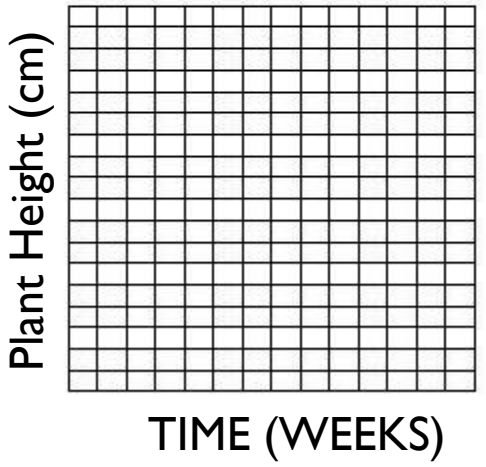
9/11 WARM-UP

- Handouts from last time
  - Handout with my handwriting on it is for your binder (nothing to write, just keep in binder for referencing)
  - Second handout: you ARE completing (use the checklist on 1st paper)
    - Line graph – two lines (one for each data set)
    - Questions on back
    - Don't forget to label x-axis, y-axis, and provide title

Week	Plants Grown in Sterilized Soil	Plants Grown in Nonsterilized Soil
1	0.8 cm	2.0 cm
2	1.5 cm	5.5 cm
3	2.0 cm	8.7 cm
4	2.3 cm	10.0 cm
5	2.4 cm	12.0 cm
6	3.8 cm	16.2 cm
7	5.0 cm	19.1 cm
8	6.0 cm	25.0 cm



Color-code lines (ex: blue for sterilized soil)

DATA ANALYSIS

PRE-AP BIOLOGY; UNIT 1 TOPIC 4

Objectives:

- I can record (quantitative) data in tables and charts, using units
- I can organize data to show the relationship between variables on appropriate graphs
- I can identify and discuss trends using data

ORGANIZING DATA COLLECTION

- During an experiment, scientists use data tables (charts) to record their data.
  - Data tables include vertical ***columns*** and horizontal ***rows***.
  - Each column and row should be labeled so you know what each number or description "means."
  - Should have a title that fully communicates what information is displayed in the table (this could be the same as your graph title)

Bird Sightings at Willow Point

Date	# Sparrows	# Wrens	# Jays
May 12	43	12	10
May 13	54	13	8
May 14	44	11	13
May 15	52	14	9
May 16	47	10	10

Organism	Direction of Movement		
	Toward Light	Away from Light	Neither
Euglena	X		
Paramecium			X
Fungus			X
Coleus plant	X		
Earthworm		X	

Plant Characteristics

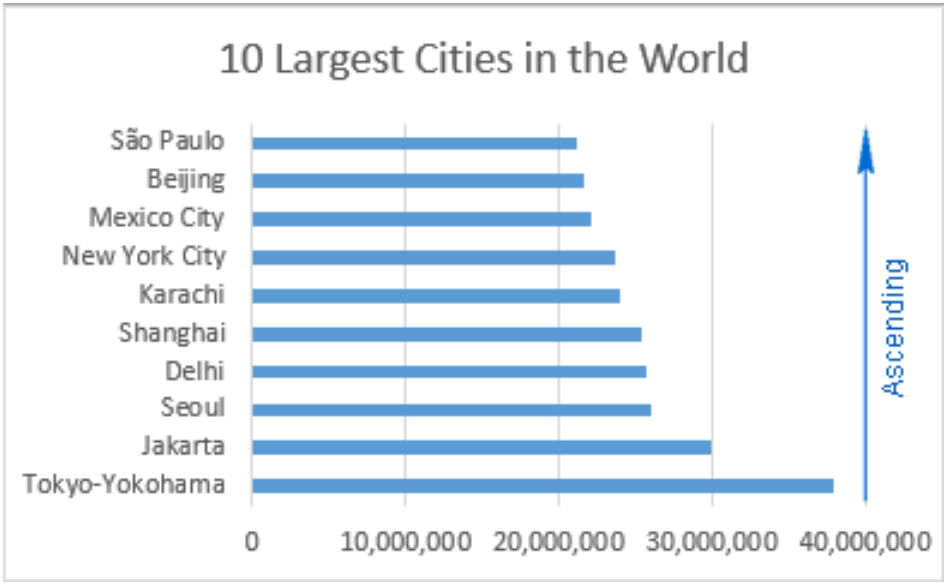
Plant	Type of Growth	Leaves	Flowers	Fruit
Cucumber	sprawling vines	fuzzy, dark green, 3-5 lobes	yellow	long and spiny
Eggplant	erect, bushy stems	fuzzy, large ovate	violet	large, egg-shaped berry, varying in color
Pumpkin	sprawling vines	large, fuzzy, triangular, lobed	yellow	large (2-20 lb), oblate to oblong, smooth rind
Pepper	straight and woody	slick, medium green	white	juiceless berries or pods, varying shape, size, and color
Okra	erect, shrub-like	heart-shaped and 3-5 lobes	yellow, crimson center	hairy, tapering capsule, 4-10 inches long

