

LESSON 17: Dot Plots, Histograms, and Box Plots

Weekly Focus: plots

Weekly Skill: interpret and create

Lesson Summary: For the Warm Up, students will solve a problem about donations. In Activity 1, they will learn and practice vocabulary about plots and histograms. In Activity 2, they will interpret box plots. In Activity 3, they will do problems in the workbook. Activity 4 is an application activity about inches of snow. The homework is the review word problems for data measurement. There is also an exit ticket. Estimated time for the lesson is 2 hours.

Materials Needed for Lesson 17:

- Video (length 10:00) on box plots. The video is required for teachers and optional for students:
- Handout 17.1, Notes on Box Plots (attached)
- Worksheet 17.2 with answers (attached), making box and whisker plots
- Worksheet 17.3 Answer to Application Problem (attached)
- *Mathematical Reasoning Test Preparation for the 2014 GED Test Student Book (pages 38-39 and 40-47) and Workbook (pages 54-55).*
- Exit ticket (attached)
- Teacher Notes:
 - You can add more examples if you feel students need them before they work. Any ideas that concretely relate to their lives make good examples.
 - When you do a worksheet, look for an easier problem to do together first as it may not necessarily be the first problem. Also, students may only have time to do part of the worksheets in class and the rest can be assigned as homework.

Objectives: Students will be able to:

- Solve the review word problem
- Understand and interpret dot plots, box plots, and histograms
- Create a box plot

ACES Skills Addressed: N, CT, LS, ALS

CCRS Mathematical Practices Addressed: Building Solution Pathways, Mathematical Fluency, Model with Math

Levels of Knowing Math Addressed: Intuitive, Abstract, Pictorial, and Application

Notes:

You can add more examples if you feel students need them before they work. Any ideas that concretely relates to their lives make good examples.

For more practice as a class, feel free to choose some of the easier problems from the worksheets to do together. The “easier” problems are not necessarily at the beginning of each worksheet. Also, you may decide to have students complete only part of the worksheets in class and assign the rest as homework or extra practice.

The GED Math test is 115 minutes long and includes approximately 46 questions. The questions have a focus on quantitative problem solving (45%) and algebraic problem solving (55%).

Students must be able to understand math concepts and apply them to new situations, use logical reasoning to explain their answers, evaluate and further the reasoning of others, represent real world

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problems algebraically and visually, and manipulate and solve algebraic expressions.

This computer-based test includes questions that may be multiple-choice, fill-in-the-blank, choose from a drop-down menu, or drag-and-drop the response from one place to another.

The purpose of the GED test is to provide students with the skills necessary to either further their education or be ready for the demands of today's careers.

Lesson 17 Warm-up: Solve the donation question

Time: 10 Minutes

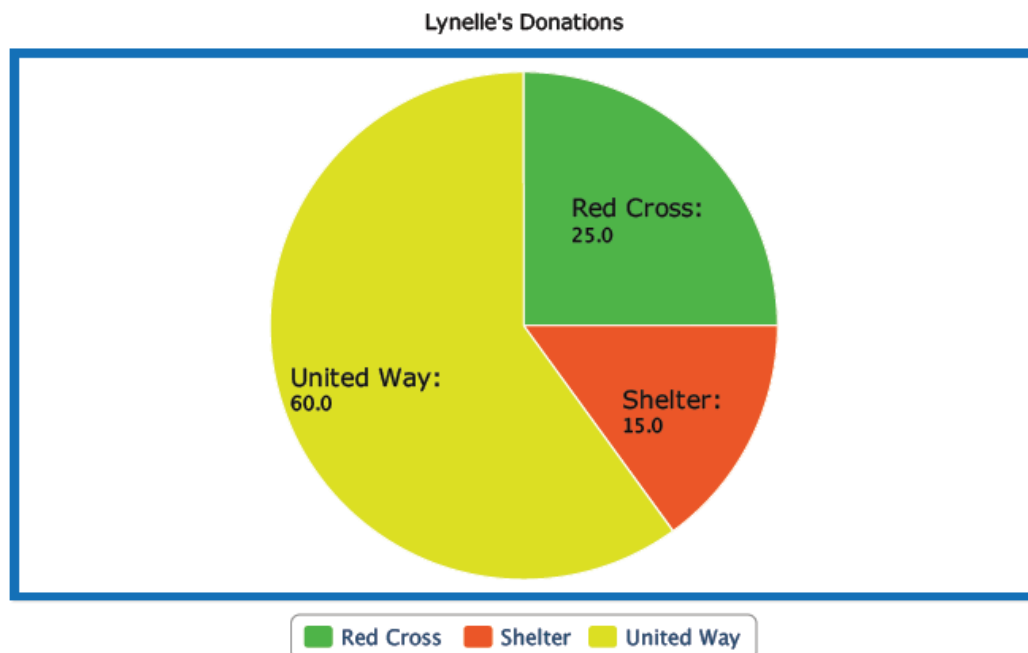
Write on the board: Lynelle donates money to charitable organizations every year. This year she gave $\frac{1}{4}$ of her donations to the Red Cross, 15% to a homeless shelter, and $\frac{3}{5}$ to the United Way. Her total donations are \$240.

