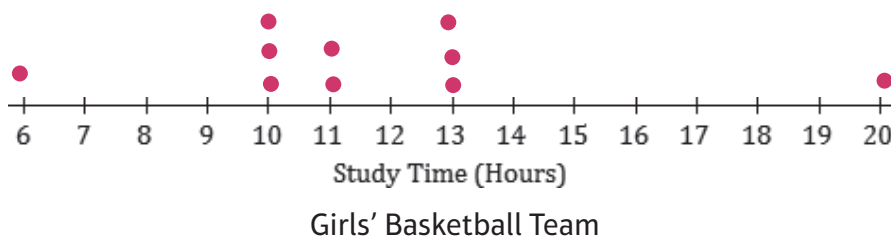


NAME: _____ PERIOD: _____ DATE: _____

Homework Problem Set

1. Ten members of a high school girls' basketball team were asked how many hours they studied in a typical week. Their responses (in hours) were 20, 13, 10, 6, 13, 10, 13, 11, 11, 10.

A. Using the axis given below, draw a dot plot of these values. (Remember, when there are repeated values, stack the dots with one above the other.)



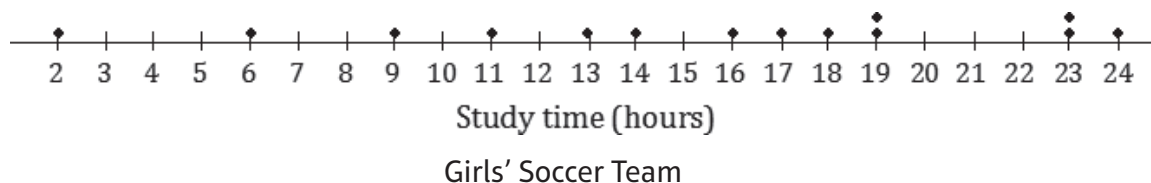
B. Calculate the mean study time for these students.

$$\frac{117}{10} = 11.7 \text{ hours} = \bar{x}$$

C. Calculate the deviations from the mean for these study times, and write your answers in the appropriate places in the table below. $x - \bar{x}$

Number of Hours Studied	20	13	10	6	13	10	13	11	11	10
Deviation from the Mean	8.3	1.3	-1.7	-5.7	1.3	-1.7	1.3	-0.7	-0.7	-1.7

D. The study times for fourteen girls from the soccer team at the same school as the one above are shown in the dot plot below.

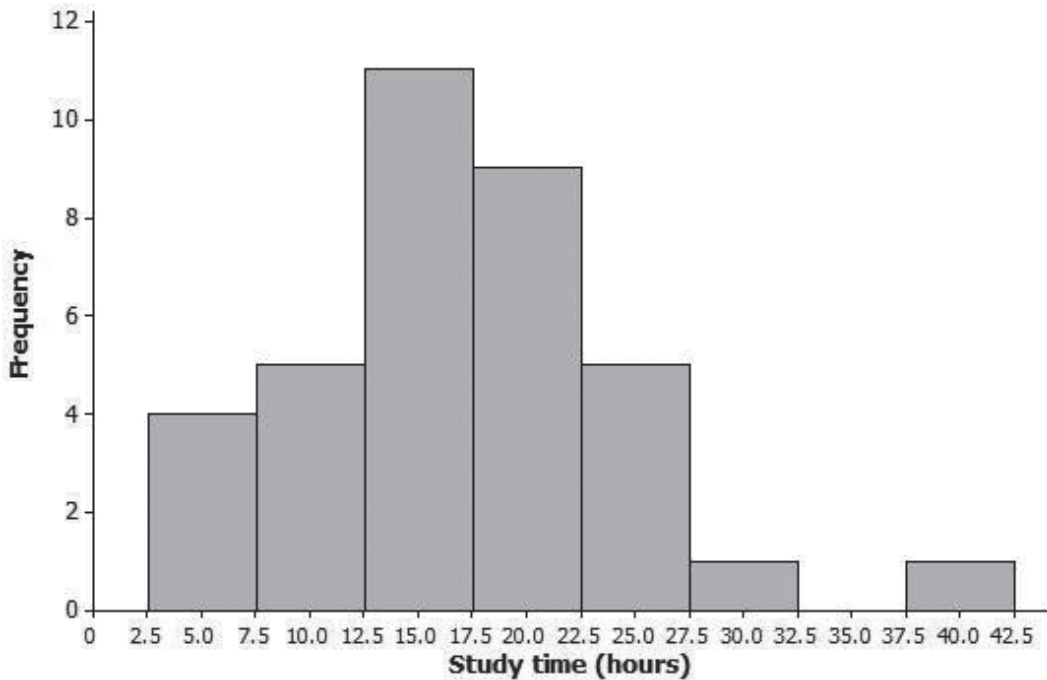


Based on the data, would the deviations from the mean (ignoring the sign of the deviations) be greater or less for the soccer players than for the basketball players?