WHY TURN A CHART INTO A GRAPH?

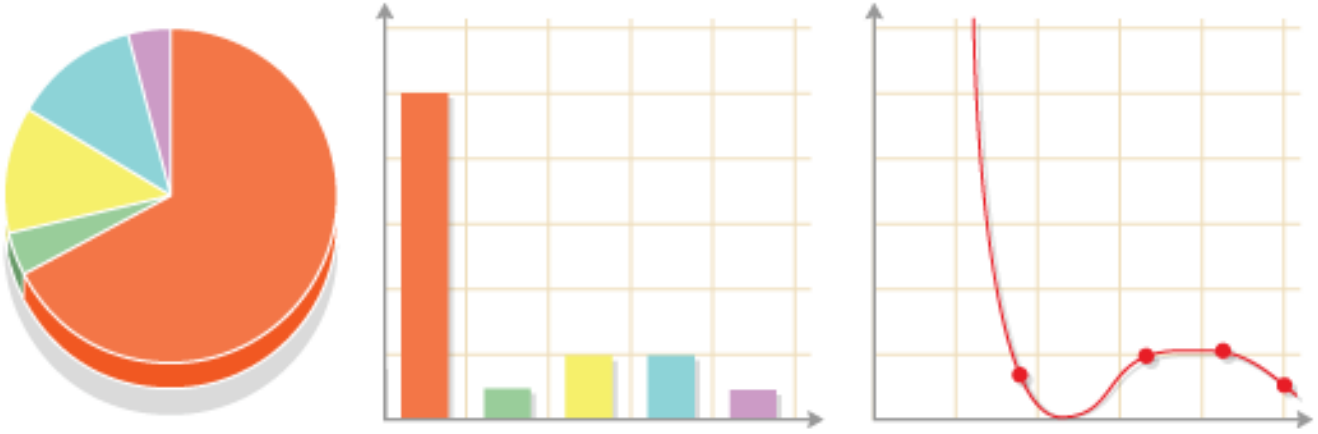
- Visualizes the data (most humans are visual learners)
- Easily and quickly identify patterns or trends in the data

10 Largest Cities in the World	
City	Population
Tokyo-Yokohama	37,900,000
Jakarta	30,000,000
Seoul	26,100,000
Delhi	25,703,000
Shanghai	25,400,000
Karachi	24,000,000
New York City	23,632,722
Mexico City	22,200,000
Beijing	21,650,000
São Paulo	21,250,000

Descending



TYPES OF GRAPHS



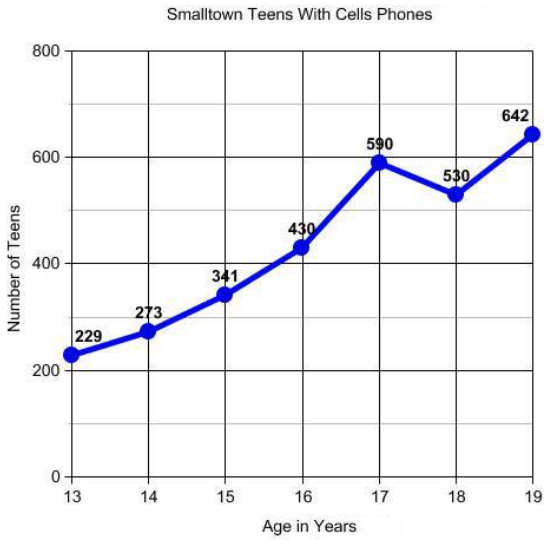
Pie Bar/Histogram Line

LINE GRAPH

- Both variables on the x (horizontal) and y (vertical) axes are quantitative / numerical
  - Often (but not always), the variable on the x axis is time (measured in days, months, years, etc.).

