Find the mean, median, mode, range, and standard deviation of each data set that is obtained after adding the given constant to each value.

1. 10, 13, 9, 8, 15, 8, 13, 12, 7, 8, 11, 12; + (−7)

**SOLUTION:**
First enter the data into L₁. Then press 2nd, L₁ – 7, S and hit ENTER.

Now L₂ is the list of data modified by subtracting 7 from each value. Next calculate the 1-variable statistics for L₂.

The mean is 3.5. The median is 3.5. The range is 8 – standard deviation is 2.4, and the mode must be found by determining which number occurs with the highest frequency. The simplest way to do this is to first sort the data in L₂, then count the number of occurrences for each piece of data.

As we can see, the number that occurs most frequently is 1, which occurs three times.
12-4 Comparing Sets of Data

2. 38, 36, 37, 42, 31, 44, 37, 45, 29, 42, 30, 42; + 23

**SOLUTION:**
First enter the data into L₁. Then press 2nd, L₁ + 23, and hit ENTER.

Now L₂ is the list of data modified by adding 23 to each value. Calculate the 1-variable statistics for L₂.

<table>
<thead>
<tr>
<th>1-Var Stats</th>
<th>1-Var Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>x̄=60.75</td>
<td>x̄=17.25</td>
</tr>
<tr>
<td>minX=60</td>
<td>minX=3</td>
</tr>
<tr>
<td>maxX=729</td>
<td>maxX=207</td>
</tr>
<tr>
<td>Sx=449</td>
<td>Sx=4635</td>
</tr>
<tr>
<td>σx=5.495</td>
<td>σx=9.8361</td>
</tr>
<tr>
<td>n=12</td>
<td>n=12</td>
</tr>
</tbody>
</table>

The mean is 60.8. The median is 60.5. The range is 13. The standard deviation is 5.5, and the mode is 65. To determine which number occurs with the highest frequency, we sort the data in L₂, and count the number of occurrences for each piece of data. The most frequently occurring value is 65, which occurs three times.

<table>
<thead>
<tr>
<th>L₁</th>
<th>L₂</th>
<th>L₃</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As we can see, the number that occurs most frequently is 65, which occurs three times.

---

Find the mean, median, mode, range, and standard deviation of each data set that is obtained after multiplying each value by the given constant.

3. 6, 10, 3, 7, 4, 9, 3, 8, 5, 11, 2, 1; × 3

**SOLUTION:**
First enter the data into L₁. Then press 2nd, L₁ × 3, STO, 2nd, L₂, and hit ENTER.

Now L₂ is the list of data modified by multiplying each value by 3. Next calculate the 1-variable statistics for L₂.

<table>
<thead>
<tr>
<th>1-Var Stats</th>
<th>1-Var Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>x̄=21</td>
<td>x̄=17.25</td>
</tr>
<tr>
<td>minX=9</td>
<td>minX=3</td>
</tr>
<tr>
<td>maxX=30</td>
<td>maxX=207</td>
</tr>
<tr>
<td>Sx=96</td>
<td>Sx=4635</td>
</tr>
<tr>
<td>σx=9.42</td>
<td>σx=9.8361</td>
</tr>
<tr>
<td>n=12</td>
<td>n=12</td>
</tr>
</tbody>
</table>

The mean is 17.3, the median is 16.5, the mode is 33, the range is 30, and the standard deviation is 9.4.
4. 42, 39, 45, 44, 37, 42, 38, 37, 41, 49, 42, 36; \times 0.5

**SOLUTION:**
First enter the data into L₁. Then press 2nd, L₁ \times 0.5, STO, 2nd, L₂, and hit ENTER.

Now L₂ is the list of data modified by multiplying each value by 3. Next calculate the 1-variable statistics for L₂.

The mean is 20.5, the median is 20.8, the mode is the most frequently occurring value which is 21, the range is 24.5 – 18 = 6.5, and the standard deviation is 1.8.

5. **TRACK** Mark and Kyle’s long jump distances are shown.

**Kyle’s Distances (ft)**
17.2, 18.28, 19.56, 17.28, 17.36, 18.06, 17.43, 17.71, 17.46, 18.25, 17.51, 17.58, 17.41, 18.21, 17.34, 17.63, 17.55, 17.26, 17.18, 17.78, 17.51, 17.83, 17.92, 18.04, 17.91

**Mark’s Distances (ft)**
18.88, 19.24, 17.63, 18.59, 17.74, 19.18, 17.92, 18.96, 18.19, 18.21, 18.46, 17.47, 18.49, 17.86, 18.93, 18.73, 18.34, 18.57, 18.56, 18.79, 18.47, 18.34, 18.87, 17.94, 18.7

a. Use a graphing calculator to construct a histogram for each set of data. Then describe the shape of each distribution.

b. Compare the data sets using either the means and standard deviations or the five-number summaries. Justify your choice.

