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Welcome!

As you come in, please take colored dots and mark where you belong on each of the charts around the room:

Number of Children

Country of Birth

Age

Gender

Color of Eyes

Years in the United States

Below are some examples of statistics:

- More than 50% of all marriages end in divorce.
- Office vacancy rate climbs to 19%.
- Asthma afflicts 12% in the United States.
- The government spends about \$300 billion a year on defense.
- The government spends about \$470 billion a year on education.*

* “Total spending at all levels of government for K-12 education is more than \$470 billion this school year (2002-2003)”. *Fact Sheet: President Bush’s FY 2004 Education Budget: Spending More, and Spending It More Wisely*. <http://edworkforce.house.gov/issues/108th/education/funding/budgetfactsheet020403.htm>

NCTM Standards and Expectations

DATA ANALYSIS STANDARDS GRADES PRE-K-2

NCTM STANDARDS	PRE-K-2 NCTM EXPECTATIONS
Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them	<ul style="list-style-type: none"> • Pose questions and gather data about themselves and their surroundings • Sort and classify objects according to their attributes and organize data about the objects • Represent data using concrete objects, pictures, and graphs
Select and use appropriate statistical methods to analyze data	<ul style="list-style-type: none"> • Describe parts of the data and the data set as a whole to determine what the data show
Develop and evaluate inferences and predictions that are based on data	<ul style="list-style-type: none"> • Describe parts of the data and the set of data as a whole to determine what the data show

NCTM Principals and Standards for School Mathematics 2000

NCTM Standards and Expectations

DATA ANALYSIS STANDARDS GRADES 3-5

NCTM STANDARDS	3-5 NCTM EXPECTATIONS
Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them	<ul style="list-style-type: none"> • Design investigations to address a question and consider how data-collection methods affect the nature of the data set • Collect data using observations, surveys, and experiments • Represent data using tables and graphs such as line plots, bar graphs, and line graphs • Recognize the differences in representing categorical and numerical data
Select and use appropriate statistical methods to analyze data	<ul style="list-style-type: none"> • Describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed • Use measures of center, focusing on the median, and understand what each does and does not indicate about the data set • Compare different representations of the same data and evaluate how well each representation shows important aspects of the data
Develop and evaluate inferences and predictions that are based on data	<ul style="list-style-type: none"> • Propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions

NCTM Principals and Standards for School Mathematics 2000

NCTM Standards and Expectations

DATA ANALYSIS STANDARDS GRADES 6-8

NCTM STANDARDS	6-8 NCTM EXPECTATIONS
Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them	<ul style="list-style-type: none"> • Formulate questions, design studies, and collect data about a characteristic shared by two populations or different • Select, create, and use appropriate graphical representations of data, including histograms, box plots, and scatterplots
Select and use appropriate statistical methods to analyze data	<ul style="list-style-type: none"> • Find, use, and interpret measures of center and spread, including mean and interquartile range • Discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatterplots
Develop and evaluate inferences and predictions that are based on data	<ul style="list-style-type: none"> • Use observations about differences between two or more samples to make conjectures about the populations from which the samples were taken • Make conjectures about possible relationships between two characteristics of a sample on the basis of scatterplots of the data and approximate lines of fit • Use conjectures to formulate new questions and plan new studies to answer them

NCTM Principals and Standards for School Mathematics 2000

NCTM Standards and Expectations

DATA ANALYSIS STANDARDS GRADES 9-12

NCTM STANDARDS	9-12 NCTM EXPECTATIONS
Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them	<ul style="list-style-type: none"> Understand the differences among various kinds of studies and which types of inferences can legitimately be drawn from each Know the characteristics of well-designed studies, including the role of randomization in surveys and experiments Understand the meaning of measurement data and categorical data, of univariate and bivariate data, and of the term variable Understand histograms, parallel box plots, and scatterplots and use them to display data Compute basic statistics and understand the distinction between a statistic and a parameter
Select and use appropriate statistical methods to analyze data	<ul style="list-style-type: none"> For univariate measurement data, be able to display the distribution, describe its shape, and select and calculate summary statistics For bivariate measurement data, be able to display a scatterplot, describe its shape, and determine regression coefficients, regression equations, and correlation coefficients using technological tools Display and discuss bivariate data where at least one variable is categorical Recognize how linear transformations of univariate data affect shape, center, and spread Identify trends in bivariate data and find functions that model the data or transform the data so that they can be modeled
Develop and evaluate inferences and predictions that are based on data	<ul style="list-style-type: none"> Use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions Understand how sample statistics reflect the values of population parameters and use sampling distributions as the basis for informal inference Evaluate published reports that are based on data by examining the design of the study, the appropriateness of the data analysis, and the validity of conclusions Understand how basic statistical techniques are used to monitor process characteristics in the workplace

NCTM Principals and Standards for School Mathematics 2000

Bringing Mathematics Home 1

Use the set of *NCTM Standards for the grade that matches your child's grade in school.



1. Remembering that your child may not have studied data yet in their classroom, make an informal evaluation of the concepts that your child knows out of the standards. Be careful! This needs to be done in a positive way that is not too threatening for your child. You might organize the list into:

Already Know	Will Be Learning Soon

2. Share some of the vocabulary that was confusing to you and see if your child can help you understand any of it.

3. Record ways that you used data this week. Be ready to share.

* *NCTM = National Council of Teachers of Mathematics*

Survey on Use of Calculators

Below is the first draft of a survey prepared to determine parents' attitudes about their children's use of calculators. In your groups, rewrite each item as you think it should appear on the final draft. Be prepared to explain any changes you would recommend.

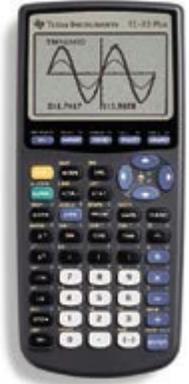
Survey on Use of Calculators by Children

1. How old are you? _____

2. Do you consider yourself good in mathematics? Yes No

3. Which type of calculator do you prefer to use?

- a. Solar powered
- b. Battery powered
- c. Scientific
- d. Other: _____



4. How often do you use a calculator and for what purposes?

5. Based on recent research, it has been found that technological advancement in today's society will eventually affect the use of calculators in schools. Do you agree or disagree?

agree disagree

6. No student who has not demonstrated success in basic skills should be permitted to use a calculator in the classroom? Do you agree or disagree?

agree disagree

7. Should immature junior high school students be exposed to the mindless activity of using a calculator to solve math problems?

yes no

8. When should calculators be used in school?

Sports Survey



At a 5th grade boys' basketball tournament, all of the boys in attendance were asked their favorite sport. The results are shown in the table below.

SPORT	NUMBER
Baseball	19
Football	23
Soccer	13
Basketball	60
Ice Hockey	5

1. What was the favorite sport?
2. From the survey, Luis decided that basketball is the favorite sport in the U.S. Give two reasons why his conclusions might not be true.

Bringing Mathematics Home 2

Survey five adults and be prepared to share your results.
Record the survey topic, questions and results below.

