Instruction

Guided Practice 6.1.2

Example 1

Rocky and Crystal are geologists who study geodes. They traveled around the country to 20 different locations, which were reported to have geodes. At each site, they recorded the number of geodes they found over a certain size. The number of large geodes each geologist found is recorded in the following tables. Use the data in the tables to compare the number of geodes each geologist found per site. Include both measures of center and spread in your analysis.

Rocky's data

Site	Geodes found
1	13
2	10
3	19
4	2
5	6
6	16
7	15
8	7
9	6
10	10

Crystal's data

Site	Geodes found
1	21
2	0
3	16
4	15
5	11
6	5
7	19
8	4
9	3
10	17

1. Order the data to determine which measure of center to use.

   Order the number of geodes found from least to greatest.

Rocky's data

Site	Geodes found
4	2
5	6
9	6
8	7
2	10
10	10
1	13
7	15
6	16
3	19

Crystal's data

Site	Geodes found
2	0
9	3
8	4
6	5
5	11
4	15
3	16
10	17
7	19
1	21

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2. Look at the range of values and determine which measure of center to use.

   If there are any data values in either table that are much larger or much smaller than the rest of the data set, use the median. Otherwise, you can use either the mean or the median.

   There are no values in either data set that are strikingly larger or smaller than any other data value. This means there are no data values that will greatly influence the mean, so either the median or the mean would be valid measures of center.

3. Calculate the chosen measure of center.

   Because either measure of center is acceptable, pick one. In this case, we'll use the mean. To find the mean, find the total number of geodes each geologist found and divide by the number of sites visited.

   Rocky:

$$\frac{2+6+6+7+10+10+13+15+16+19}{10} = 10.4$$

   Crystal:

$$\frac{0+3+4+5+11+15+16+17+19+21}{10} = 11.1$$

4. Compare the measures of center for the two data sets.

   Both geologists found a similar number of geodes at the sites they visited. At any given site, the geologists could expect to find around 10 large geodes.

5. Calculate a measure of spread.

   Because we calculated the mean, it will be less work to find the mean absolute deviation. This is because mean absolute deviation compares the range of values with the mean value. To find the mean absolute value, first find the absolute value of the difference between each data point and the mean:

   $|\text{data point} - \text{mean}|$

   The mean of Rocky's data is 10.4. Find the absolute difference from the mean for each data point in Rocky's data set.

Rocky's data

Site	Geodes found	Absolute difference from mean
4	2	$\lvert 2 - 10.4 \rvert = 8.4$
5	6	$\lvert 6 - 10.4 \rvert = 4.4$
9	6	$\lvert 6 - 10.4 \rvert = 4.4$
8	7	$\lvert 7 - 10.4 \rvert = 3.4$
2	10	$\lvert 10 - 10.4 \rvert = 0.4$
10	10	$\lvert 10 - 10.4 \rvert = 0.4$
1	13	$\lvert 13 - 10.4 \rvert = 2.6$
7	15	$\lvert 15 - 10.4 \rvert = 4.6$
6	16	$\lvert 16 - 10.4 \rvert = 5.6$
3	19	$\lvert 19 - 10.4 \rvert = 8.6$

   Next, sum the absolute differences.

   $8.4 + 4.4 + 4.4 + 3.4 + 0.4 + 0.4 + 2.6 + 4.6 + 5.6 + 8.6 = 42.8$

   Finally, divide the sum of the absolute differences by the number of data points (10).

   $$\frac{42.8}{10} = 4.28$$

   The mean absolute deviation for Rocky's data is 4.28.

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The mean for Crystal's data is 11.1. Find the absolute difference from the mean for each data point in Crystal's data set.

Crystal's data

Site	Geodes found	Absolute difference from mean
2	0	$\|0 - 11.1\| = 11.1$
9	3	$\|3 - 11.1\| = 8.1$
8	4	$\|4 - 11.1\| = 7.1$
6	5	$\|5 - 11.1\| = 6.1$
5	11	$\|11 - 11.1\| = 0.1$
4	15	$\|15 - 11.1\| = 3.9$
3	16	$\|16 - 11.1\| = 4.9$
10	17	$\|17 - 11.1\| = 5.9$
7	19	$\|19 - 11.1\| = 7.9$
1	21	$\|21 - 11.1\| = 9.9$

Next, sum the absolute differences.

$$11.1 + 8.1 + 7.1 + 6.1 + 0.1 + 3.9 + 4.9 + 5.9 + 7.9 + 9.9 = 65$$

Finally, divide the sum of the absolute differences by the number of data points (10).

$$\frac{65}{10} = 6.5$$

The mean absolute deviation for Crystal's data is 6.5.

6. Compare the measures of spread and center for each data set.

Rocky found slightly fewer large geodes on average, but the number of large geodes at each site varied less than it did in Crystal's data. Crystal found a higher number of large geodes on average, but the number she found at each site varied more.