**SOLUTION:**
a. Enter the data for Kyle into L₁, and the data for Mark into L₂. The histogram for Kyle, with a range from 17 to 19.25 and a scale of 0.25 looks like the following:

The histogram for Mark, with the same scale looks like:

Both distributions are skewed. Kyle has a positively skewed distribution and Mark has a negatively skewed distribution.

b. Since both sets of data are skewed, we should compare the five-number summaries for each. For Kyle and Mark respectively:
Kyle’s upper quartile is 17.98, while Mark’s lower quartile is 18.065. This means that 75% of Mark’s distances are greater than 75% of Kyle’s distances. Therefore, we can conclude that overall, Mark’s distances are higher than Kyle’s.

6. **TIPS** Miguel and Stephanie are servers at a restaurant. The tips that they earned to the nearest dollar over the past 15 workdays are shown.

<table>
<thead>
<tr>
<th>Miguel’s Tips ($)</th>
<th>Stephanie’s Tips ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14, 68, 52, 21, 53, 32, 43, 35, 70, 37, 42, 16, 47, 38, 48</td>
<td>34, 52, 43, 39, 41, 50, 46, 36, 37, 47, 39, 49, 44, 36, 50</td>
</tr>
</tbody>
</table>

**a.** Use a graphing calculator to construct a box-and-whisker plot for each set of data. Then describe the shape of each distribution.

**b.** Compare the data sets using either the means and standard deviations or the five-number summaries. Justify your choice.

**SOLUTION:**

**a.** Put the data for Miguel's tips in L₁, and the data from Stephanie's tips in L₂. Make sure both stat plots are turned on and set to box-and-whisker plots. Choose an appropriate window and graph.

Each graph is roughly symmetric.

**b.** The distributions are symmetric so the mean and standard deviation should be used to compare the data.

The mean for Miguel's tips is about $41.73 with a standard deviation of about $16.64. The mean for Stephanie's tips is about $42.87 with a standard deviation of about $5.73. On average, they both make about the same amount in tips however Miguel's tips are more varied - some tips he makes a lot more, some tips a lot less.
Find the mean, median, mode, range, and standard deviation of each data set that is obtained after adding the given constant to each value.

7. 52, 53, 49, 61, 57, 52, 48, 60, 50, 47; + 8

**SOLUTION:**
Place the data into L_1. Then add 8 to each value in L_1 and store this in L_2.

\[
\text{L}_1 + 8 \rightarrow \text{L}_2
\]

\[\{60, 61, 57, 69, 65, \ldots\}\]

Now calculate the statistics for L_2.

\[
\begin{align*}
\text{1-Var Stats} \\
\bar{x} &= 60.9 \\
\sum x &= 509 \\
\sum x^2 &= 37305 \\
\Sigma x &= 4.909175083 \\
\sigma x &= 4.657252409 \\
\downarrow n &= 10 \\
\end{align*}
\]

The mean is 60.9. The median is 60. The mode is the most frequently occurring value which is 60. The range is 69 – 55 = 14, and the standard deviation is 4.7.

8. 101, 99, 97, 88, 92, 100, 97, 89, 94, 90; + (–13)

**SOLUTION:**
Place the data into L_1. Then subtract 13 from each value and store this in L_2.

\[
\text{L}_1 - 13 \rightarrow \text{L}_2
\]

\[\{88, 86, 84, 75, 79, \ldots\}\]

Now calculate the statistics for L_2.

\[
\begin{align*}
\text{1-Var Stats} \\
\bar{x} &= 81.7 \\
\sum x &= 817 \\
\sum x^2 &= 66953 \\
\Sigma x &= 4.762119043 \\
\sigma x &= 4.517742799 \\
\downarrow n &= 10 \\
\end{align*}
\]

The mean is 81.7. The median is 82.5. The mode is the most frequently occurring value which is 84. The range is 88 – 75 = 13, and the standard deviation is 4.5.
12-4 Comparing Sets of Data

9. 27, 21, 34, 42, 20, 19, 18, 26, 25, 33; + (−4)

**SOLUTION:**
Place the data into L₁. Then subtract 4 from each value in L₁ and store this in L₂.

Now calculate the statistics for L₂.

The mean is 22.5. The median is 21.5. There is no mode since all the values occur with the same frequency. The range is 38 – 14 = 24, and the standard deviation is 7.4.

10. 72, 56, 71, 63, 68, 59, 77, 74, 76, 66; + 16

**SOLUTION:**
Place the data into L₁. Then subtract 4 from each value in L₁ and store this in L₂.

Now calculate the statistics for L₂.

The mean is 84.2. The median is 85.5. There is no mode since all the values occur with the same frequency. The range is 21, and the standard deviation is 6.8.
12-4 Comparing Sets of Data

Find the mean, median, mode, range, and standard deviation of each data set that is obtained after multiplying each value by the given constant.

