ANALYZING DATA WITH GRAPHS
SAMPLING

Graphs are visual ways to summarize data. Some data is better displayed in a circle graph, while other data is most effectively displayed in a line graph. We'll first look at a summary of the types of graphs, and the type of data for which they are suitable.

A graph is more effective when a scale is used that depicts data most efficiently. A well-matched scale makes the graph easier to read and interpret. We will examine ways to increase the effectiveness of displaying data in graphs by choosing the "right scale".

Different types of graphs can display the same data but used to support opposing arguments. We will examine the same data displayed in different two different types of graph.

Graphs and statistics can be used to mislead interpretations of the real data by only telling part of the story or by using pictures that disguise the actual data. We will examine misleading graphs that have subtle attributes that bias the interpretation of the data.

Sampling is way to use statistics that give predictions of total amounts when the number is too large to count or impossible to count. Sampling may be used to determine wild animal populations, numbers of fish in bodies of water, or numbers of defective units in mass production of manufactured items. You will use percent to investigate sampling data. We will review finding percent and finding part (percent of a number).

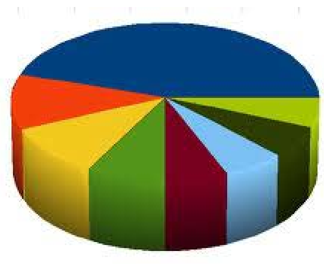
Types of Graphs for Display

Circle graph - compares all the categories of data in a pie chart

Line Graph – used to show growth or decline over a specified length of time

Bar Graph – used to show an amount for each category

Pictograph – uses small pictures that represent equal amounts to compare categories of data