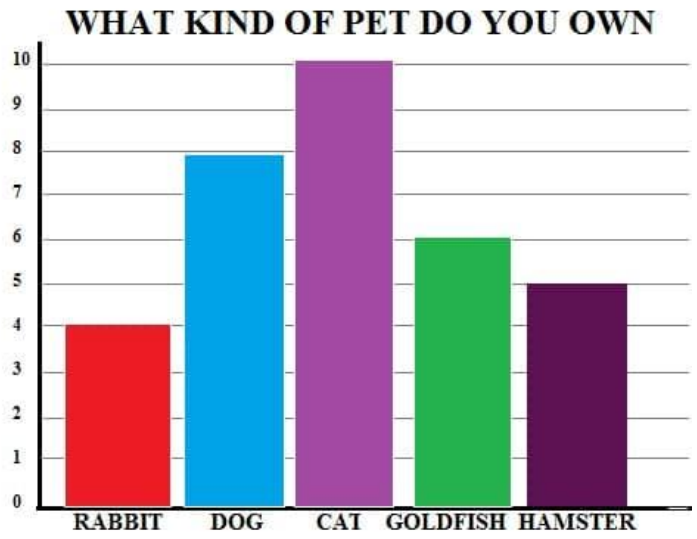
- Connected points allow us to see an overall trend in the data.

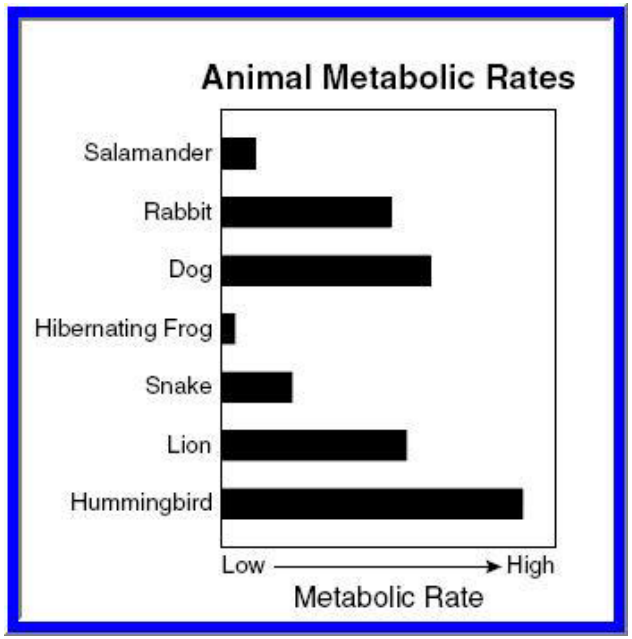
- ***Extrapolation:*** when we estimate values beyond our given data points on the x axis.



BAR GRAPH

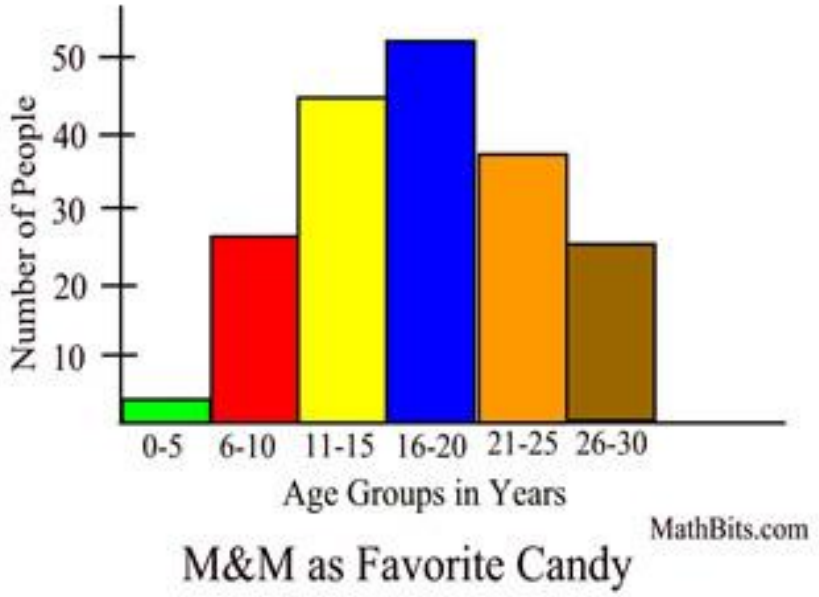
- Used to ***compare*** values from different "categories"
- One variable on the x axis that is typically QUALITATIVE
- One variable on the y axis that IS QUANTITATIVE