11. 11, 7, 3, 13, 16, 8, 3, 11, 17, 3; \times 4

\textbf{SOLUTION:}

Place the data into \textit{L}_1. Then multiply each value in \textit{L}_1 by 4 and store this in \textit{L}_2.

$$\textit{L}_1: \times 4 \rightarrow \textit{L}_2$$

| 44 | 28 | 12 | 52 | 64 |

Now calculate the statistics for \textit{L}_2.

\begin{tabular}{l}
\texttt{1-Var Stats} \\
\hline
\textit{x} = 36.8 \\
\textit{sx} = 368 \\
\sum x^2 = 17536 \\
\sum x = 21.06497884 \\
\sigma x = 19.98399359 \\
\downarrow n = 10 \\
\end{tabular}

\begin{tabular}{l}
\texttt{1-Var Stats} \\
\hline
\uparrow n = 10 \\
\textit{min} x = 12 \\
\textit{Q}_1 = 12 \\
\textit{Med} = 38 \\
\textit{Q}_3 = 52 \\
\textit{Max} x = 68 \\
\end{tabular}

The mean is 36.8. The median is 38. The mode is the most frequently occurring value which is 12. The range is 68 – 12 = 56, and the standard deviation is 20.0.

12. 64, 42, 58, 40, 61, 67, 58, 52, 51, 49; \times 0.2

\textbf{SOLUTION:}

Place the data into \textit{L}_1. Then multiply each value in \textit{L}_1 by 0.2 and store this in \textit{L}_2.

\begin{tabular}{l}
\textit{L}_1: \times 0.2 \rightarrow \textit{L}_2 \\
\hline
12.8 | 8.4 | 11.6 |
\end{tabular}

Now calculate the statistics for \textit{L}_2.

\begin{tabular}{l}
\texttt{1-Var Stats} \\
\hline
\textit{x} = 10.84 \\
\textit{sx} = 108.4 \\
\sum x^2 = 1204.16 \\
\sum x = 1.798270774 \\
\sigma x = 1.705989449 \\
\downarrow n = 10 \\
\end{tabular}

\begin{tabular}{l}
\texttt{1-Var Stats} \\
\hline
\uparrow n = 10 \\
\textit{min} x = 8 \\
\textit{Q}_1 = 9.8 \\
\textit{Med} = 11 \\
\textit{Q}_3 = 12.2 \\
\textit{Max} x = 13.4 \\
\end{tabular}

The mean is 10.8. The median is 11. The mode is the most frequently occurring value which is 11.6. The range is 13.4 – 8 = 5.4, and the standard deviation is 1.7.
12-4 Comparing Sets of Data

13. 33, 37, 38, 29, 35, 37, 27, 40, 28, 31; \times 0.8

**SOLUTION:**
Place the data into L₁. Then multiply each value in L₁ by 0.2 and store this in L₂.

\[
\begin{array}{l}
L1*0.8+L2 \\
\{26.4  29.6  30.4... \\
\end{array}
\]

Now calculate the statistics for L₂.

\[
\begin{array}{l}
1-\text{Var Stats} \\
\uparrow n=10 \\
\text{minX}=21.6 \\
Q1=23.2 \\
\text{Med}=27.2 \\
Q3=29.6 \\
\text{maxX}=32 \\
\end{array}
\]

The mean is 26.8. The median is 27.2. The mode is the most frequently occurring value which is 29.6. The range is \(32 - 21.6 = 10.4\), and the standard deviation is 3.5.

14. 1, 5, 4, 2, 1, 3, 6, 2, 5, 1; \times 6.5

**SOLUTION:**
Place the data into L₁. Then multiply each value in L₁ by 0.2 and store this in L₂.

\[
\begin{array}{l}
L1*6.5+L2 \\
\{6.5  32.5  26  13... \\
\end{array}
\]

Now calculate the statistics for L₂.

\[
\begin{array}{l}
1-\text{Var Stats} \\
\uparrow n=10 \\
\text{minX}=6.5 \\
Q1=6.5 \\
\text{Med}=16.25 \\
Q3=32.5 \\
\text{maxX}=39 \\
\end{array}
\]

The mean is 19.5. The median is 16.25. The mode is the most frequently occurring value which is 6.5. The range is \(39 - 6.5 = 32.5\), and the standard deviation is 11.6.

15. **BOOKS** The page counts for the books that the student is reading are given above. The maximum for the boys is $131, by the girls is positively skewed.

<table>
<thead>
<tr>
<th>1st Period</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>6th Period</th>
</tr>
</thead>
</table>

a. Use a graphing calculator to construct a histogram.
Find the mean, median, mode, range, and standard deviation of each data set that is obtained after adding the given constant. Determine if their means are different and how skewed the distributions are, and in what direction. We determine this by comparing the statistics for each set of data. Then describe the shape of each distribution.

**SOLUTION:**

**a.** Enter the data for first period into L₁ and the data into L₂. Choose a window range from 200 to 600 with and create histograms for each set of data. For simplification, it's easiest to view each graph individually.

For first period:

![Histogram 1](image1)

For sixth period:

![Histogram 2](image2)

The data for first period is positively skewed, and the period is symmetric.

