Introduction

The lessons in this section focus on methods of data collection and use of technology to represent data with various types of graphs. Students learn that different graphs represent different types of data effectively and to use measures of center and dispersion to analyze and interpret data.

These lessons form an outline for your ARI classes, but you are expected to add other lessons as needed to address the concepts and provide practice of the skills introduced in the *ARI Curriculum Companion.*

Some of the lessons cross grade levels, as indicated by the SOL numbers shown below. This is one method to help students connect the content from grade to grade and to accelerate.

Standards of Learning

5.15 The student, given a problem situation, will collect, organize, and interpret data in a variety of forms, using stem-and-leaf plots and line graphs.

5.16 The student will
a) describe mean, median, and mode as measures of center;
b) describe mean as fair share;
c) find the mean, median, mode, and range of a set of data; and
d) describe the range of a set of data as a measure of variation.

6.14 The student, given a problem situation, will
a) construct circle graphs;
b) draw conclusions and make predictions, using circle graphs; and
c) compare and contrast graphs that present information from the same data set.

6.15 The student will
a) describe mean as balance point; and
b) decide which measure of center is appropriate for a given purpose.

7.11 The student, given data for a practical situation, will
a) construct and analyze histograms; and
b) compare and contrast histograms with other types of graphs presenting information from the same data set.

8.13 The student will
a) make comparisons, predictions, and inferences, using information displayed in graphs; and
b) construct and analyze scatterplots.

Table of Contents

Lesson plans pertaining to the following Standards of Learning are found in this section. Click (or CTRL+click) on each to jump to that lesson.

* SOL 5.15

Lesson Summary
Following a discussion of the stem-and-leaf plot, students will work in pairs to collect data. The data will then be graphed by the whole class. Students will again work in pairs to construct back-to-back stem-and-leaf plots comparing test data from two classes.

Materials:
Blank transparencies (5 or more), overhead transparency pens, small post-it notes in two colors, Background Information Activity Sheet, Copies of Test Data Activity Sheet, Test Data Activity Sheet, Stem-and-Leaf Plot Activity Sheet, chart paper, magic markers, clock with second hand (optional)

Vocabulary
Stem and leaf plot allows exact values of data to be listed in a meaningful array.
Line graphs are used to show how to continuous variables are related.

Background
A stem-and-leaf plot is a useful way to display data that range over several tens (or hundreds). The stem represents the tens and the leaves represent the ones. Each number is represented by one stem and one leaf.

Students surveyed fifth grade teachers at Ames School to find out the ages of their teacher's sons and daughters. The results of this survey are displayed on the stem-and-leaf plot below.

Ages of Fifth Grade Teachers' Children

0	2
1	0, 4, 5, 5
2	3, 6
3	9

key: 2 | 3 = one child age 23

As shown in the plot, the fifth grade teachers have a total of eight children ranging in age from 2 to 39 years. The median (15) and mode(s) (15) of the data are displayed on the stem-and-leaf plot and can easily be determined. Clusters can be identified; for instance, more teachers have teenagers than toddlers.

Two sets of comparable data can be displayed on a back-to-back stem-and-leaf plot.

Ages of 6th Grade Teachers' Children		Ages of 5th Grade Teachers' Children
9, 7, 6, 5, 4, 3, 1	0	2
6, 4, 2	1	0, 4, 5, 5
	2	3, 6
	3	9

Students can compare the information presented; find the range, mean, median, and mode; locate clusters; and make inferences such as the fact that 6th grade teachers' children are younger than the fifth grade teachers' children.

Lesson

1. Use a copy of "Ages of Teachers' Children" to go over background data with the whole class. Be certain to include:
    - Each number is represented by a combined stem and leaf. Each leaf may contain only one digit, but a stem may contain more than one digit For example, 123 would be represented by a stem of 12 and a leaf of 3.
    - The leaves are arranged from the stem outward and are in numerical order.

2. Have students pair up to collect data on how long each can hold his or her breath. Give each student one color-coded post-it note. (The colors will be used for demonstrating an easy way to divide data into two groups. For example, you can give males one color and females another.) Have each student time how long their partner can hold his or her breath, recording that number on the appropriate post-it note.

3. Collect the post-it notes and arrange them all. Construct a stem-and-leaf plot using the data collected. Follow the model in the Background Information.

4. Briefly, have the students discuss with their partner what they see on the plot. Have them share their ideas. Be certain to discuss:
    - All the data is visible on a stem-and-leaf plot.
    - It is easy to find the range and mode(s) of the data just by looking. This would be an appropriate time to introduce the terms "bimodal" (having two modes) and "trimodal" (having three modes) as it often happens in this type of data collection.
    - Share finding the median of the data by counting. Remind the students that, when starting with the largest number, one must count backward to find the median.
    - The mean can be found in the normal manner.
    - Discuss any other interesting clusters or trends that the group sees.

5. Discuss using two sets of comparable data to construct back-to-back stem-and-leaf plots. Dividing the data into two sets by using the color-coded sticky notes makes this an easy task. Use another blank transparency and five or six pieces of data from the two colors of notes to quickly construct a sample of a back-to-back plot showing the students how to collect the information on one stem-and-leaf plot and then reorganizing it on another.

Example:

record

stem	leaf
2	5,3,7
3	1,8,4,7

reorganize

stem	leaf
2	3,5,7
3	1,4,7,8

6. Give each pair of students a copy of the grade data from two math classes. Have them construct a back-to-back stem-and-leaf plot from the data. Have them briefly analyze what they found prior to a whole group discussion.

7. Use a transparency of the grade data to share the measures of central tendencies for each class. Have the students analyze the data discussing such things as why one class may have done better than the other.

8. Have the whole class brainstorm suggestions for question stems that could be represented on stem-and-leaf plots such as hopping on 1 foot for 30 seconds and using data from other sources.

Ages of Teachers' Children

Data Set for 5th Grade Teachers:
2, 10, 14, 15, 15, 23, 26, 39

Stem-and-Leaf Plot

Ages of Fifth Grade Teachers' Children

0	2
1	0, 4, 5, 5
2	3, 6
3	9

key: 2 | 3 = one child age 23

Ages of Teachers' Children

Data Set for 6th Grade Teachers:

1, 3, 4, 5, 6, 7, 9, 12, 14, 16

Back-to-Back Stem-and-Leaf Plots

Ages of 6th Grade Teachers' Children		Ages of 5th Grade Teachers' Children
9, 7, 6, 5, 4, 3, 1	0	2
6, 4, 2	1	0, 4, 5, 5
	2	3, 6
	3	9

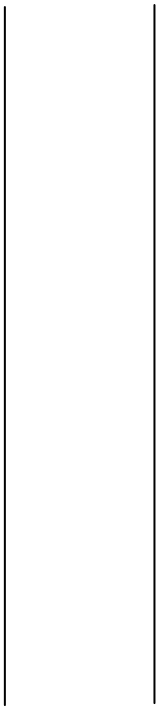
key: 4 | 1 | = age 14

| 1 | 4 = age 14

Data from Math Classes

The following are scores obtained by two classes of 25 grade five students on a math test. Compare the two sets of scores by using back-to-back stem-and-leaf plots. What conclusions might you draw by studying the data displayed in this way?

Class A	73	75	42	93	88	62	62	37	73	76
	96	54	80	75	69	66	81	79	83	56
	69	88	80	52	59					
Class B	65	80	67	80	87	44	82	71	91	93
	75	76	79	80	87	83	54	56	57	82
	62	69	75	80	91					



Data from Math Classes

The following are scores obtained by two classes of 25 fifth grade students on a math test. Compare the two sets of scores by using back-to-back stem-and-leaf plots. What conclusions might you draw by studying the data displayed in this way?

Class A	73	75	42	93	88	62	62	37	73	76
	96	54	80	75	69	66	81	79	83	56
	69	88	80	52	59					
Class B	65	80	67	80	87	44	82	71	91	93
	75	76	79	80	87	83	54	56	57	82
	62	69	75	80	91					

Class B		Class A
	3	7
4	4	2
7, 6, 4	5	2, 4, 6, 9
9, 7, 5, 2	6	2, 2, 6, 9, 9
9, 6, 5, 5, 1	7	3, 3, 5, 5, 6, 9
7, 7, 3, 2, 2, 0, 0, 0, 0	8	0, 0, 1, 3, 8, 8
3, 1, 1	9	3, 6
range - 49		range - 59
median - 79		median - 73
mode - 80		mode - 62, 69, 73, 75, 80, 88
mean - 74.64		mean - 70.72

* SOL 5.15

Lesson Summary
Students will use their knowledge of line graphs to match graphs with data sets.

Materials
When It Rains Activity Sheet

Vocabulary
Line graphs are used to show how to continuous variables are related.

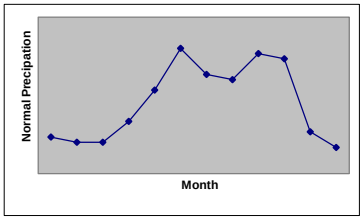
Background
A line graph is used to show changes over time for continuous data. Points are plotted on the coordinate plane to represent change over time or any linear function. The units of division on the axes are evenly spaced and plotted points are connected by line segments or dotted line segments.

Multiline graphs are used to compare two or more sets of continuous data over time.

Lesson
1. Distribute When It Rains Activity Sheet.
2. Have the students match each line graph to its data set.
3. Have the pairs write a paragraph describing the analytical process used.

When It Rains

1.



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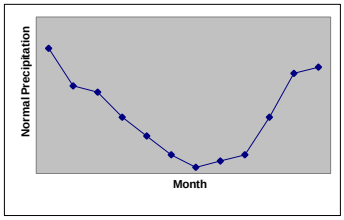

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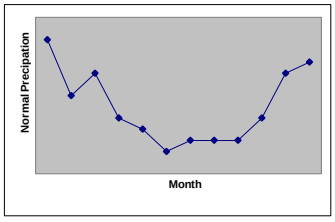

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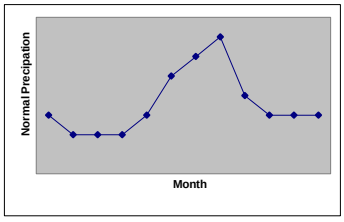

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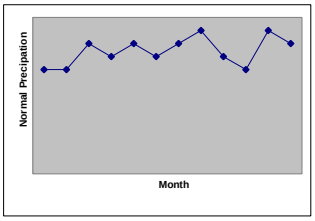

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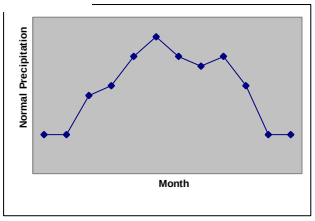


When It Rains

NORMAL PRECIPITATION
(in centimeters)

	Kansas City	New York City	Fairbanks	Honolulu	Eureka	Miami
Jan.	4	8	3	12	20	7
Feb.	4	8	2	7	14	6
Mar.	8	10	2	9	13	6
Apr.	10	9	2	5	9	10
May	12	10	3	4	6	16
Jun.	15	9	5	2	3	24
Jul.	12	10	6	3	1	19
Aug.	11	11	7	3	2	18
Sep.	12	9	4	3	3	23
Oct.	9	8	3	5	9	22
Nov.	5	11	3	9	16	8
Dec.	5	10	3	10	18	4

* SOL 5.15, 6.14, 8.13 a,b

Lesson Summary
Students will develop skills in interpreting graphical representations of data. They will discuss statistics that can be developed from graphs, compare and contrast data, find unique and common features, describe trends and relationships between variables, and make predictions from the data.

Materials
Graph, data, and written summary cards for matching, Matching Game Activity Sheet

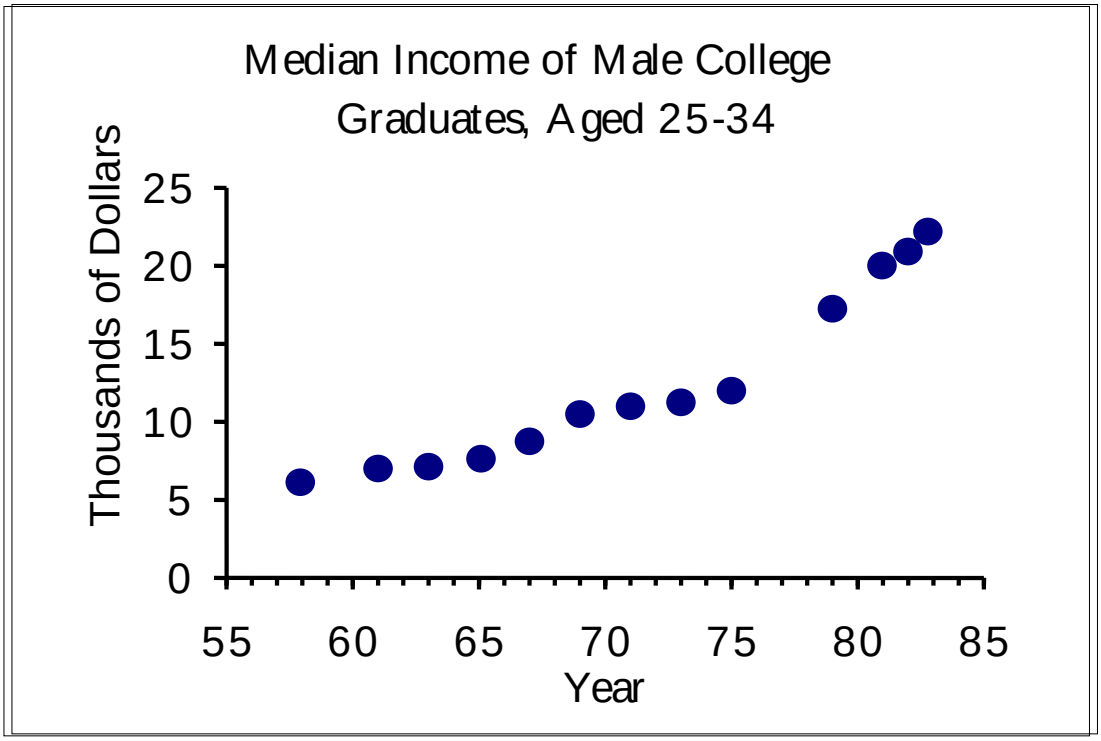
Vocabulary
Stem and leaf plot allows exact values of data to be listed in a meaningful array.
Line graphs are used to show how to continuous variables are related.
Scatterplot illustrates the relationship between two sets of data.
Circle graphs show a relationship of the parts to a whole.