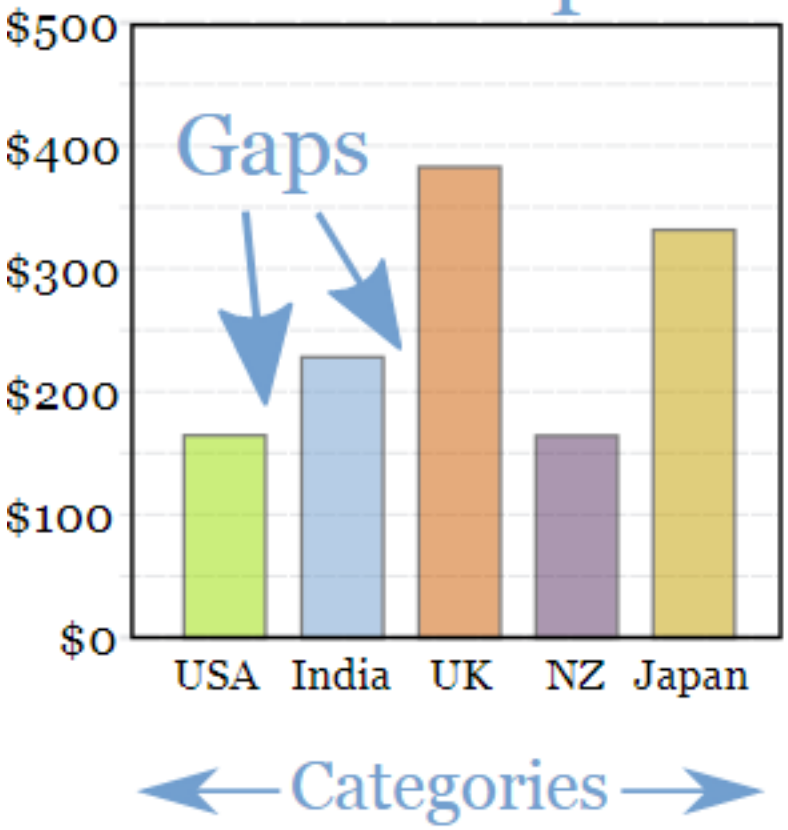
HISTOGRAM

- Similar to a bar graph.
- Compares numerical ranges, rather than "categories."

