construct and interpret displays of data, (including circle, line, bar, and box-and-whisker graphs) and explain how different displays of data can lead to different interpretations.

MA.E.1.3.2.8.1 Find the mean, median, and mode of a set of data.

## How to Construct a Box-and-Whisker Graph

- Arrange all data from least to greatest
- Identify the minimum and maximum values for the data set excluding outliers (an outlier is a value that does not appear to fit with the rest of the data set- an example would be if you were collecting data about the average height of men and in the data that you collected you had only one individual who was 8 feet tall and the closest height to that was 7 feet 4 inches, then 8 feet would be considered an outlier because it is an example of an unusual case and is not representative of the data)
- Find the difference between the minimum and the maximum value, known as the range of the data
- Determine the median of the data set which is the middle value when arranged from least to greatest-if there are two values in “the middle” take the average of those two values-this value is also known as the second quartile  $Q_2$
- Identify the first quartile ( $Q_1$ ) and the third quartile ( $Q_3$ ). The first quartile ( $Q_1$ ) is determined by finding the median of the lower half of the data. Using the minimum value and the median of the entire data set, determine the median of that section of the data. The median of the lower half of the data is  $Q_1$ . To determine  $Q_3$ , use the median and the maximum of the entire data set and find the median of that section of the data. The third quartile ( $Q_3$ ) is the median of the upper half of the data set
- Find the difference between the upper half of the data  $Q_3$  and the lower half of the data  $Q_1$ , also known as the interquartile range ( $IQR=Q_3-Q_1$ )
- Construct a number line using the minimum and maximum values as the guide
- Create two end points above the constructed number line-one at the minimum value and one at the maximum value
- Above the number line create a box (rectangle) whose parameters are  $Q_1$  and  $Q_3$  (note: the width of the box is not significant)
- Find  $Q_2$  (median of the data) on the number line; at that point on the number line create a line dividing the box into two sections
- Connect the minimum value to  $Q_1$  with a straight line (whisker); connect the maximum value  $Q_3$  with another straight line (whisker)

## Box-and-Whisker Graph Construction

1. The following data set represents math scores from the first test in Ms. Rodriguez's 3<sup>rd</sup> 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.

Be sure to:

- Title the graph
- Choose an appropriate scale
- Identify the minimum and maximum values, the median  $Q_2$  and the quartiles ( $Q_1$  and  $Q_3$ )
- Construct the box and the whiskers
- Accurately graph the data

b. Explain why a box-and-whisker graph helps when interpreting data.

THINK  
SOLVE  
EXPLAIN

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## Data for Displays

Read the data below. The students at Mystery Falls Middle School collected the data. The data represents a random sample.

### Homework Hints and Helps

Student	Advice	Student	Advice
Fred	Check your work	Ben	Ask for help
Sally	Ask for help	Tom	Copy someone else
John	Copy someone else	Paul	Ask for help
Susan	Ask for help	George	Check your work
Mark	Check your work	Kathy	Ask for help
Elizabeth	Follow directions	Pat	Check your work
Spencer	Follow directions	Zane	Follow directions
Julie	Check your work	Mary	Check your work
Cynthia	Ask for help	Tim	Ask for help
Jean	Ask for help	Sam	Follow directions
Peggy	Ask for help	Marie	Follow directions
Jack	Follow directions	Eddie	Ask for help
Mackenzie	Ask for help	Ethan	Ask for help
Carol	Check your work	Ken	Check your work
Michelle	Copy someone else	Dan	Check your work

2. Organize the data concerning “Homework Hints and Helps” in a *table*. Include in the table: Advice Given, Number of Students (per type of advice) and the fraction of the class OR the percentage of the entire class that suggested each type of advice.

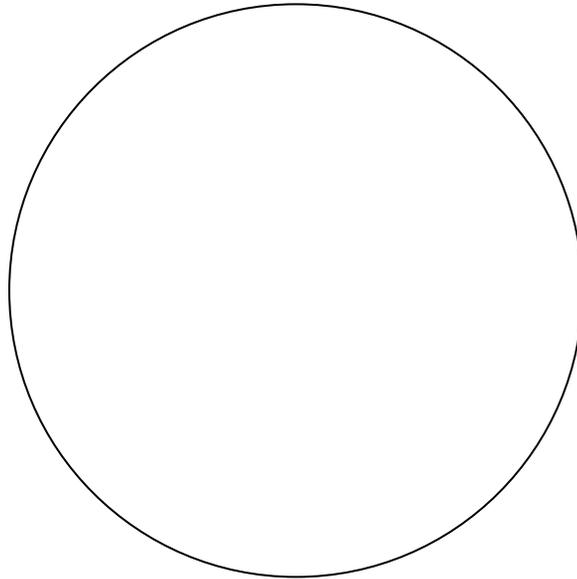



## Circle Graph Construction

4. Using the data from the table in # 2 (pg. 4) “Homework Hints and Helps,” construct a circle graph.

Be sure to:

- Write a title for your graph
- Label all the parts



## Data Display Practice

Read the information provided below.

