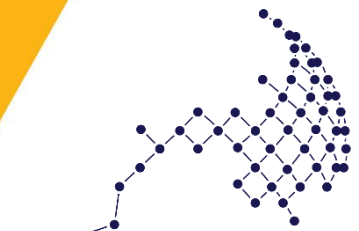
UNIVERSITY OF
SCIENCE AND TECHNOLOGY
OF SOUTHERN PHILIPPINES

QUANTITATIVE METHODS



Presented by:
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Stem and Leaf Plots

- A stem and leaf plot is a data plot that uses part of the data value as the stem and part of the data value as the leaf to form groups or classes.

Stem and Leaf Plots

At an outpatient testing center, the number of cardiograms performed each day for 20 days is shown. Construct a stem and leaf plot for the data.

25	31	20	32	13
14	43	02	57	23
36	32	33	32	44
32	52	44	51	45

Stem and Leaf Plots

Solution

Step 1 Arrange the data in order:

02, 13, 14, 20, 23, 25, 31, 32, 32, 32,
32, 33, 36, 43, 44, 44, 45, 51, 52, 57

Note: Arranging the data in order is not essential and can be cumbersome when the data set is large; however, it is helpful in constructing a stem and leaf plot. The leaves in the final stem and leaf plot should be arranged in order.

Step 2 Separate the data according to the first digit, as shown.

02 13, 14 20, 23, 25 31, 32, 32, 32, 32, 33, 36
43, 44, 44, 45 51, 52, 57

Stem and Leaf Plots

Step 3 A display can be made by using the leading digit as the *stem* and the trailing digit as the *leaf*. For example, for the value 32, the leading digit, 3, is the stem and the trailing digit, 2, is the leaf. For the value 14, the 1 is the stem and the 4 is the leaf. Now a plot can be constructed as shown in Figure 2–22.

Leading digit (stem)	Trailing digit (leaf)
0	2
1	3 4
2	0 3 5
3	1 2 2 2 2 3 6
4	3 4 4 5
5	1 2 7

Stem and Leaf Plot

- An insurance company researcher conducted a survey on the number of car thefts in a large city for a period of 30 days last summer. The raw data are shown. Construct a stem and leaf plot by using 50-54, 55-59, 60-64, 65-69, 70-74, and 75-79.

Stem and Leaf Plot

52	62	51	50	69
58	77	66	53	57
75	56	55	67	73
79	59	68	65	72
57	51	63	69	75
65	53	78	66	55

Stem and Leaf Plot

Solution

Step 1 Arrange the data in order.

50, 51, 51, 52, 53, 53, 55, 55, 56, 57, 57, 58, 59, 62, 63,
65, 65, 66, 66, 67, 68, 69, 69, 72, 73, 75, 75, 77, 78, 79

Step 2 Separate the data according to the classes.

50, 51, 51, 52, 53, 53 55, 55, 56, 57, 57, 58, 59
62, 63 65, 65, 66, 66, 67, 68, 69, 69 72, 73
75, 75, 77, 78, 79

Stem and Leaf Plot

Step 3 Plot the data as shown here.

Leading digit (stem)	Trailing digit (leaf)
5	0 1 1 2 3 3
5	5 5 6 7 7 8 9
6	2 3
6	5 5 6 6 7 8 9 9
7	2 3
7	5 5 7 8 9

Stem and Leaf Plot

The number of stories in two selected samples of tall buildings in Atlanta and Philadelphia is shown. Construct a back-to-back stem and leaf plot, and compare the distributions.

Atlanta					Philadelphia				
55	70	44	36	40	61	40	38	32	30
63	40	44	34	38	58	40	40	25	30
60	47	52	32	32	54	40	36	30	30
50	53	32	28	31	53	39	36	34	33
52	32	34	32	50	50	38	36	39	32
26	29								

Source: *The World Almanac and Book of Facts.*

Histogram

- The histogram is a graph that displays the data by using contiguous vertical bars (unless the frequency of a class is 0) of various heights to represent the frequencies of the classes.

Procedure Table

Constructing a Histogram, Frequency Polygon, and Ogive

Step 1: Draw and label the x and y axes.

Step 2: On the x axis, label the class boundaries of the frequency distribution for the histogram and ogive. Label the midpoints for the frequency polygon.

Step 3: Plot the frequencies for each class, and draw the vertical bars for the histogram and the lines for the frequency polygon and ogive.

(Note: Remember that the lines for the frequency polygon begin and end on the x axis while the lines for the ogive begin on the x axis.)

Histogram

Construct a histogram to represent the data shown for the record high temperatures for each of the 50 states.