Lesson
1. Distribute the graph, data, and summary cards. Each student should receive only one card. There are three cards that represent the same set of data. One card will have the raw data, a second card will have a graph of the data, and the third card will have a written summary of the data and graph. There are three sets of three cards representing the following data:
   - Calories in Ice Cream and Yogurt
   - Income for Male College Graduates
   - Fat grams in Fast Food
   - Level of Education for Adults
2. Because there are three sets for each of the above, the students cannot determine their match by just looking at the titles. The students must sort out which data matches the graph and summary. There are a total of 36 cards. If there are fewer than 36 students, remove cards in matching sets.
3. Use one matching set of cards as a demonstration. Show the data, discuss what type of graph would be appropriate for this data, provide an example graph that could be used for the data, and discuss the conclusions that can be drawn from the graph and the data, showing an example write-up of the data.
4. Students should circulate around the room to find the two people who have cards that match their card.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Year	Income Thousands of Dollars
1958	6
1961	6.8
1963	6.9
1965	7.3
1967	8.7
1969	10.4
1971	10.9
1973	11.3
1975	12.1
1979	17.2
1981	20.3
1982	21.1
1983	21.9

DATA-GRAPH-SUMMARY MATCH ACTIVITY



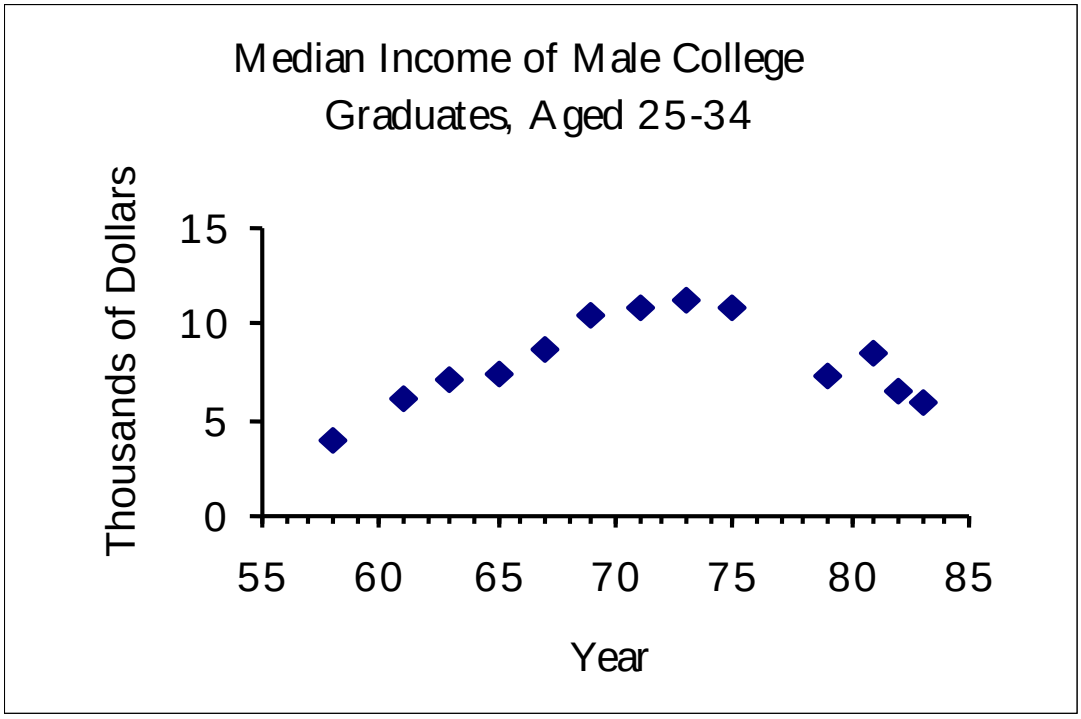
DATA-GRAPH-SUMMARY MATCH ACTIVITY

The graph illustrates the median income of college graduates, aged 25 - 34. It shows an upward trend in income over the past 25 years from 1958 to 1983. It appears that incomes rose slowly from 1958 to 1975 and then rose more rapidly from 1975 to 1983, with the largest one-year increase in the late seventies.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Year	Income Thousands of Dollars
1958	4
1961	6.2
1963	6.9
1965	7.3
1967	8.7
1969	10.4
1971	10.9
1973	11.3
1975	10.9
1979	7.3
1981	8.5
1982	6.5
1983	6

DATA-GRAPH-SUMMARY MATCH ACTIVITY



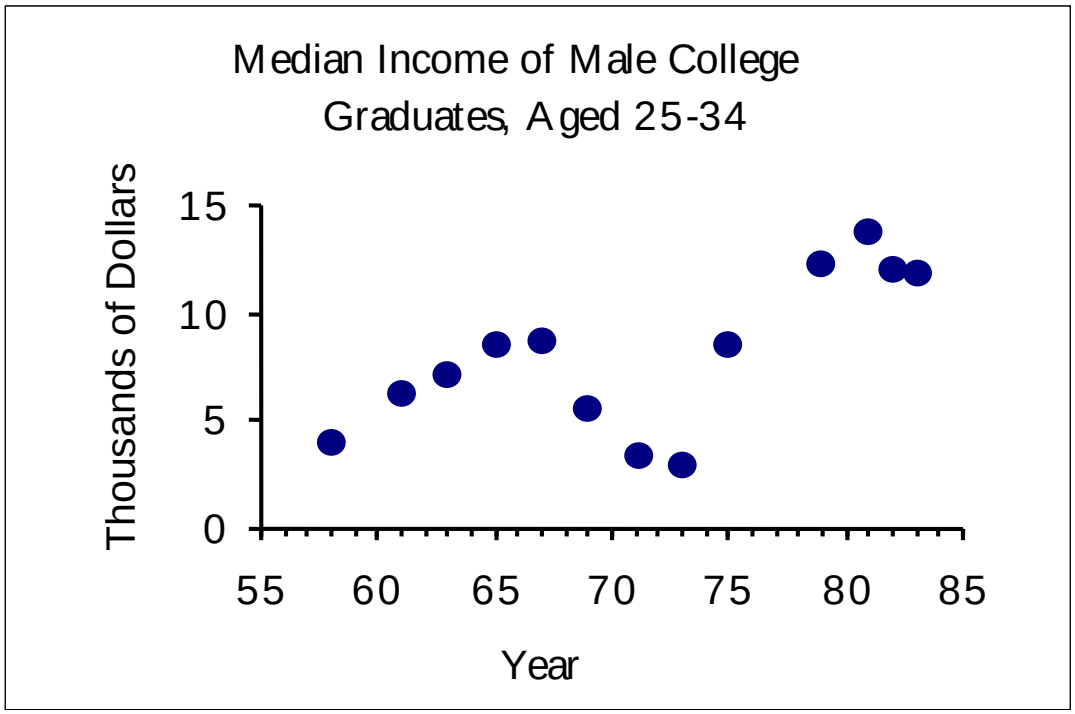
DATA-GRAPH-SUMMARY MATCH ACTIVITY

The graph illustrates the median income of college graduates, aged 25 - 34. It illustrates that income rose during approximately the first twenty years of this analysis from 1958 to 1973. After 1973, incomes began declining, dropping rapidly from 1975 and 1978.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Year	Income Thousands of Dollars
1958	4
1961	6.2
1963	7
1965	8.5
1967	8.7
1969	5.5
1971	3.5
1973	3
1975	8.5
1979	12.5
1981	13.8
1982	12
1983	11.8

DATA-GRAPH-SUMMARY MATCH ACTIVITY



DATA-GRAPH-SUMMARY MATCH ACTIVITY

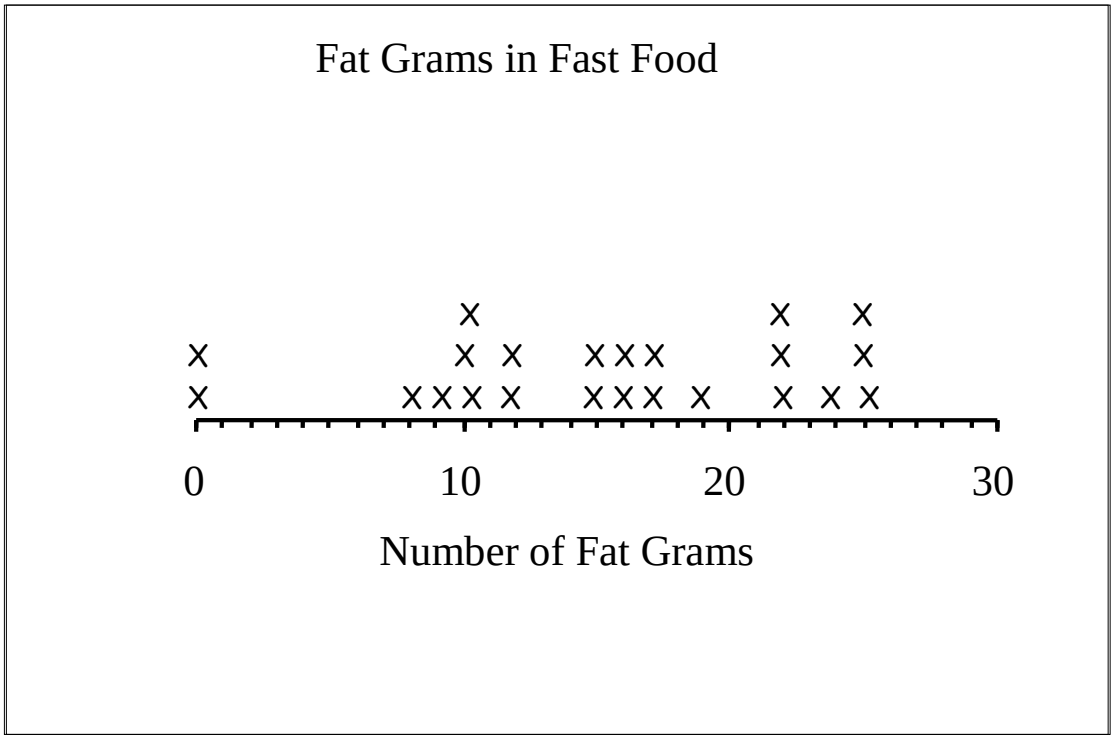
The graph illustrates the median income of college graduates, aged 25 - 34. The graph suggests that median income followed a cyclical pattern during the years from 1958 to 1983. Specifically, the median income rose steadily from 1958 to 1967, declined rapidly from 1967 to 1973, rose rapidly form 1973 to a peak of approximately $15,000 in 1982 before leveling off in 1982 and 1983.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Fat Grams in Fast Food

0	22
17	17
12	12
16	0
9	8
10	16
22	15
15	10
25	25
10	19
22	24
25	

DATA-GRAPH-SUMMARY MATCH ACTIVITY



DATA-GRAPH-SUMMARY MATCH ACTIVITY

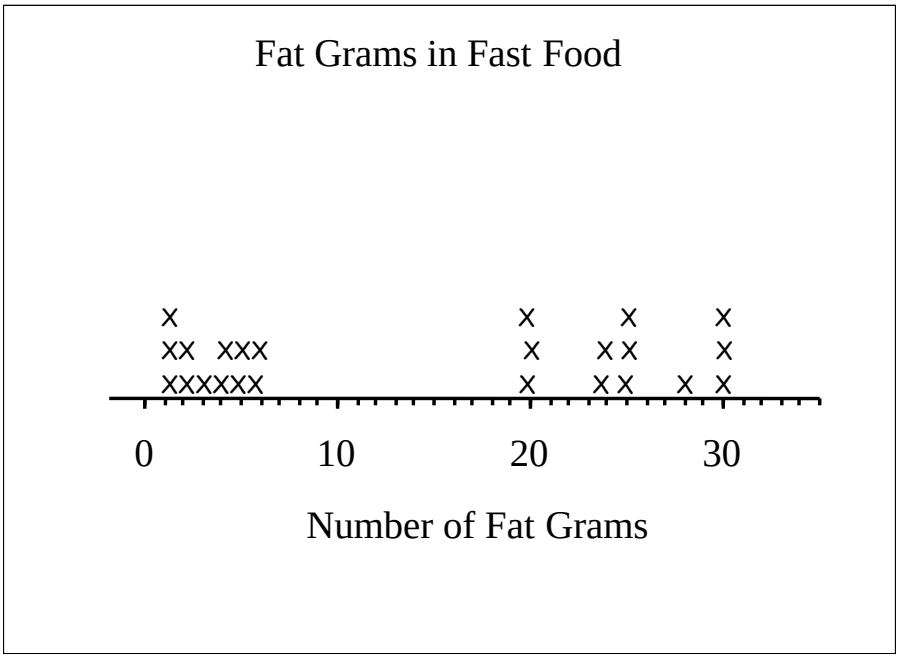
The data represent the number of fat grams in food purchased from a fast food restaurant. The graph shows that the amount of fat grams range from 0 grams to approximately 25 grams. There are a few items with zero grams of fat, most likely diet soda. However, most of the items have over 10 grams of fat.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Fat Grams in Fast Food

20	28
4	5
1	20
30	1
20	25
2	1
2	30
3	24
25	5
6	30
4	24
25	6

DATA-GRAPH-SUMMARY MATCH ACTIVITY



DATA-GRAPH-SUMMARY MATCH ACTIVITY

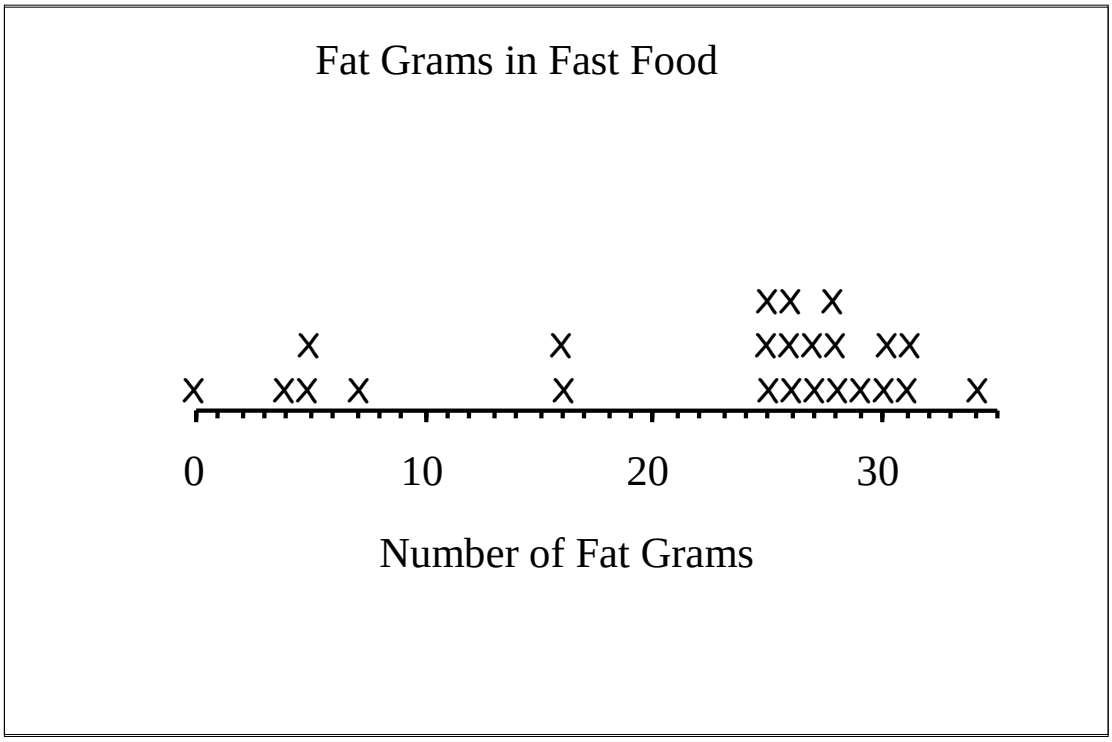
The data represent the number of fat grams in food purchased from a fast food restaurant. The graph shows that there appears to be two clusters of data, relatively healthy food with between 1 and 6 grams of fat and food that is not healthy with between 20 and 30 grams of fat.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Fat Grams in Fast Food