Basic Questions:

- How much did she donate to the Red Cross? ($\frac{1}{4}$ of \$240 = \$60)
- To the homeless shelter? ($0.15 \times \$240 = 36$)
- To the United Way? ($\frac{3}{5} = \frac{6}{10} = 60\% = 0.6 \times \$240 = \$144$)

Extension Questions:

- Make a graph to represent Lynelle's donations.
 - Let students start and see if they think of making a circle graph. It should look about like this:



Lesson 17 Activity 1: Vocabulary

Time: 15-20 Minutes

1. Write the vocabulary words on the board: **dot plots**, **box plots**, **quartile**, and **histogram**.
2. You will teach the vocabulary with class examples and the **student book pages 38-39**.
3. For **dot plot**, write a number line on the board. Ask five students how many children they have. For each response, put a dot above the number line at the correct spot. Explain that dot plots consist of a number line and dots are used to visually see the outcomes.
 - a. Ask students what the median of the dot plot is. (It's the middle number)
 - b. Ask what the minimum number is. (It will be the lowest and could be 0)
 - c. Ask what the maximum is. (It's the highest number)
 - d. Now find the median of the bottom half. That is the **first quartile**.
 - e. Now find the median of the top half. That is the **third quartile**.
 - f. Draw a box plot to represent these measurements.
4. A **histogram** is a bar graph in which each bar represents a range of frequency. Unlike dot plots, they are often used to represent large amounts of data. See the example on page 39.
5. Note to teacher: Using data from the class is preferable to explain dot plots and box plots. However, if you prefer, you can use the example on page 38 to explain these types of graphs.
6. Do the exercises on **pages 38-39 in the student book** together.

Lesson 17 Activity 2: Interpret Box and Whisker Plot

Time: 15-20 Minutes

1. Give students **Handout 17.1**. Go through the example together.
2. Practice interpreting a box and whisker plot by doing **Worksheet 17.2**. Circulate to help and if someone finishes early, he/she can do answers on the board as long as other students are almost done.

Lesson 1 Activity 3: Word Problems

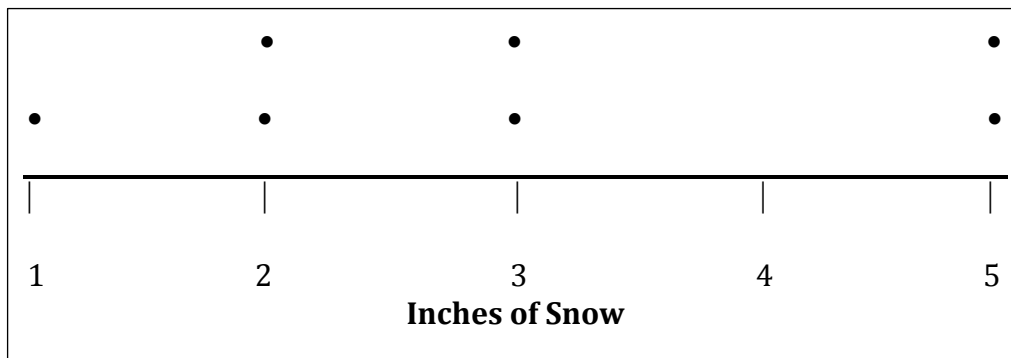
Time: 25 Minutes

Have students work independently in the **workbook pages 54-55**. Circulate to help. Review any questions that students found challenging. Point out the graphs for questions 14-16 in which the dot plot was converted to a histogram. This should help students understand both.

Lesson 17 Application: Graph the Inches of Snow

Time: 15 Minutes

1. Write on the board: In one week in January, Minneapolis got this many inches of snow on Monday through Sunday: 2 inches, 5 inches, 3 inches, 1 inch, 3 inches, 2 inches, and 5 inches.
2. Make a Dot Plot with the above information.
 - a. Help the students get started by asking them what they should do first. (Make a number line)
 - b. The results should look like the example below:



3. Make a Box Plot that includes the median, Quartile 1, and Quartile 3.
 - a. Before you start, ask students how to find the median (by counting from left or right to the middle).
 - b. Results should be like **Worksheet 17.3**.