Class boundaries	Frequency
99.5–104.5	2
104.5–109.5	8
109.5–114.5	18
114.5–119.5	13
119.5–124.5	7
124.5–129.5	1
129.5–134.5	1

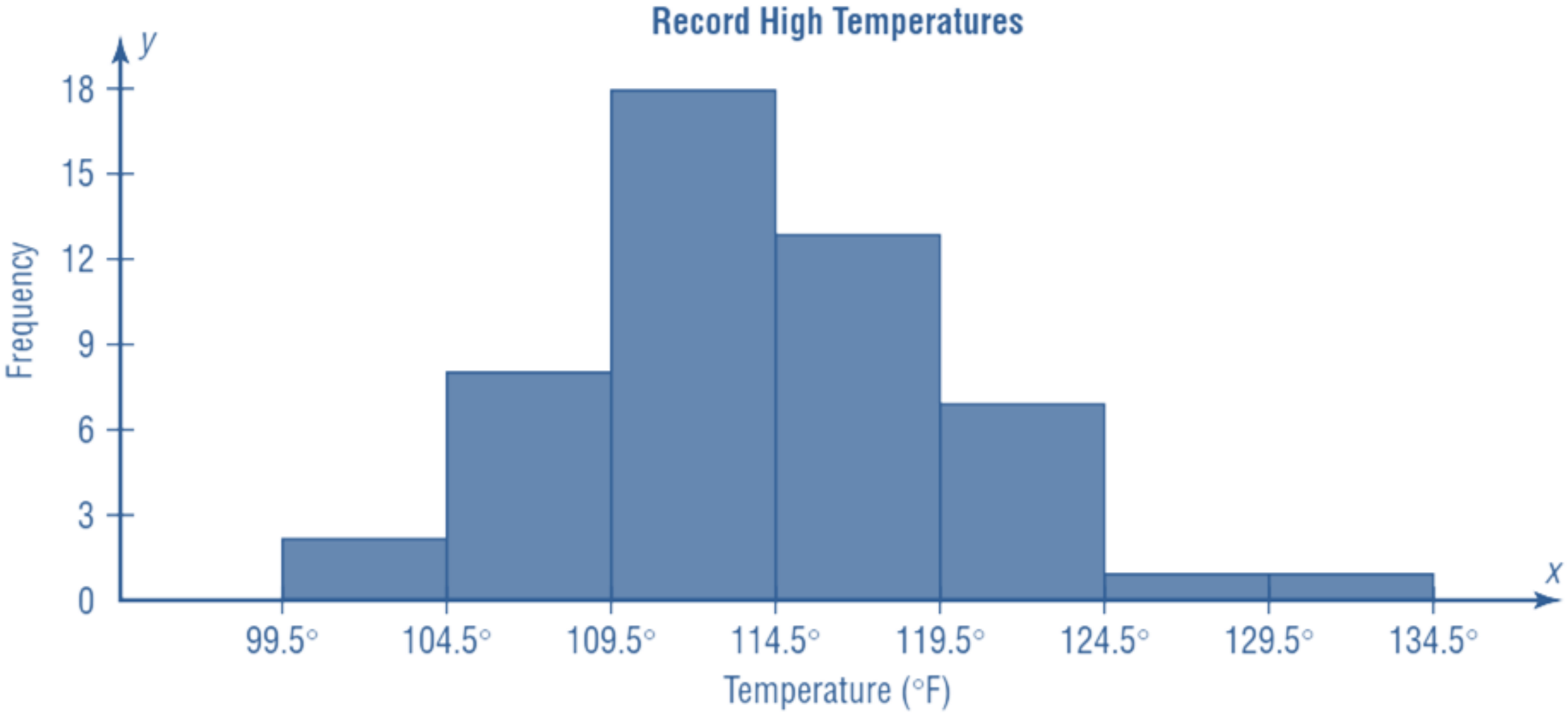
Solutions:

Step 1: Draw and label the x and y axes. The x axis is always the horizontal axis, and the y axis is always the vertical axis.

Step 2: Represent the frequency on the y axis and the class boundaries on the x axis.

Step 3: Using the frequencies as the heights, draw vertical bars for each class.

Histogram


Record High Temperatures
y
18
15
12
9
6
3
0
Frequency
x
99.5°
104.5°
109.5°
114.5°
119.5°
124.5°
129.5°
134.5°
Temperature (°F)

Frequency Polygon

- The frequency polygon is a graph that displays the data by using lines that connect points plotted for the frequencies at the midpoints of the classes. The frequencies are represented by the heights of the points.

Frequency Polygon

Solutions:

Step 1: Find the midpoints of each class. Recall that midpoints are found by adding the upper and lower boundaries and dividing by 2.

Step 2: Draw the x and y axes. Label the x axis with the midpoint of each class, and then use a suitable scale on the y axis for the frequencies.