**b.** One distribution is symmetric and the other is skewed. The number summary works best when comparing the data.

**1-Var Stats**

<table>
<thead>
<tr>
<th>The Electronics Superstore</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=26</td>
</tr>
<tr>
<td>minX=206</td>
</tr>
<tr>
<td>Q1=291</td>
</tr>
<tr>
<td>Med=350.5</td>
</tr>
<tr>
<td>Q3=439</td>
</tr>
<tr>
<td>MaxX=578</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1-Var Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=27</td>
</tr>
<tr>
<td>minX=294</td>
</tr>
<tr>
<td>Q1=333</td>
</tr>
<tr>
<td>Med=392</td>
</tr>
<tr>
<td>Q3=451</td>
</tr>
<tr>
<td>MaxX=506</td>
</tr>
</tbody>
</table>

Above shows the statistics for first and sixth period respectively. The lower quartile for 1st period is 291 and the minimum for 6th period is 294 pages. This means 25% of data for 1st period is lower than any data from the range for 1st period is 578 – 206 or 372 pages. The 6th period is 506 – 294 or 212 pages. The median for about 351 pages, while the median for 6th period is 3 means that, while the median for 6th period is greater

pages have a greater range and include greater value period.

16. **TELEVISIONS** The prices for a sample of televisions

<table>
<thead>
<tr>
<th>The Electronics Superstore</th>
</tr>
</thead>
<tbody>
<tr>
<td>46, 25, 62, 45, 30, 43, 40, 46, 33, 53, 35, 38,</td>
</tr>
<tr>
<td>39, 40, 52, 42, 44, 48, 50, 35, 32, 55, 28, 58</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Game Central</th>
</tr>
</thead>
<tbody>
<tr>
<td>53, 49, 26, 61, 40, 50, 42, 35, 45, 48, 31, 48,</td>
</tr>
<tr>
<td>33, 50, 35, 55, 38, 50, 42, 53, 44, 54, 48, 58</td>
</tr>
</tbody>
</table>

**a.** Use a graphing calculator to construct a histogram data. Then describe the shape of each distribution.

**b.** Compare the data sets using either the means and deviations or the five-number summaries. Justify you

**SOLUTION:**

**a.** Enter the data for The Electronics Superstore into data for Game Central into L₂. Choose a window range of 65 with a scale of 5 and create histograms for each set of data. It's easiest to view each graph individually.

For The Electronics Superstore:

![Histogram 3](image3)

For Game Central:

![Histogram 4](image4)

The data for The Electronics Superstore is symmetric for Game Central is negatively skewed.

**b.** One distribution is symmetric and the other is skewed. The number summary works best when comparing the da
12-4 Comparing Sets of Data

**17. BRAINTEASERS** The time that it took Leon and C complete puzzles is shown.

<table>
<thead>
<tr>
<th>Leon's Times (minutes)</th>
<th>Cassie's Times (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5, 1.8, 3.2, 5.1, 2.0, 2.6, 4.8, 2.4, 2.2, 2.8, 1.8, 2.2, 3.9, 2.3, 3.3, 2.4</td>
<td>2.3, 5.8, 4.8, 3.3, 5.2, 4.6, 3.8, 5.7, 3.8, 4.2, 5.0, 4.3, 5.5, 4.0, 2.4, 5.2</td>
</tr>
</tbody>
</table>

a. Use a graphing calculator to construct a box-and-whisker plot for each set of data. Then describe the shape of each distribution.

b. Compare the data sets using either the means and deviations or the five-number summaries. Justify your choice.

**SOLUTION:**

a. Put Leon's times in L1 and put Cassie's times in L2 and enter the window range from 1.5 to 6 with a scale of 0.5, and construct box-and-whisker plots. Use the trace button to determine which values belong to each set of data.

b. Compare the data sets using either the means and deviations or the five-number summaries. Justify your choice.

**18. DANCE** The total amount of money that a sample of students spent on tickets to attend the homecoming dance is shown.

```
<table>
<thead>
<tr>
<th>Boys (dollars)</th>
<th>Girls (dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>114, 68, 131, 83, 91, 64, 94, 77, 96, 105, 72, 108, 87, 112, 58, 126</td>
<td>124, 74, 105, 123, 85, 162, 90, 109, 94, 102, 98, 171, 139, 90, 154, 76</td>
</tr>
</tbody>
</table>
```

a. Use a graphing calculator to construct a box-and-whisker plot for each set of data. Then describe the shape of each distribution.

b. Compare the data sets using either the means and deviations or the five-number summaries. Justify your choice.

**SOLUTION:**

a. Put the amount the Boys spent in L1 and put the amount the Girls spent in L2. Change the window range from 55 to 17 of 10, and plot the box-and-whisker plots. Use the trace button to determine which values belong to each set of data.
The amount spent by the boys is symmetric, while that by the girls is positively skewed.

b. Since one set of data is skewed, it's best to use a five-number summary for comparison.

The five-number summaries for the boys and the girls are given above. The maximum for the boys is $131, upper quartile for the girls is $135.50. This means that data from the girls is greater than all of the data from When listed from least to greatest, each statistic for the boys is greater than its corresponding statistic for the boys. We conclude that in general, the girls spent more money than the boys.