Survey topic:

Question 1:

Question 2:

Question 3:

Question 4:

Results:

Part 1: Scores on a Math Test

Ms Castro's class took a math test. Ms Castro then put the test scores into her computer as follows:

Scores on Math Test 1

65, 70, 70, 85, 69, 85, 100, 81, 70, 83, 81, 90,
82, 87, 96, 68, 94, 100, 95, 81, 83, 100, 66, 81,
83, 96, 84, 85.

Ms Castro gives an:

- A for 90-100
- B for 80-89
- C for 70-79
- D for 60-69
- F for 59 and lower.

1. How many As are there?
2. How many Bs?
3. How many Cs?

Part 2: Scores on a Math Test

Mr. Rodriguez's class took a math test. Mr. Rodriguez put the test scores into his computer in a frequency table.

Frequency Table

Score	Tally	Frequency
90-100		8
80-89		13
70-79		3
60-69		4

Mr. Rodriguez gives an:

- A for 90-100
- B for 80-89
- C for 70-79
- D for 60-69
- F for 59 and lower.

1. How many As are there?
2. How many Bs?
3. How many Cs?

Many Ways to Organize Data

There are many ways to organize data. Over the next few weeks, we will be reviewing several. This sheet gives you a chance to write down things you want to remember.

Frequency Table

Bar Graph

Circle Graph

Stem-and-Leaf Plot

Box-and-Whisker Plot

Line Plot

- Shows groups of numbers in order
- Groupings of numbers should generally be the same size
- Groupings must be non-overlapping and use up all the data
- Has tallies or frequencies to show number of times an item occurs
- Data are ordered and tallied

Birth Month Data

BIRTH MONTH	TALLY	FREQUENCY
January		
February		
March		
April		
May		
June		
July		
August		
September		
October		
November		
December		

- Make a table with 3 columns
- List the intervals in the first column, labeling it
- Label the second column "Tally."
Make a tally mark in the second column next to each interval for every score that falls within that interval
- Label the 3rd column "Frequency."
Record the total number of tally marks for each interval in the 3rd column
- Title the frequency table