31	27
27	30
16	4
0	28
26	5
16	30
7	5
25	25
26	28
28	25
26	29
31	34

DATA-GRAPH-SUMMARY MATCH ACTIVITY



DATA-GRAPH-SUMMARY MATCH ACTIVITY

The data represent the number of fat grams in food purchased from a fast food restaurant. The graph shows that the amount of fat grams ranges from 0 grams to approximately 34 grams. There is a cluster of items around 5 to 8 grams but the largest cluster is between 25 and 31 grams. This cluster at the high fat contents implies that fast food is very high in fat grams.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Calories per Serving	
Ice Cream	**Yogurt**
150	100
150	120
175	125
200	130
205	140
205	150
210	155
215	155
215	160
220	165
225	170
225	170
230	175
240	180
250	180
275	185
300	190
305	200

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Ice Cream Versus Yogurt - Calories Per Serving

Ice Cream		Yogurt
	10	0
	11	
	12	0, 5
	13	0
	14	0
0, 0	15	0, 5, 5
	16	0, 5
5	17	0, 0, 5
	18	0, 0, 5
	19	0
5, 5,0	20	0
5, 5, 0	21	
5, 5, 0	22	
0	23	
0	24	
0	25	
	26	
5	27	
	28	
	29	
5, 0	30	

Key: 5| 21 = 215
21| 0 = 210

DATA-GRAPH-SUMMARY MATCH ACTIVITY

The data represent the number of calories in a serving of various brands of ice cream and yogurt. It appears that ice cream generally has more calories. Its median is approximately 220 calories compared to 160 calories for yogurt. Yogurt ranges from a low of 100 calories to a high of 200 calories, a range of 100 calories, compared to ice cream which ranges from 150 calories to over 300 calories, a range of 150 calories.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Calories per Serving	
Ice Cream	**Yogurt**
100	120
150	125
180	125
250	125
255	130
260	135
275	135
275	140
275	140
300	150
300	150
310	155
325	155
325	160
325	170
325	180
340	190
340	250

DATA-GRAPH-SUMMARY MATCH ACTIVITY

The data represent the number of calories in a serving of different brands of ice cream and yogurt. The graph illustrates that ice cream generally has more calories. Seventy-five percent of the ice cream brands have more than 250 calories. In contrast, seventy-five percent of the yogurt brands is below 170 calories. Furthermore, the median number of calories for yogurt is approximately 150 calories compared to nearly 300 calories for ice cream. We can also see from the graph that ice cream brands have more variation in calories than yogurt.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Ice Cream Versus Yogurt - Calories Per Serving

Ice Cream		Yogurt
0	10	
	11	
		0, 5, 5,
	12	5
	13	0, 5, 5
	14	0, 0
		0, 0, 5,
0	15	5
	16	0
	17	0
0	18	0
	19	0
	20	
	21	
	22	
	23	
	24	
5, 0	25	0
0	26	
5, 5, 5	27	
	28	
	29	
0, 0	30	
0	31	
5, 5, 5,		
5	32	
	33	
0, 0	34	

Key: 5| 21 = 215
21| 0 = 210

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Calories per Serving	
Ice Cream	**Yogurt**
220	100
220	100
240	100
240	120
250	140
250	140
260	150
260	150
270	160
270	170
300	170
300	170
300	170
300	180
345	185
345	185
350	190
350	200

DATA-GRAPH-SUMMARY MATCH ACTIVITY

The data represent the number of calories in a serving of different brands of ice cream and yogurt. The graph illustrates that ice cream generally has more calories. In fact, all of the brands of ice cream examined have higher calories than all of the brands of yogurt selected. The maximum number of calories for yogurt is 200 calories compared to the minimum number of calories for ice cream is 220 calories. Furthermore, the median number of calories for ice cream is approximately 270 calories compared to 170 calories for yogurt. Both ice cream and yogurt have similar ranges and variation. Yogurt's range is approximately 100 calories. Similarly, ice cream's range is about 125 calories.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Ice Cream Versus Yogurt - Calories Per Serving

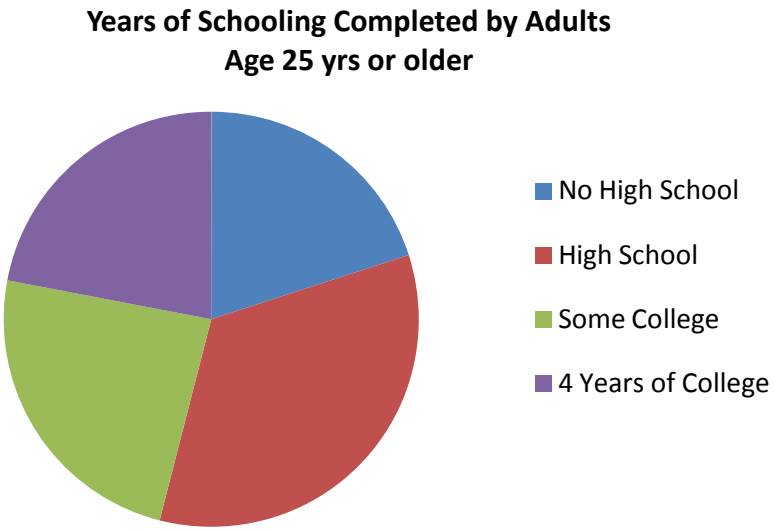
Ice Cream		Yogurt
	10	0, 0, 0
	11	
	12	0
	13	
	14	0, 0
	15	0, 0
	16	0
		0, 0, 0,
	17	0
	18	0, 5, 5
	19	0
	20	0
	21	
0, 0	22	
	23	
0, 0	24	
0, 0	25	
0, 0	26	
0, 0	27	
	28	
	29	
0, 0, 0,		
0	30	
	31	
	32	
	33	
5, 5	34	
0, 0	35	

Key: 5| 21 = 215
21| 0 = 210

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Years of Schooling	Percent
No High School	20
High School	34
Some College	24
4 Years of College	22

DATA-GRAPH-SUMMARY MATCH ACTIVITY



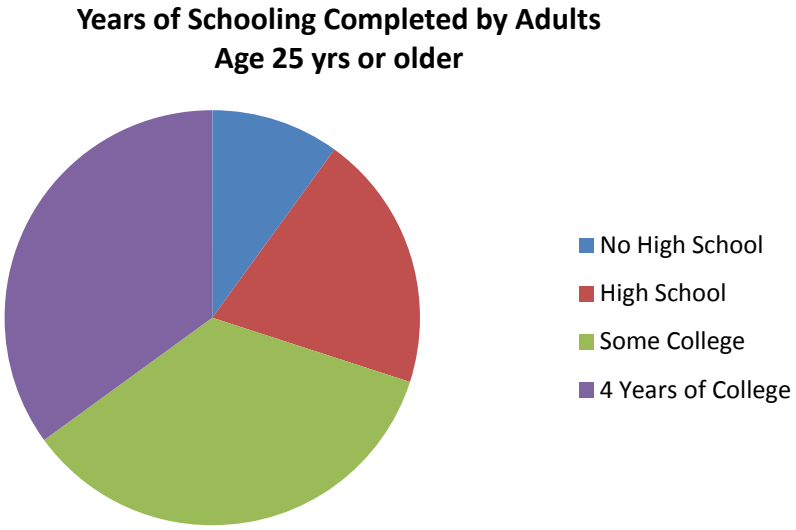
DATA-GRAPH-SUMMARY MATCH ACTIVITY

The data represent the percent of adults, age 25 and older, who have completed a certain level of schooling. Based on the graph, it appears that nearly equal percentages completed no high school, some college, and four years of college. The largest percentage was those adults who completed high school only.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Years of Schooling	**Percent**
No High School	10
High School	20
Some College	35
4 Years of College	35

DATA-GRAPH-SUMMARY MATCH ACTIVITY



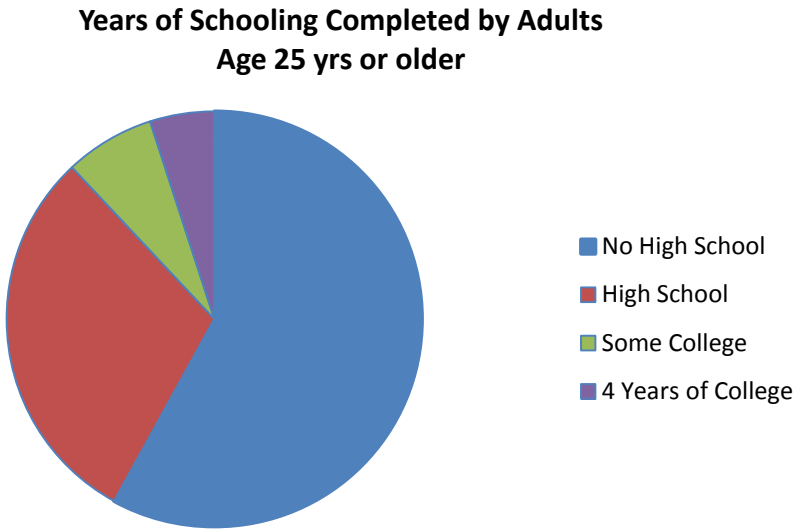
DATA-GRAPH-SUMMARY MATCH ACTIVITY

The data represent the percent of adults, age 25 and older, who have completed a certain level of schooling. Based on the graph, it appears that this population is fairly well educated with approximately 70 percent completing at least some college. Those completing no high school made up the smallest percentage at only 10 percent of the population.

DATA-GRAPH-SUMMARY MATCH ACTIVITY

Years of Schooling	Percent
No High School	58
High School	30
Some College	7
4 Years of College	5

DATA-GRAPH-SUMMARY MATCH ACTIVITY



DATA-GRAPH-SUMMARY MATCH ACTIVITY

The data represent the percent of adults, age 25 and older, who have completed a certain level of schooling. Based on the graph, it appears that the majority of this population has not completed high school. Those with some college and/or 4 years make up less than 15% of the entire population. These facts suggest that the population is not well educated.

* SOL 5.15, 8.13a

Lesson Summary
Students will understand how to choose a graphical method that best displays a set of data.

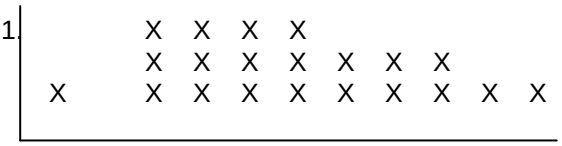
Materials
Name That Graph Activity Sheet, Name That Graph Recording Sheet

Vocabulary
Stem and leaf plot allows exact values of data to be listed in a meaningful array.
Line graphs are used to show how to continuous variables are related.
Scatterplot illustrates the relationship between two sets of data.
Circle graphs show a relationship of the parts to a whole.
Frequency distribution (chart) shows how often an item, a number, or range of numbers occurs.
Histogram is a form of bar graph in which the categories are consecutive and equal intervals.

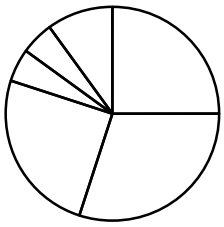
Lesson
1. Distribute the Name That Graph Activity and Recording Sheets to students. Students examine the various graphs and decide on a specific collection of data that exists in the room that could fit one of the graphs shown. An example may be the number of family members in each student's home for graph 2.
2. The instructor should facilitate the actual collection of the data chosen by having students raise hands or some other method. Students decide if the graphical display chosen is accurate. Discuss what other graphs could have been chosen, if any, for the data.
3. Encourage students to work in small groups and come up with another set of data that will match a different graphical display. Students collect the data and decide if their choice of graphs was accurate.
4. Collect Recording Sheets from each student.
5. Lead a discussion with the whole class.

Name That Graph

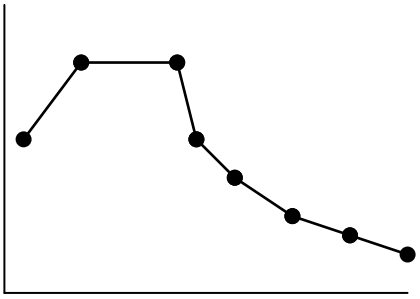
1.



2.



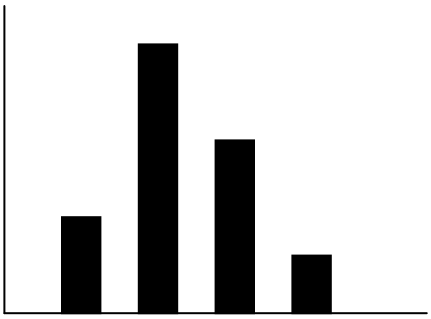
3.



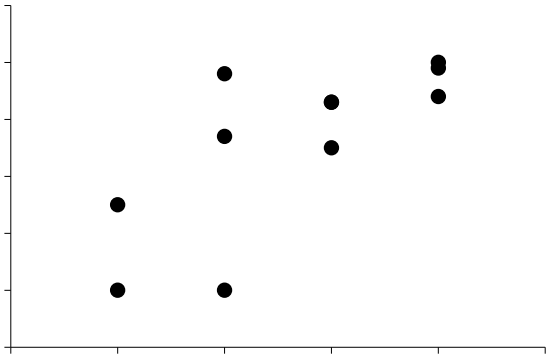
4.

0	3 3 5 7 8 9
1	0 2 3 5 6 6 8 9
2	0 1 3 3 3 5 5 8
3	0 5
4	5

5.



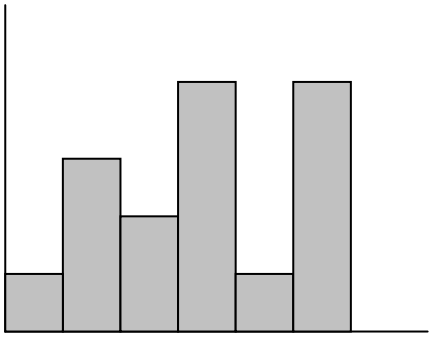
6.



7.

Number of marks	Tally marks	Frequency
1	𝍸 ||	7
2	𝍸	5
3	𝍸 |	6
4	𝍸	5
5	|||	3
Total		**26**

8.



Name That Graph

Recording Sheet

Name _____ ***Date*** _____

1. **What graphical display will best represent the data you plan to collect?**

2. **Describe the data you will collect.**

After the Data Collection

3. **Is the graphical display you chose appropriate for the data you collected? Why or why not?**

4. **Is there another graph that would be more appropriate for the data you collected? If so, what one would it be?**

5. **Choose another graphical display and describe the data collection you would use for that display.**

* SOL 5.15, 6.14, 8.13 a,b

Lesson Summary
Students will organize a set of data using one of the data organizera. Pairs will share what their data looks like using the appropriate organizing tool.