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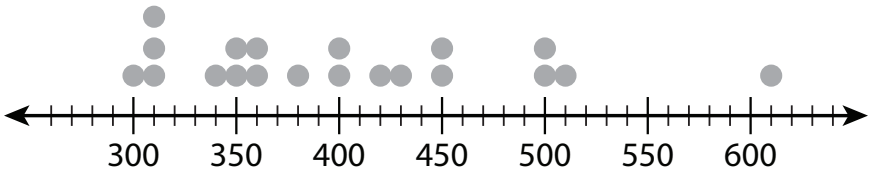
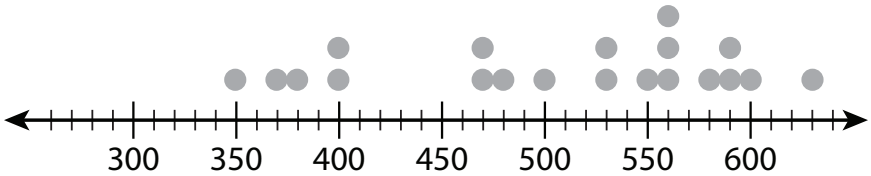
Example 2

Emmet and Esme study pythons. They each recorded the length (in cm) of 20 different adult pythons found in the wild. The lengths are plotted on the following dot plots. Use the dot plots to compare the lengths of the pythons.

Emmet's data



Esme's data



1. Compare the range of recorded values.

   The overall range of lengths of pythons is similar for both data sets. The pythons in Emmet's set range in length from 300 to 610 centimeters. The pythons in Esme's set range in length from 350 to 630 centimeters.

2. Compare the middle values of the data sets

   The pythons in Esme's set appear to be longer than the pythons in Emmet's set. By looking at where the dots are clustered, we can estimate that the middle length in Emmet's set is about 390 cm. The middle length in Esme's set is 530 cm.

3. Compare the variation in the data sets.

   The variation in the two sets of lengths appears to be similar, except Emmet's data is slightly skewed to the right and Esme's data is slightly skewed to the left. However, the majority of the lengths are within 60 cm in both sets. The majority of the pythons in Emmet's set are between 340 and 450 cm in length. The majority of the pythons in Esme's set are between 470 and 590 cm in length.

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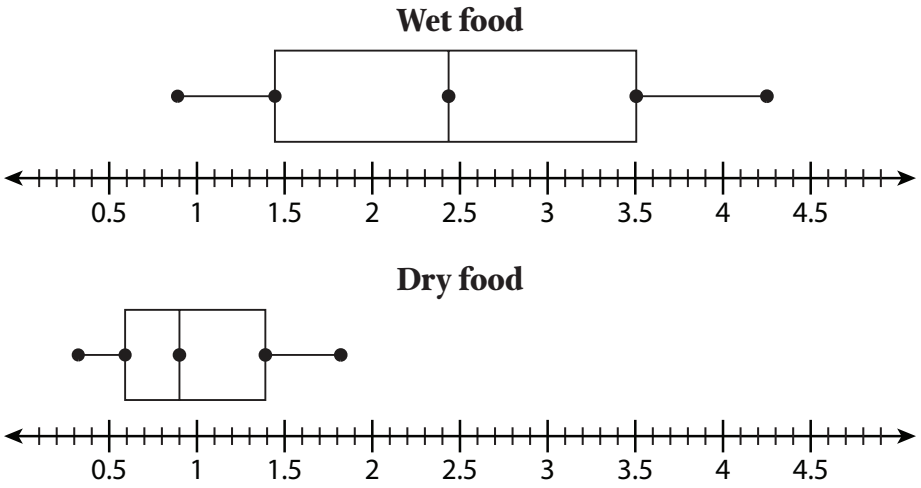
Example 3

Aarav is comparing the cost of wet cat food with dry cat food. He analyzed all the brands at his local store to find the price per daily serving size of each type of food. The information is presented in two box plots, as shown. Use the two box plots to compare the cost per daily serving of dry cat food vs. wet cat food.



1. Compare the range of data.

   The range of costs is different for each set. The cost per daily serving of wet cat food ranges from about \$0.90 to about \$4.25, while the cost per daily serving of dry cat food ranges from about \$0.30 to \$1.80.

2. Compare the center of the data sets.

   The median of each data set is shown by the vertical line inside each box. The median cost per daily serving is considerably higher for wet food than for dry food.

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3. Compare the variation of the data.

   The interquartile range of cost per daily serving of wet cat food is larger than the interquartile range of cost per daily serving of dry cat food. The middle 50% of costs range from about $1.40 to about $3.50 for wet cat food. The median cost for wet cat food is about $2.40 per daily serving, indicating that half the brands cost more than $2.40 and the other half of the brands cost less than $2.40 per daily serving. The interquartile range for dry cat food is about $0.60 to $1.40 per daily serving. The median cost for dry cat food is about $0.90 per daily serving, indicating that half the dry cat food brands cost less than $0.90 and the other half of dry cat food brands cost more than $0.90 per daily serving. Notice that for dry cat food, 75% of the brands have a cost of less than $1.40 per daily serving, while 75% of the wet cat food brands have a cost of more than $1.40 per daily serving. This tells you that wet cat food is generally more expensive than dry cat food on a per-serving basis.