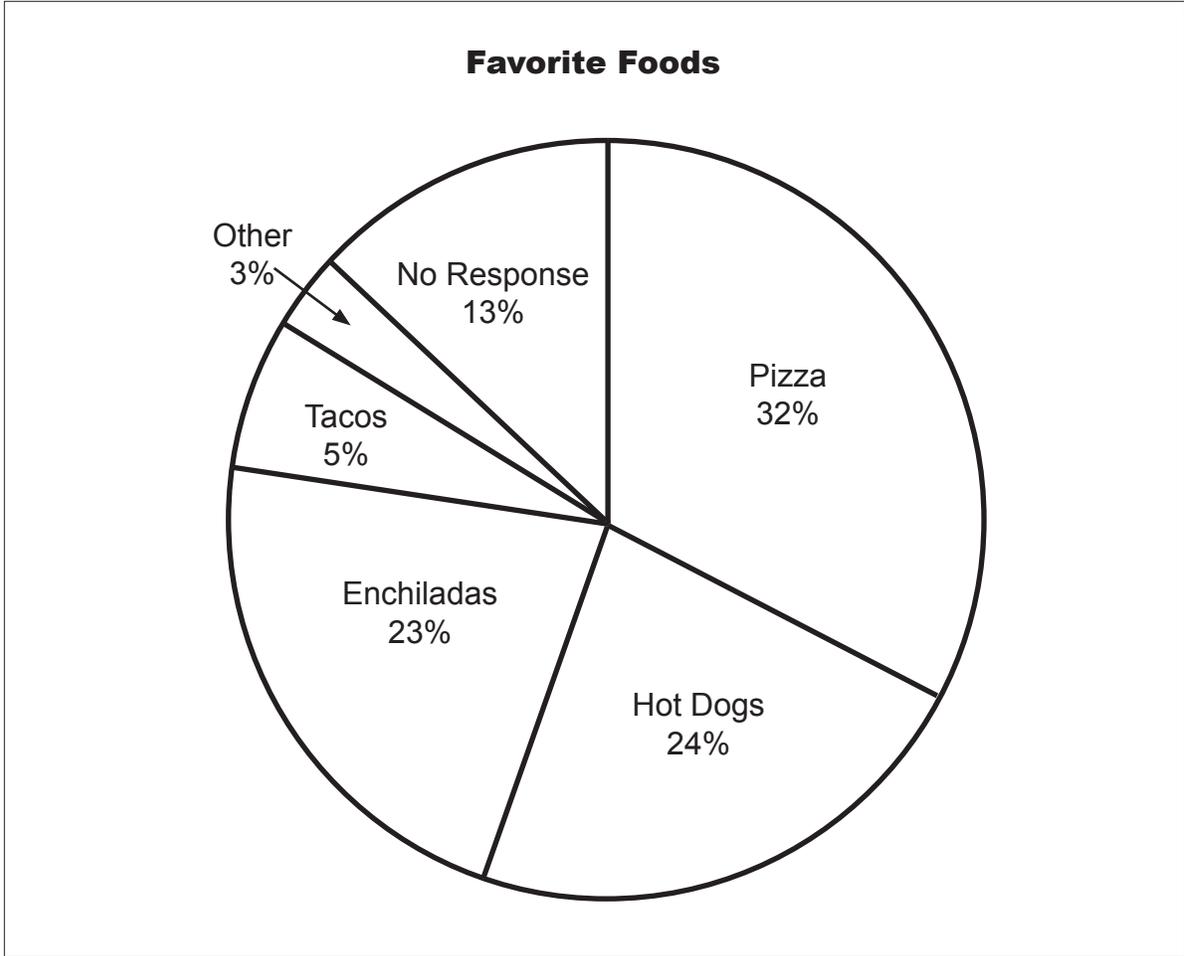
Bar Graph Template

Title _____

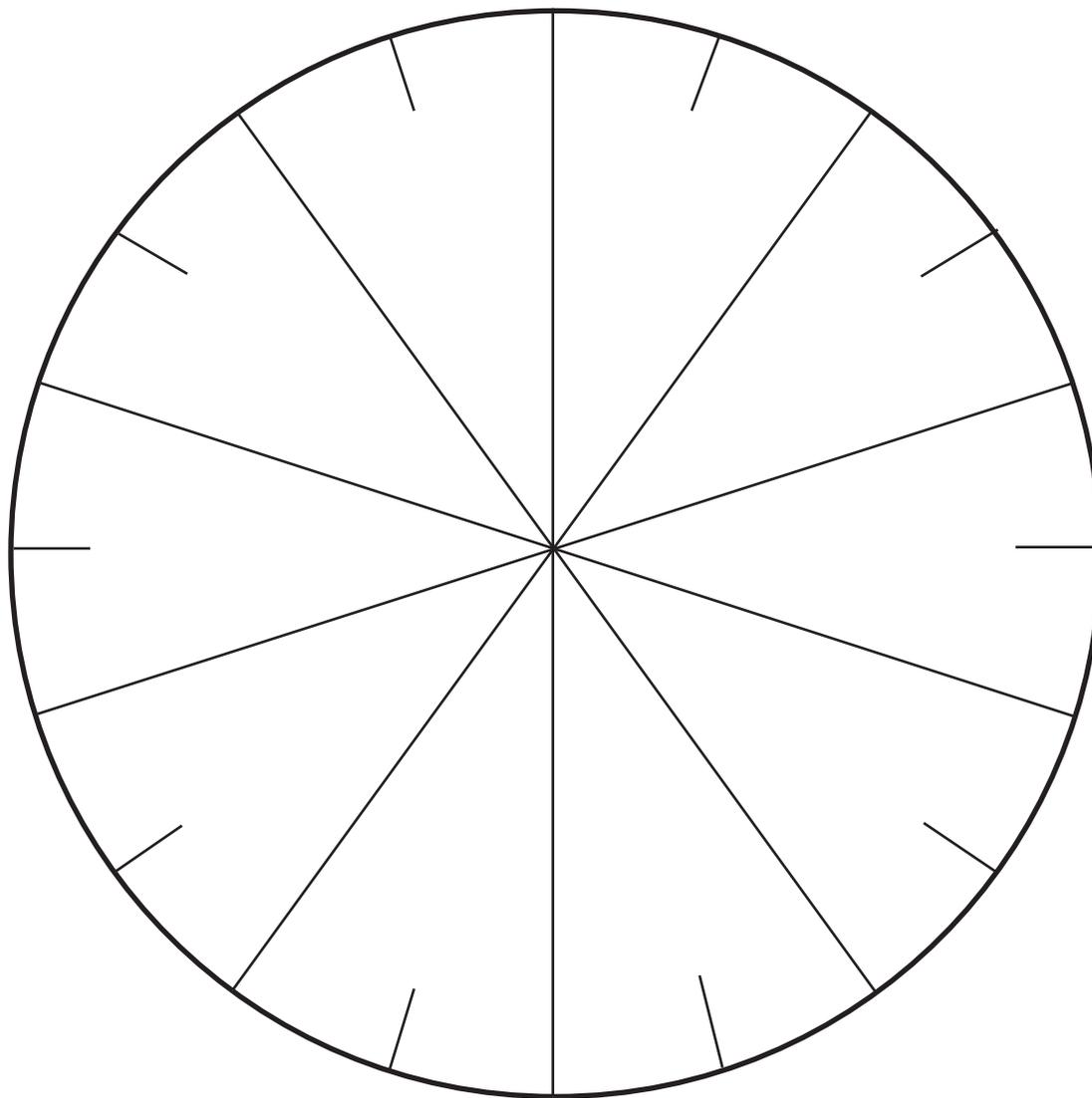
Frequency

Intervals

Favorite Foods Graph



Hundredths Disk



Bringing Mathematics Home 3

Assignment

With your child:

Find some examples of graphs in the newspaper or magazines. Together create 2 questions that can be answered from the graph, and at least one question that cannot be answered from the graph. Be prepared to share these next week.

**Practice on the concepts of the session:**

Use the survey results to practice the bar and circle graphs. Make one of each type of graph for each of the questions.

Constructing Stem-and-Leaf Plot

Some students were estimating the points our school would score at the next basketball game. Their estimates are as follows:

59, 64, 45, 48, 57, 73, 58

To make a stem and leaf plot of this information, do the following:

Step 1: Organize the data from smallest to largest.

Step 2: A stem and leaf plot is organized according to place values. In this list, all of the 40s would be grouped together, all of the 50s, all of the 60s and all of the 70s. However, it is done in shorthand.

Grouping the 40s look like: 40 | 5, 8

Grouping the 50s look like: 50 | 7, 8, 9

What is going on here? Check with a neighbor to see if you can discover the pattern of how this groupings are represented. After you think you understand, try filling out the whole stem and leaf plot.

40	
50	
60	
70	

Step 3: After you feel confident, try making a stem and leaf plot with our raisin estimates.

- Compare the stem-and-leaf plot and the bar graph.

What is similar?

What is different?

- Compare the stem-and-leaf plot and the line plot.

What is similar?

What is different?

- When might it be more useful to use a stem-and-leaf plot than a bar graph?

Many Ways to Describe Data

There are many ways to describe data. Over the next few weeks, we will be reviewing several. This sheet gives you a chance to write down things you want to remember.

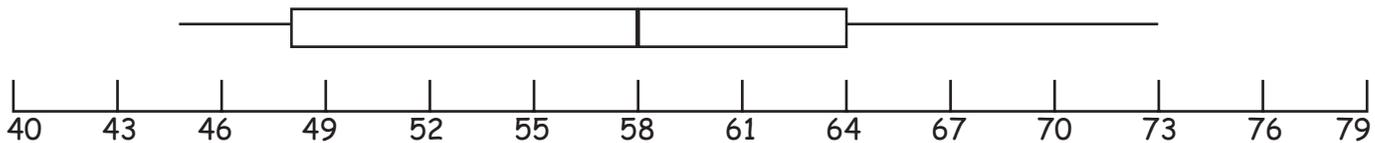
Median

Mode

Mean

Constructing a Box-and-Whisker Plot

Basketball Score Estimates organized in a box-and-whisker plot



Step 1: Copy the numbers from the sample strip onto your own strip.

Sample Strip Arrangement of Data

16	20	20	20	22	25	25	25	27	27	27	30	30	30	32	32	35	35	40
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Step 2: a) Fold the strip in half to find the median.

b) Record the median _____

c) Draw a short vertical line at the median above the number line below.

Step 3: a) Fold each half strip in half to find the two new medians (quartiles).

b) Record the quartiles:

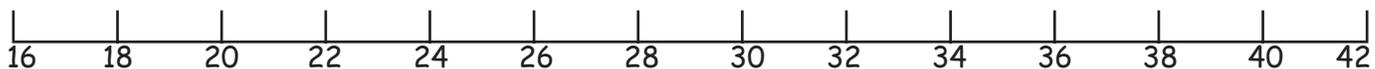
• median of lower half (1st quartile) _____

• median of upper half (3rd quartile) _____

c) Mark the two quartiles in a similar fashion as the median.

Step 4: Draw a box connecting the 1st quartile, the median, and the 3rd quartile

Box-and-Whisker Plot



- What is different about a bar graph and a box-and-whisker plot?
- What information can you obtain from a stem-and-leaf plot that you cannot obtain from a box-and-whisker plot?
- When do you think it would be more appropriate to use a box-and-whisker plot than a stem-and-leaf plot?
- How can we determine which is the best graph form to display our data?

Bringing Mathematics Home 4

Learning Strategies

At home, survey your children on how they learned mathematics this week. Tally the number of times they used each of the following learning strategies in their mathematics class.