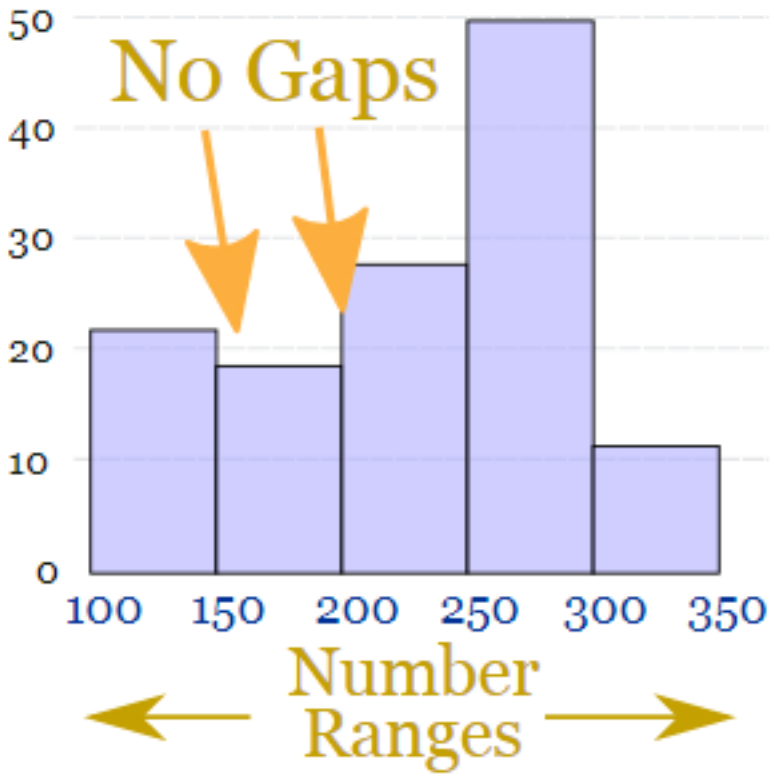


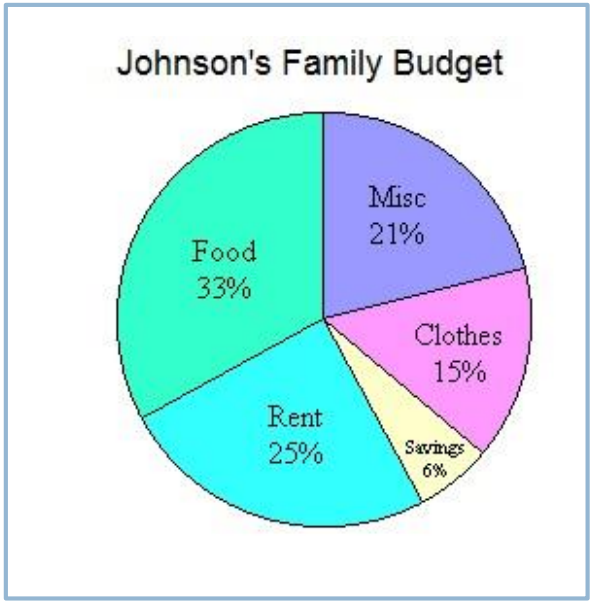
- *Example:* the number of people within various age ranges who consider M&M's to be their favorite candy at various age is depicted in the histogram shown below. Notice that the bars are not spaced apart like in a bar graph. Instead, they are connected.

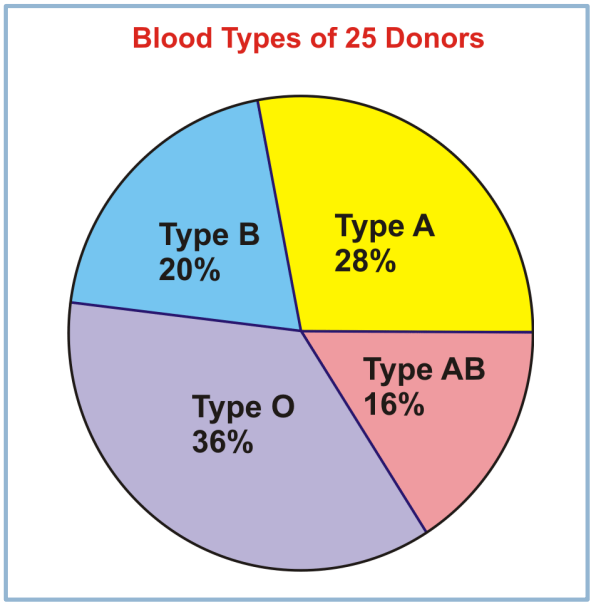
Bar Graph



Histogram





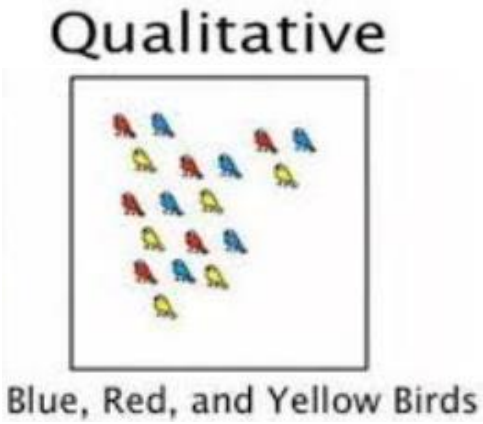


PIE GRAPH (CHART)

- Used to compare the parts of a whole.
  - Percentages or fractions
  - We don't make these in biology, but you should know how to read/analyze one.