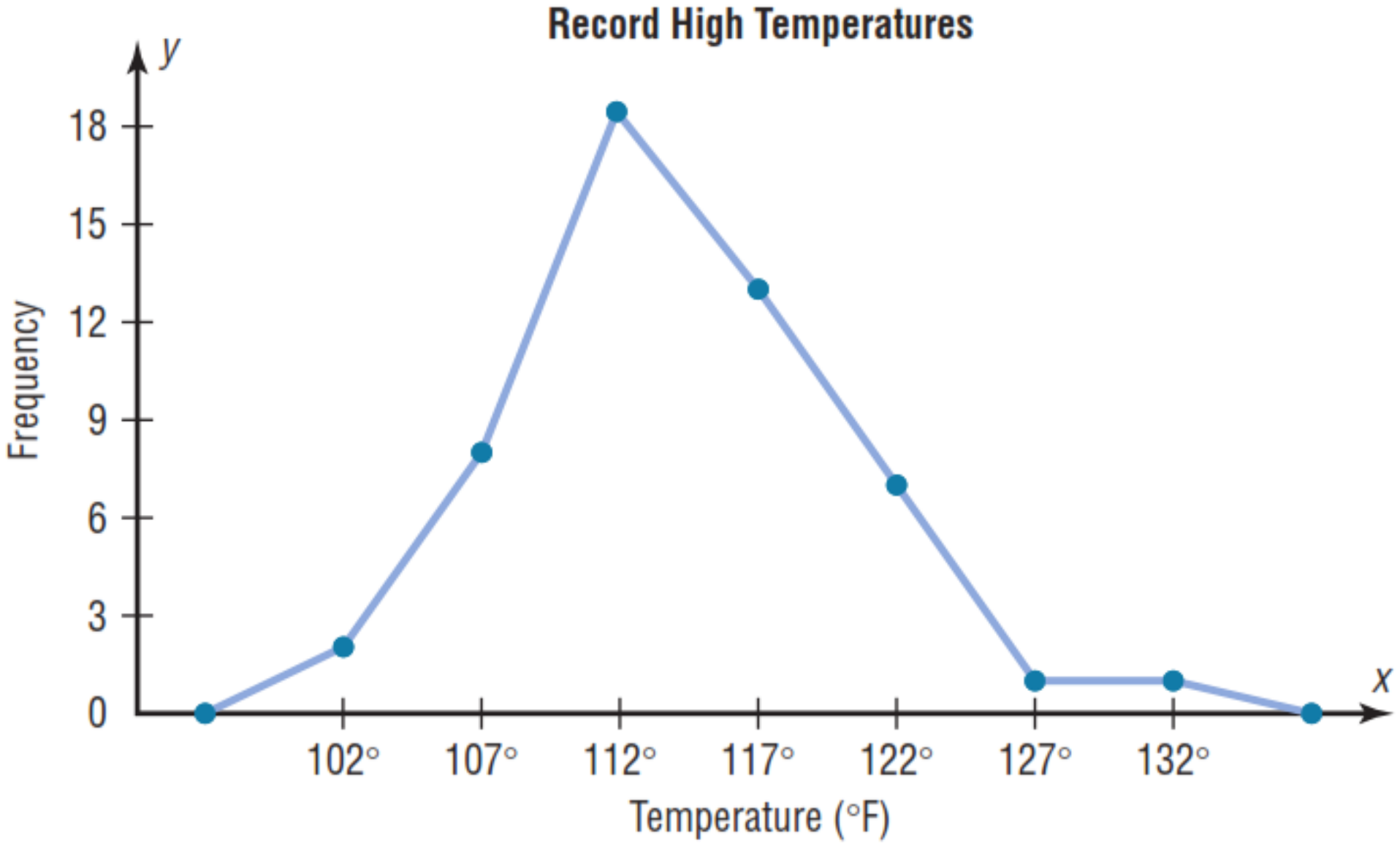
Step 3: Using the midpoints for the x values and the frequencies as the y values, plot the points.

Step 4: Connect adjacent points with line segments. Draw a line back to the x axis at the beginning and end of the graph, at the same distance that the previous and next midpoints would be located.

Frequency Polygon

Class boundaries	Midpoints	Frequency
99.5–104.5	102	2
104.5–109.5	107	8
109.5–114.5	112	18
114.5–119.5	117	13
119.5–124.5	122	7
124.5–129.5	127	1
129.5–134.5	132	1

Frequency Polygon



Cumulative Frequency Graph or Ogive

- The ogive is a graph that represents the cumulative frequencies for the classes in a frequency distribution.

Ogive

Solutions:

Step 1: Find the cumulative frequency for each class.

Step 2: Draw the x and y axes. Label the x axis with the class boundaries. Use an appropriate scale for the y axis to represent the cumulative frequencies.

