

Objective 0003:

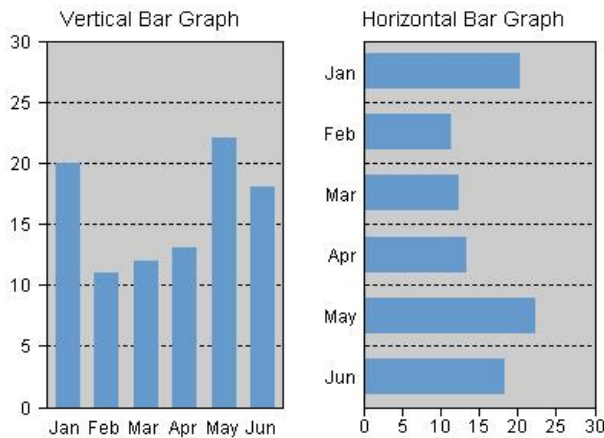
Understand mathematical modeling and apply multiple mathematical representations to connect mathematical ideas and solve problems.

Mathematical models:

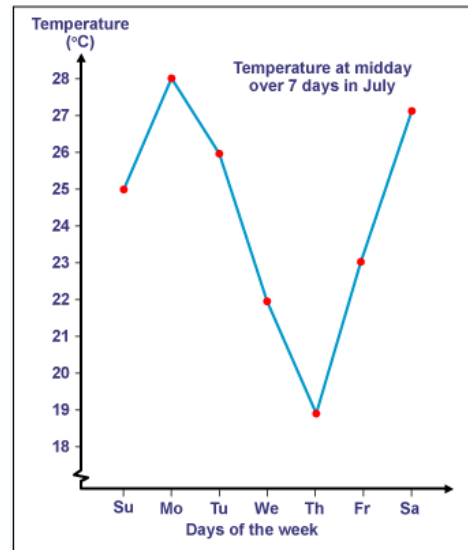
A mathematical model is an abstract model that uses mathematical language to describe the behavior of a system.

graph - a picture of numerical facts, organized in such a way that this picture is easier to understand than the table of numbers.

bar graph - used to compare *different* items; the length of each bar represents a numerical fact. A *double bar graph* may be used to compare the value of related things, in which case different colors are usually used.

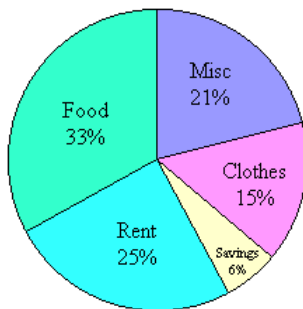


line graph - shows *changes in one* particular item, the line shows changes or trends usually over time. A *double line graph* may be used to compare two things within the same conditions; typically different colors are used to make it easier to read.



circle graph - also known as a pie graph; circle charts used to show percentage or fractions of the whole.

Milton Family's Budget (Title)



picture graph - compares *different* items; presents information by using a *hidden* or understood number line; a symbol is used to represent a definite quantity.

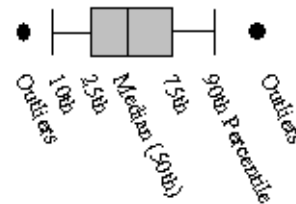


frequency table - a way of summarizing a set of data; it is a record of how often each value (or set of values) of the variable in question occurs.

Score	Frequency	Frequency (%)
0	4	13%
1	3	10%
2	5	17%
3	5	17%
4	6	20%
5	7	23%

box and whisker plot - is a way of summarizing a set of data measured on an interval scale. It is often used in exploratory data analysis. It is a type of graph which is used to show the shape of the distribution, its central value, and variability.

Boxplot key



graphing equations can also be used to represent data. These equations consist of ordered pairs, that when put into the equation, are equal.

Connections:

- a histogram or bar chart is a drawing that helps you visualize the information presented in a frequency table.
- a frequency polygon is a line graph made by connecting the midpoints of the tops of consecutive bars of a frequency histogram.
- use a computer or calculator to create two tables or graphs and to compare them.