REVIEW: QUALITATIVE VS. QUANTITATIVE

- **Qualitative:** descriptions or categories of something.
  - Example: types of candy or the characteristics of an apple



- **Quantitative:** numerical or counted measurements
  - Example: number of students or how much an apple weighs

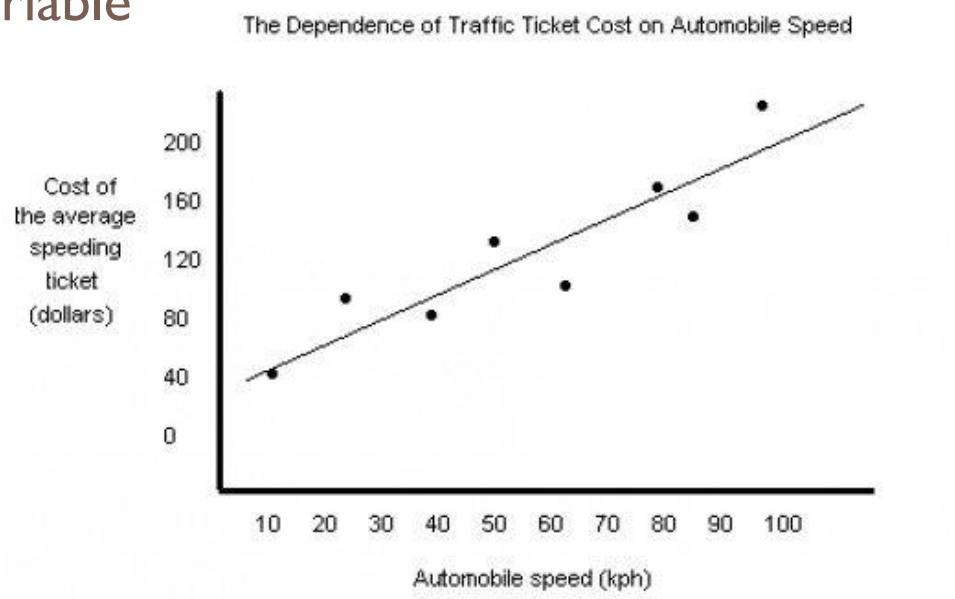
SCIENTIFIC GRAPHS MUST INCLUDE:

1. a descriptive title
2. variables placed on the correct axes
3. labeled axes with units in parentheses (if applicable)
4. properly scaled axes
5. properly plotted points or bars
6. a key/legend (if applicable)

MORE DETAIL: TITLE

- "The effect of _____ on _____"
- "How _____ effects _____"
  - first blank is independent variable
  - second blank is dependent variable

For example, the title for the scatter plot given below could be rewritten as "The effect of automobile speed on speeding ticket cost."