19. LANDSCAPING Refer to the beginning of the less another employee that works with Tom, earned the following:

<table>
<thead>
<tr>
<th>Rhonda’s Pay ($)</th>
<th>45</th>
<th>55</th>
<th>53</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>47</td>
<td>53</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>56</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>47</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>57</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>44</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>53</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>62</td>
<td>47</td>
<td></td>
</tr>
</tbody>
</table>

a. Find the mean, median, mode, range, and standard deviation of Rhonda’s earnings.

b. A $5 bonus had been added to each of Rhonda’s days. Find the mean, median, mode, range, and standard deviation of Rhonda’s earnings before the $5 bonus.

SOLUTION:

The mean of Rhonda’s earnings is 53.75, the median is 53, the mode is 53, the range is 62, and the standard deviation is 8.63. After adding the $5 bonus, the mean becomes 59.25, the median remains 53, the mode is 58, the range remains 62, and the standard deviation becomes 9.81.

The mean is 52.96. The median is 53. The mode is 5.63 – 44 = 19, and the standard deviation is 6.08.

b. Subtract 5 from L1, and store it in L2.

Next calculate the statistics for L2.

The mean is 57.96. The median is 48. The mode is 4 is 68 – 39 = 19, and the standard deviation is 6.08.

20. SHOPPING The items Lorenzo purchased are shown in the table below:

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseball hat</td>
<td>$14.98</td>
</tr>
<tr>
<td>Jeans</td>
<td>$24.61</td>
</tr>
<tr>
<td>T-shirt</td>
<td>$12.84</td>
</tr>
<tr>
<td>T-shirt</td>
<td>$16.05</td>
</tr>
<tr>
<td>Backpack</td>
<td>$42.80</td>
</tr>
<tr>
<td>Folders</td>
<td>$2.14</td>
</tr>
<tr>
<td>Sweatshirt</td>
<td>$19.26</td>
</tr>
</tbody>
</table>

a. Find the mean, median, mode, range, and standard deviation of the prices.

SOLUTION:

The mean price is $22.00, the median is $12.84, the mode is $42.80, the range is $42.80, and the standard deviation is $10.57.
12-4 Comparing Sets of Data

b. A 7% sales tax was added to the price of each item. Determine the mean, median, mode, range, and standard deviation of each data set that is obtained after adding the given constant to each value.

**SOLUTION:**

a. Enter the data into L1 and compute the 1-variable summary statistics.

<table>
<thead>
<tr>
<th>1-Var Stats</th>
<th>1-Var Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>x=18.95428571</td>
<td>x=7.0</td>
</tr>
<tr>
<td>Sx=132.68</td>
<td>minX=2.1</td>
</tr>
<tr>
<td>Sx²=3459.8878</td>
<td>Q1=12.84</td>
</tr>
<tr>
<td>Sx=12.55012066</td>
<td>Med=16.0</td>
</tr>
<tr>
<td>σx=11.61915396</td>
<td>Q3=24.61</td>
</tr>
<tr>
<td>n=7</td>
<td>MaxX=42.</td>
</tr>
</tbody>
</table>

The mean is 18.95. The median is 16.05. There is no range, and the standard deviation is 11.62.

b. If a 7% sales tax was added, then the prices from 1.07 times larger than normal. Divide the prices from get the pre-tax prices.

\[
\text{L1/1.07} \to \text{L2} \\
\{1.4 \ 2.3 \ 1.2 \ 1.5 \ 4.0\}
\]

Store these values in L2 and calculate the 1-variable summary statistics.

<table>
<thead>
<tr>
<th>1-Var Stats</th>
<th>1-Var Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>x=17.71428571</td>
<td>x=7.0</td>
</tr>
<tr>
<td>Sx=124</td>
<td>minX=2</td>
</tr>
<tr>
<td>Sx²=3022</td>
<td>Q1=12</td>
</tr>
<tr>
<td>Sx=11.72908473</td>
<td>Med=15</td>
</tr>
<tr>
<td>σx=10.85902239</td>
<td>Q3=23</td>
</tr>
<tr>
<td>n=7</td>
<td>MaxX=40</td>
</tr>
</tbody>
</table>

The mean is 17.71. The median is 15. There is no mode, and the standard deviation is 10.86.

21. **CHALLENGE** A salesperson has 15 SUVs priced between $33,000 and $37,000 and 5 luxury cars priced between $44,000 and $48,000. The average price for all of the vehicles is $39,250. The salesperson decides to reduce the prices of the SUVs by $2000 per vehicle. What is the new average price for all of the vehicles?

**SOLUTION:**

Let \( x \) be the average cost of the SUVs and \( y \) be the average cost of the luxury cars. The total cost of the SUV's is then \( 15x \), and the total cost of the luxury cars is \( 5y \).

The average cost of all the vehicles is then

\[
\frac{15x + 5y}{20} = 39,250
\]

If we reduce the price of all of the SUVs by $2000, then the average price will be \( x - 2000 \). We can use this along with the previous equation to determine the new average, \( A \), of all the vehicles.

\[
A = \frac{15(x - 2000) + 5y}{20} = \frac{15x + 5y - 15(2000)}{20} = \frac{15x + 5y}{20} - \frac{15 \cdot 2000}{20} = 39,250 - 1500 = 37,750
\]
22. **REASONING** If every value in a set of data is multiplied by a constant $k$, $k < 0$, then how can the mean, median, mode, range, and standard deviation of the new data set be found?