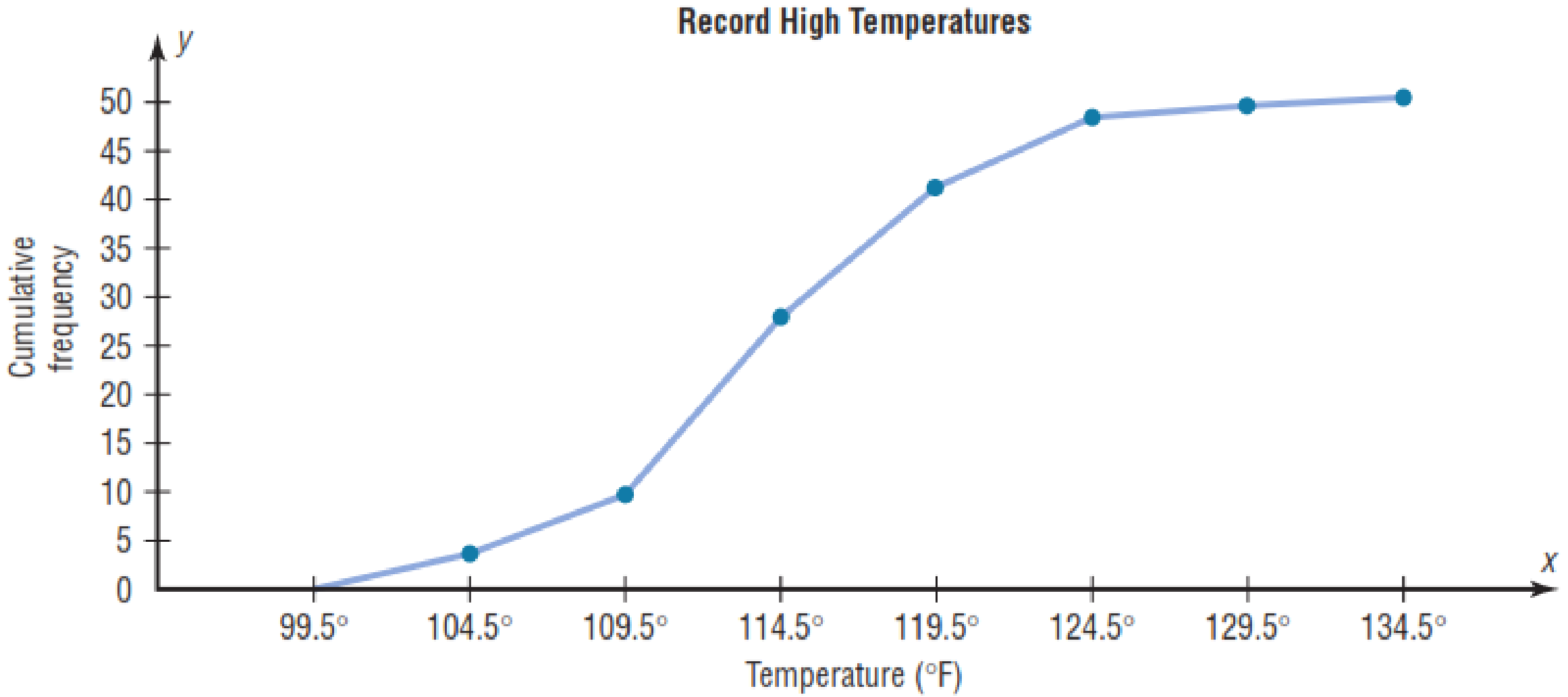
(Depending on the numbers in the cumulative frequency columns, scales

such as 0, 1, 2, 3, . . . , or 5, 10, 15, 20, . . . , or 1000, 2000, 3000, . . . can be used. Do not label the y axis with the numbers in the cumulative frequency column.)

Step 3: Plot the cumulative frequency at each upper class boundary. Upper boundaries are used since the cumulative frequencies represent the number of data values accumulated up to the upper boundary of each class.

Step 4: Starting with the first upper class boundary, 104.5, connect adjacent points with line segments. Then extend the graph to the first lower class boundary, 99.5, on the x axis.

Ogive


Record High Temperatures
y
Cumulative frequency
50
45
40
35
30
25
20
15
10
5
0
x
99.5°
104.5°
109.5°
114.5°
119.5°
124.5°
129.5°
134.5°
Temperature (°F)