MORE DETAIL: VARIABLES LABELED ON THE CORRECT AXES

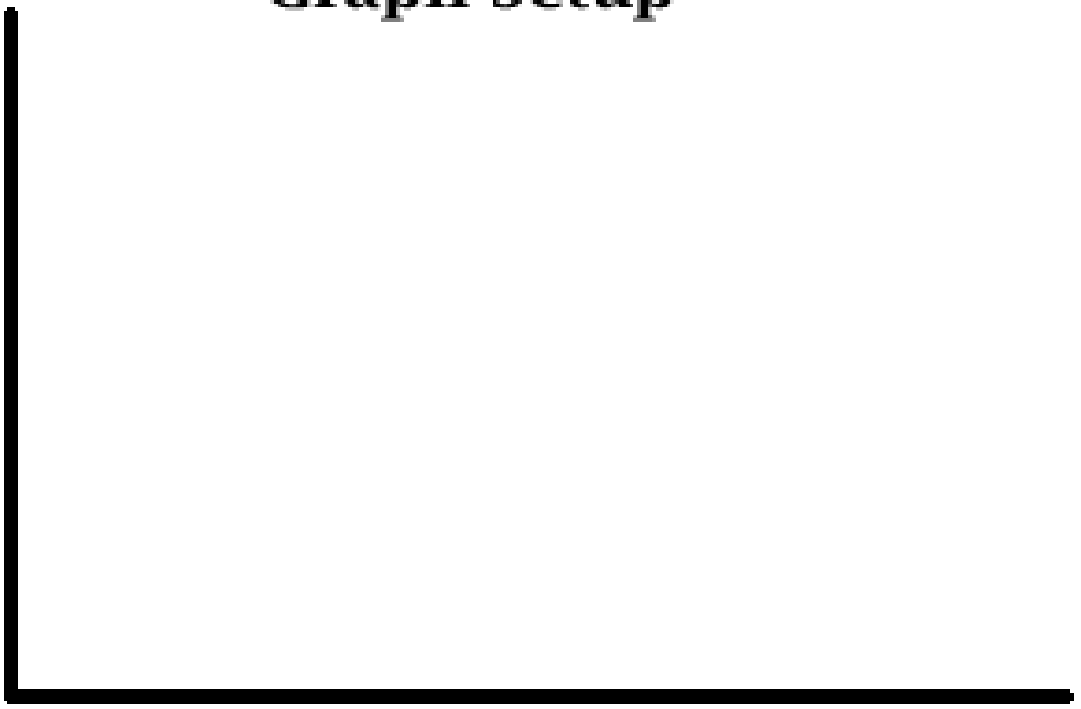
- independent variable label goes on the x-axis
- dependent variable label goes on the y-axis
  - You can remember this using the memory trick **"DRY MIX"**

DRY = **D**ependent **R**esponding **Y** axis

MIX = **M**anipulated **I**ndependent **X** axis

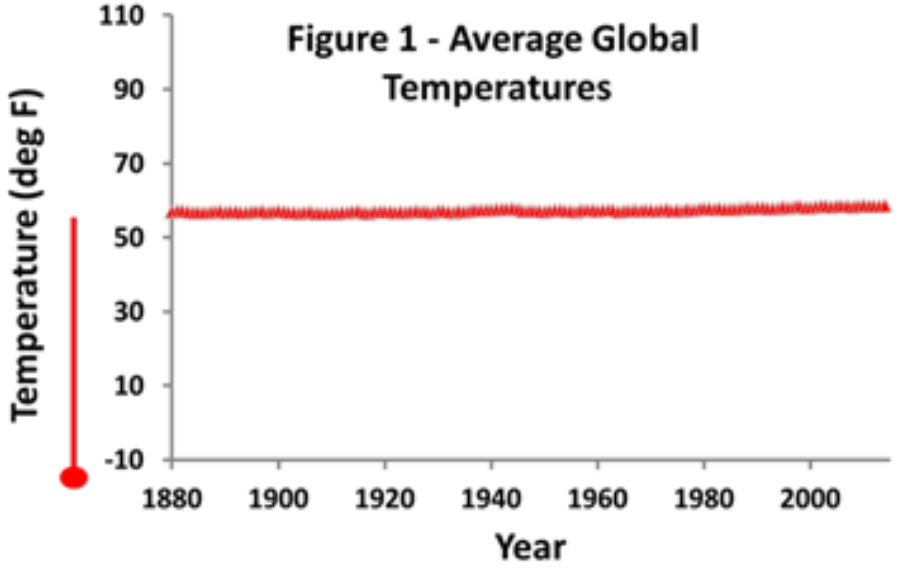
- For most labels, you should ***include units*** (in parentheses)
  - *Example*: Average Height of Grass ***(cm)***