Several students at Mystery Falls Middle School were asked to select their “Favorite Book” from the following list:

- Harry Potter and the Sorcerer’s Stone by J.K. Rowling
- Brian’s Winter by Gary Paulsen
- Dragon of the Lost Sea by Lawrence Yep
- Letters from Rifka by Karen Hess
- Homecoming by Cynthia Voigt

Out of the 180 students who were surveyed, here were the results:

65 preferred Harry Potter and the Sorcerer’s Stone

41 preferred Brian’s Winter

15 preferred Dragon of the Lost Sea

29 preferred Letters from Rifka

30 preferred Homecoming

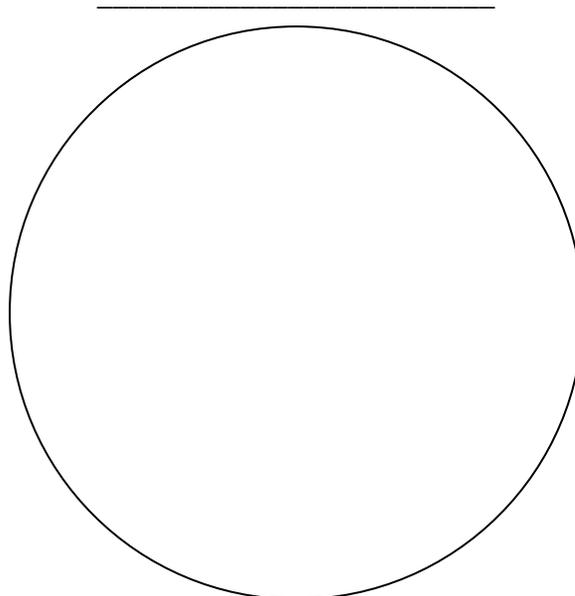
1. Organize the data concerning “Favorite Book” in a table. Include in the table: Number of Students and the Fraction OR Percentage of the entire school that selected each title.

Title of Book	Number of Students	Fraction OR Percentage of School
<u>Harry Potter and the Sorcerer’s Stone</u>		
<u>Brian’s Winter</u>		
<u>Dragon of the Lost Sea</u>		
<u>Letters from Rifka</u>		
<u>Homecoming</u>		

2. Using the information in the table above, represent the data on circle graph.

Be sure to:

- Write a title for your graph
- Label all the parts



## Data Display Practice (continued)

3. Use the circle graph to interpret the data collected. Describe how the fraction or percentage of students reading these books relates to one another.

THINK \_\_\_\_\_  
SOLVE \_\_\_\_\_  
EXPLAIN \_\_\_\_\_

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4. What would be the purpose of displaying the data in a circle graph?

THINK \_\_\_\_\_  
SOLVE \_\_\_\_\_  
EXPLAIN \_\_\_\_\_

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5. What would be the purpose of using a bar graph to display the data?