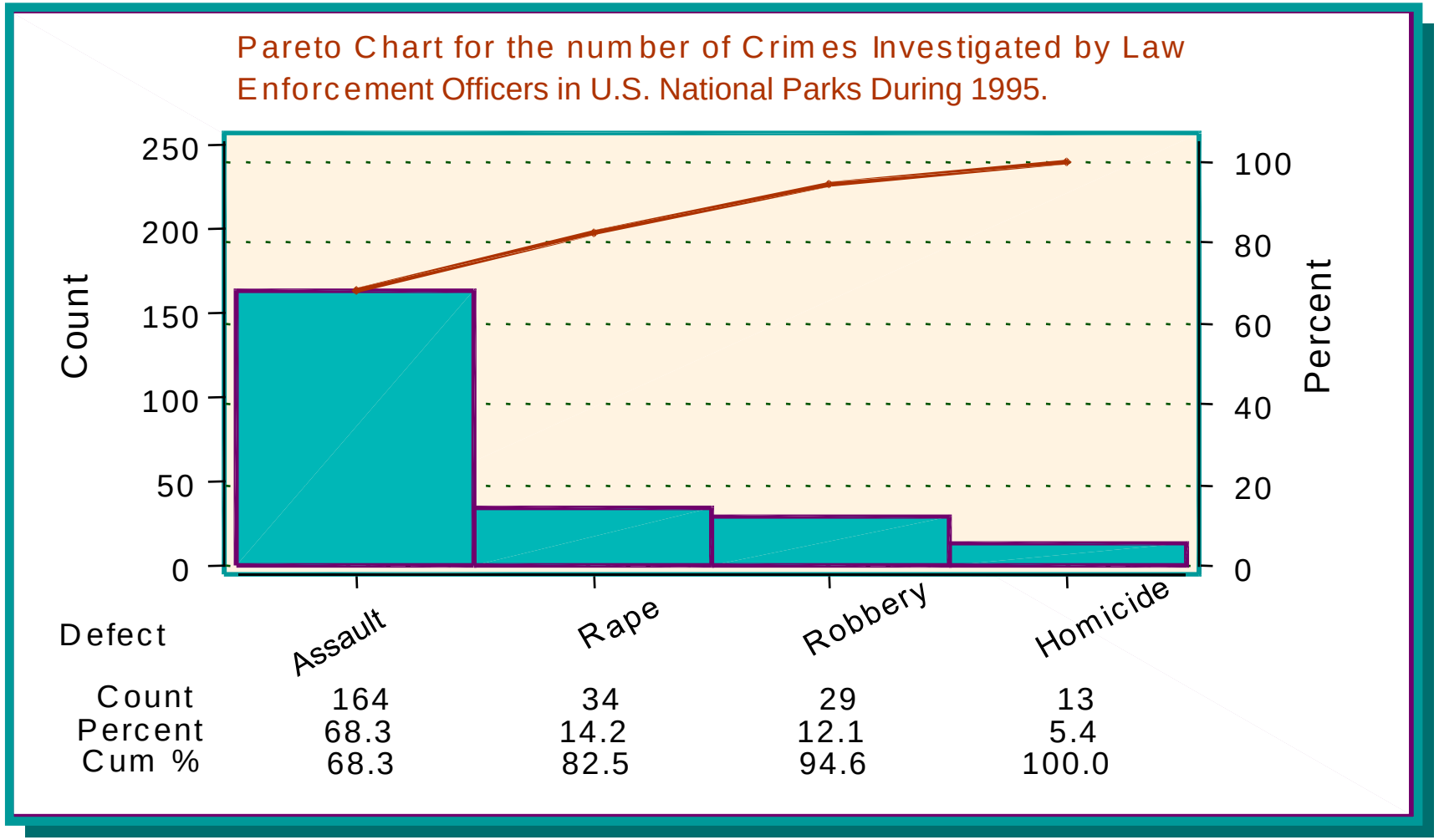
Other Types of Graphs

- Pareto charts - a Pareto chart is used to represent a frequency distribution for a categorical variable.

Other Types of Graphs-Pareto Chart

- When constructing a Pareto chart -
- Make the bars the same width.
- Arrange the data from largest to smallest according to frequencies.
- Make the units that are used for the frequency equal in size.