Stem-and-leaf – provides a way to organize data quickly

Scatter Plot – shows multiple occurrences of the same data

Histogram – shows amounts of data that fall into equally-spaced intervals

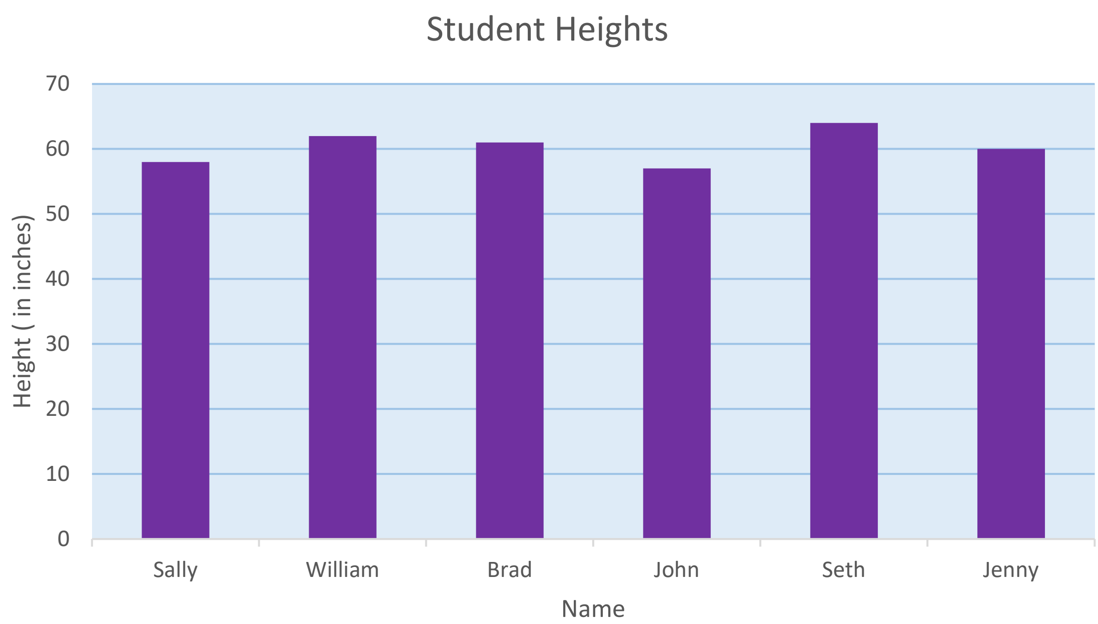
Choosing the Right Scale

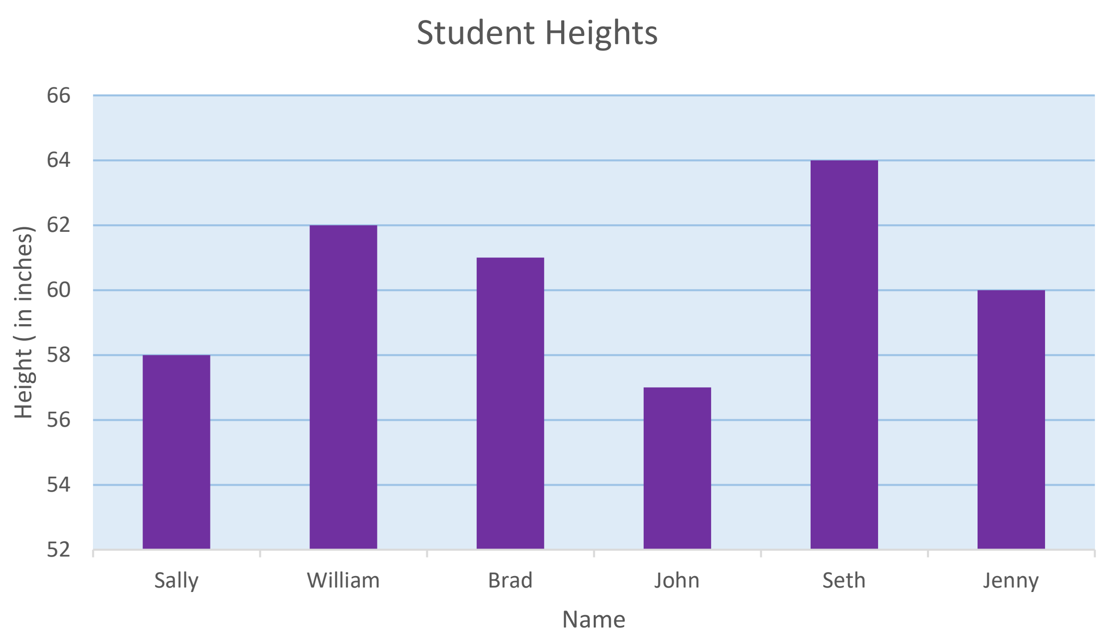
The graphs below represent the same data but have different scales to represent the height of the students.

Notice that the first graph has a scale divided into tens. The heights of the students must be estimated and all the bars range between 50 and 70.

Notice that in the second graph, the heights are easier to read because the scale starts at 52 and ends at 66 and is divided into smaller increments (twos). The numbers between 0 and 52 were not needed for this set of data.

Therefore, the second graph is a better graph because the scale is easier to read for accuracy and much less space is wasted