Greater because the data is more spread out.

2. All the members of a high school softball team were asked how many hours they studied in a typical week. The results are shown in the histogram below.

Source: The data set in this question comes from NCTM Core Math Tools, <http://www.nctm.org/Classroom-Resources/Core-Math-Tools/Data-Sets/>



Softball Team

A. We can see from the histogram that four students studied around 5 hours per week. How many students studied around 15 hours per week?

11 students

B. How many students were there in total?

$$4 + 5 + 11 + 9 + 5 + 1 + 0 + 1 = 36$$

C. Suppose the four students represented by the histogram bar centered at 5 had all studied exactly 5 hours, the five students represented by the next histogram bar had all studied exactly 10 hours, and so on. If you were to add up the study times for all of the students, what result would you get?

data in that interval → $4(5) + 5(10) + 11(15) + 9(20) + 5(25) + 1(30) + 0(35) + 1(40) = 610$

D. What is the mean study time for these students?

$$610 / 36 = 16.94$$

E. What would you consider to be a typical deviation from the mean for this data set?

? (E) Guess?

3. A small car dealership tests the fuel efficiency of sedans on its lot. It chooses 12 sedans for the test. The fuel efficiency (mpg) values of the cars are given in the table below. Complete the table as directed below.

Fuel Efficiency (miles per gallon)	29	35	24	25	21	21	18	28	31	26	26	22
Deviation from the Mean	3.5	9.5	-1.5	-0.5	-4.5	-4.5	-7.5	2.5	5.5	0.5	0.5	-3.5
Squared Deviation from the Mean	12.25	90.25	2.25	0.25	20.25	20.25	56.25	6.25	30.25	0.25	0.25	12.25

- A. Calculate the mean fuel efficiency for these cars.

$$\bar{x} = 25.5 \rightarrow 306/12$$

- B. Calculate the deviations from the mean, and write your answers in the second row of the table.

$$x - \bar{x}$$

- C. Square the deviations from the mean, and write the squared deviations in the third row of the table.

$$(x - \bar{x})^2$$

- D. Find the sum of the squared deviations.

$$\sum (x - \bar{x})^2 = 251.25$$

- E. What is the value of n for this data set? Divide the sum of the squared deviations by $n - 1$.

$$n = 12 \rightarrow \text{sample of the population so we are going to use } (n-1) \rightarrow 12-1 = 11 \rightarrow 251.25/11 \approx 22.84$$

- F. Take the square root of your answer to part (E) to find the standard deviation of the fuel efficiencies of these cars. Round your answer to the nearest hundredth.

$$\sqrt{22.84} \approx 4.78 \text{ miles/gallon}$$

- G. Explain what the standard deviation of the fuel efficiencies of the cars tells you.

Since the standard deviation is smaller, more of their cars are closer to the mean of 25.5 gallons/mi.

SUVs

4. The same dealership decides to test fuel efficiency of SUVs. It selects six SUVs on its lot for the test. The fuel efficiencies (in miles per gallon) of these cars are shown below.

21 21 21 30 28 24

A. Calculate the mean and the standard deviation of these values. Be sure to show your work, and include a unit in your answer.

mean = $145/6 \approx 24.1667$

$x - \bar{x}$: -3.1667, -3.1667, -3.1667, 5.8333, 3.8333, -0.1666

$\sum (x - \bar{x})^2 = 78.82753356$

$\sqrt{\frac{78.82753356}{6-1}} \approx 3.97 \text{ miles}$

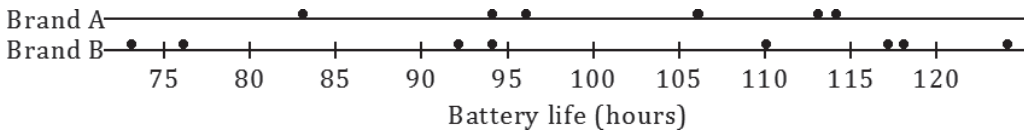
B. Which of the two data sets (Problem 3 or Problem 4) has the larger standard deviation? What does this tell you about the two types of cars (sedans and SUVs)?

Problem 3 → more variability in gas mileage among sedans than SUVs.