THINK \_\_\_\_\_  
SOLVE \_\_\_\_\_  
EXPLAIN \_\_\_\_\_

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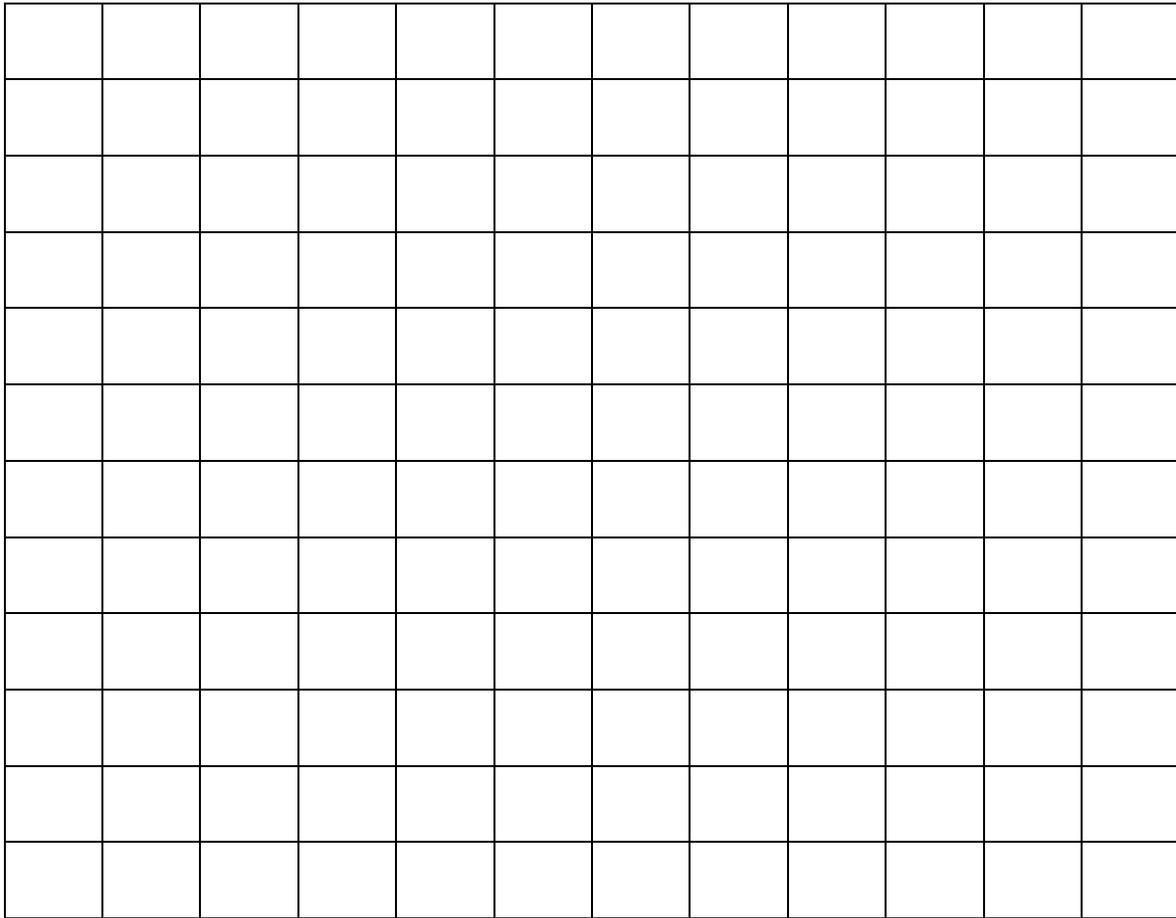
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## Data Display Practice (continued)

6. Using the results of the students surveyed at Mystery Falls Middle School regarding their "favorite book," construct a bar graph that accurately displays the data.

Be sure to:

- Title the graph
- Labels for the axes
- Appropriate and consistent scales
- Accurately graphed data



7. On the lines below, write two statements that compare the students' favorite book choices using the data provided in the bar graph.

THINK _____
SOLVE _____
EXPLAIN _____


## Data Display Practice (continued)

8. Explain how each of these data displays: circle and bar graphs lead to a different interpretation of the same data.

THINK _____
SOLVE _____
EXPLAIN _____

_____
_____
_____

9. The following data set represents reading test scores from some of the students who read Brian's Winter:

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

Using the test scores in the data set above, sketch a box-and-whisker graph of the data.

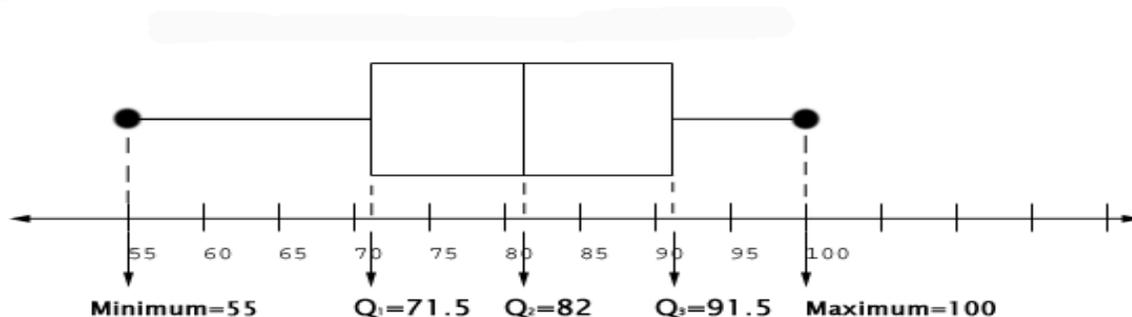
Be sure to:

