


CHAPTER 8: STATISTICS AND MULTIPLICATION EQUATIONS

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MATH NOTES

MEASURES OF CENTRAL TENDENCY



Numbers that locate or approximate the “center” of a set of data are called the **measures of central tendency**. The mean and the median are measures of central tendency.

The **mean** is the arithmetic average of the data set. One way to compute the mean is to add the data elements and then to divide the sum by the number of items of data. The mean is generally the best measure of central tendency to use when the set of data does not contain **outliers** (numbers that are much larger or smaller than most of the others). This means that the data is symmetric and not skewed.

The **median** is the middle number in a set of data arranged numerically. If there is an even number of values, the median is the average (mean) of the two middle numbers. The median is more accurate than the mean as a measure of central tendency when there are outliers in the data set or when the data is either not symmetric or skewed.

When dealing with measures of central tendency, it is often useful to consider the distribution of the data. For symmetric distributions with no outliers, the mean can represent the middle, or “typical” value, of the data well. However, in the presence of outliers or non-symmetrical distributions, the median may be a better measure.

Examples: Suppose the following data set represents the number of home runs hit by the best seven players on a Major League Baseball team:

16, 26, 21, 9, 13, 15, 9

The mean is $\frac{16+26+21+9+13+15+9}{7} = \frac{109}{7} \approx 15.57$.

The median is 15, since, when arranged in order (9, 9, 13, 15, 16, 21, 26), the middle number is 15.

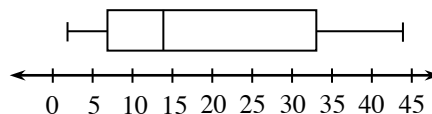
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BOX PLOTS



A **box plot** (also known as a “box-and-whiskers” plot) displays a summary of data using the median, quartiles, and extremes of the data. The box contains “the middle half” of the data. The right segment represents the top 25% of the data, and the left segment represents the bottom 25% of the data. A box plot makes it easy to see where the data are spread out and where they are concentrated. The larger the box, the more the data are spread out.

To construct a box plot using a number line that shows the range of the data, draw vertical line segments above the median, first quartile and third quartile. Then connect the lines from the first and third quartiles to form a rectangle. Place a vertical line segment above the number line at the maximum (highest) and minimum (lowest) data values. Connect the minimum value to the first quartile and the maximum value to the third quartile using horizontal segments. For the data set used in the Quartile Math Note, namely, 2, 7, 9, 12, 14, 22, 32, 36, and 43, the box plot is shown at right.

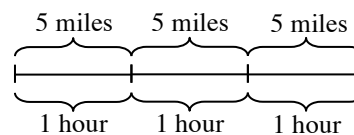


DISTANCE, RATE, AND TIME



Distance (d) equals the product of the **rate** (or **speed**) (r) and the **time** (t). This is usually written as $d = r \cdot t$. The units of distance (such as feet or miles) and units of time (such as seconds or hours) are used to write the units of rate (feet per second or miles per hour). The equation can also be written in the equivalent forms of $r = \frac{d}{t}$ and $t = \frac{d}{r}$.

One way to make sense of this relationship is to treat rate as a unit rate that equals the distance covered in one hour (or minute) of travel. Then $r \cdot t$ is t sets of r lengths, which is rt long. For example, if someone travels for 3 hours at 5 miles per hour, you could represent this situation by the diagram at right.



You can also use the same equation to find either rate or time if you know the other two variables. For example, if you need to travel 200 miles and need to be there in 4 hours, you have the equation $r \frac{\text{mi.}}{\text{hr.}} = \frac{200 \text{ mi.}}{4 \text{ hrs.}}$, so $r = 50 \frac{\text{mi.}}{\text{hr.}}$.