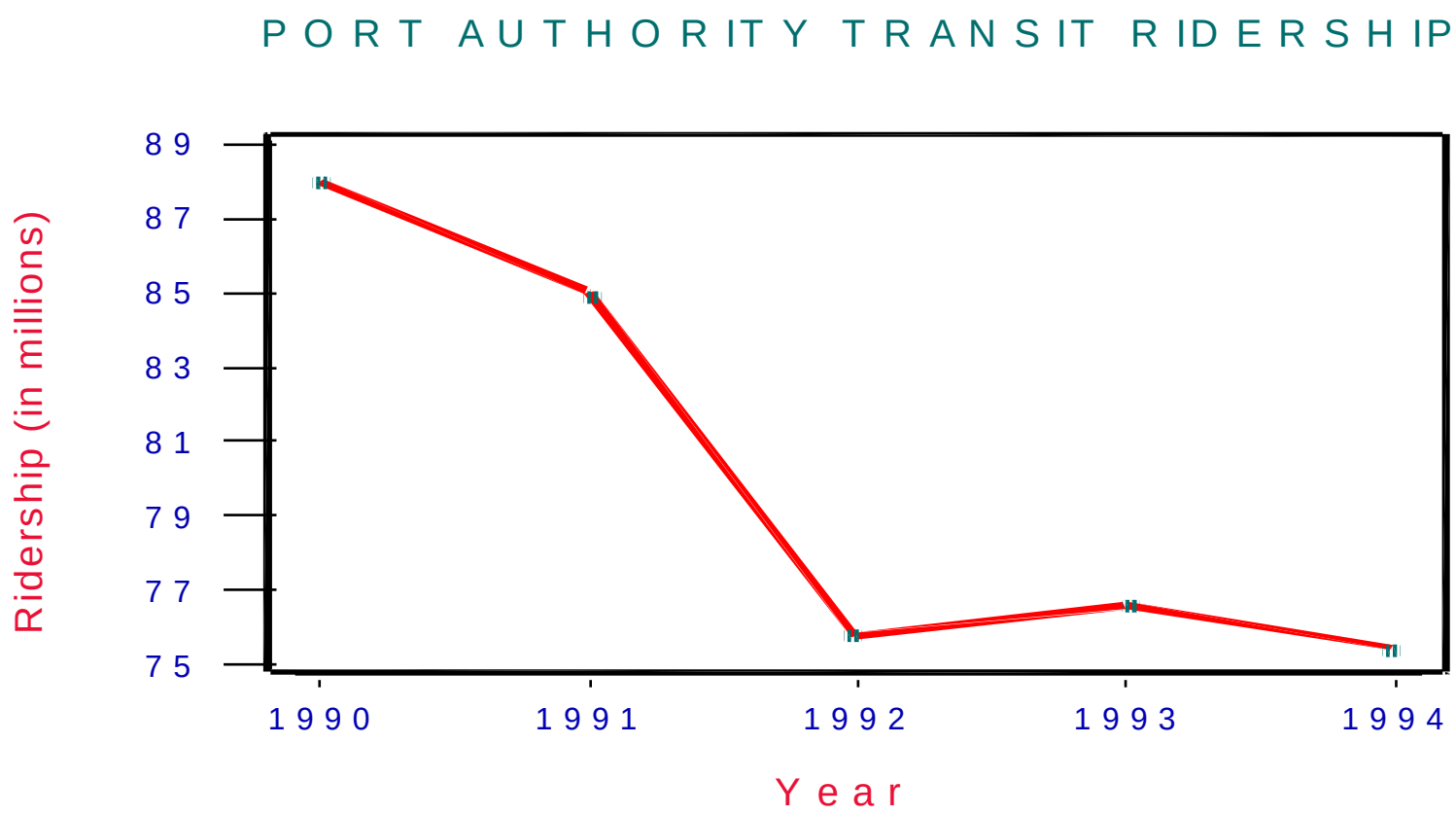
Example of a Pareto Chart



Other Types of Graphs

- Time series graph - A time series graph represents data that occur over a specific period of time.

Other Types of Graphs - Time Series Graph



Other Types of Graphs - Time Series Graph

Arson Damage to Churches

The arson damage to churches for the years 2001 through 2005 is shown. Construct and analyze a time series graph for the data.

Year	Damage (in millions)
2001	$2.8
2002	3.3
2003	3.4
2004	5.0
2005	8.5

Source: U.S. Fire Administration.