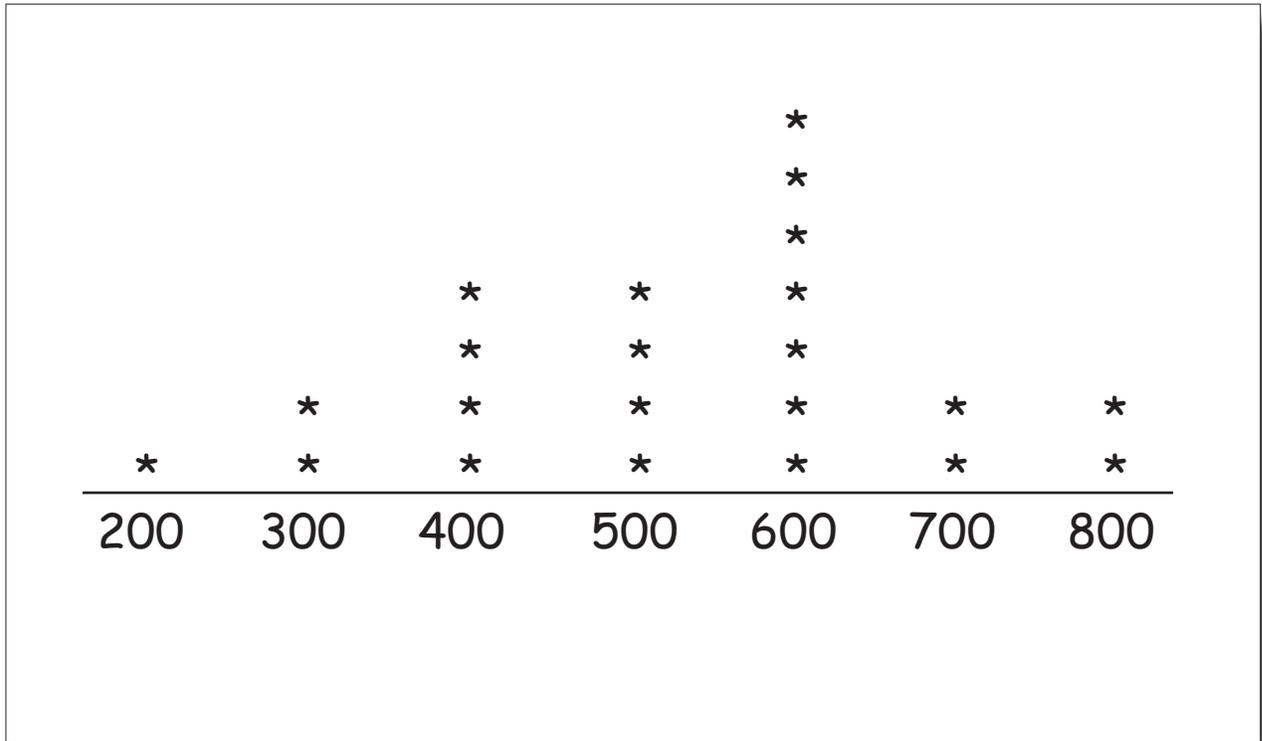
Grades	Small Groups	Lecture	Work-sheets	Tests	Student Presentations	Use of Technology	Materials
K-2							
3-5							
6-8							
9-12							

Make a graph of your own choosing to display your data. Bring this data with you to the next session.

Welcome! As you come in, please do the following:

- **Type of Learning Strategies:** Place tally marks on Chart 1 showing these strategies. (This data is from the home assignment from the last session.)
- **Number of Cans of Soda:** Put a dot on Chart 2 to show the number of soft drink cans you use in a typical week.
- **Types of Shoes:** Put a dot on Chart 3 to show the kind of shoes you are wearing. Add a category if you need a new one.

Line Plot Graph



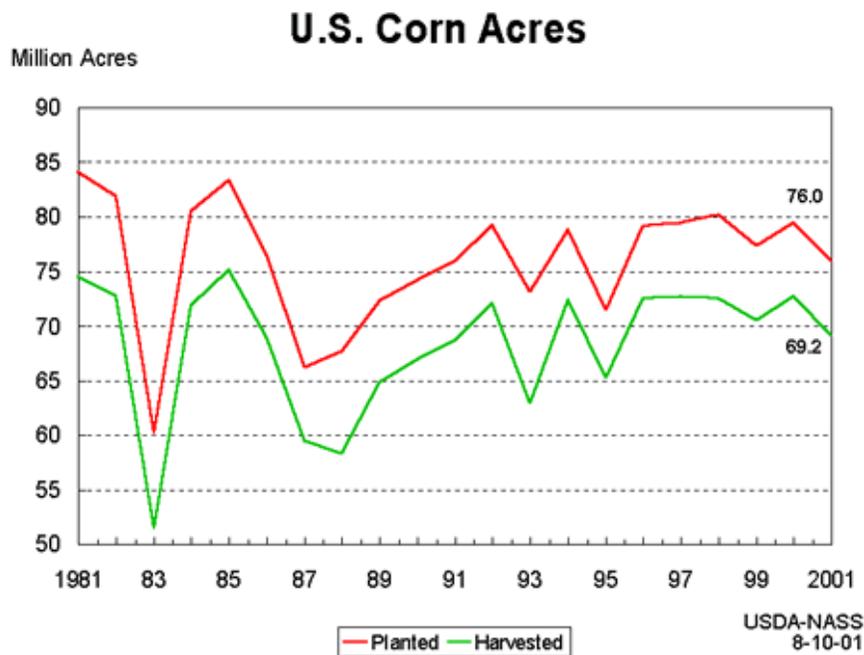
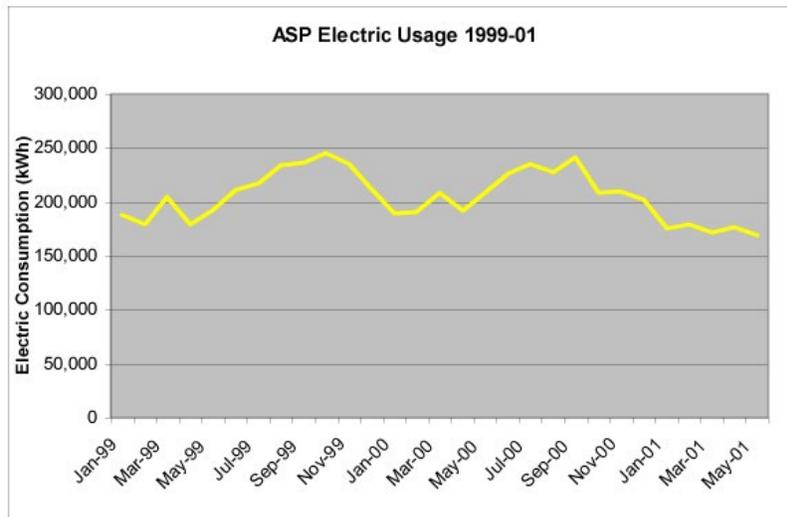
Bringing Mathematics Home 5

Discuss the following sample graphs with one of your children.
 Questions to discuss:



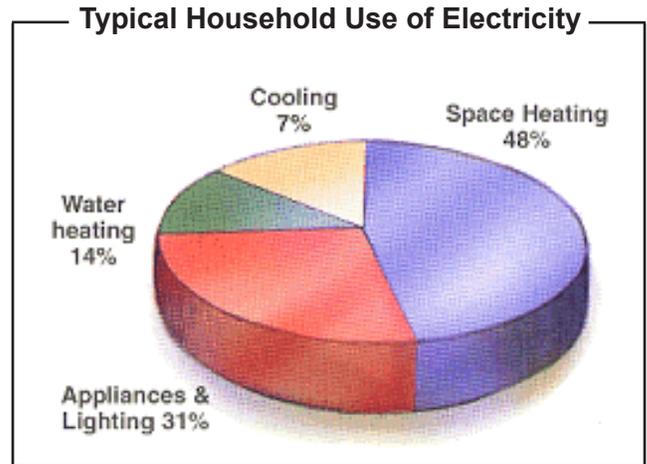
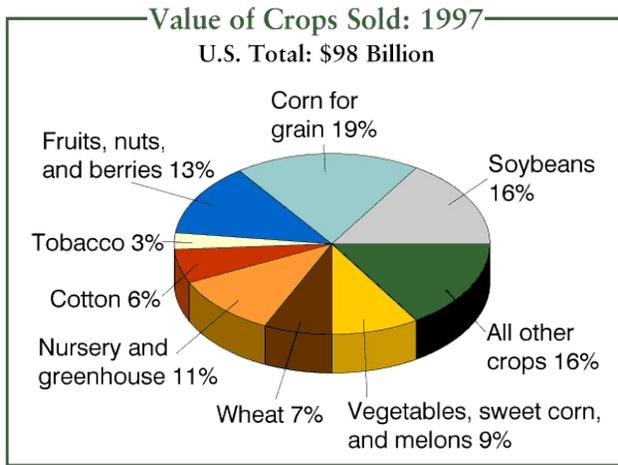
- What kind of graph is it?
- What is the graph about?
- What information can you obtain from the graph?
- What questions can you ask that the graph can answer?
- What else would you like to know that couldn't be found in the graph?

Sample Graphs:

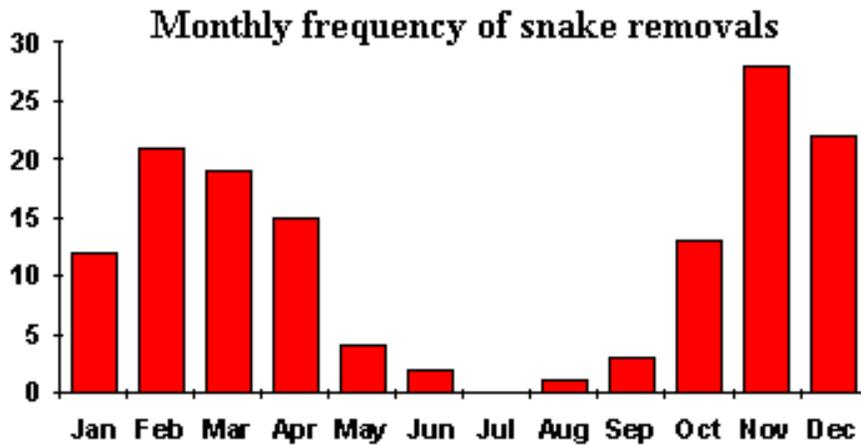
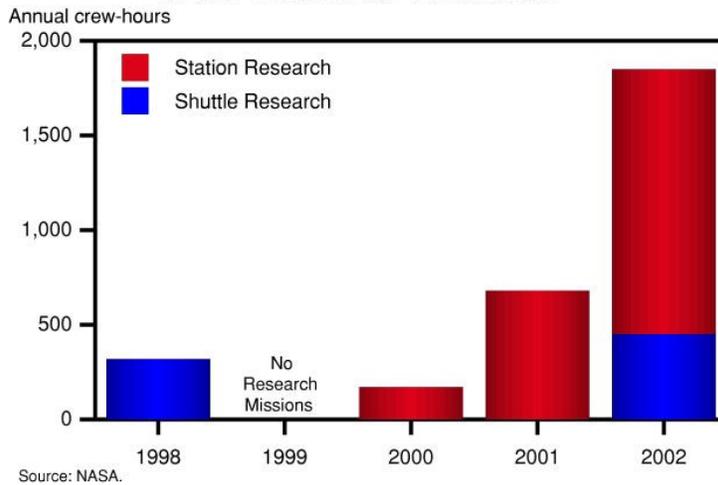


Bringing Mathematics Home 5

Sample Graphs:

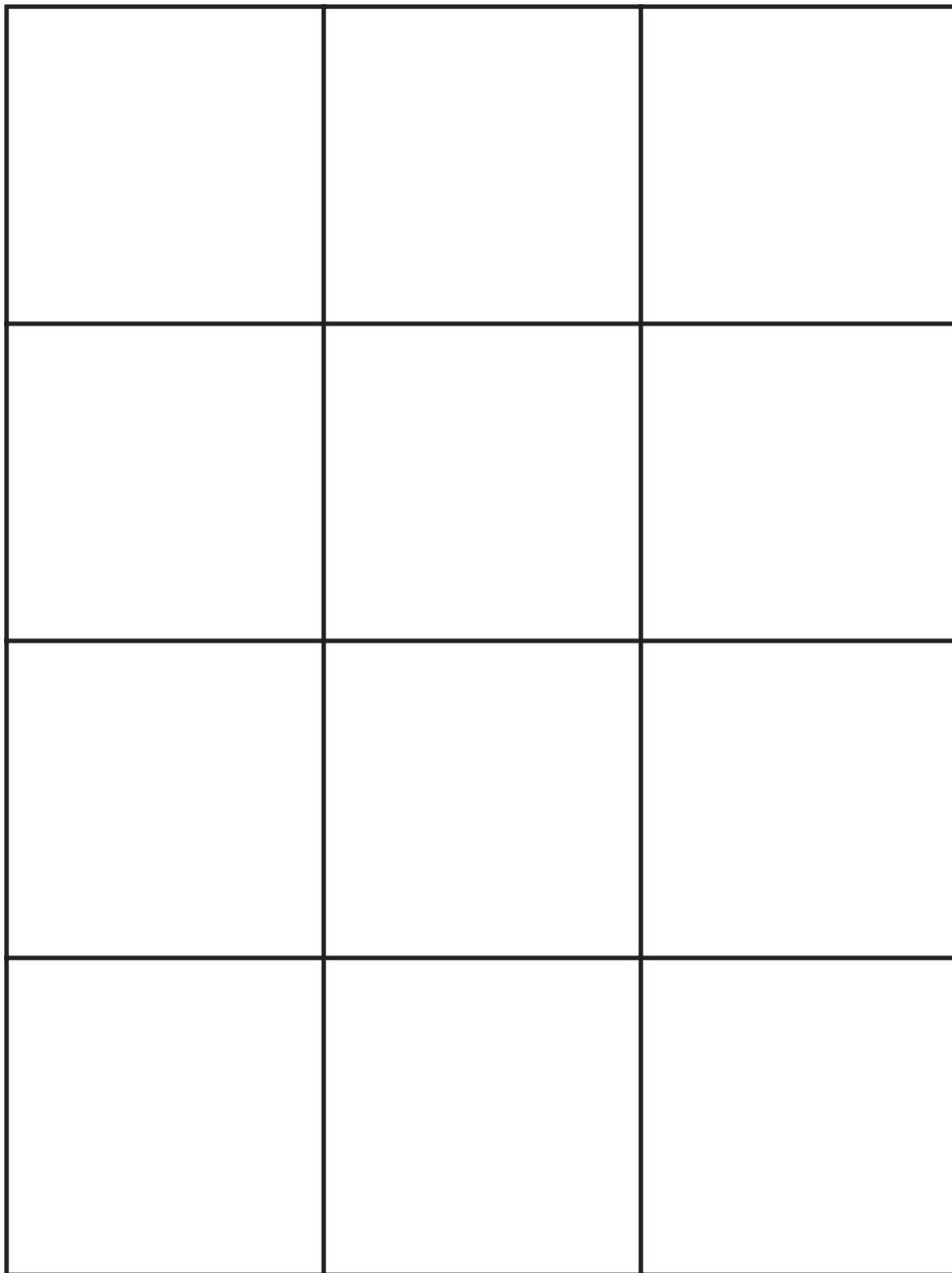


Space Station Significantly Increasing Crew-Hours for Research



2 x 2 Squares

Copy on colored cardstock and cut out 2 x 2 squares.



Tanisha has 9 M&Ms, Julio has 5 M&Ms, and Liu has 7 M&Ms.



- How can you find the amount of M&Ms each would have if they decide to share equally?
- Can you do it without pencil and paper?

Company Salaries

Type of Job	Number Employed	Salary	Union Member?
President	1	\$250,000	No
Vice-president	1	\$130,000	No
Plant Manager	2	\$55,000	No
Supervisor	6	\$18,000	Yes
Worker	12	\$15,000	Yes
Payroll Clerk	4	\$13,500	Yes
Secretary	5	\$12,000	Yes
Sales Clerk	11	\$10,000	Yes
Custodian	3	\$8,000	Yes
Total	45		

Questions for Company Salaries

Salaries

The head of the employees' union at the Reyes Manufacturing Company and some employees' representatives were negotiating with Mr. Reyes, president of the company.

The head of the union, Ms. Ortiz: *The cost of living is going up. Our workers need more money. No one in our union earns more than \$18,000 a year.*

Mr. Reyes: *It's true that costs are going up. It's the same for us. Besides the average salary in our company is almost \$23,000. I don't see how we can afford a wage increase at this time.*

A sales clerk, Mrs. Smith: *We sales clerks make only \$10,000 a year. Most workers in this union make \$15,000. We want our pay increased to at least that level.*

The union official decided to take a careful look at the salary distribution for the company. The payroll department provided her with the salary information in the table below.

Type of Job	Number Employed	Salary	Union Member?
President	1	\$250,000	No
Vice-president	1	\$130,000	No
Plant Manager	2	\$55,000	No
Supervisor	6	\$18,000	Yes
Worker	12	\$15,000	Yes
Payroll Clerk	4	\$13,500	Yes
Secretary	5	\$12,000	Yes
Sales Clerk	11	\$10,000	Yes
Custodian	3	\$8,000	Yes
Total	45		

- Consider the salaries of all employees. What is the mean of their salaries? mode? median? Which measure of central tendency do you think accurately represents the typical salary of the employees? Explain.
- If the salaries for just union members are counted, what is the mean? mode? median? Which measure of central tendency do you think accurately represents the typical salary of union workers? Explain.
- Compare the two sets of measures. Which stayed the same? Which changed? Why?
- Which measure of central tendency did Mr. Reyes use as his "average" salary at the company?
- Which measure of central tendency did Mrs. Smith use when she said most workers make \$15,000 at the company?
- Which measurement do you think best describes the typical salary in this company? Why?

Bringing Mathematics Home 6

Movie theater attendance: The table below shows the daily attendance at two movie theaters for 5 days and the mean and median attendance.

Day Number	Theater A	Theater B
1	100	72
2	87	97
3	90	70
4	10	71
5	91	100
Mean	75.6	82
Median	90	72

- a) *You are in charge of stocking the drink counter and want to anticipate how many people you can expect to come to the movies. Which statistic, the mean or the median, would you use to describe the typical daily attendance at Theater A? Justify your answer.*
- b) *Which statistic, the mean or the median, would you use to describe the typical daily attendance at Theater B? Justify your answer.*

What Are Our Measurements?