A consumers' organization is planning a study of the various brands of batteries that are available. They are interested in how long a battery can be used before it must be replaced. As part of its planning, it measures lifetime for each of six batteries of Brand A and eight batteries of Brand B. Dot plots showing the battery lives for each brand are shown below.



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5. Does one brand of battery tend to last longer, or are they roughly the same? What calculations could you do in order to compare the battery lives of the two brands?

They roughly have about the same mean.

Brand A ~ 101 and Brand B ~ 100.5

6. Do the battery lives tend to differ more from battery to battery for Brand A or for Brand B? Explain your thinking.

Brand B batteries tend to vary more since the data is more spread out.

7. Would you prefer a battery brand that has battery lives that do not vary much from battery to battery? Why or why not?

Less variability because it's more consistent and reliable.

The table below shows the lives (in hours) of the Brand A batteries. We are going to follow a multi-step process to calculate the **Standard Deviation**, which will help us measure how spread out the values are—how long can we expect an average Brand A Battery to last. The first value has been done for you.

de·vi·a·tion

1. the action of departing from an established course or accepted standard.
2. Statistics: the amount by which a single measurement differs from a fixed valuesuch as the mean.

Life (Hours)	83	94	96	106	113	114
Deviation from the Mean	-18	-7	-5	5	12	13
Squared Deviations from the Mean	324	49	25	25	144	169

$\bar{x} = 101$

736

8. A. Calculate the mean.

101 hours

- B. Calculate the deviations from the mean (actual value minus the mean) for the remaining values, and write your answers in the appropriate places in the table. The first one has been done for you.

$$x - \bar{x}$$

- C. Square the deviations from the mean. For example, when the deviation from the mean is -18 the squared deviation from the mean is $(-18)^2 = 324$.

$$(x - \bar{x})^2$$

- D. Add up the squared deviations (This result is the *sum* of the squared deviations).

$$\sum (x - \bar{x})^2 = 736$$

- E. The number of values in the data set is denoted by n . In this example, n is 6. You divide the sum of the squared deviations by $n - 1$, which here is $6 - 1 = 5$.

$$\text{sample } \frac{\sum(x-\bar{x})^2}{n-1} = 147.2$$

- F. Finally, you take the square root of the value you found in Part E. Units for Standard Deviation are the same as the units for the data set (hours, in this case). What does this answer mean?

$$\sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} \approx 12.132 \text{ hours}$$

The average distance from the mean

The table below shows the battery lives and the deviations from the mean for Brand B.

Life (Hours)	73	76	92	94	110	117	118	124
Deviation from the Mean	-27.5	-24.5	-8.5	-6.5	9.5	16.5	17.5	23.5
Squared Deviation from the Mean	756.25	600.25	72.25	42.25	90.25	272.25	306.25	552.25

9. Follow the steps to find and interpret the Standard Deviation for Brand B.

- A. Calculate the mean.

$$100.5 \text{ hours}$$

- B. Calculate the deviations from the mean (actual value minus the mean) for the remaining values, and write your answers in the appropriate places in the table.

$$x - \bar{x}$$

- C. Square the deviations from the mean.

$$(x - \bar{x})^2$$

- D. Add up the squared deviations (this result is the *sum* of the squared deviations).

$$\sum(x - \bar{x})^2$$

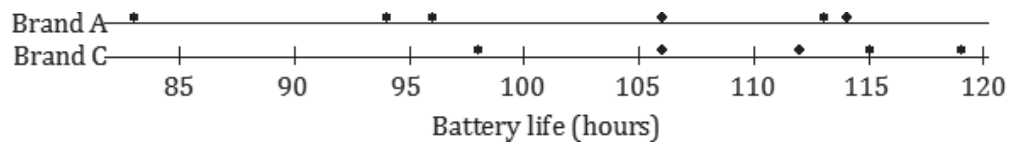
- E. Divide the sum of the squared deviations by $n - 1$. $8 - 1 = 7$

$$\frac{2692}{7} \approx 384.57$$

- F. Finally, you take the square root of the value you found in Part E. Units for Standard Deviation are the same as the units for the data set (hours, in this case). What does this answer mean?

$$\sqrt{384.57} \approx 19.61 \text{ hours}$$

The lives of five batteries of a third brand, Brand C, were determined. The dot plot below shows the lives of the Brand A and Brand C batteries.



10. Which brand has the greater mean battery life? (You should be able to answer this question without doing any calculations.)

Brand C

11. Which brand shows greater **variability**?

Brand A

Variability: The extent to which data points diverge from the mean and from each other.