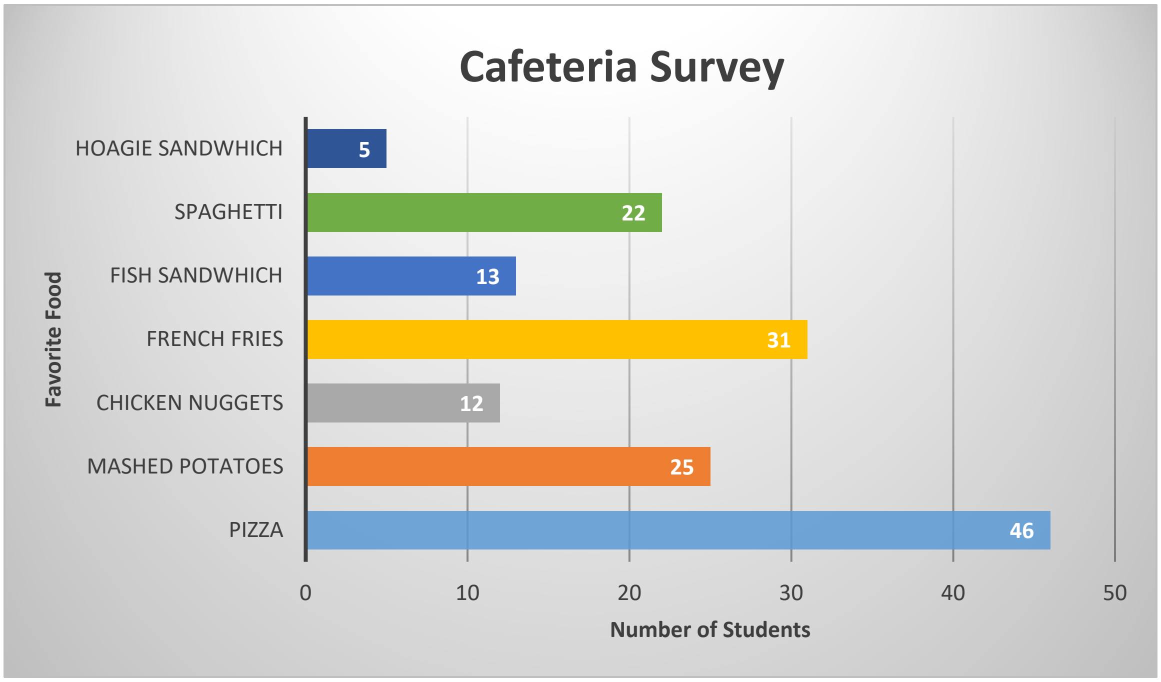

Student Heights
70
60
50
40
30
20
10
0
Height (in inches)
Sally
William
Brad
John
Seth
Jenny
Name

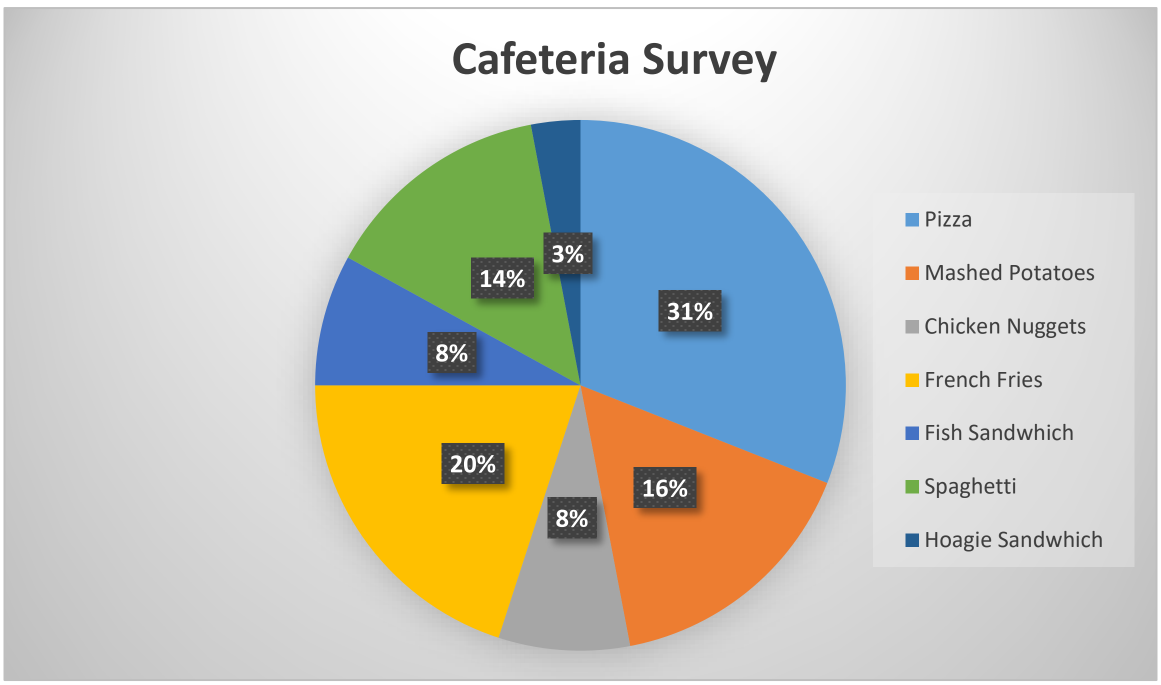

Student Heights
66
64
62
60
58
56
54
52
Height (in inches)
Sally
William
Brad
John
Seth
Jenny
Name