Materials
Chart paper, markers/pens, tape, Household Survey Data Activity Sheet
Prepare index cards beforehand with the following data organizer directions (one direction per card):

- Use a list to show the number of adults in each household.
- Use a chart to show the ratio of cars to adults.
- Use a chart to show the ratio of TVs to people.
- Use a frequency table to show the number of people in households.
- Use a stem-and-leaf plot to show the number of TVs in households.
- Use a scatterplot to show the number of children in households. Change this one
- Use a frequency table to show the number of cars in households.
- Use a scatterplot to show the relationship between the children in a household and the total number of people in a household.
- Use a matrix to show the number of children versus the number of cars per household.
- Using a circle graph, show the total number of children and the total number of adults in all households.

Vocabulary
Stem and leaf plot allows exact values of data to be listed in a meaningful array.
Line graphs are used to show how to continuous variables are related.
Circle graphs show a relationship of the parts to a whole.
Scatterplot illustrates the relationship between two sets of data.
Bar graphs use categorical data.

Lesson
1. Organize students into pairs. Explain to the students that they will be working together to organize a set of data.
2. Brainstorm together ways that data can be organized. Make a chart or write ideas on board or overhead.
3. When all methods are thought of/discussed, give each pair an index card with a data organizer written on it. Give all pairs the same Household Survey Data Activity Sheet.
4. Pairs need to use the data organizer from their index card to organize the Household Survey data they just received onto chart paper.
5. Have pairs post their displays on the wall for others to see.
6. If time, have pairs share the similarities/differences they notice about the different ways the data is displayed.
7. Discuss why the same set of data looks different. Does the organization of the data change its meaning?

Survey of Household Members

Name	Children in Household	Total Number of People in Household	Number of TVs in Household	Number of Cars in Household
Adams	2	4	4	2
Brown	1	3	2	2
Bury	0	3	3	3
Chambers	4	6	5	3
Cleveland	1	3	2	2
Critzen	2	3	3	1
Cunningham	2	4	2	1
Davis	3	5	4	3
Dumante	1	2	2	2
Elliot	2	3	3	3
Gale	0	1	2	1
Galland	0	2	3	2
Herrig	2	4	4	2
Kerby	1	3	2	2
Kincaid	2	4	2	2
Leigh	2	3	3	1
Lowe	1	3	2	2
Mazick	2	4	3	2
Martinez	3	5	5	3
Moore	2	3	4	2
Nunez	2	5	4	3
Pranter	2	4	4	1
Richards	0	2	1	1
Riley	0	1	3	1
Roberts	1	3	3	2
Shaw	2	3	3	1
Whitten	1	2	2	1

* SOL 5.15, 6.14b, 8.13b

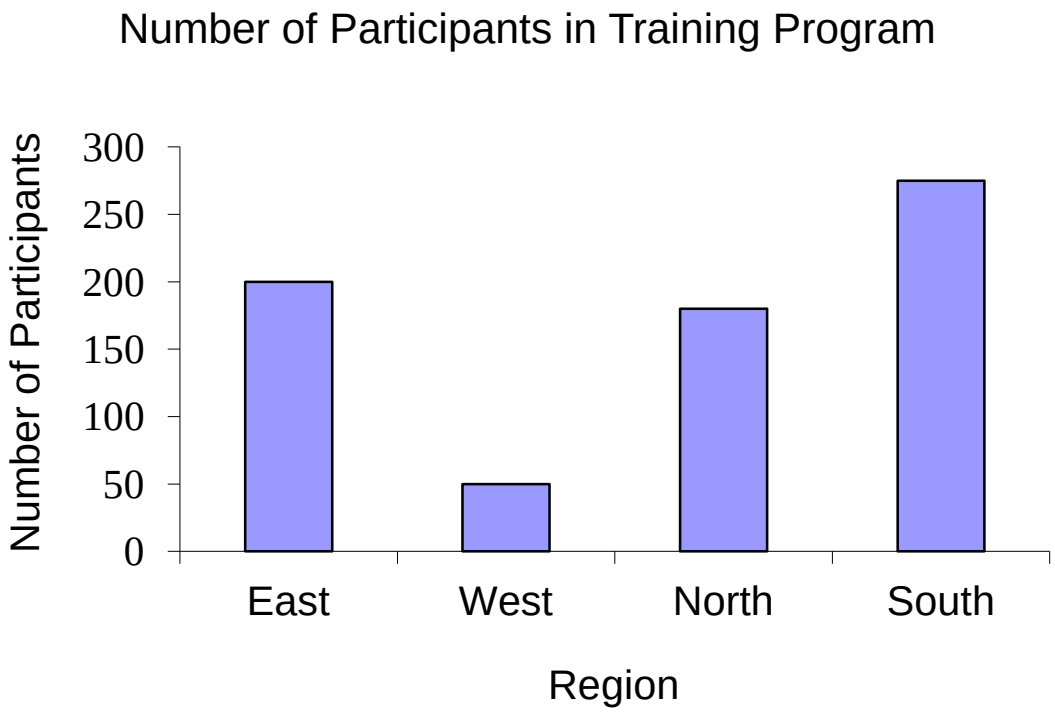
Lesson Summary
Students will develop skills in interpreting graphical representations of data. They will discuss statistics that can be developed from graphs, compare and contrast data, find unique and common features, describe trends and relationships between variables, and make predictions from the data.

Materials
Three different graphs for groups (types of graphs and level of analysis should vary depending on the grade level of the students)

Vocabulary
Stem and leaf plot allows exact values of data to be listed in a meaningful array.
Line graphs are used to show how to continuous variables are related.
Circle graphs show a relationship of the parts to a whole.
Scatterplot illustrates the relationship between two sets of data.
Bar graphs use categorical data.

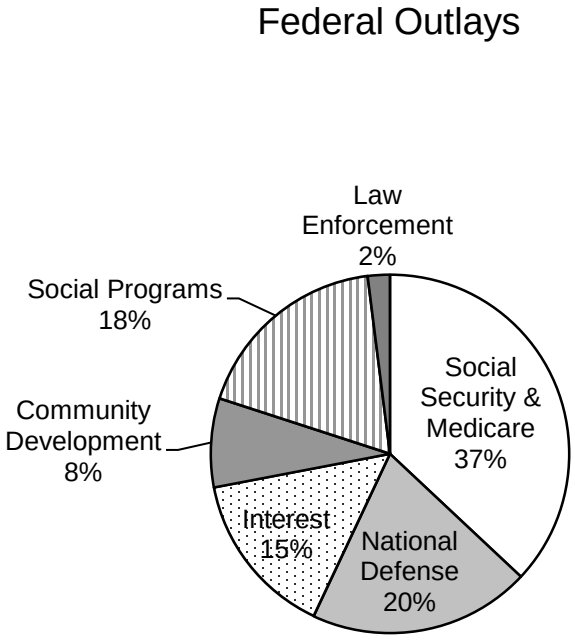
Lesson
1. Each individual student in the group is given a different graph. Students should not allow other members of their group to see their graph. Individually, the students should write a summary of the graph using key words appropriate to the type of graph illustrated. The summaries should focus on comparing and contrasting categories, describing trends, identifying outliers and clusters. The summaries should not report numbers (such as, in 1990, there were 20 people and, in 1995, there were 300 people) or non-interpretative statements about the graph.
2. After each student has written their summary, the group will play the game “Draw that Graph”. In this game, there should be two “drawers” and one “analyzer”. The analyzer will be the person whose graph is being drawn. The other two members of the group will be drawers. The analyzer reads his/her summary slowly to the group and the other two members attempt to recreate the graph. The analyzer cannot give specifics about where to draw what lines or points. Rather, he/she must rely on the written analysis. After the drawers are finished, the group can compare the graphs to the original graph and discuss what parts of the summary allowed them to graph the data and what could have been included in the summary to better explain the graph.

Graph 1:



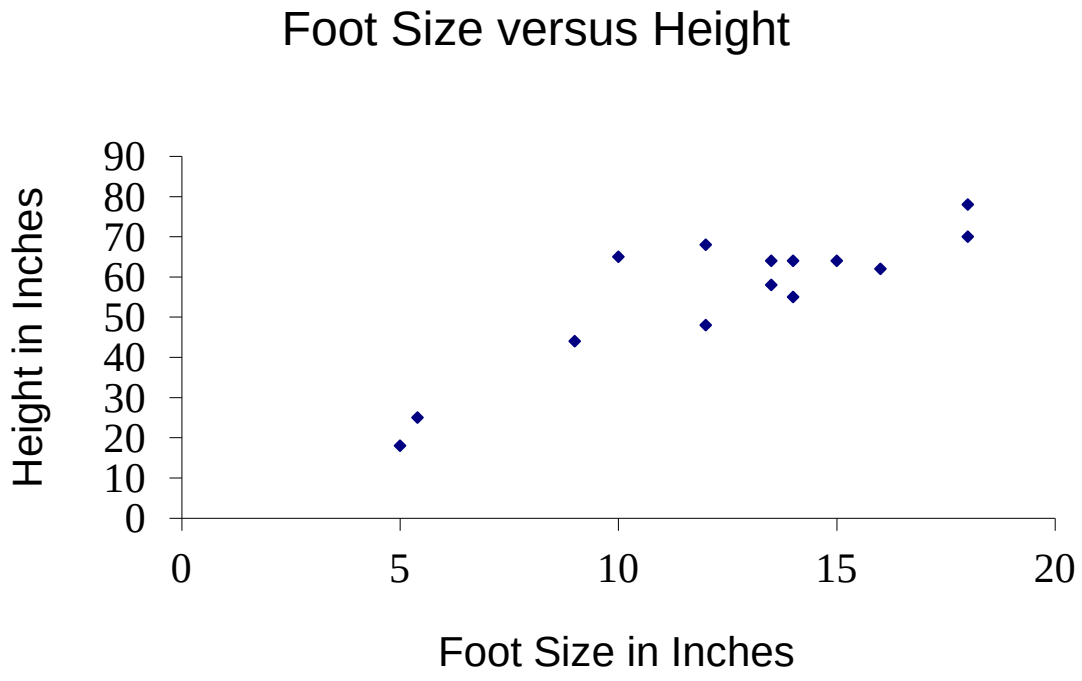
Summary:

Graph 2:



Summary:

Graph 3:



Summary:

❋ SOL 5.15, 7.11b, 8.13a

Lesson Summary
Students will develop an understanding of the relationship between the question and the analysis of the data.

Materials
Copies of Sixth Grade Mystery Data, Copies of Questions
Copies of Graphs A, B, and C

Vocabulary
Stem-and-leaf plot allows exact values of data to be listed in a meaningful array.
Line graphs are used to show how to continuous variables are related.
Circle graphs show a relationship of the parts to a whole.
Scatterplot illustrates the relationship between two sets of data.
Bar graphs use categorical data.
Line plot shows the frequency of data on a number line.
Histogram is a form of bar graph in which the categories are consecutive and equal intervals.
Frequency distribution (chart) shows how often an item, a number, or range of numbers occurs.

Lesson
1. Divide the students into small groups of four to five. Give each group a copy of the Sixth Grade Mystery Data and a copy of the questions to be answered. Tell them they have 15 minutes to answer the questions and to discuss their solutions.
2. After the small groups have completed the task, have the entire class share their solutions and how they arrived at those solutions. Focus the discussion on the relationship of the question to the data.
3. Discuss Graph A (Ice Cream Preferences). Have groups share questions about this graph that could be asked.
4. Discuss Graph B (Number of Cavities). Have groups share questions about this graph that could be asked.

Reflection

Have students review Graph C (Relationship of Height to Age). Have students generate a list of questions about this graph that could be asked.

Sixth Grade Mystery Data

Look at the graphs on the next pages. Each graph shows something about a classroom of sixth graders.

1. Which of the five graphs do you think shows:
   a) the number of cavities the sixth graders have?

   b) the number of people in the sixth graders' families?

   c) the ages of the sixth graders' mothers?

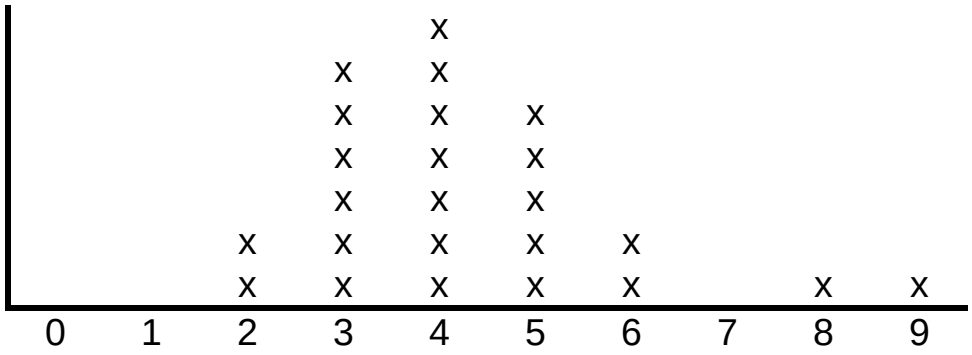
   d) the heights of the sixth graders in inches?

2. Why do you think the graph you picked for *d* is the one that shows the heights of sixth graders? Why do you think the other graphs don't show the sixth graders' heights?

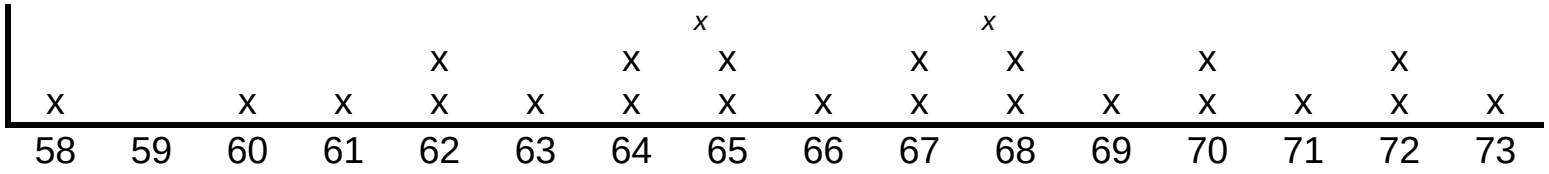
3. One of the graphs was not selected to answer question one above. What do you think this data display might represent? Why?