Statistics:

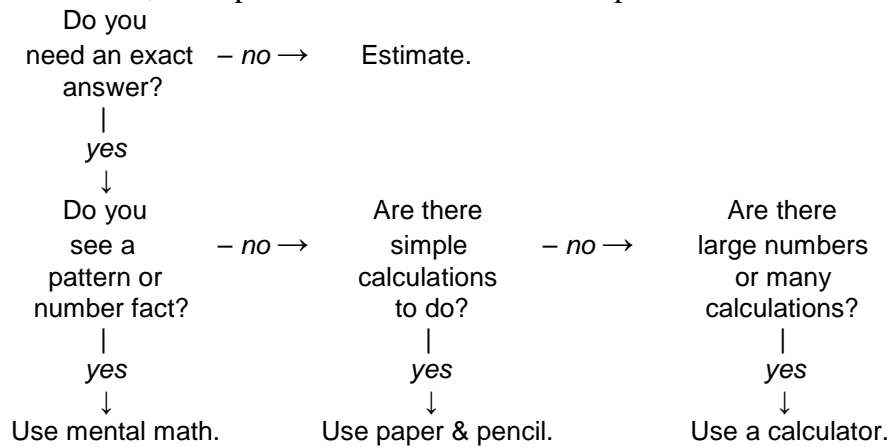
Statistics is a branch of mathematics that consists of collecting, organizing, and summarizing numerical facts. When the data is collected and displayed in a graph, you can look for trends and make predictions based on these facts.

- *Descriptive statistics* is concerned with analyzing or summarizing data that have been collected.
- *Inferential statistics* is concerned with making predictions and drawing conclusions based on incomplete information.
- the estimate is often based on a small random sample.

Estimating & Reasonableness:

- Estimating provides a quick answer when an exact number is not necessary and it allows you to check the reasonableness of an answer.
- Use patterns to estimate outcomes.
- Estimate decimal place, whole number, using compatible numbers (numbers that are easy to divide or multiply mentally), by finding the mean, median, or mode.
- If the estimate is close to the answer found on the calculator, the calculator is probably correct.

- Use this chart, taken from Mathematics Applications and Connections Interactive Software Edition Course 2, to help decide what method of computation to use:



- *expected value, E*, of an experiment is the sum of the products of each outcome times its corresponding probability

Cautions:

- outliers may distort the data
- data may be inaccurate
- data may be incomplete
- models are not identical to the situations they represent

Use of Software:

Calculators can be used to check estimates.

Be careful how you interpret and use the information given in the display. Calculators, at times, give the exact value, but, more often, display rational approximates.

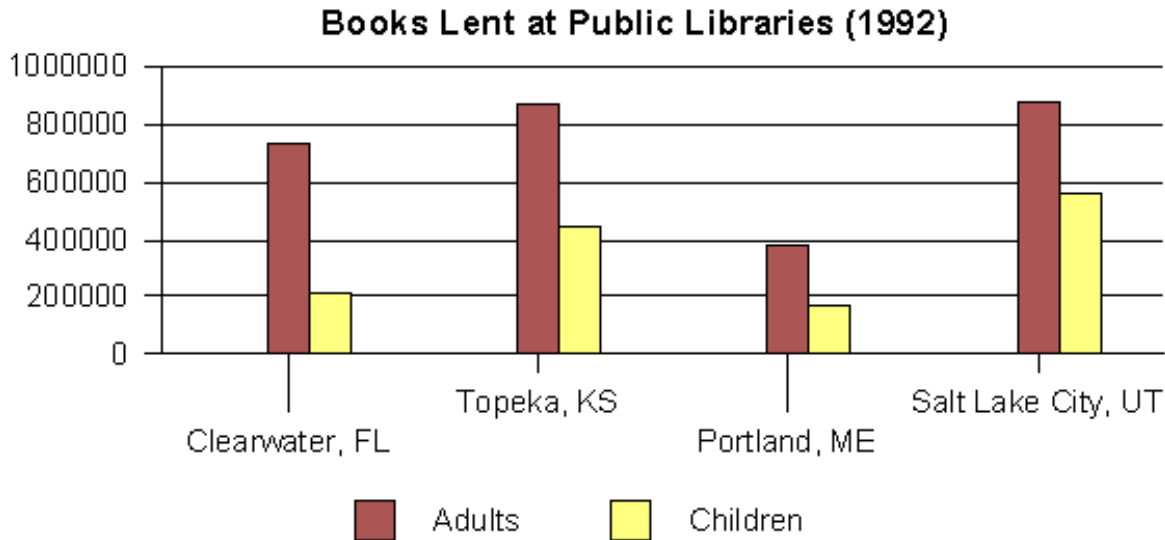
On a computer, use a *spreadsheet* program. A spreadsheet is a tool for organizing and analyzing data.