Same Data in Different Graphs

Jennifer surveyed the sixth grade students to determine the favorite food in the school cafeteria with these results: Pizza (46), Mashed Potatoes (25), Chicken Nuggets (12), French Fries (31), Fish Sandwich (13), Spaghetti (22), Hoagie Sandwich (5). She made a table to display her results.

Jennifer then decided to compare her results in two different types of graphs. In the bar graph, the number of students surveyed can be determined. In the circle graph, the percent of students is shown rather than the number. In both graphs, pizza is clearly the favorite choice of the students. *Which graph would you use to display the results to the student body?*


Cafeteria Survey
Favorite Food
HOAGIE SANDWHICH
SPAGHETTI
FISH SANDWHICH
FRENCH FRIES
CHICKEN NUGGETS
MASHED POTATOES
PIZZA
5
22
13
31
12
25
46
0
10
20
30
40
50
Number of Students


Cafeteria Survey
31%
16%
8%
20%
8%
14%
3%
Pizza
Mashed Potatoes
Chicken Nuggets
French Fries
Fish Sandwhich
Spaghetti
Hoagie Sandwhich

Misleading Statistics

Example 1: Timothy purchased five raffle tickets that cost $1 each based on the sales promotion that the top prize was $400 and the average award amount was $20. What the salesperson failed to mention to Timothy is that the rest of the prize awards were for $1.

This promotion was mathematically correct but if Timothy won, most likely his prize would be $1, not $400.