Sixth Grade Mystery Data

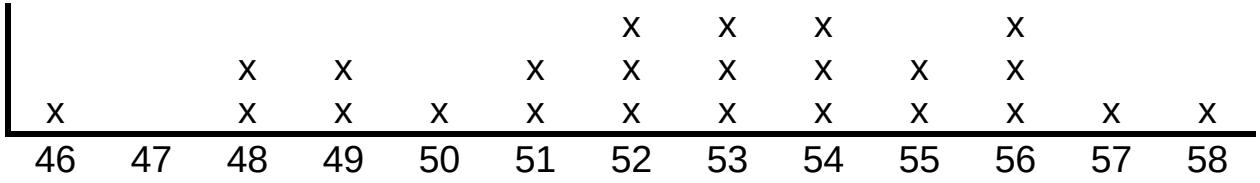
Graph 1



Graph 2

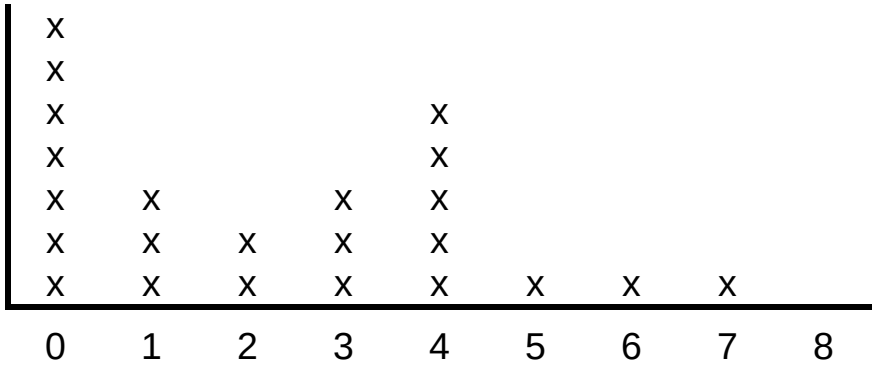


Graph 3

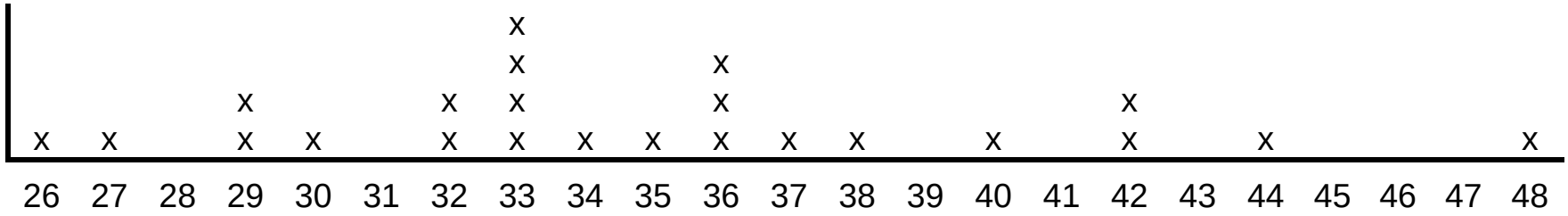


Sixth Grade Mystery Data

Graph 4



Graph 5



Graph A

Ice Cream Preferences

Vanilla 

Chocolate 

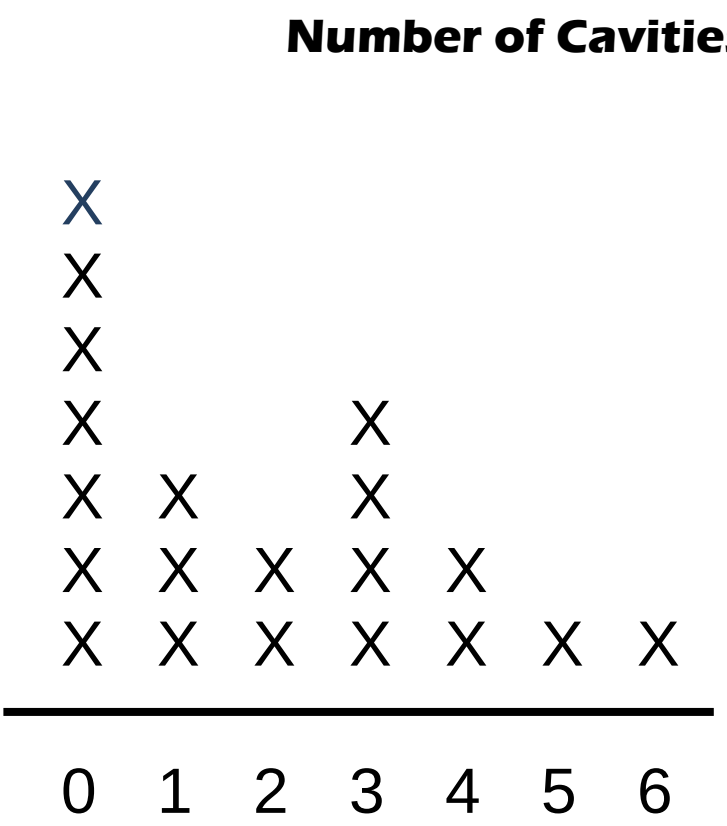
Mint Chip 

Cookies & Cream 

Other 

 = 1 student

Graph B



Graph C


Relationship of Height to Age
Height in Inches
75
70
65
60
55
50
45
40
35
30
25
20
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Age in Years

* SOL 6.14a

Objectives
Students will analyze fraction, percent, and central angle relationships in circle graphs.

Materials
Concept Activity Sheets of circle graphs (THIRDS, FOURTHS, FIFTHS, SIXTHS, and EIGHTHS), each marked or to be marked and shaded (or colored) with a fractional part, a percent, and the measure of the central angle. Concept Understanding Assessment Activity Sheet: Mystery Circle Graphs

Vocabulary
Circle graphs show a relationship of the parts to a whole.

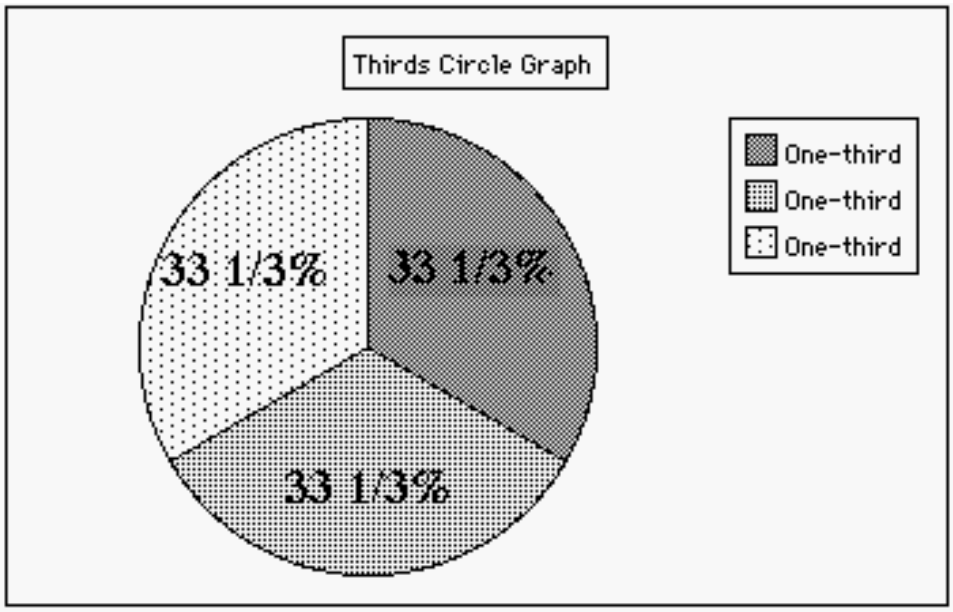
Directions
1. The students are each given an activity sheet to complete, followed by the instructor's questions related to the shading completed (THIRDS, FOURTHS, FIFTHS).

2. The students shade a part of the interiors for SIXTHS and name the measures of the central angles. The instructor's questions about equivalents follow.

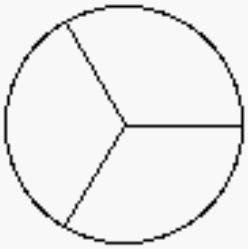
3. The students shade a part of the interiors for EIGHTHS and name the percent equivalents and measures of the central angles. The instructor's questions about equivalents follow.

4. The students use information from their THIRDS, FOURTHS, FIFTHS, SIXTHS, and EIGHTHS Activity Sheets to assist in completing the Mystery Circle Graphs activity.

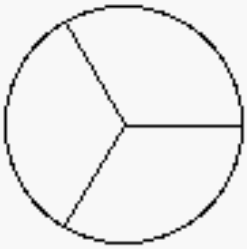
THIRDS



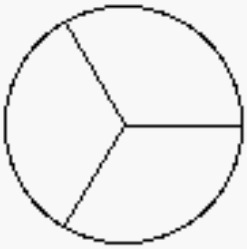
Shade 1/3 of the circle.



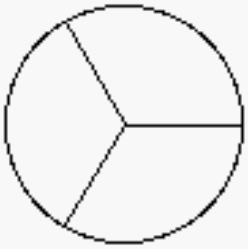
Shade 33 1/3% of the circle.



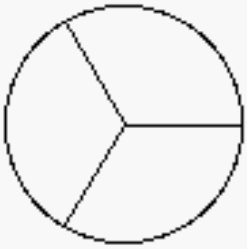
Shade a 120° angle.



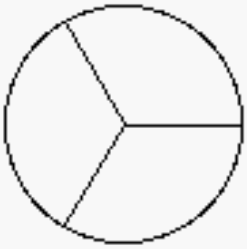
Shade 2/3 of the circle.



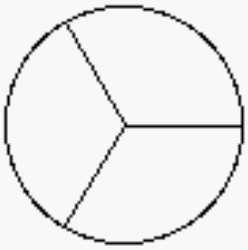
Shade 66 2/3% of the circle.



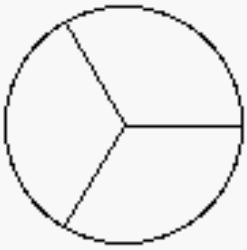
Shade a 240° angle.



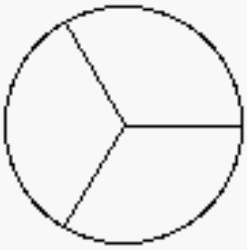
Shade 3/3 of the circle.



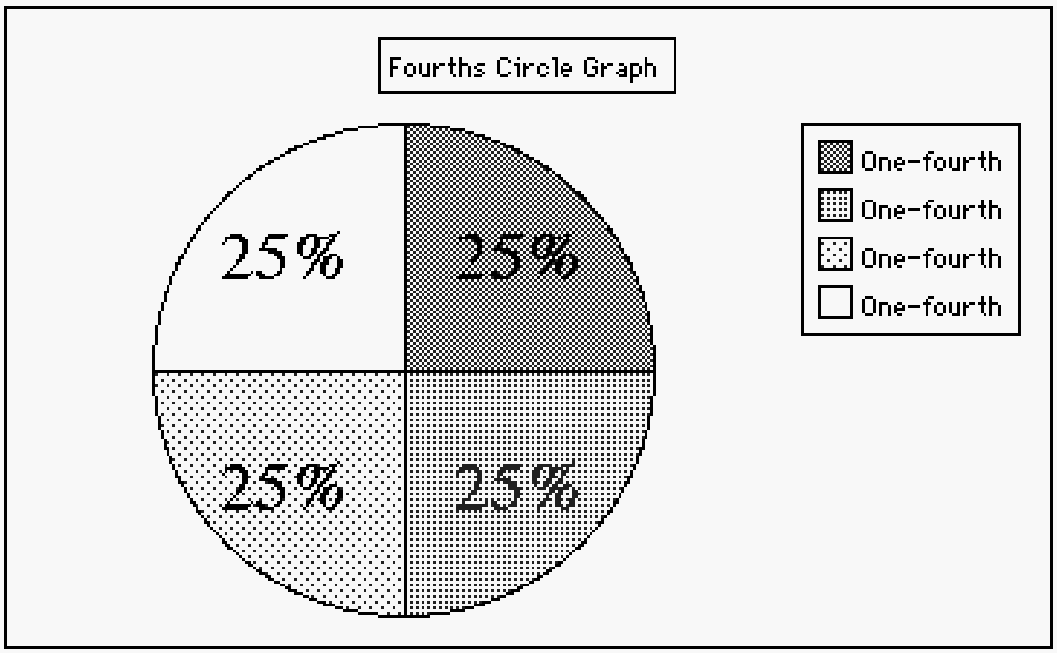
Shade 100% of the circle.



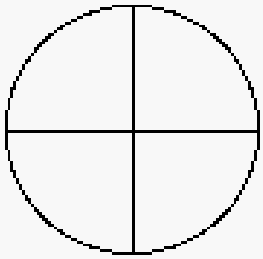
Shade a 360° angle.



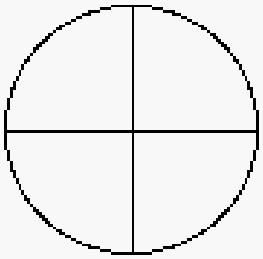
FOURTHS



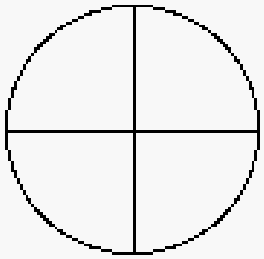
Shade 1/4 of the circle.



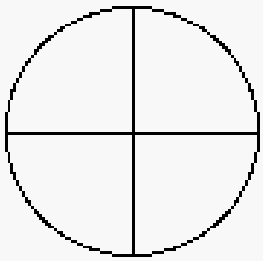
Shade 25% of the circle.



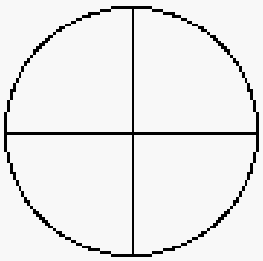
Shade a 90° angle.



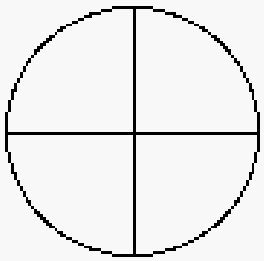
Shade 2/4 of the circle.



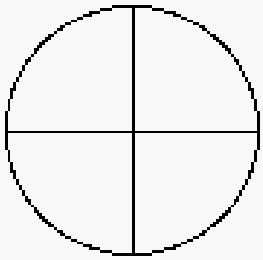
Shade 50% of the circle.



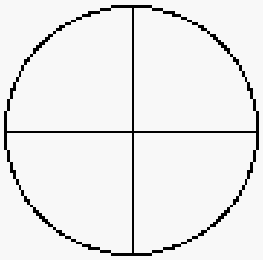
Shade a 180° angle.



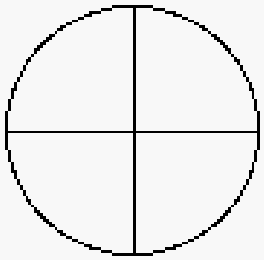
Shade 3/4 of the circle.