Other Types of Graphs - Time Series Graph

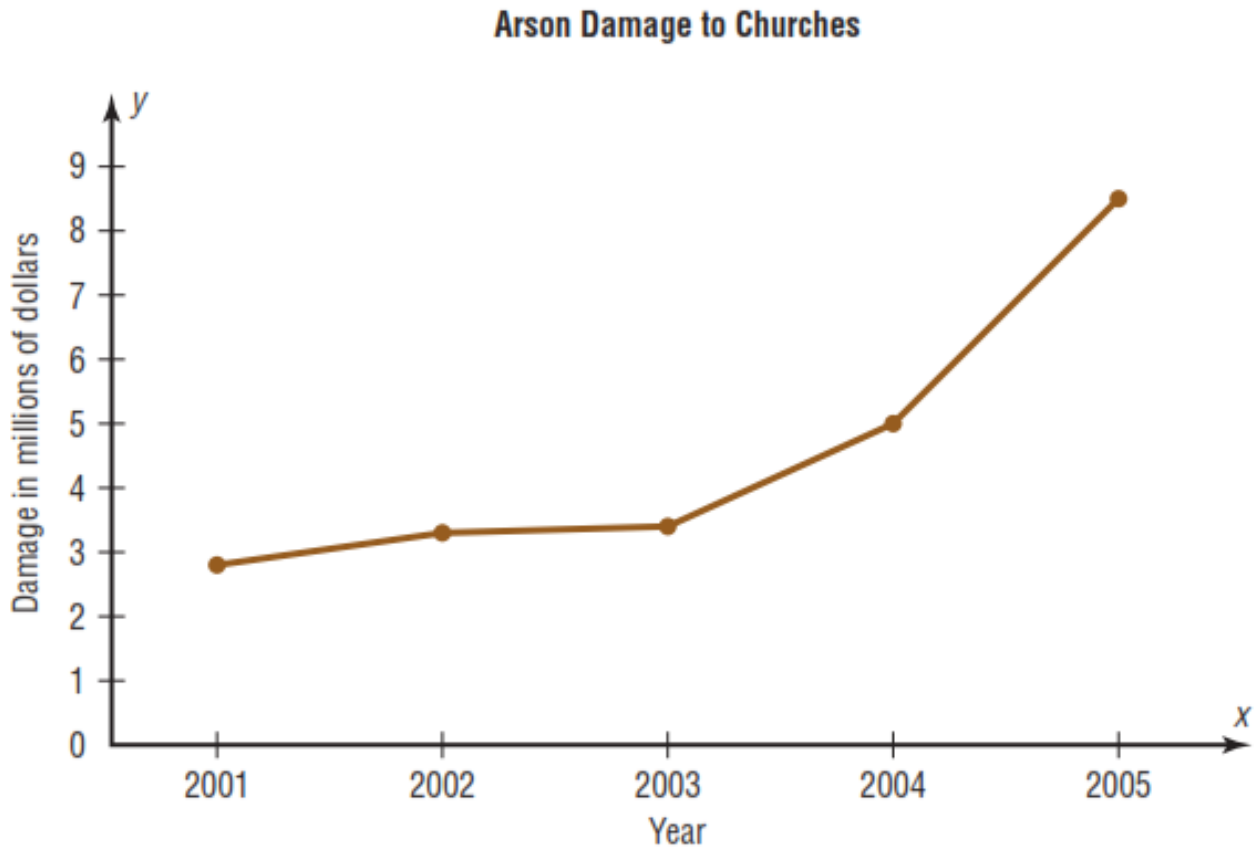
Solution:

Step 1: Draw and label the x and y axes.

Step 2: Label the x-axis for years and the y-axis for the damage.

Step 3: Plot each point according to the table.

Step 4: Draw line segments connecting adjacent points. Do not try to fit a smooth curve through the data points.

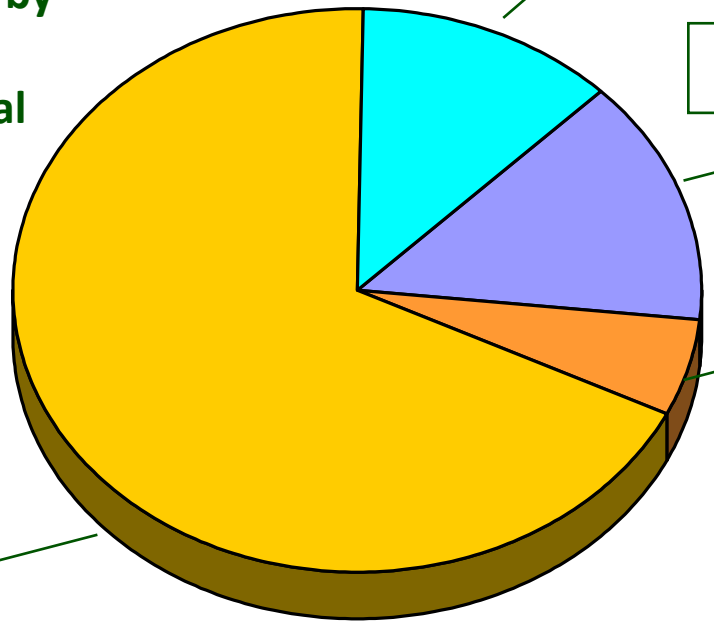


Other Types of Graphs

- Pie graph is a circle that is divided into sections or wedges according to the percentage of frequencies in each category of the distribution.
- Pie graphs are used extensively in statistics. The purpose of the pie graph is to show the relationship of the parts to the whole by visually comparing the sizes of the sections. Percentages or proportions can be used. The variable is nominal or categorical.

Other Types of Graphs - Pie Graph

Pie Chart of the Number of Crimes Investigated by Law Enforcement Officers In U.S. National Parks During 1995



Robbery (29, 12.1%)

Rape (34, 14.2%)

Homicide (13, 5.4%)

Assaults (164, 68.3%)

Other Types of Graphs - Pie Graph

Super Bowl Snack Foods

This frequency distribution shows the number of pounds of each snack food eaten during the Super Bowl. Construct a pie graph for the data.