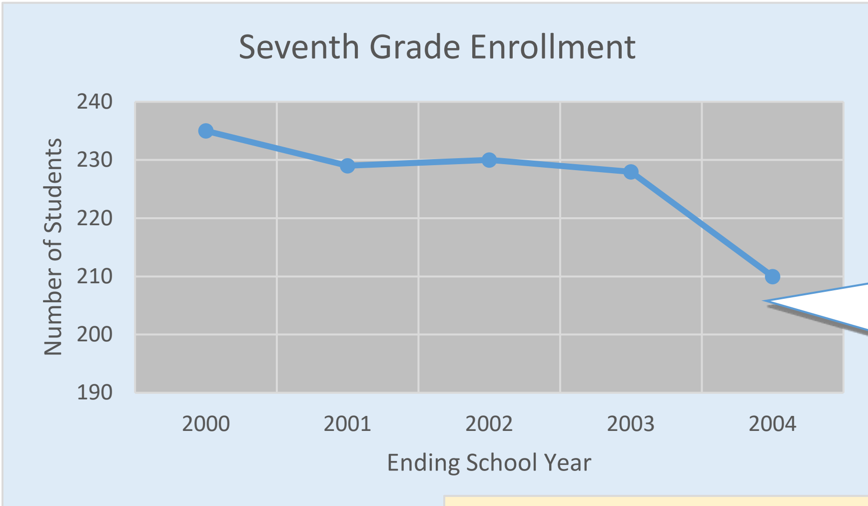
The Math

1 prize of $400	=	400
20 prizes of $1	=	20
21 prizes	=	420

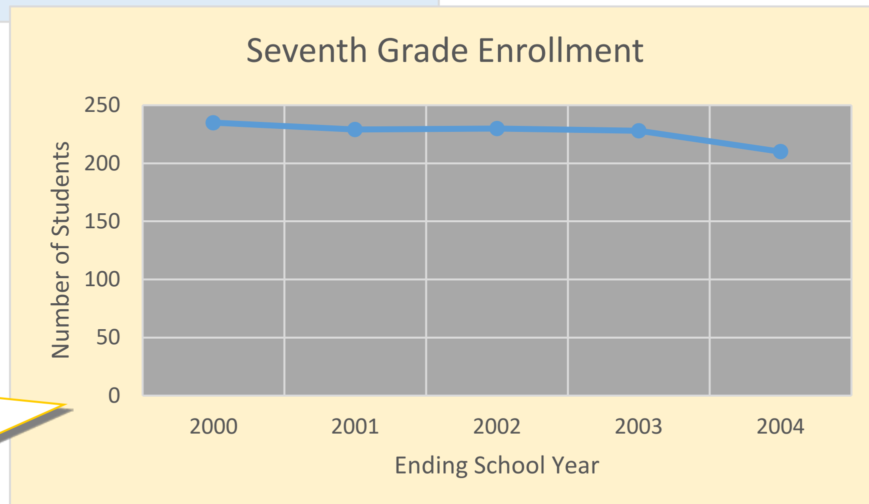
Average prize amount is $\frac{420}{21} = \$20$

Example 2: Graphs may be constructed in a way to emphasize certain data presented.

Here are two graphs that show the enrollment of a seventh grade class over the school years 2000 through 2004.



In this graph, an overall decline in enrollment is shown with a sharp decline in the year 2004.



In this graph, the enrollment looks pretty steady with a small decline in the year 2004.

The different appearance of these two graphs was simply achieved by making changes in the beginning and ending values of the vertical axis and also the amount of increments in the scale of the vertical axis.

Comparing Samples

When collecting data to make predictions, it is necessary to get an "unbiased" sample selection (small group) that will be representative of the population (the whole group).

Suppose Rita wanted to determine the favorite past time activity of the students in her class by surveying a sample of the entire class.

A **biased** sample would be to survey the computer club. These members have a common interest in computers so surveying them would probably reflect a lot of computer-related activities.

An **unbiased** sample would be to list all of the students in the class in alphabetical order, then survey every 5^{th} person on the list.

Finding Percent

To solve percent problems, the percent box comes in handy to set up problem.

Part	Percent
Whole	**100**

Fifteen middle school students ride the school bus. **Forty** students in all ride the bus. ***What percent of students on the bus are middle school students?***

The math sentence for this problem is:

15 is what percent of 40?

15 middle school students is **part** of the students riding the bus.

15	n
40	**100**

"**What percent** of the students are middle school students" is the unknown (***n***). The **percent** goes above the 100 in the percent box.

40 students in all is the **whole** number of students riding the bus.

To solve for percent, make a proportion, then cross multiply.

$$\frac{15}{40} = \frac{n}{100} \xrightarrow[\text{multiply}]{\text{cross}} 40 \times n = 15 \times 100 \xrightarrow[\text{equation}]{\text{make an}} 40n = 1500 \quad (1500 \div 40)$$

***n* = 60%** are middle school students

Finding Part

To solve percent problems, the percent box comes in handy to set up problem.

Part	**Percent**
Whole	**100**

There are **70** students in the class. **Eighty percent** have blue eyes. How many students have blue eyes?

The math sentence for this problem is:
80% of 70 = *n*

"How many have **blue** eyes" is the **part** that is **unknown.**

n	**80**
70	**100**

"**Eighty** percent have blue eyes. The **percent** goes above the 100 in the percent box.

70 students in the class is the **whole** number of students.

To solve for "part" of the class, make a proportion, then cross multiply.

$$\frac{n}{70} = \frac{80}{100} \xrightarrow[\text{multiply}]{\text{cross}} n \times 100 = 70 \times 80 \xrightarrow[\text{equation}]{\text{make an}} 100n = 5600 \quad (5600 \div 100)$$

***n* = 56** have blue eyes

Constant Proportionality - the constant value of the ratio of two proportional quantities x and y; usually written $y = kx$, where k is the factor (constant) of proportionality

Constant - a number representing a quantity assumed to have a fixed value in a specified mathematical context; "the velocity of light is a constant"

The constant ratio between two quantities is also called as constant of proportionality.