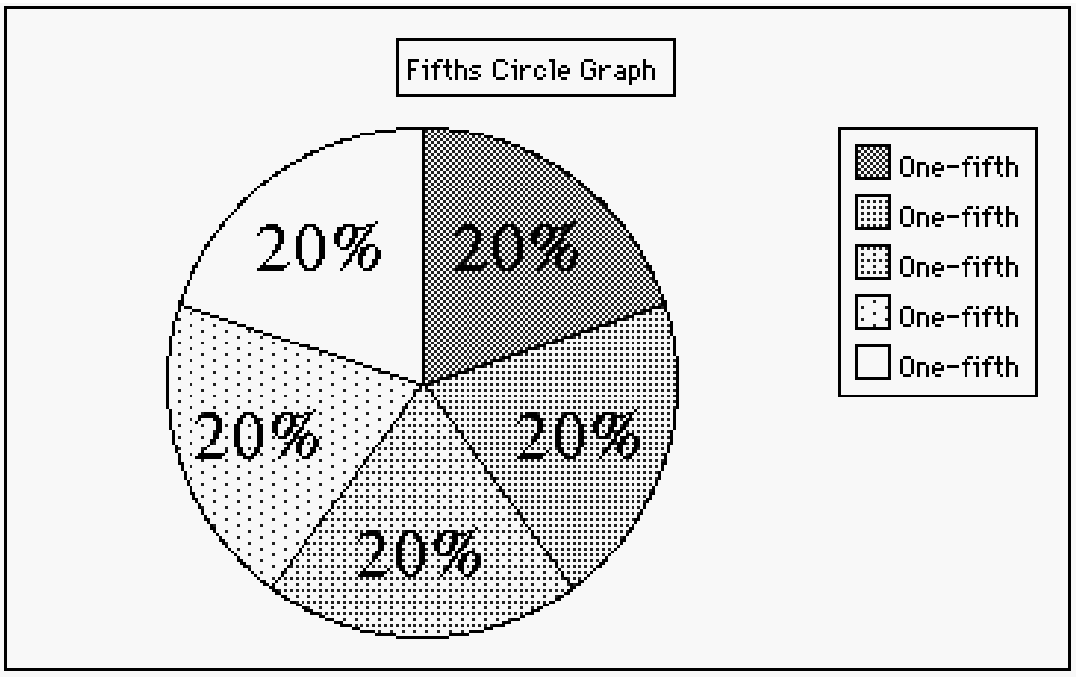
Shade 75% of the circle.



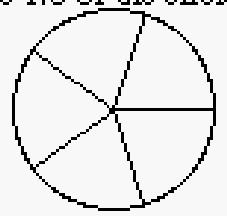
Shade a 270° angle.



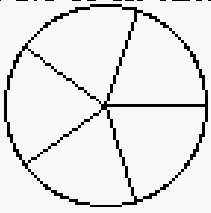
FIFTHS



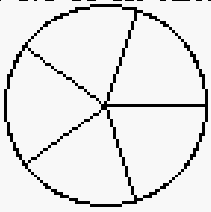
Shade 1/5 of the circle.



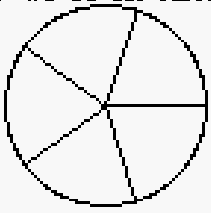
Shade 2/5 of the circle.



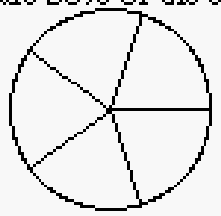
Shade 3/5 of the circle.



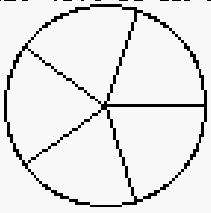
Shade 4/5 of the circle.



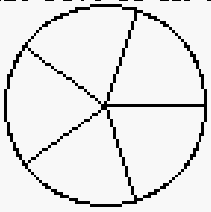
Shade 20% of the circle.



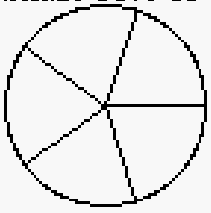
Shade 40% of the circle.



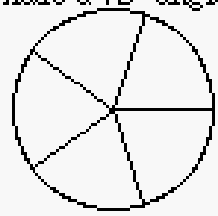
Shade 60% of the circle.



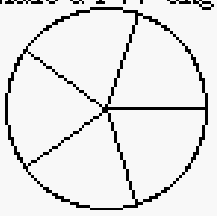
Shade 80% of the circle.



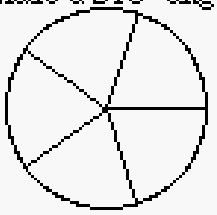
Shade a 72° angle.



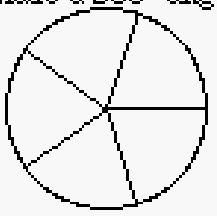
Shade a 144° angle.



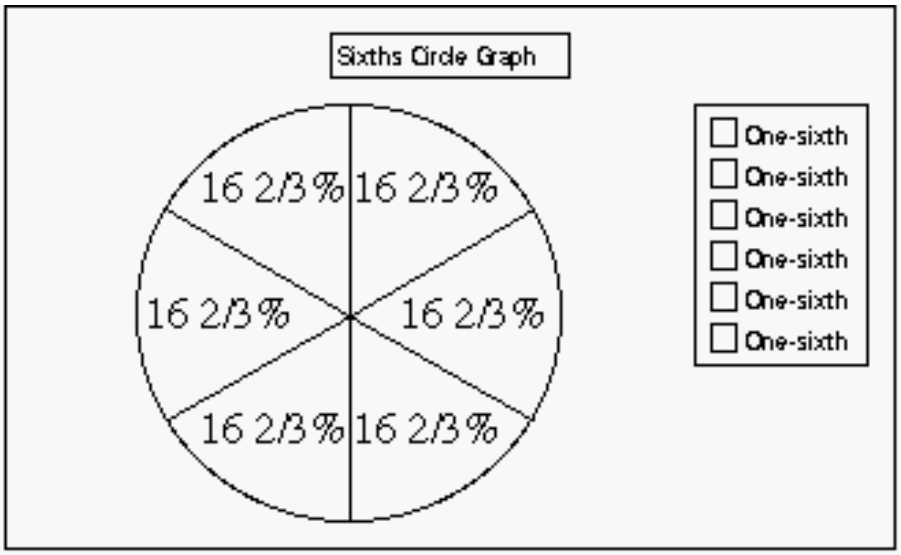
Shade a 216° angle.



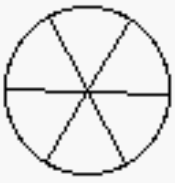
Shade a 288° angle.



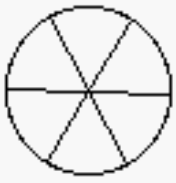
SIXTHS



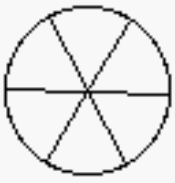
Shade 1/6 of the circle.



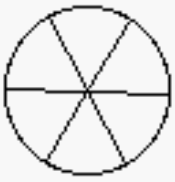
Shade 16 2/3%.



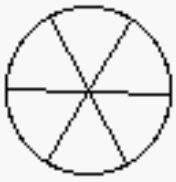
Shade a ___° angle.



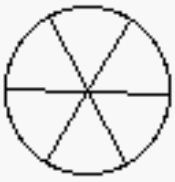
Shade 2/6 of the circle.



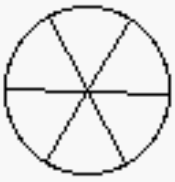
Shade 33 1/3%.



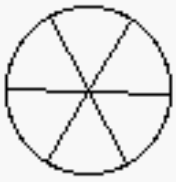
Shade a ___° angle.



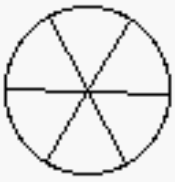
Shade 3/6 of the circle.



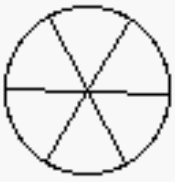
Shade 50%.



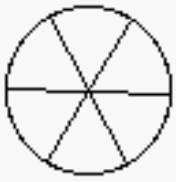
Shade a ___° angle.



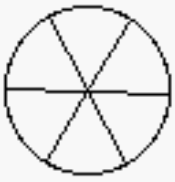
Shade 4/6 of the circle.



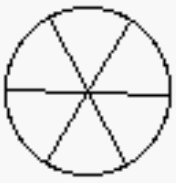
Shade 66 2/3%.



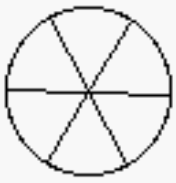
Shade a ___° angle.



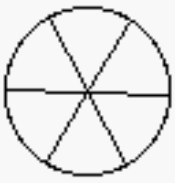
Shade 5/6 of the circle.



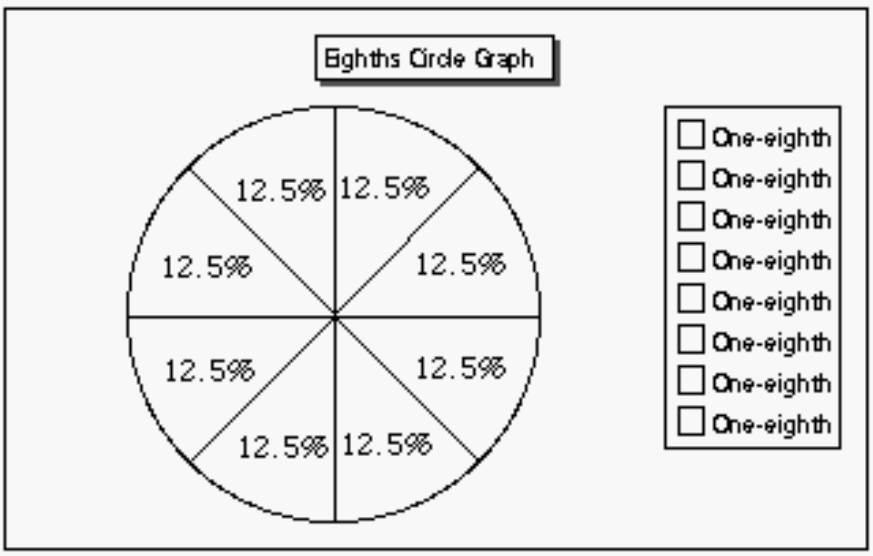
Shade 83 1/3%.



Shade a ___° angle.



EIGHTHS



Shade 1/8 of the circle.

Shade 2/8 of the circle.

Shade 3/8 of the circle.

Shade 4/8 of the circle.

Shade 5/8 of the circle.

Shade 6/8 of the circle.

Shade 7/8 of the circle.

Shade _____%.

Shade _____% .

Shade _____% .

Shade _____% .

Shade _____% .

Shade _____% .

Shade _____% .

Shade a ___° angle.

Shade a ___° angle.

Shade a ___° angle.

Shade a ___° angle.

Shade a ___° angle.

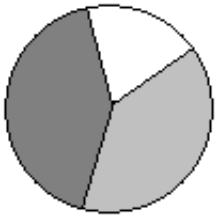
Shade a ___° angle.

Shade a ___° angle.

Mystery Circle Graphs

For each sector in the circle graph, find the fractional part represented, the percent of the whole circle, and the measure of the central angle.

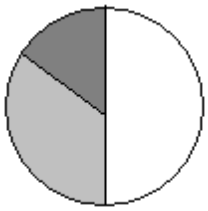
Mystery Circle Graph 1



You decide.
You decide.
You decide.

Fraction			
Percent			
Central Angle			

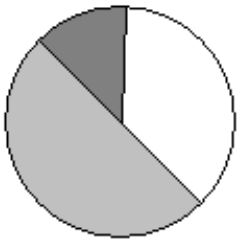
Mystery Circle Graph 2



You decide.
You decide.
You decide.

Fraction			
Percent			
Central Angle			

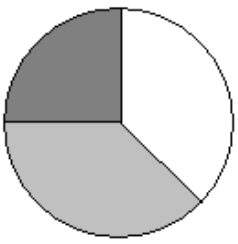
Mystery Circle Graph 3



You decide.
You decide.
You decide.

Fraction			
Percent			
Central Angle			

Mystery Circle Graph 4



You decide.
You decide.
You decide.

Fraction			
Percent			
Central Angle			

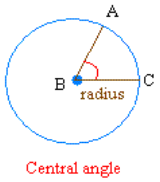
* SOL 6.14a

Lesson Summary
Students will analyze data by displaying it in circle graphs.

Materials
Compasses, rulers, protractors, construction of a circle graph activity sheet (Favorite Amusement Park Rides), circle graph construction assessment activity sheet (Favorite Chocolate Treat)

Vocabulary
Circle graphs show a relationship of the parts to a whole.
Central angle is an angle whose vertex is the center of the circle.

Lesson
1. The instructor describes the attributes of a circle graph and demonstrates how the sectors are determined.
   a. A circle graph is a graph of data in which parts of a whole are represented as sectors of a circle.
   b. Each sector, or pie-shaped wedge, usually contains the actual number or percent of the whole and a label of what the part represents. Some circle graphs use a legend to label the sectors of the graph.
   c. A central angle is bound by two radii and an arc of the circle. An arc is part of a circle connecting two points on the circle.
   d. When computing the number of degrees in the angle, use the following ratio or formula to find the number of degrees in the central angle to be drawn.



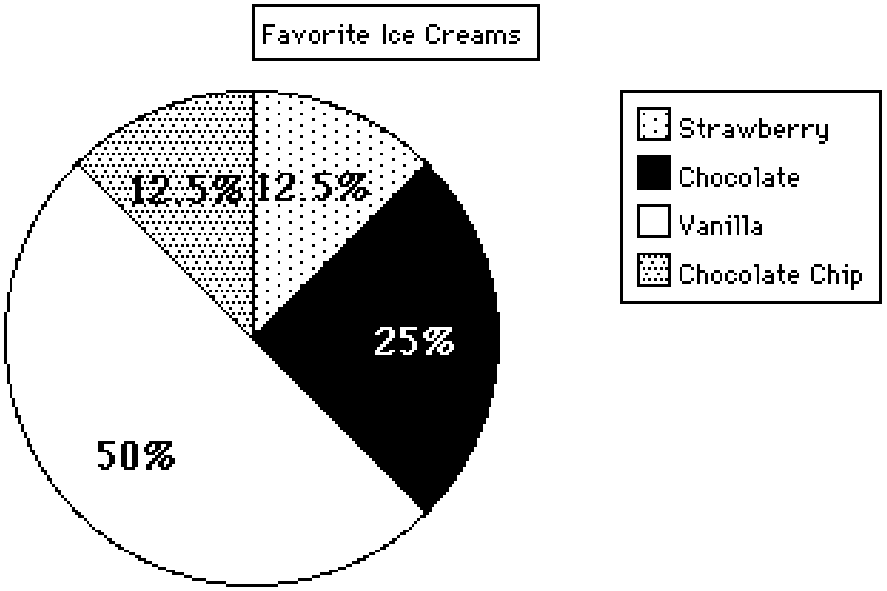
$$\frac{\text{Central angle}}{360}$$

   A central angle to represent – could be found by solving – = —— or finding 2/3 of 360 degrees. Therefore, the central angle x would have 240 degrees. Using a protractor may draw the central angle in the circle.
   e. The graph has a descriptive title.
   f. The instructor's explanation includes all the attributes described.
2. The instructor provides a set of data (Favorite Amusement Park Rides Activity Sheet) for the students to generate a circle graph. Students work in pairs to construct the graph, share their results with another pair of students, and assess whether or not they have included all the attributes of a well-constructed circle graph.
3. The instructor provides a set of data (Favorite Chocolate Treat Activity Sheet) for each student to generate a circle graph. Students work individually to construct the graph and self-assess whether or not they have included all the attributes of a well-constructed circle graph.