- Title the graph
- Choose an appropriate scale
- Identify the minimum and maximum values, the mean, and the quartiles ( $Q_1$ ,  $Q_2$ ,  $Q_3$ )
- Construct the box and the whiskers
- Accurately graph the data

## Key for Graph Construction

### Box-and-Whisker Graph Construction

1a.



b. 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.

### 2. Data for Displays

#### Homework Hints and Helps

Type of Advice	Number of Students	Percentage of Students
Check your work	9	$9/30 = 3/10$
Ask for help	12	$12/30 = 4/10$
Copy someone else	3	$3/30 = 1/10$
Follow directions	6	$6/30 = 2/10$

### 3. Bar Graph Construction

Be sure to:

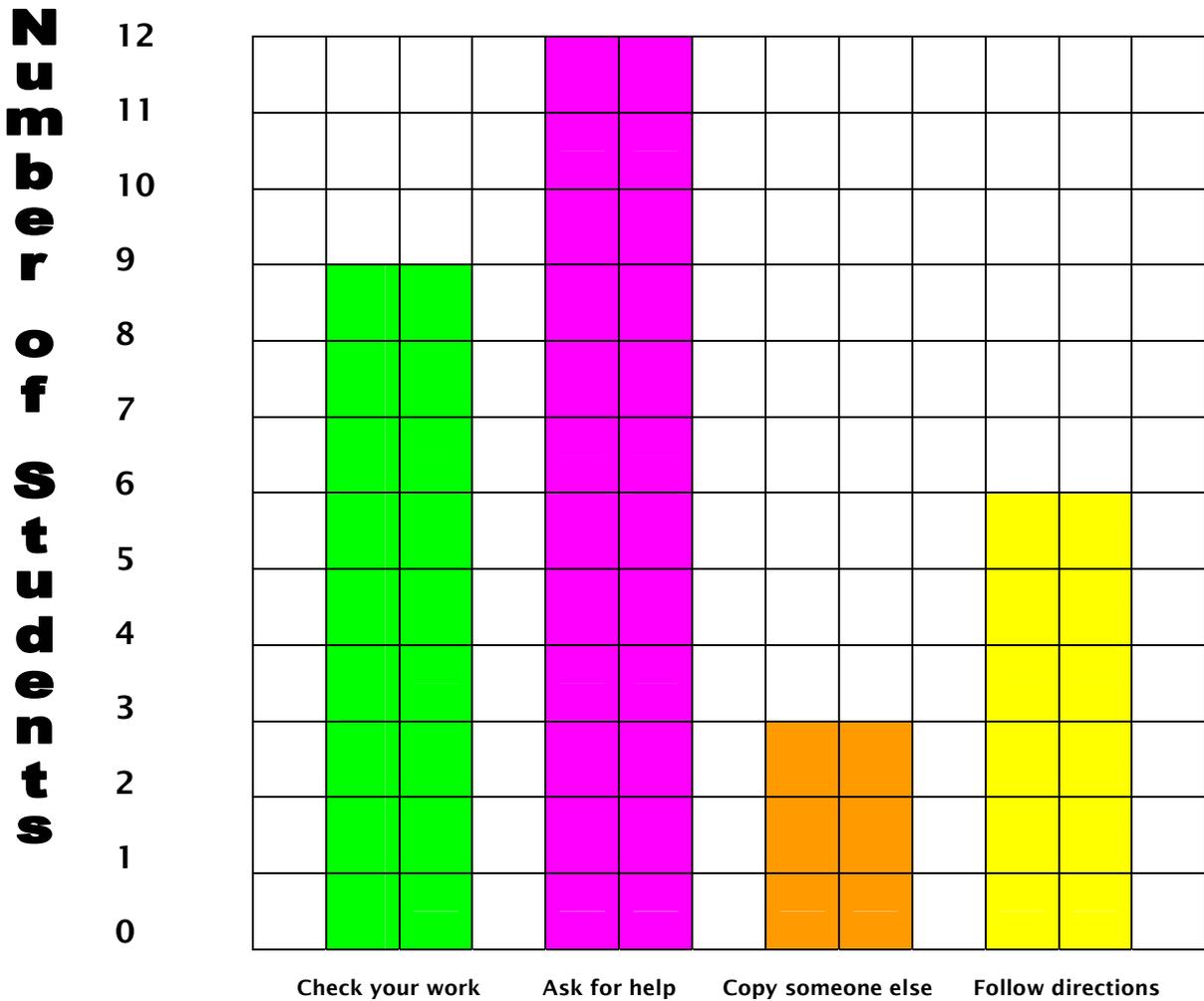
- ✓ Title the graph
- ✓ Choose an appropriate scale
- ✓ Label each bar of your graph
- ✓ Accurately graph the data