1. Measure the height, head size, and foot size of each person in your small group. Record the data in the table below.

Name	Height	Head Size	Foot Size

2. Using the data from the big table for the whole class, find:

The average height of the group _____

The average head size _____

The average foot size _____

3. Which average did you use: mean, median, or mode?

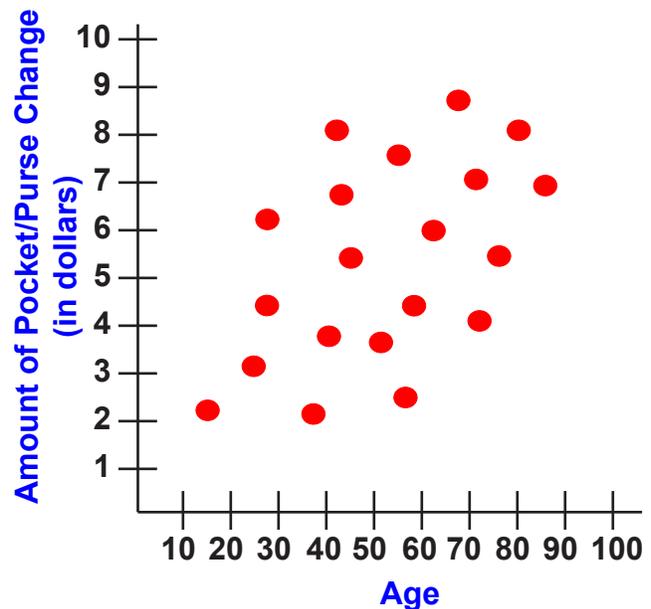
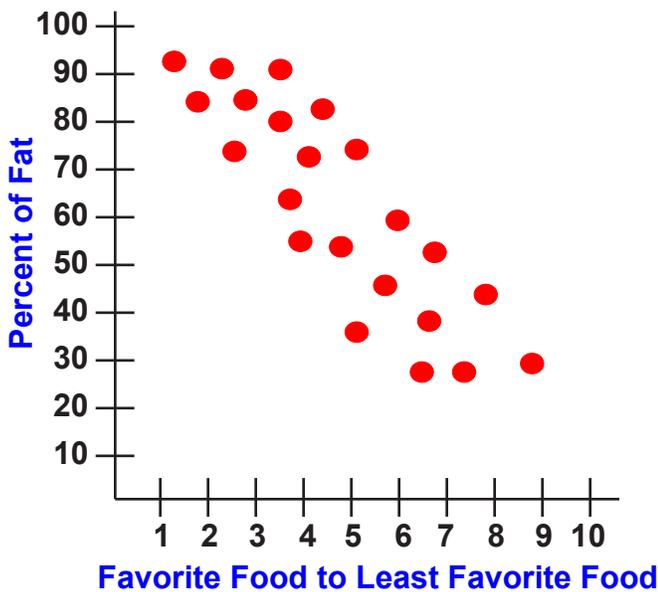
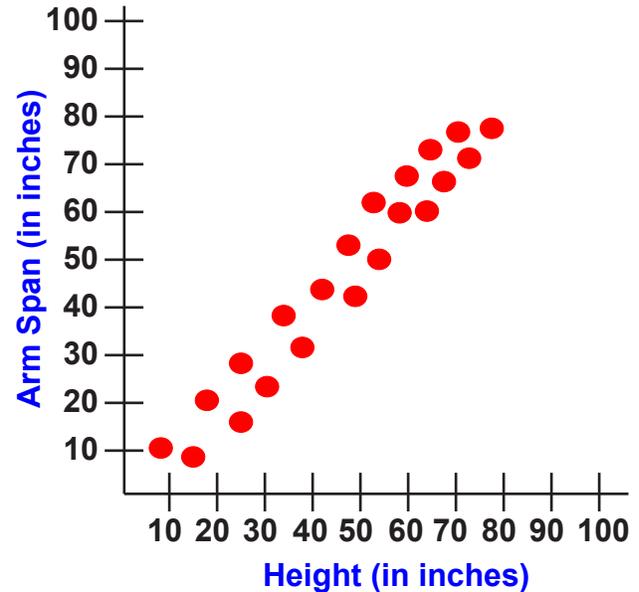
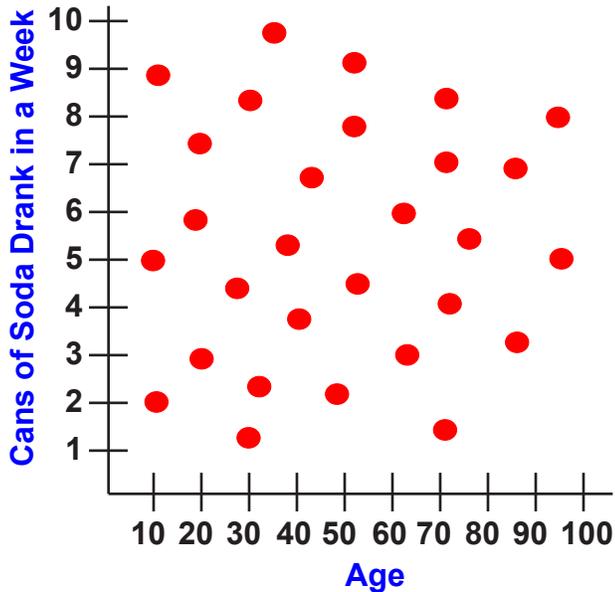
Why did you use that form of the average?

4. Use a piece graph of paper in order to do a graph of one of the sets of information.

5. Write one or two sentences that describe our class in relationship to the information on your graph.

Deepening Understanding

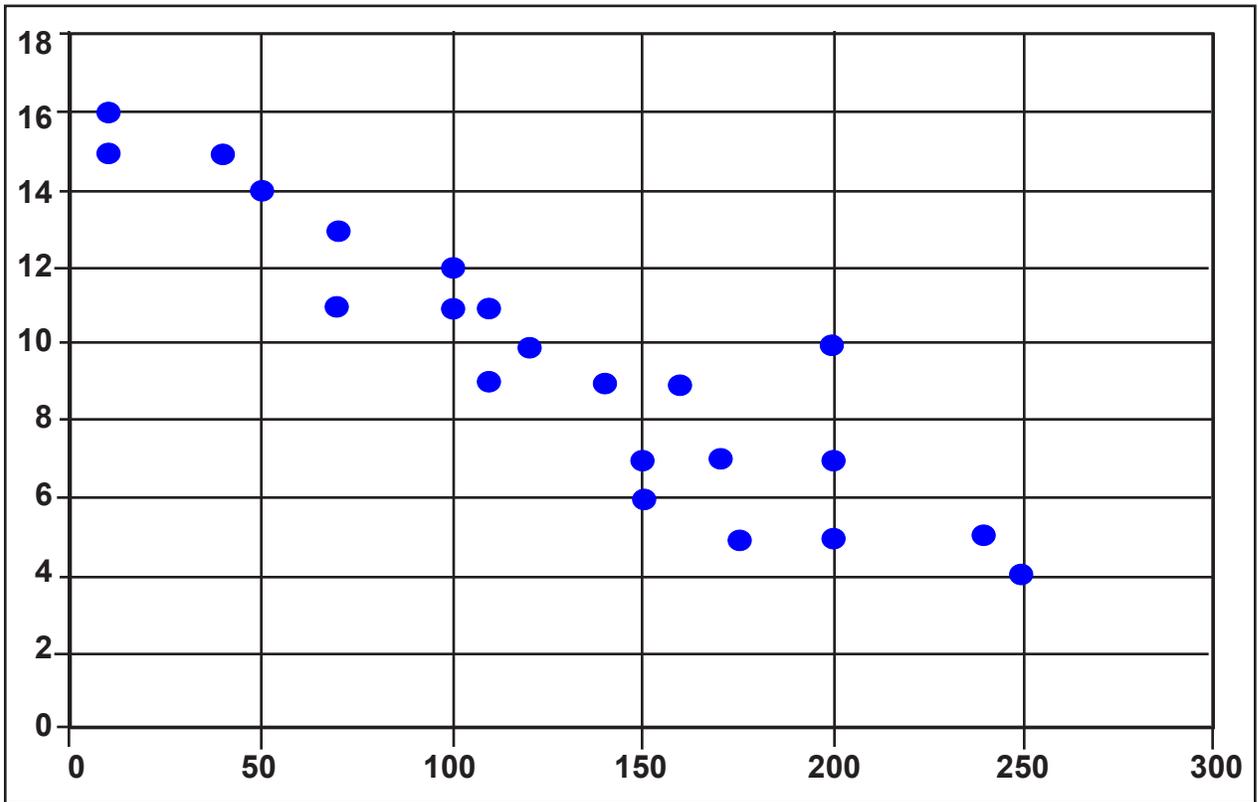
- For each of the graphs shown, indicate whether it reveals positive, negative, or zero correlation.
- Is it a strong or a weak correlation?
- Draw a line of best fit, and make a prediction for what might happen at some point that is not on the graph.
- Write one or two sentences about the information that you can get from each graph.



Mystery Graph

Here is a graph of a pair of data.

What might the measurements represent?



Bringing Mathematics Home 7

At home, have your children measure the height and the head size of each member of your family. Together, make a scatter plot of the height vs head size. Compare it to the graph we made in class.

- *How are they similar?*

How are they different?

Why?

- *Which graph would be better for predicting height if you know someone's head size?*

Why?

- *Is there a difference if the people are all male or all female?*

Why?