**SOLUTION:**

The mean is equal to:

$$\bar{x} = \frac{x_1 + x_2 + \ldots + x_n}{n}$$

If each term is multiplied by a constant $k$, $k < 0$, then the new mean will be:

$$\bar{x} = \frac{kx_1 + kx_2 + \ldots + kx_n}{n}$$

$$= k \left( \frac{x_1 + x_2 + \ldots + x_n}{n} \right)$$

$$= k \bar{x}$$

The new mean is just the old mean multiplied by $k$.

The median is just the middle number of the set of data. If everything in the set of data is multiplied by a constant, then the term in the middle will still be in the middle when multiplied by $k$. So the new median is just the old median multiplied by $k$. The mode is just the most frequently occurring value, so the new value will be $k$ times the old value.

If $x$ and $y$ are the max and min respectively then $x > y$ and the range is $x - y$. If all of the values are multiplied by a negative constant $k$, then the new max will be $ky$, the min will be $kx$, and the range will be $ky - kx = -k(x - y)$. Here $-k$ is the same as $|k|$, so the range can be found by multiplying the old range by $|k|$.

Similarly for the standard deviation:

$$\sigma = \sqrt{\frac{(kx_1 - k\bar{x})^2 + (kx_2 - k\bar{x})^2 + \ldots + (kx_n - k\bar{x})^2}{n}}$$

$$= |k| \sqrt{\frac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \ldots + (x_n - \bar{x})^2}{n}}$$

$$= |k| \sigma$$

The standard deviation is just multiplied by the absolute value of $k$.

23. **WRITING IN MATH** Compare and contrast the benefits of displaying data using histograms and box-and-whisker plots.

**SOLUTION:**

A histogram and a box-and-whisker plot for the same set of data are given on a graph.

With a box-and-whisker plot, it’s easy to determine the range, the quartile values, and the overall spread of the data. With histograms, you can see the frequency of values within each interval. The box-and-whisker plots show the data divided into four sections. This aids when comparing the spread of one set of data to another. However, the box-and-whisker plots are limited because they cannot display the data any more specifically than showing it divided into four sections.
24. **CCSS REGULARITY** If \( k \) is added to every value in a set of data, and then each resulting value is multiplied by a constant \( m, m > 0 \), how can the mean, median, mode, range, and standard deviation of the new data set be found? Explain your reasoning.

**SOLUTION:**

The mean is equal to:

\[
\bar{x}_a = \frac{x_1 + x_2 + \ldots + x_n}{n}
\]

If \( k \) is added to each term and then they're multiplied by \( m \):

\[
\bar{x}_b = \frac{m(x_1 + k) + m(x_2 + k) + \ldots + m(x_n + k)}{n}
\]

\[
= m \left( \frac{x_1 + x_2 + \ldots + x_n}{n} + \frac{n}{n} \right)
\]

\[
= m(\bar{x}_a + k)
\]

The new mean is just the old mean plus \( k \) and then multiplied by \( m \). The median is just the middle number of the set of data. If everything in the set of data increased by \( k \) and multiplied by a constant \( m \), then the term in the middle will still be in the middle when increased by \( k \) and multiplied by \( m \). So the new median is just the old median increased by \( k \) and multiplied by \( m \). The mode is just the most frequently occurring value, so the new value will be increased by \( k \) and multiplied by \( m \).

Since the range and the standard deviation are not affected when a constant is added to a set of data, they can be found by multiplying each original value by the constant \( m \).

25. **WRITING IN MATH** Explain why the mean and standard deviation are used to compare the center and spread of two symmetrical distributions and the five-number summary is used to compare the center and spread of two skewed distributions or a symmetric distribution and a skewed distribution.

**SOLUTION:**

When two distributions are symmetrical, we want to determine if their means are different and how spread out the distribution is. In the histograms above, both have the same mean, but the first graph has a larger distribution. We can compare these by determining the mean and standard deviation.

For skewed distributions, the mean and standard deviation do not provide enough information. If the distributions are skewed, we need a measure of how skewed the distributions are, and in what direction. We determine this by comparing the range, quartiles, and median, provided in the five number summaries.
26. A store manager recorded the number of customers each day for a week: {46, 57, 63, 78, 91, 110, 101}. Find the mean absolute deviation.

A 16.8  
B 18.1  
C 19.4  
D 22.7  

**SOLUTION:**  
To find the absolute deviation, first calculate the mean:

\[ \bar{x} = \frac{46 + 57 + 63 + 78 + 91 + 110 + 101}{7} = \frac{546}{7} = 78 \]

\[ \text{MAD} = \frac{\sum |x_i - \bar{x}|}{n} = \frac{12 + 2 + 5 + 13 + 32 + 21}{7} = \frac{43}{7} \approx 6.14 \]

The MAD is 19.4, which is answer choice C.