**KEY FOR BAR GRAPH:**

- Check your work
- Ask for help
- Copy someone else
- Follow directions

#### HOMEWORK HINTS AND HELPS

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#### 4. Circle Graph Construction

Be sure to:

- ✓ Write a title for your graph
- ✓ Label all the parts

Type of Advice	Number of Students	Fraction/Percentage of Students
<b>Check your work</b>	9	$9/30 = 3/10$ 30%
<b>Ask for help</b>	12	$12/30 = 4/10$ 40%
<b>Copy someone else</b>	3	$3/30 = 1/10$ 10%
<b>Follow directions</b>	6	$6/30 = 2/10$ 20%

#### HOMEWORK HINTS AND HELPS

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## Key for Data Display Practice

1.

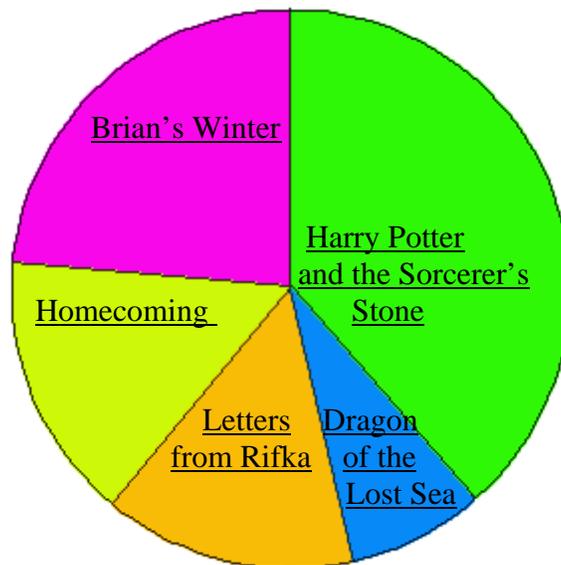
### Mystery Falls Favorite Books

Title of Book	Number of Students	Fraction OR Percentage of School
<u>Harry Potter and the Sorcerer's Stone</u>	65	$65/180=36.1\%$
<u>Brian's Winter</u>	41	$41/180=22.7\%$
<u>Dragon of the Lost Sea</u>	15	$15/180=8.3\%$
<u>Letters from Rifka</u>	29	$29/180=16.1\%$
<u>Homecoming</u>	30	$30/180=16.6\%$

2. Be sure to:

- ✓ Write a title for your graph
- ✓ Label all the parts

### Mystery Falls Favorite Books



## Key for Data Display Practice (Continued)

3. 

Harry Potter and the Sorcerer's Stone is the all time favorite for the students at Mystery Falls Middle School with approximately 36% of the students voting for this title out of the 180 surveyed. The second most popular book is Brian's Winter, which pulled in approximately 22% of the overall votes.
  
4. 

One purpose for using a circle graph to display data, it clearly shows the relationship of the data of parts to the whole AND it shows a comparison between the data. It is easy to see the most popular response from several possibilities.
  
5. 