Snack	Pounds (frequency)
Potato chips	11.2 million
Tortilla chips	8.2 million
Pretzels	4.3 million
Popcorn	3.8 million
Snack nuts	2.5 million
Total n =	30.0 million

Source: *USA TODAY Weekend.*

Other Types of Graphs - Pie Graph

Solution

Step 1 Since there are 360° in a circle, the frequency for each class must be converted into a proportional part of the circle. This conversion is done by using the formula

$$\text{Degrees} = \frac{f}{n} \cdot 360°$$

where f = frequency for each class and n = sum of the frequencies. Hence, the following conversions are obtained. The degrees should sum to 360°.*

Potato chips	$\frac{11.2}{30} \cdot 360° = 134°$
Tortilla chips	$\frac{8.2}{30} \cdot 360° = 98°$
Pretzels	$\frac{4.3}{30} \cdot 360° = 52°$
Popcorn	$\frac{3.8}{30} \cdot 360° = 46°$
Snack nuts	$\frac{2.5}{30} \cdot 360° = 30°$
Total	360°

Other Types of Graphs - Pie Graph

Step 2 Each frequency must also be converted to a percentage. Recall from Example 2–1 that this conversion is done by using the formula

$$\% = \frac{f}{n} \cdot 100\%$$

Hence, the following percentages are obtained. The percentages should sum to 100%.†

Potato chips $\frac{11.2}{30} \cdot 100\% = 37.3\%$

Tortilla chips $\frac{8.2}{30} \cdot 100\% = 27.3\%$

Pretzels $\frac{4.3}{30} \cdot 100\% = 14.3\%$

Popcorn $\frac{3.8}{30} \cdot 100\% = 12.7\%$

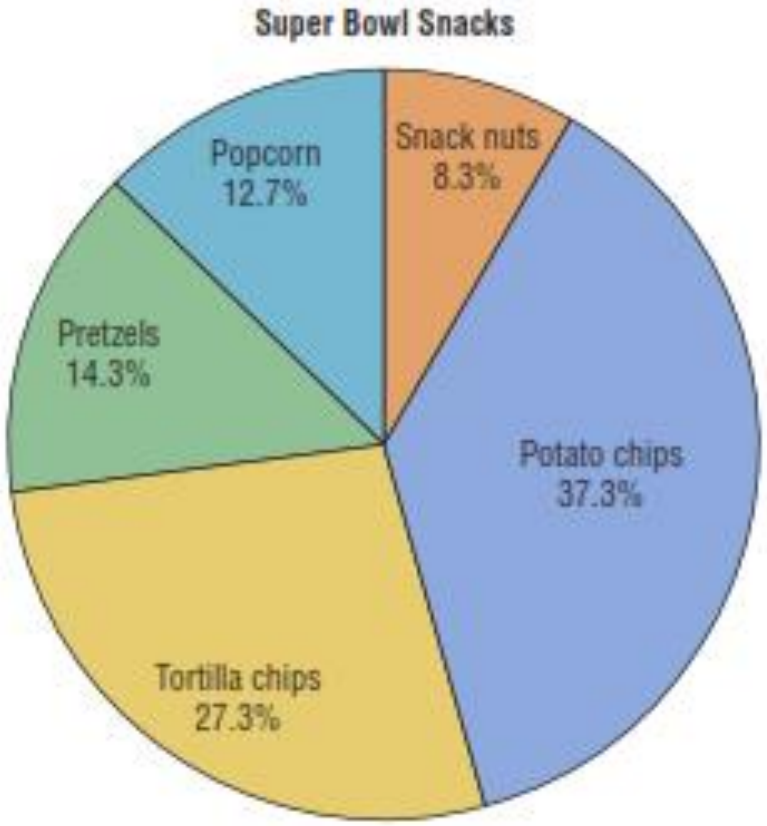
Snack nuts $\frac{2.5}{30} \cdot 100\% = 8.3\%$

Total 99.9%

*Note: The degrees column does not always sum to 360° due to rounding.
†Note: The percent column does not always sum to 100% due to rounding.

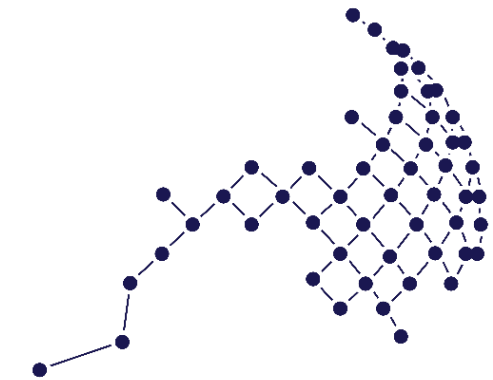
Other Types of Graphs - Pie Graph

Step 3 Next, using a protractor and a compass, draw the graph using the appropriate degree measures found in step 1, and label each section with the name and percentages, as shown in Figure 2–14.



Other Types of Graphs - Pie Graph

Class	Frequency	Percent
A	5	20
B	7	28
O	9	36
AB	4	16
	25	100



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