27. **SHORT RESPONSE** Solve the right triangle. Round each side length to the nearest tenth.

**SOLUTION:**

\[ \angle A = 180^\circ - 90^\circ - 54^\circ = 36^\circ. \]

\[ \sin 54^\circ = \frac{8}{c} \]

\[ c = \frac{8}{\sin 54^\circ} \]

\[ c \approx 9.9 \]

\[ \tan 54^\circ = \frac{8}{a} \]

\[ a = \frac{8}{\tan 54^\circ} \]

\[ a \approx 5.8 \]

\[ \angle A = 36^\circ, c \approx 9.9, a \approx 5.8 \]

28. A research company divides a group of volunteers by age, and then randomly selects volunteers from each group to complete a survey. What type of sample is this?

F simple  
G systematic  
H self-selected  
J stratified  

**SOLUTION:**

Dividing a sample into groups first is an example of a stratified sample - J.
29. Which set of measures can be the measures of the sides of a right triangle?

A 6, 7, 9  
B 9, 12, 19  
C 12, 15, 17  
D 14, 48, 50

**SOLUTION:**
A 6, 7, 9  
B 9, 12, 19  
C 12, 15, 17  
D 14, 48, 50

The measures will define a right triangle only if the Pythagorean Theorem holds.

\[6^2 + 7^2 \neq 9^2\]
\[36 + 49 \neq 81\]
\[85 \neq 81\]

\[9^2 + 12^2 \neq 19^2\]
\[81 + 144 \neq 361\]
\[225 \neq 361\]

\[12^2 + 15^2 \neq 17^2\]
\[144 + 225 \neq 289\]
\[369 \neq 289\]

\[14^2 + 48^2 \neq 50^2\]
\[196 + 2304 \neq 2500\]
\[2500 = 2500\]

The sides 14, 48, and 50 define a right triangle. Answer choice D is correct.

30. Use a graphing calculator to construct a histogram for the data, and use it to describe the shape of the distribution.

23, 45, 50, 22, 37, 24, 36, 46, 24, 52, 25, 42, 25, 26, 54, 47, 27, 55

63, 28, 29, 30, 45, 31, 55, 43, 32, 34, 30, 23, 30, 35, 27, 35, 38, 40

**SOLUTION:**
Enter the data into L1, on your calculator, choose a suitable window, and create a histogram.

![Histogram](image)

The distribution is positively skewed.

31. **SUBSCRIPTIONS** Ms. Wilson’s students are selling magazine subscriptions. Her students recorded the total number of subscriptions they each sold: \(\{8, 12, 10, 7, 4, 3, 0, 4, 9, 0, 5, 3, 23, 6, 2\}\). Find and interpret the standard deviation of the data set.

**SOLUTION:**
First enter the data into L1 and calculate the 1-variable statistics:

<table>
<thead>
<tr>
<th>1-Var Stats</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\bar{x} = 6.4)</td>
</tr>
<tr>
<td>(\sum x^2 = 1082)</td>
</tr>
<tr>
<td>(\sigma = 5.779273311)</td>
</tr>
<tr>
<td>(n = 15)</td>
</tr>
</tbody>
</table>

The mean is 6.4 and the standard deviation is 5.58. The standard deviation is high compared to the mean. This means that the values of the data are very spread out.
Find the value of $x$ for each figure. Round to the nearest tenth if necessary.

32. $A = 45 \text{ in}^2$

SOLUTION:

$$(x + 3)(x + 7) = 45$$

$$x^2 + 10x + 21 = 45$$

$$x^2 + 10x - 24 = 0$$

$$(x + 12)(x - 2) = 0$$

$$x = -12 \text{ or } x = 2$$

If $x = -12$, then the values for the length and width of the rectangle will be negative, so we cannot use this value. Therefore $x = 2$.

33. $A = 20 \text{ ft}^2$

SOLUTION:

$$\frac{1}{2}x(x + 6) = 20$$

$$x(x + 6) = 40$$

$$x^2 + 6x - 40 = 0$$

$$(x + 10)(x - 4) = 0$$

$$x = -10 \text{ or } x = 4$$

If $x = -10$, then the values for the base and height of the triangle will be negative, so we cannot use this value. Therefore $x = 4$.

34. $A = 42 \text{ m}^2$

SOLUTION:

$$3x(x + 2) = 42$$

$$3x^2 + 6x = 42$$

$$3x^2 + 6x - 42 = 0$$

$$x^2 + 2x - 14 = 0$$

The trinomial in the last line above does not factor, so we must use the quadratic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-2 \pm \sqrt{60}}{2}$$

$$x \approx 2.9$$

The result above is from taking the additive term, since subtraction would result in negative values for the length and width of the rectangle. Therefore $x \approx 2.9$.

Factor each polynomial.

35. $x^2 - 4x - 21$

SOLUTION:

In this trinomial $b = -4$ and $c = -21$, so we need to find one positive and one negative factor of 21 whose sum is $-4$. The negative term should be larger in absolute value since $b$ is negative.