FAVORITE ICE CREAM

Flavor	# of Students	Fraction	Central Angle
Strawberry	3	3/24 or 1/8	45°
Chocolate	6	6/24 or 1/4	90°
Vanilla	12	12/24 or 1/2	180°
Chocolate Chip	3	3/24 or 1/8	45°
Total	24	24/24	360°

Students	Fraction	Central Angle

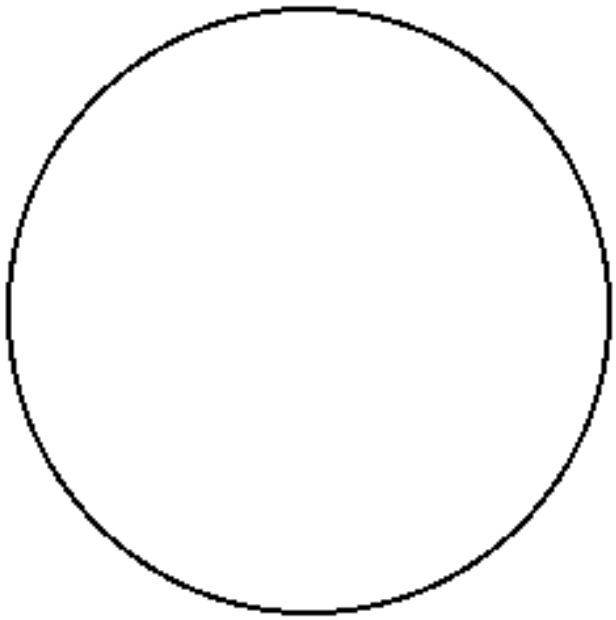


Favorite Amusement Park Rides

Use the information in the chart to make a circle graph of the favorite amusement park rides of the students surveyed.

Favorite Ride	Number of Students	Fraction	Central Angle
Sea Monster	16		
Twizzler	12		
Super Spin	8		
Water Log	6		
Wall Climber	6		
Total			
	Students	Fraction	Central Angle

Circle Graph



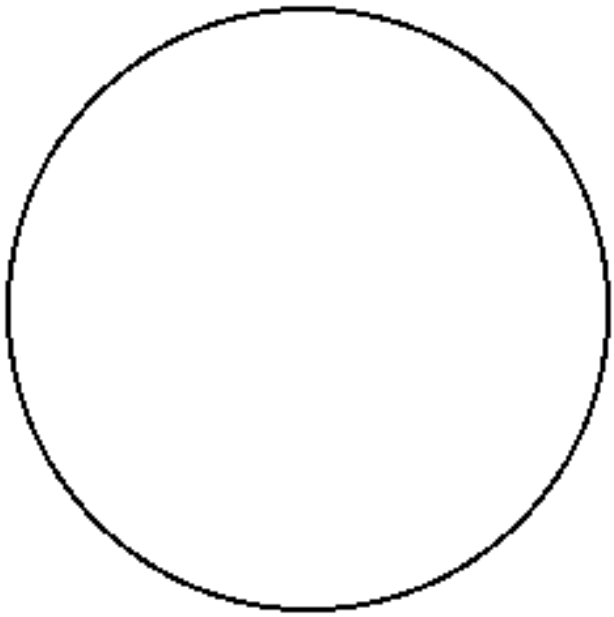
Explain what the graph tells you about the students' preferences for amusement park rides.

Favorite Chocolate Treat

Use the information in the chart to make a circle graph of the favorite chocolate treat of the students surveyed.

Favorite Chocolate Treat	Number of Students	Fraction	Central Angle
Chocolate Cake	6		
Chocolate Ice Cream	12		
Chocolate Chip Cookie	20		
Chocolate Candy	16		
Chocolate Milk	6		
Total	Students	Fraction	Central Angle

Circle Graph



Explain what the graph tells you about the students' preferences for chocolate treats.

* SOL 7.11a

Lesson Summary

Students will analyze data by sorting, classifying, and displaying it in frequency distributions and histograms.

Materials

One bag of counters, rulers, data collection activity sheet (Hand Full), First Histograms Activity Sheet, Refined Histograms Activity Sheet, Attributes of Frequency Distributions and Histograms Information Sheet

Vocabulary

Histogram is a form of bar graph in which the categories are consecutive and equal intervals.
Frequency distribution (chart) shows how often an item, a number, or range of numbers occurs.

Lesson

1. The instructor explains the procedure that initiates the lesson.

    a. Each student will make an estimate of how many counters he/she can grasp in one hand from the bag of counters. Each student will declare his/her estimate and all students will write the number estimated in the Estimate column on their Hand Full Activity Sheets.

    b. Each student, in turn, will grasp as many counters as he/she can from the bag of counters, count the number of counters, and return the counters to the bag. The student will declare orally the number of counters grasped. All students will write down the number grasped in the Actual column on the Hand Full Activity Sheets.

2. Using the data in the Estimate column, students count the number of pieces of data that belong to each interval in the frequency distribution for the estimates and record it in the Frequency column in the frequency distribution of the estimates.

3. Using the data in the Actual column, students count the number of pieces of data that belong to each interval in the frequency distribution for the actual number grasped and record it in the Frequency column in the frequency distribution of the actuals.

4. The instructor explains to the students to construct bars on the First Histograms Activity Sheet. (Note: Graphs are not likely to accurately reflect all of the attributes of histograms that the instructor will next describe.)

5. The instructor explains the process that the students experienced in making their first histograms from collecting data to putting the data in intervals to drawing a histogram. The instructor then defines and describes frequency distributions and histograms in terms of the way a statistician thinks.

    a. A frequency distribution is a chart that shows the number of times that a particular measure or observation occurs.

    b. The chart contains two columns. The first column lists all the measures (from highest to lowest) or observations. The second column gives the frequency, or number of times, that the measure or observation occurred.

    c. Usually, the first step in making a frequency distribution is to list the possible measures or observations (first column) and then go through the data and make tally marks (second column) every time a measure or observation occurs. Then, the number of tally marks for

each measure or observation is counted to find the frequency. Measures in a frequency distribution are usually grouped into intervals if the difference between the highest and lowest measures is 20 or greater.

d. To decide the size of an interval, the range (the difference between the highest and lowest measures) is divided by the desired number of intervals. If the quotient does not come out even, statisticians usually round it to the nearest odd number.

e. A histogram is a special type of bar graph in which the categories are equal ranges (intervals) of numbers and there are no spaces between the bars. The height of each bar is the numerical count of numbers in the range (interval).

f. The center of the horizontal axis is usually the midpoint of the intervals. It is customary to start with the lowest value on the left and proceed to the right with as many intervals as are necessary to include all the data. The horizontal axis does NOT need to begin at zero. An empty interval should be left at the lower and upper ends of the axis.

g. The vertical axis is the frequency of numbers in an interval. The vertical axis is marked off beginning with zero at the bottom and proceeding to the highest frequency. When statisticians graph frequency distributions, they use the "three-quarter-high rule" which means that the height of the highest bar is approximately three-fourths of the length of the horizontal axis. This rule prevents personal bias from influencing the height of the vertical axis. The vertical axis should be labeled "frequency" and the horizontal axis should be labeled to describe what is being measured.

h. The graph should have a descriptive title.

i. The instructor's explanation should have all the attributes described.

6. Following the instructor's explanation, the students are given a blank Refined Histogram Activity Sheet and a written copy of the instructor's description of a frequency distribution and histogram, Attributes of Frequency Distributions and Histograms.

7. The students work in pairs to construct a refined histogram using the frequency distribution of their estimates of the number of chocolate bars they could grasp.

8. When the pairs of students have completed their histograms, they share them with other students and assess whether or not they have included all the attributes of a well-constructed histogram.

9. The students work individually to construct a refined histogram using the frequency distribution of the actual number of chocolate bars they grasped.

10. When the students have completed their histograms, they share them with other students and assess whether or not they have included all the attributes of a well-constructed histogram.

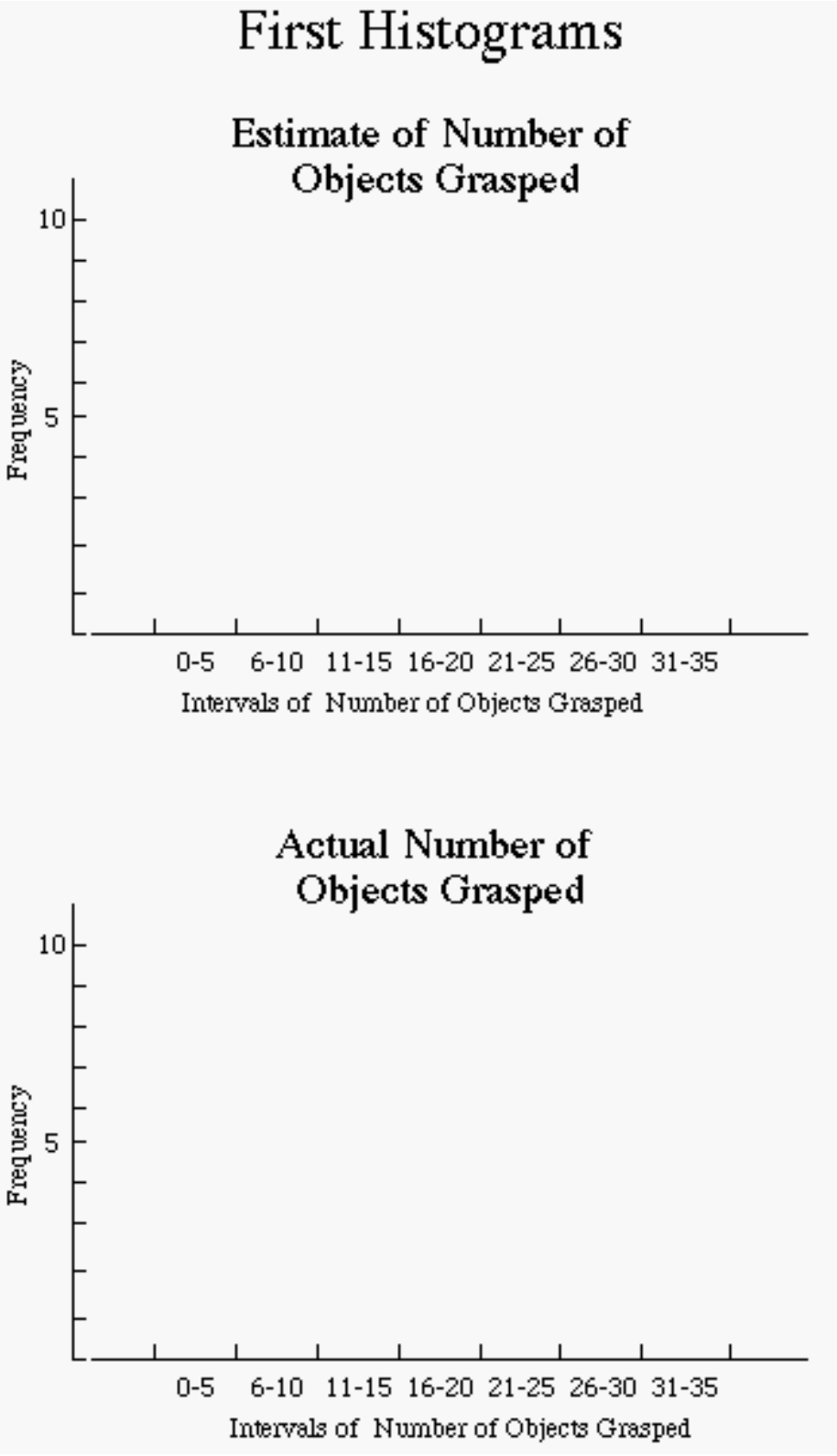
Hand Full

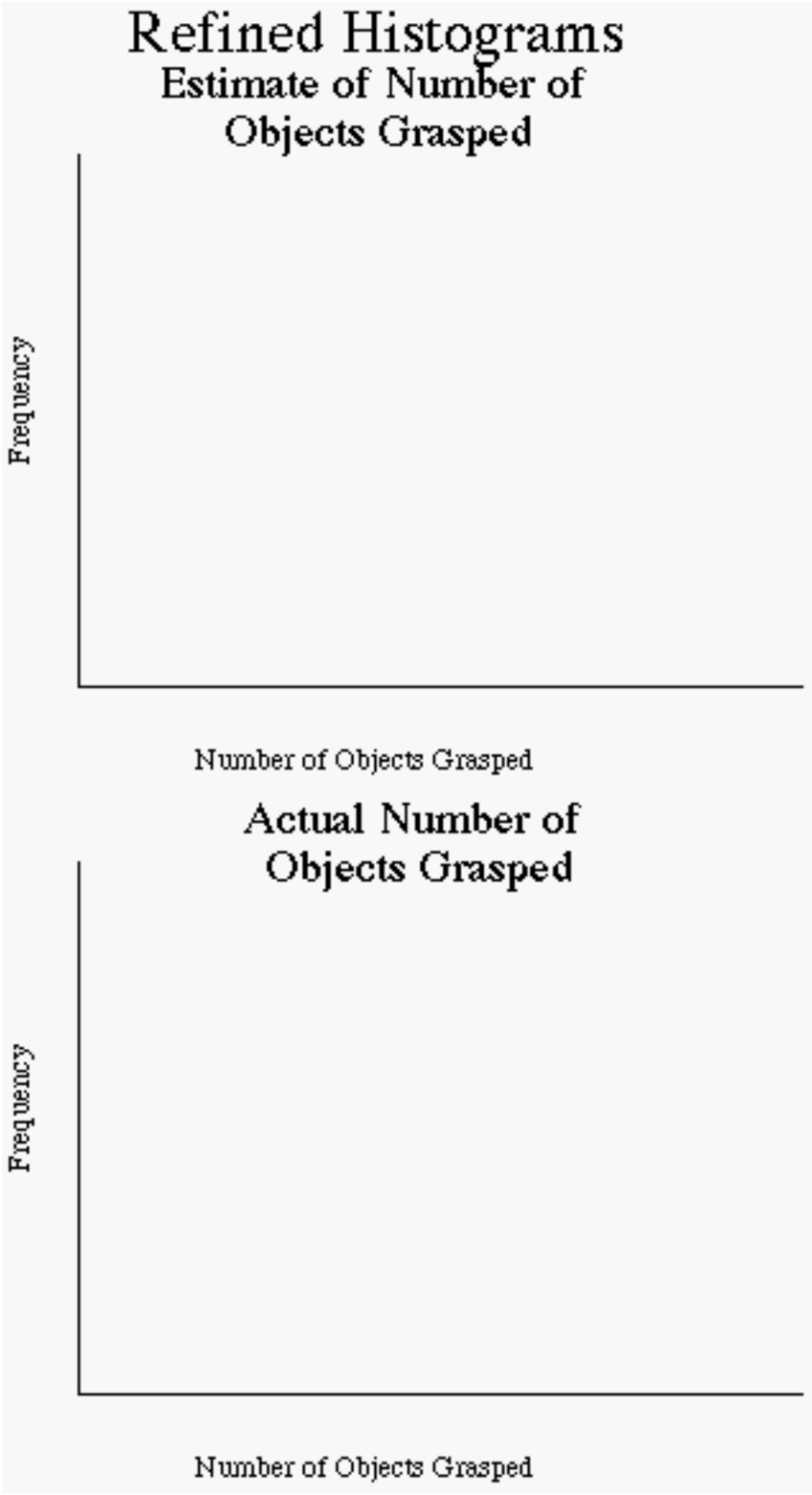
Number of Objects Grasped

Student	Estimate	Actual

Frequency Distribution Estimate	
Interval	Frequency
0-5	
6-10	
11-15	
16-20	
21-25	
26-30	
31-35	

Frequency Distribution Actual	
Interval	Frequency
0-5	
6-10	
11-15	
16-20	
21-25	
26-30	
31-35	


First Histograms
Estimate of Number of Objects Grasped
10
5
Frequency
0-5
6-10
11-15
16-20
21-25
26-30
31-35
Intervals of Number of Objects Grasped
Actual Number of Objects Grasped
10
5
Frequency
0-5
6-10
11-15
16-20
21-25
26-30
31-35
Intervals of Number of Objects Grasped


Refined Histograms
Estimate of Number of Objects Grasped
Frequency
Number of Objects Grasped
Actual Number of Objects Grasped
Frequency
Number of Objects Grasped

Attributes of Frequency Distributions and Histograms

1. A **frequency distribution** is a chart that shows the number of times that a particular measure or observation occurs.