Lesson 17 Exit Ticket

Time: 5 Minutes

Debate as a class or in pairs/ small groups which type of graph to use for the scenarios provided in the attached exit ticket (have them give reasons for their choices).

Answers:

- 1) Box plot
- 2) Dot plot
- 3) Histogram

Lesson 17 Homework: Review of Data Measurement and Analysis

Time: 30-40 Minutes

There will not be a lesson to review the data measurement and analysis lessons. Students should do **pages 40 to 47 of the student book** on their own at home.

Handout 17.1—Example of Box Plot

Making and Understanding Box and Whisker Plots - Step-by-Step Lesson

Problem: Draw the box and whisker plot for the data set:

40, 42, 28, 38, 41, 39, 40, 47, 44

Explanation:

Box and whisker plots contain 5 key pieces of data: The range, minimum, median, lower quartile, upper quartile, and maximum.

Step 1) Order the data and find the range. The data in order (lowest to highest) would be:

28, 38, 39, 40, 40, 41, 42, 44, 47

This means the range (highest to lowest) would be: 28-47.

We subtract the largest value by the smallest value: $47 - 28 = 19$ (range)

Step 2) Find the median (middle number)

The median is the middle value. If there are an odd number of items, it is simple because there will be just one middle number. If there are an even number of items, we would average the two middle numbers. There are 9 pieces of data (odd), so the middle number will have 4 integers above and below it:

28, 38, 39, 40, **40**, 41, 42, 44, 47

Median can be determined by the equation: $\frac{1}{2}(n + 1)$, n is the number of data values (9)

$\frac{1}{2}(9 + 1) = 5$ or 5th data value.

The median is: **40**

Step 3) Find the lower quartile:

The lower quartile is the median of the lower half of data. The lower half of the data consists of (28, **38, 39**, 40) When you have an even number of data, take the average of the middle number numbers = 38.5

Step 4) Find the upper quartile.

The upper quartile is the median of the upper half of data. The upper half of the data consists of (41, **42, 44**, 47). 43 is the median of lower half of the data set.

Handout 17.1 [cont.]—Example of Box Plot

Step 5) Find the average: 39.88. Add up all the data and divide by the number of pieces of data you have (9).

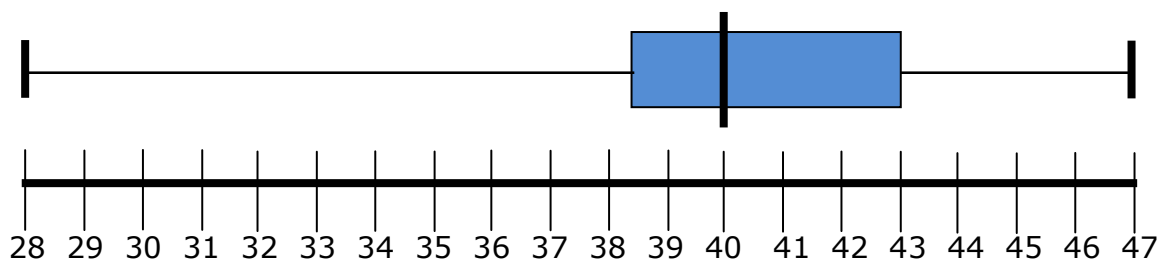
Step 6) It is time to visualize this data. We have all the values we need.

a) Make a range chart. (28 – 47)

b) Draw three large lines to indicate the minimum, maximum, and median (40).

c) Draw a box from the median to the lower quartile (38.5) and enclose the box.

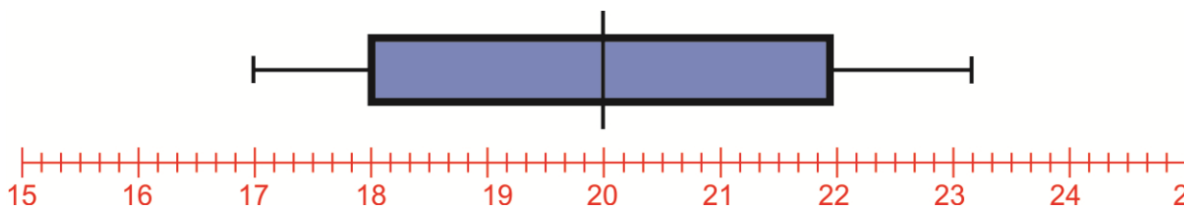
d) Draw a box from the median to the upper quartile (43) and enclose the box.