<table>
<thead>
<tr>
<th>Factors of 21</th>
<th>Sum of Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>-21, 1</td>
<td>-20</td>
</tr>
<tr>
<td>-7, 3</td>
<td>-4</td>
</tr>
</tbody>
</table>

$$x^2 - 4x + 21 = (x - 7)(x + 3)$$
12-4 Comparing Sets of Data

36. \(11x + x^2 + 30\)

**SOLUTION:**
In this trinomial \(b = 11\) and \(c = 30\), so we need to find two positive factors of 30 whose sum is 11.

<table>
<thead>
<tr>
<th>Factors of 21</th>
<th>Sum of Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 30</td>
<td>31</td>
</tr>
<tr>
<td>2, 15</td>
<td>17</td>
</tr>
<tr>
<td>3, 10</td>
<td>13</td>
</tr>
<tr>
<td>5, 6</td>
<td>11</td>
</tr>
</tbody>
</table>

\[x^2 + 11x + 30 = (x + 6)(x + 5)\]

37. \(32 + x^2 - 12x\)

**SOLUTION:**
32 + \(x^2 - 12x\)

In this trinomial \(b = -12\) and \(c = 32\), so we need to find two negative factors of 32 whose sum is -12.

<table>
<thead>
<tr>
<th>Factors of 32</th>
<th>Sum of Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1, -32</td>
<td>-33</td>
</tr>
<tr>
<td>-2, -16</td>
<td>-18</td>
</tr>
<tr>
<td>-4, -8</td>
<td>-12</td>
</tr>
</tbody>
</table>

\[x^2 - 12x + 32 = (x - 8)(x - 4)\]

38. \(-36 - 9x + x^2\)

**SOLUTION:**
In this trinomial \(b = -9\) and \(c = -36\), so we need to find one positive and one negative factor of 21 whose sum is -9. The negative term should be larger in absolute value since \(b\) is negative.

<table>
<thead>
<tr>
<th>Factors of 36</th>
<th>Sum of Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, -36</td>
<td>-35</td>
</tr>
<tr>
<td>2, -18</td>
<td>-16</td>
</tr>
<tr>
<td>3, -12</td>
<td>-9</td>
</tr>
<tr>
<td>4, -9</td>
<td>-5</td>
</tr>
<tr>
<td>6, -6</td>
<td>0</td>
</tr>
</tbody>
</table>

\[x^2 - 9x - 36 = (x - 12)(x + 3)\]

39. \(x^2 + 12x + 20\)

**SOLUTION:**
In this trinomial \(b = 12\) and \(c = 20\), so we need to find two positive factors of 20 whose sum is 12.

<table>
<thead>
<tr>
<th>Factors of 20</th>
<th>Sum of Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 20</td>
<td>21</td>
</tr>
<tr>
<td>2, 10</td>
<td>12</td>
</tr>
<tr>
<td>4, 5</td>
<td>9</td>
</tr>
</tbody>
</table>

\[x^2 + 12x + 20 = (x + 4)(x + 5)\]

40. \(-x + x^2 - 42\)

**SOLUTION:**
\(-x + x^2 - 42\)

In this trinomial \(b = -1\) and \(c = -42\), so we need to find one positive and one negative factor of 42 whose sum is -1. The negative term should be larger in absolute value since \(b\) is negative.

<table>
<thead>
<tr>
<th>Factors of 36</th>
<th>Sum of Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, -42</td>
<td>-41</td>
</tr>
<tr>
<td>2, -21</td>
<td>-19</td>
</tr>
<tr>
<td>3, -14</td>
<td>-11</td>
</tr>
<tr>
<td>6, -7</td>
<td>-1</td>
</tr>
</tbody>
</table>

\[x^2 - x - 42 = (x - 7)(x + 6)\]
12-4 Comparing Sets of Data

41. MANUFACTURING A company is designing a box for dry pasta in the shape of a rectangular prism. The length is 2 inches more than twice the width, and the height is 3 inches more than the length. Write an expression for the volume of the box.

**SOLUTION:**

MANUFACTURING A company is designing a box for dry pasta in the shape of a rectangular prism. The length is 2 inches more than twice the width, and the height is 3 inches more than the length. Write an expression for the volume of the box.

The volume of the box is:

\[ V = lwh \]

The second sentence tells us that:

\[ l = 2w + 2 \]

and

\[ h = l + 3 \]

\[ = (2w + 2) + 3 \]

\[ = 2w + 5 \]

Substituting these equations into the volume equation gives:

\[ V = (2w + 2)w(2w + 5) \]

\[ = w(4w^2 + 14w + 10) \]

\[ = 4w^3 + 14w^2 + 10w \]

Find the degree of each polynomial.

42. \(2x^2 + 5y - 21\)

**SOLUTION:**

For this expression, the term with the highest powers of \(x\), and \(y\) is \(2x^2\), which is of degree 2.

43. \(16xy^3 - 17x^2y - 16x^3\)

**SOLUTION:**

\(16xy^3\) has a degree of \(1 + 3 = 4\).

\(17x^2y\) has a degree is \(2 + 1 = 3\).

\(16x^3\) has a degree of 3.

So the polynomial has a degree of 4.