    - The chart contains two columns. The first column lists all the measures (from highest to lowest) or observations. The second column gives the frequency, or number of times, that the measure or observation occurred.

    - Usually the first step in making a frequency distribution is to list the possible measures or observations (first column) and then go through the data and make tally marks (second column) every time a measure or observation occurs. Then the number of tally marks for each measure or observation is counted to find the frequency. Measures in a frequency distribution are usually grouped into intervals if the difference between the highest and lowest measures is 20 or greater.

    - To decide the size of an interval, the range (the difference between the highest and lowest measures) is divided by the desired number of intervals. If the quotient does not come out even, statisticians usually round it to the nearest odd number.

2. A **histogram** is a special type of bar graph in which the categories are equal ranges (intervals) of numbers and there are no spaces between the bars. The height of each bar is the numerical count of numbers in the range or interval.

    - The center of the horizontal axis is usually the midpoint of the intervals. It is customary to start with the lowest value on the left and proceed to the right with as many intervals as are necessary to include all the data. The horizontal axis does NOT need to begin at zero. An empty interval should be left at the lower and upper ends of the axis.

    - The vertical axis is the frequency of numbers in an interval. The vertical axis is marked off beginning with zero at the bottom and proceeding to the highest frequency. When statisticians graph frequency distributions, they use the “three-quarter-high rule” which means that the height of the highest bar is approximately three-fourths of the length of the horizontal axis. This rule prevents personal bias from influencing the height of the vertical axis. The vertical axis should be labeled “frequency” and the horizontal axis should be labe led to describe what is being measured.

    - The graph should have a descriptive title.

* SOL 8.13a

Lesson Summary
Students will apply the skills they learned from the previous activities to analyze graphs for missing attributes.

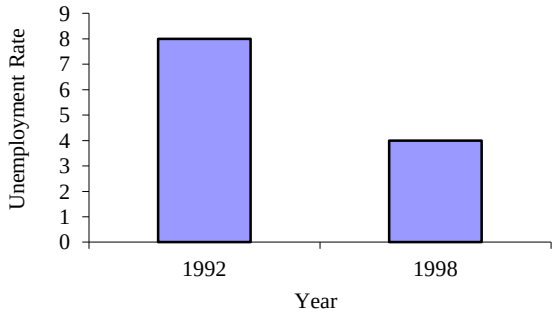
Materials
Set of graphs with missing information

Lesson
Give each group a set of three graphs and conclusions and ask them to discuss whether the conclusion is accurate and what factors about the graph may have lead to inaccurate conclusions. Key factors in the misleading graphs include the following:

- Graph 1: Missing years – A trend cannot be seen by examining only two years. *USA Today* uses a lot of these graphs to compare two years. This graph compares unemployment in 1992 and 1998. Although 1998 may be lower than 1992, we should not assume that 1999 will be lower than 1998 or that the trend between 1992 and 1998 was downward. We need to see the other years to determine if there is a trend over time or if 1998 is a fluctuation.
- Graph 2: Broken scales – Often graphs imply larger differences than are true because the scale is broken. In this graph, because the scale is broken, it appears that there were twice as many births in July than there were in June.
- Graph 3: Size Distortions – Picture graphs using objects to demonstrate change can be misleading because the size of the objects may not truly represent the relative numerical value. This graph shows the relative earnings of men and women. Women earn approximately 70¢ for every dollar that men earn; yet, the graph implies that men earn nearly three times as much as women because of the relative size of the three-dimensional bars.

Would You Draw the Same Conclusion?

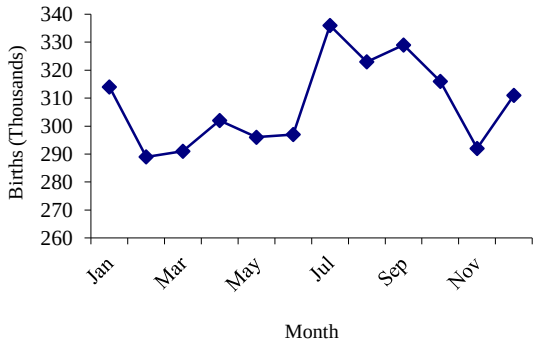
Unemployment Rates (1992 - 1998)



Conclusion: Unemployment rates have fallen steadily since 1992 and will continue to fall in the near future.

Group's Conclusion:

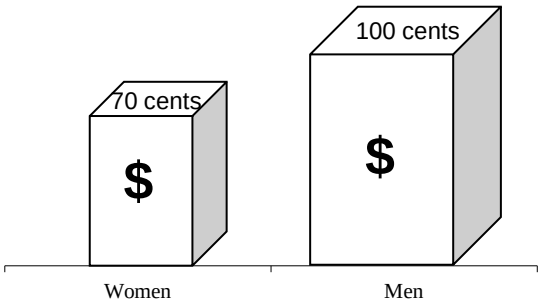
Number of Births per Month



Conclusion: The number of births doubled between June and July.

Group's Conclusion:

Earning Power of Men versus Women



Conclusion: Men make almost three times as much as women. The bar for men has nearly three times as much volume.

Group's Conclusion

* SOL 8.13a

Lesson Summary
Students will develop skills in interpreting graphical representations of data. They will discuss statistics that can be developed from graphs, compare and contrast data, find unique and common features, describe trends and relationships between variables, and make predictions from the data.

Materials
Graph, data, and written summary cards for matching, example graphs for discussion, and graphs for students to analyze (types of graphs and level of analysis should vary depending on the grade level of the students), Graph 1 and Graph 2 Activity Sheets

Background:
Once students have learned how to display data in graphs, it is very important that they are able to summarize what they see in the graph. This interpretation should include drawing conclusions, comparing and contrasting, predicting, and examining relationships. Of course, the type of analysis that can be done depends on the data and the graph. Some examples used in these activities include the following:

A **bar graph** enables the researcher to compare how many subjects fall into specific categories. For example, a bar graph could show how many adults earned less than a high school education, earned a high school education, completed some college, and earned a college education. By examining the graph, determine how well the population is educated, comparing the number of people in each of the four groups.

A **scatterplot** enables the researcher to determine trends, make predictions, or see if there is a relationship between two variables. For example, a scatterplot could show the trend in median income of college graduates overtime. From this graph, use what happened historically to predict what might happen to income in the future.

A **line plot** enables the researcher to examine the distribution of a single variable. A line plot could illustrate the number of fat grams in food purchased from a fast food restaurant. It shows how many foods had very few grams of fat versus many grams of fat. Draw a conclusion regarding how healthy the food is at such a restaurant.

Lesson
1. Start with a graph from the newspaper or the example graphs provided. Show the graph to the students and ask the students to describe what information and interpretation can be taken from the graph.
2. Lead this discussion with probing questions such as those given in the examples below.

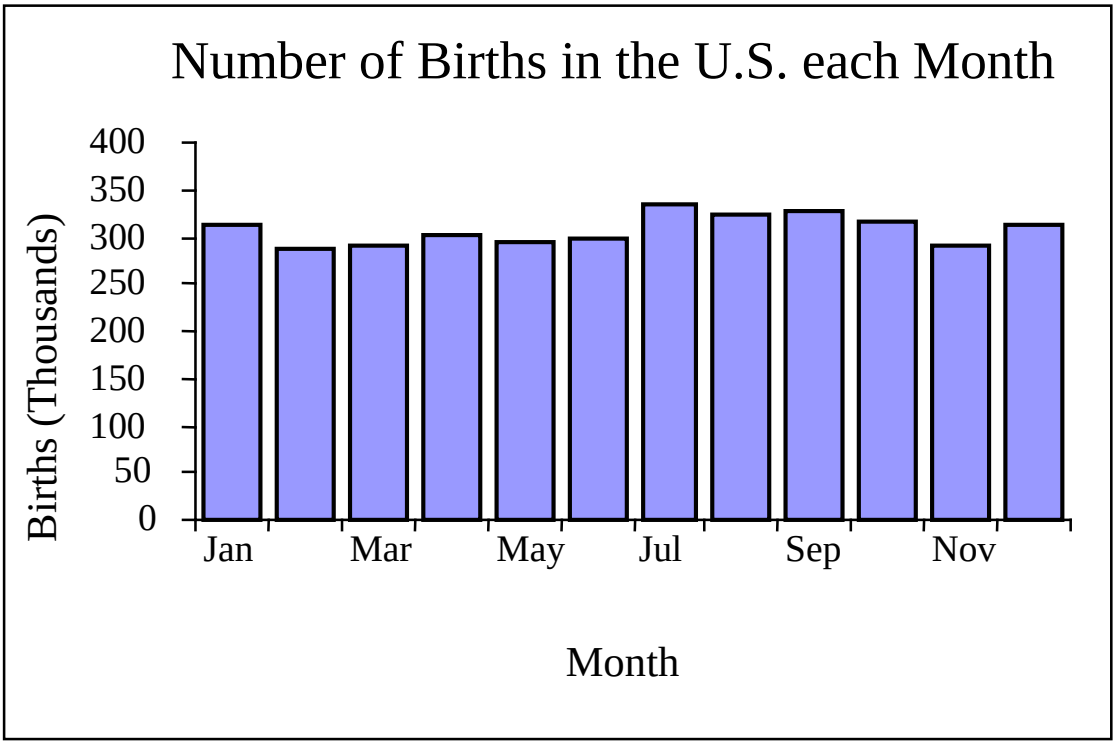
   Two Example Graphs and Leading Questions

Bar Graph of Births for each Month
- Which months had the most number of births?
- Did one part of the year tend to have more births than another part of the year?
- How does the number of births in November compare to the number of births in July?
- Is there a trend during the year?

Line Plot of the Number of Days of Thunderstorms

- What was the most number of days of thunderstorms? the least number of days?
- Would you consider either of these points an outlier?
- What would you estimate to be the average number of thunderstorms for these cities?
- Is the data skewed left or right? What does this fact tell us about the distribution of thunderstorms in each city?

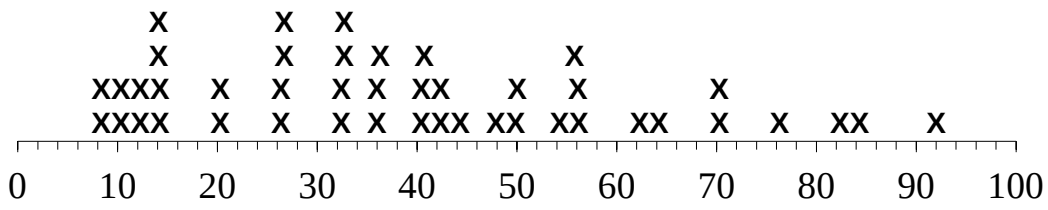
Example Graph 1



- Which months had the most number of births?
- Did one part of the year tend to have more births than another part of the year?
- How does the number of births in November compare to the number of births in July?
- Is there a trend during the year?

Example Graph 2

Number of Days per Year of Thunderstorms for Various Cities



Number of Thunderstorms

- What was the most number of days of thunderstorms? the least number of days?
- Would you consider either of these points an outlier?
- What would you estimate to be the average number of thunderstorms for these cities?
- Is the data skewed left or right? What does this fact tell us about the distribution of thunderstorms in each city?

* SOL 8.13b

Lesson Summary
Students will use scatterplots to analyze relationships in data.

Materials
Graph paper, measuring tape, recording sheet, graphing calculator (optional)

Vocabulary
Scatterplot illustrates the relationship between two sets of data using points. The coordinates of the point represent the measures of the two attributes of the point.

Background:
A **scatterplot**, which is also called a scattergram, suggests whether or not two sets of data are related. The data are graphed as a collection of ordered pairs of numbers (x, y). Whenever you graph two sets of data as ordered pairs, you make a scatterplot.

To determine if the data in a scatterplot are related, pretend that a line is drawn so that about half the points in the scatterplot are above the line and about half are below. Scatterplots can be used to predict trends and estimate a line of best fit.

If the y-coordinates tend to increase as the x-coordinates increase, then x and y have a positive correlation. If the y-coordinates tend to decrease as the x-coordinates increase, then x and y have a negative correlation. If no pattern exists between the coordinates, then x and y have no correlation. In general, if the line between the points slants up and to the right, there is a positive relationship. If the line slants downward and to the right, there is a negative relationship. If no line is apparent, there is no relationship.

Lesson
1. Pose the question: Do you think there is a relationship between a person's arm span and a person's height?
2. Each group should use a measuring tape to measure the height and arm span of each person in the group. Measurements may be in inches or centimeters. To measure arm span, lift both arms to shoulder height and measure from fingertip to fingertip across the back.
3. Record the value of each person's measurements in the chart on the worksheet.
4. Send a "runner" to each of the other groups in the room and record their data on the worksheet.
5. Graph the data on a coordinate plane. Label the horizontal axis "Height" and the vertical axis "Arm Span".
6. Draw a trend line. What kind of relationship does the trend line show? (As an extension, a graphing calculator could be used to determine the line of best fit for the data.)

RECORDING SHEET

NAME	HEIGHT	ARM SPAN

Additional Ideas for Determining Positive, Negative, or No Correlations

- height and shoe size*
- salary and shoe size
- year and winning time at the Olympics
- student study time and test scores*
- age and value of a family car
- student's height and test scores
- height and age of a pine tree
- number of pets owned and your age
- number of hours of TV watching and test score
- number of trees in a small park and the temperature on a summer day
- weight and speed in a foot race
- test scores and shoe size*
- amount of education and annual salary*
- washing the car and rain fall
- outdoor temperature and layers of clothing
- eating nutritious food and being healthy
- speed of typing and the number of pages to be typed
- area of a soccer field and height of the grass
- age and height*
- age and value of antiques
- school attendance and grades*
- watching the news and scores on a current events quiz
- practicing basketball and the ability to play well
- taking a school bus and completing homework
- wrist and shoe size*

*These topics might prove very interesting when the data are collected and graphed in a scattergram.