Quality Drinks Problem

Company Name	Injuries at Work	Years in Business
Best Drinks	1,000	50
Quality Drinks	100	2

Quality Drinks used the data in the table above to create an advertisement. It claims, "Quality Drinks cares. We have one-tenth the number of injuries at work as Best Drinks has."

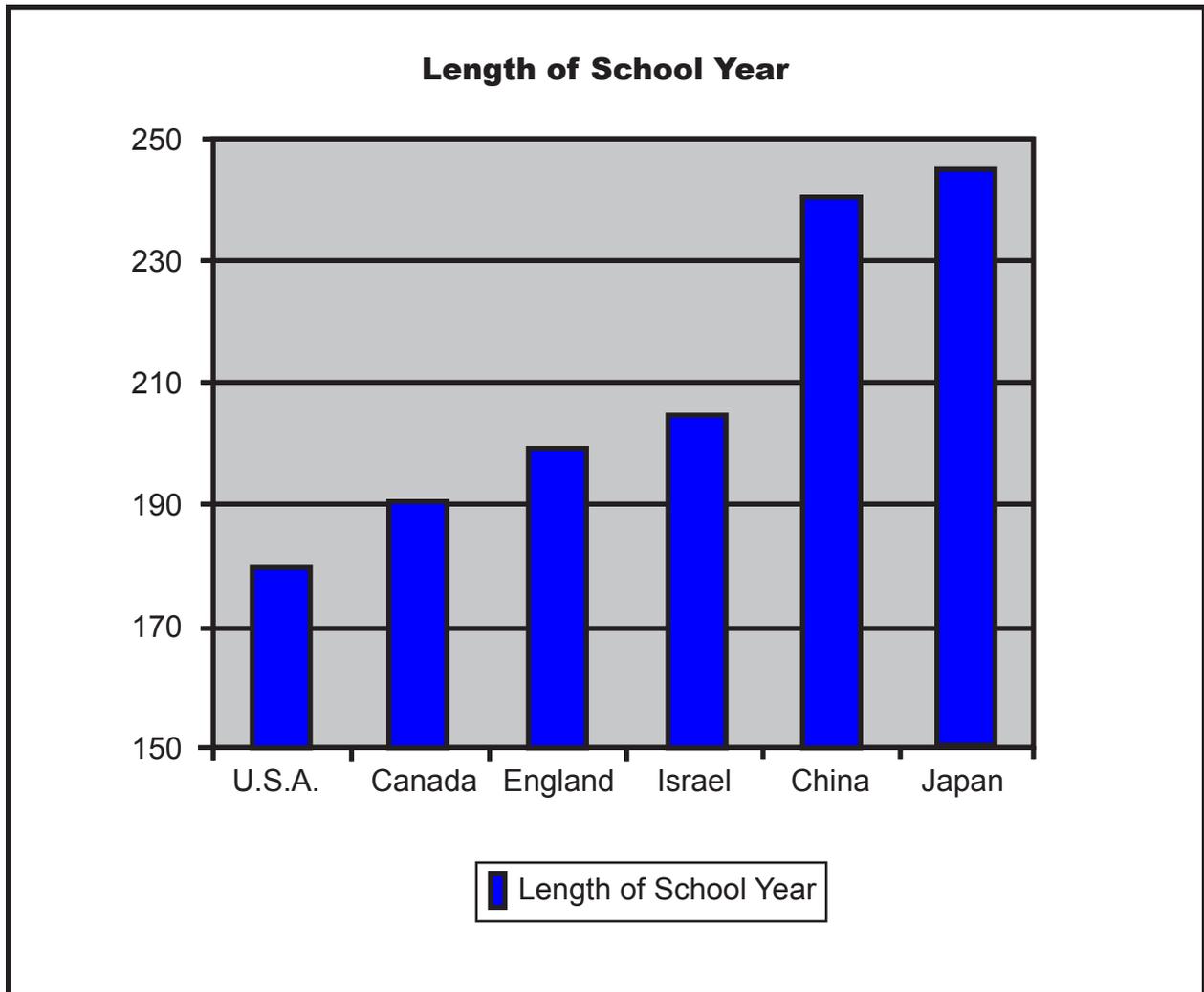
Why is this claim misleading?

Quality Drinks Multiple Choice

- A. On the average, Best Drinks has more injuries per year.
- B. The claim should say, "one-fifth the number of injuries."
- C. The claim should say, "twenty-five percent fewer injuries."
- D. On the average, Quality Drinks has more injuries per year.

Length of School Year

The following bar graph shows the number of days in the school year of selected countries.



1. Write two sentences about the information this graph presents.

2. Is there anything about the way the graph is set up that would influence your thinking?

Degrees Earned by Women Problem

The table below shows degrees earned by women in a recent year.

Field of Study	Bachelor (%)	Doctorate (%)
Business	37	15
Computer Science	30	11
Education	74	44
Engineering	9	4
Arts	63	37
Geography	32	14
Library Science	95	56
Mathematics	42	14
Philosophy	27	24
Physical Sciences	24	13
Social Sciences	44	27
Social Work	81	50

Use your bar graph to answer the following questions.

1. *In pairs, describe in your own words some of the things you notice from the bar graph.*
2. *Why do you think there are so few women pursuing doctorates in engineering, math, and the physical sciences?*
3. *What might be done to encourage more women to enter these fields?*

Degrees Earned by Women Table

Field of Study	Bachelor (%)	Doctorate (%)
Business	37	15
Computer Science	30	11
Education	74	44
Engineering	9	4
Arts	63	37
Geography	32	14
Library Science	95	56
Mathematics	42	14
Philosophy	27	24
Physical Sciences	24	13
Social Sciences	44	27
Social Work	81	50

Curriculum in Mathematics Problem

In your small groups, examine the tables below and choose any way you want to summarize the information (graph, words). If you were going to make recommendations to the local school board about curriculum in mathematics, what might you say? How would you justify your recommendations? Prepare a report to share with the class.

Percentage of High School Class of 1982 Attending College by Algebra Courses

Algebra	Students In Group	Attended College by 6/86	Attending College by 10/82	Attended 4-yr College by 6/86	Attending 4-yr College by 10/82
Less than 1 yr	44%	34%	21%	18%	12%
1 yr or more	56%	72%	58%	51%	38%
All Students	100%	55%	42%	37%	27%

Percentage of High School Class of 1982 Attending College by Geometry Courses

Geometry	Students In Group	Attended College by 6/86	Attending College by 10/82	Attended 4-yr College by 6/86	Attending 4-yr College by 10/82
Less than 1 yr	65%	41%	27%	22%	14%
1 yr or more	35%	83%	70%	66%	51%
All Students	100%	55%	42%	37%	27%

Percentage of High School Class of 1982 Taking Geometry - by Race/Ethnicity

Race/Ethnicity	Students in Group	Students Taking Geometry
European American	75%	40%
African American	13%	19%
Latino/a	8%	17%
Other	4%	29%

Please prepare a presentation of your recommendation to the school board on a piece of chart paper.

Your presentation should include:

- **Your recommendation**
- **Justification for your recommendation**
- **A graph to support your position**