12. Which brand would you expect to have the greater standard deviation?

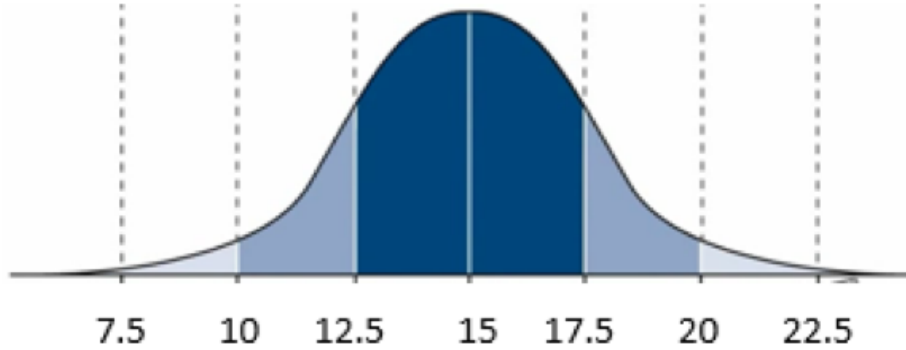
Brand A (wider spread)

13. Why would we want to know this information? (Quality control, reliability, etc.)

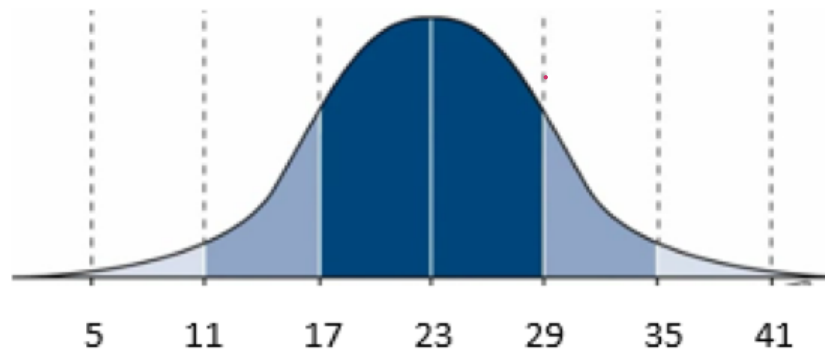
For making a better choice in choosing new batteries.

For Problems 14–16, fill in an appropriate axis label on each graph. Identify the areas associated with the 68–95–99.7 rule.

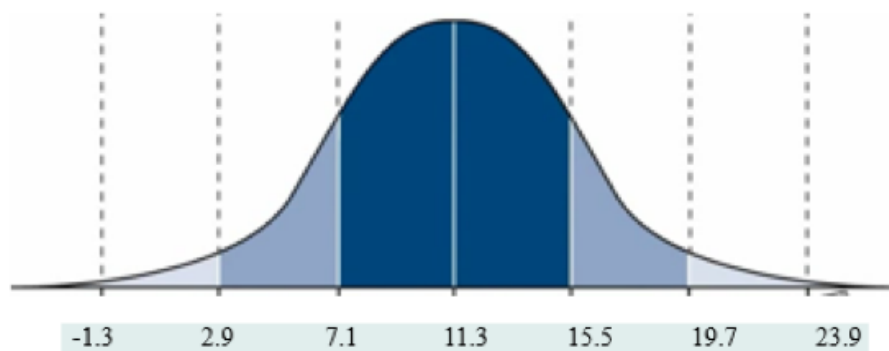
14. Mean = 15; Standard Deviation = 2.5



15. Mean = 23; Standard Deviation = 6



16. Mean = 11.3; Standard Deviation = 4.2



REVIEW—Slope

17. For each slope and point given below, determine a point that is on the graph of the line determined by the slope and point. For example, if the slope is $\frac{1}{3}$ and the point is $(1, 2)$, then $(4, 3)$ or $(-2, 1)$ are also on the line with slope $\frac{1}{3}$ and point $(1, 2)$. There are many possible answers to each one.

A. slope = $\frac{4}{5}$ and point A $(0, 3)$

$(-10, -5)$ $(-5, -1)$ $(5, 7)$

B. slope = $-\frac{1}{2}$ and point B $(2, 0)$

$(-2, 2)$ $(0, 1)$ $(4, -1)$

C. slope = 3 and point C $(2, 3)$

$(0, -3)$ $(1, 0)$ $(3, 6)$

D. slope = -4 and point D $(-1, 2)$

$(-2, 6)$ $(0, -2)$ $(1, 6)$

18. Explain the method you used to complete Problem 17.

add the $\frac{\text{rise}}{\text{run}}$ to the $\frac{\text{y-coordinate}}{\text{x-coordinate}}$