References:

- http://en.wikipedia.org/wiki/Main_Page
- http://www.stats.gla.ac.uk/steps/glossary/presenting_data.html#freqtab
- Course 1 Integrated Mathematics Third Edition (Isidore Dressler & Edward P. Keenan)
- Houghton Mifflin Unified Mathematics Book 1
- Mathematics: Modeling Our World Course 1
- Prentice Hall Middle Grades Mathematics An Interactive Approach Course 2
- Mathematics Applications and Connections Interactive Software Edition Course 2

Problems:

1.) The double bar graph below compares the 1992 circulation of adults' books and children's books at four libraries. Study the graph and answer the questions.



- Which library lent the most children's books?
- Which libraries lent about the same number of adults' books?
- Which library lent almost 400,000 adults' books? children's books?
- Which library had the greatest difference between the number of adults' books and children's books lent?
- Suppose you were the librarian in the community found in (d). About how many adults' books would you buy for every children's book?

2.) Decide whether a double bar or a double line graph is appropriate for the given data.

a.) population of four western states

Population		
State	1980	1990
ID	943,935	1,006,749
NV	800,493	1,201,833
OR	2,633,105	2,842,321
WA	4,132,156	4,866,692

b.) Education nationwide SAT scores

Year	Verbal	Math
1970	460	488
1975	434	472
1980	424	466
1985	431	475
1990	424	476

3.) Your math teacher makes a frequency table of students' test scores on the last test. Find the mode, median, and mean of these scores.

Test Score	Tally	Number
100	++++	5
95		3
90		2
85	++++	5

4.) Use the following data. These are the average daily temperatures in degrees Celsius for a two-week period in Sun City.

26.9, 24.1, 20.3 28.6, 27.2, 22.9, 23.2, 27.0, 28.3, 19.8, 22.1, 24.4, 25.8, 23.7

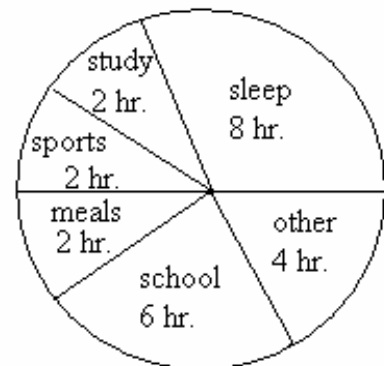
- Round the temperatures to the nearest degree and make a frequency table.
- Construct a frequency histogram and a frequency polygon.

5.) Estimate the area of a living room that measures 10.5 ft. by 9.25 ft.

6.) Graph the lines $y = 3x - 5$ and $y = -x - 1$. Estimate their point of intersection by looking at the graph, then verify by plugging the ordered pair into each equation.

7.) Ricardo made a circle graph show how he spent his time.

- What fraction of the day is spent sleeping?
- How much more time is spent in school than in sports?
- What fraction of the day is spent in school or sleeping?



8.) Estimate the average of the following numbers, then use a calculator to verify your result.
20, 28, 30, 46