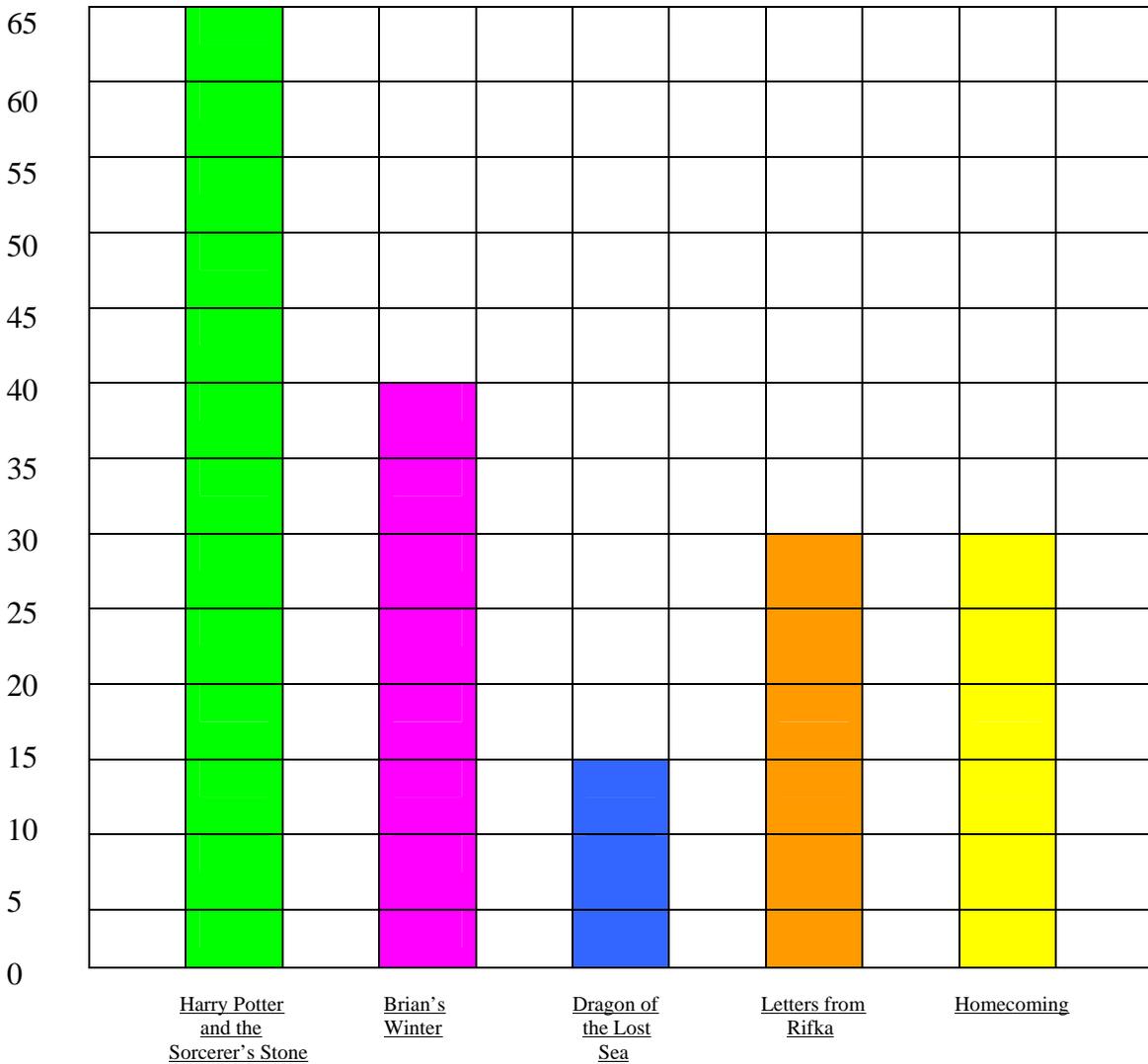
One purpose for using a bar graph to display data is to compare two things (or more) in a simple manner. Unlike a circle graph, it is not necessary to determine the fraction or percentage of the parts to the whole. The numerical data for a bar graph does not need any conversion and can be simply organized with the group that it is associated with, which makes the data easier to used in a display.

## Key for Data Display Practice (Continued)

6.

**Mystery Falls Favorite Books**

0  
5  
10  
15  
20  
25  
30  
35  
40  
45  
50  
55  
60  
65



7.

Letters from Rifka and Homecoming had approximately the same number of students that considered each of them their favorite book. The least popular book of the five was Dragon of the Lost Sea.

8.

Unlike a circle graph, a circle graph also shows the relationship of the data of the parts to the whole group. A bar graph simply shows how much is in each group represented on the graph.

## Key for Data Display Practice (Continued)

9. Teachers please note that this is the same box-and-whisker graph that was used in the diagnostic assessment and the activity box-and-whisker construction. The information that changed in this activity was the arrangement of the data in the table and the wording of the problem. (The reason for using the same graph was due to the technical difficulty in creating this display in an electronic medium. Feel free to adapt the data and the box-and-whisker graph, as you deem necessary.)