Worksheet 17.2—Practicing Box Plots

Making and Understanding Box and Whisker Plots- Independent Practice Worksheet

Complete all the problems.



1. What is the median?
2. What is the lower quartile ?
3. What is the Upper quartile ?
4. What is the minimum value?
5. What is the maximum value?
6. The above two values are used to find the _____.
7. What is the range of the data?
8. What percentage of data is below upper quartile?
9. What percentage of data is located between the lower quartile and the median?
10. What percentage of data is above the median?

Worksheet 17.2—Practicing Box Plots **Answers**

1. 20

2. 18

3. 22

4. 17

5. 23.2

6. Range.

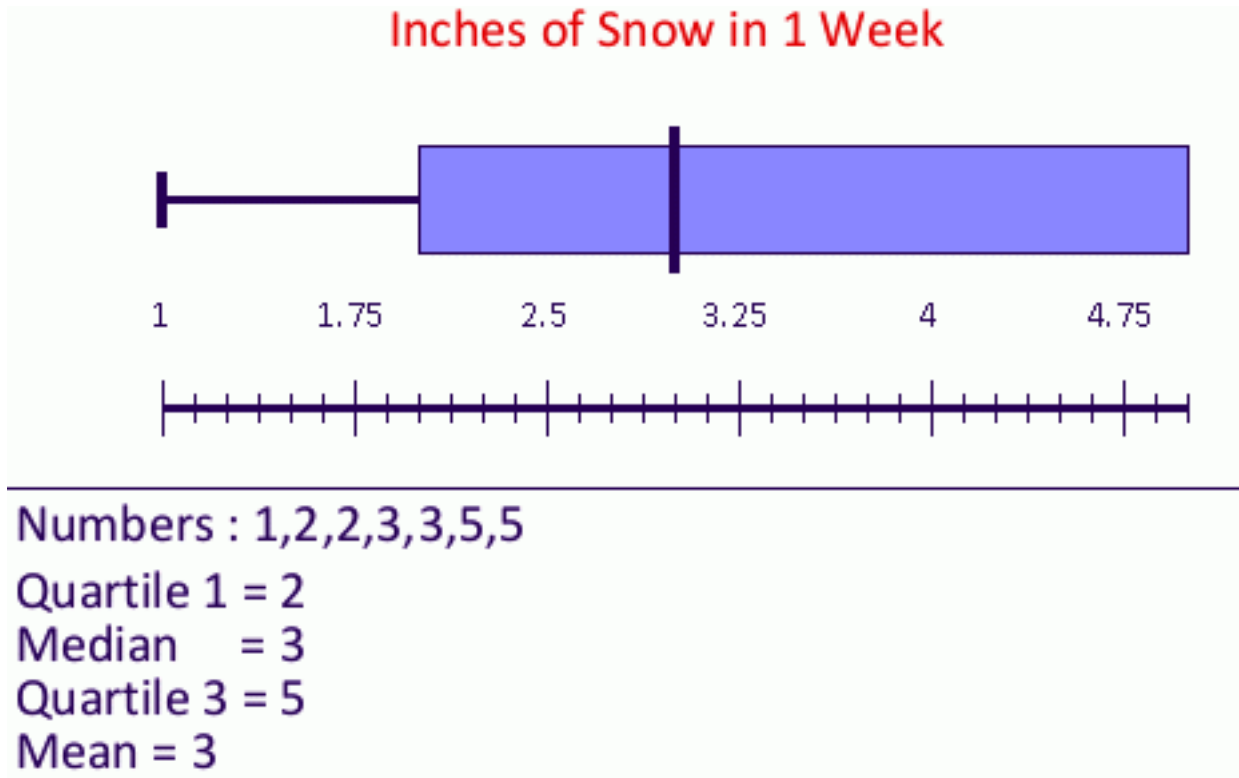
7. 6.2

8. 75%

9. 25%

10. 50%

Worksheet 17.3 Application Activity Box Plot **Answer**



Exit Ticket

Would a dot plot, histogram or box plot work best for the data in the following scenarios?

- 1) An economic website wants to publish a graph that reflects annual incomes of government workers in Minnesota last year. They want to highlight the range of salaries of workers in the middle 50% of the sample.
- 2) A manager surveys employees to see if they prefer work events that include breakfast, brunch, lunch or dinner. She wants her graph to show which is most popular.
- 3) The MN Department of Natural Resources is monitoring how thick the ice is over Lake Minnetonka from December-April. They measure the ice's thickness every week, and want to make a graph that groups their measurements by ranges of ice thickness.

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