Graph Setup



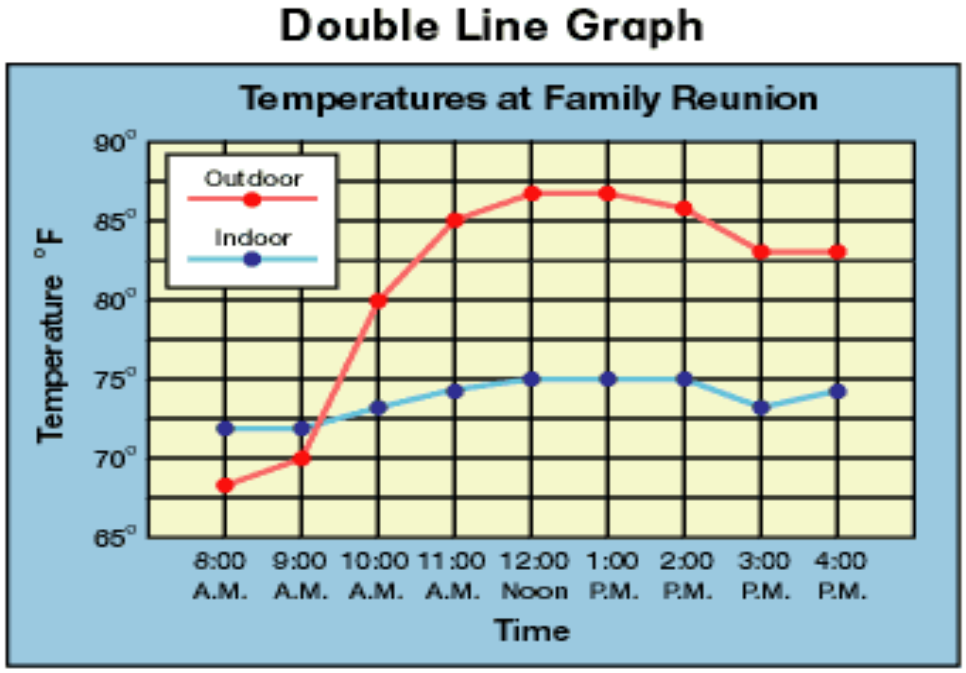
MORE DETAIL: APPROPRIATE SCALES

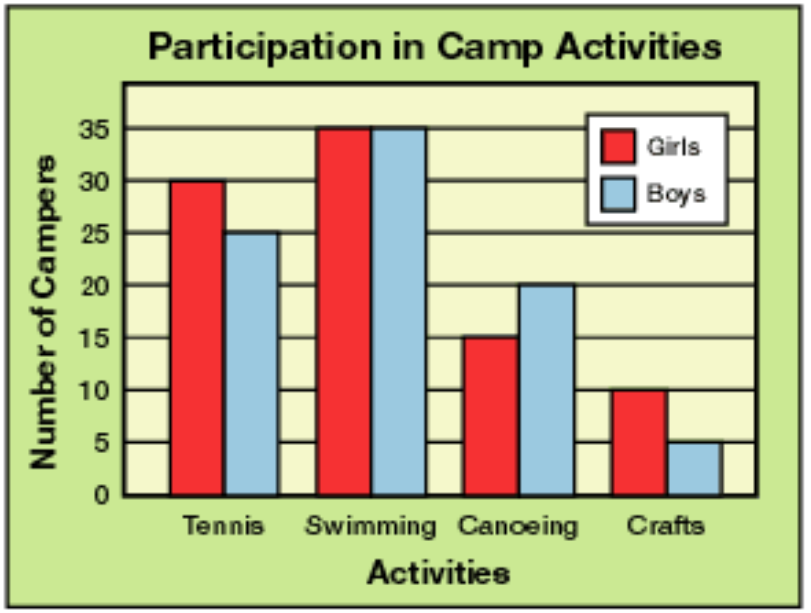
- Scale your axes so that the data is spread out across the ***whole grid***
- The graph given below has an ***badly*** scaled y axis
  - scale of the y-axis should only include values between 50-70*F
- When creating your scale, you must write values along the **entire axis!**



MORE DETAIL: KEY / LEGEND

- Two different sets of data can be plotted on the same graph to compare them to each other.
  - Must include a ***key/legend*** to distinguish between the different lines.





PRACTICE GRAPH #1:

- Let's say scientists were attempting to determine the effect of changing pH levels (a measure of acidity) in a pond on the number of surviving tadpoles. They counted the number of tadpoles found in ponds at various pH levels. Their data is given below. Please graph the data on the next page—making sure to include all the elements of a "proper scientific graph"—and answer the questions on your notes.

pH of water	Number of tadpoles
8.0	45
7.5	69
7.0	78
6.5	88
6.0	43
5.5	23

pH of water	Number of tadpoles
8.0	45
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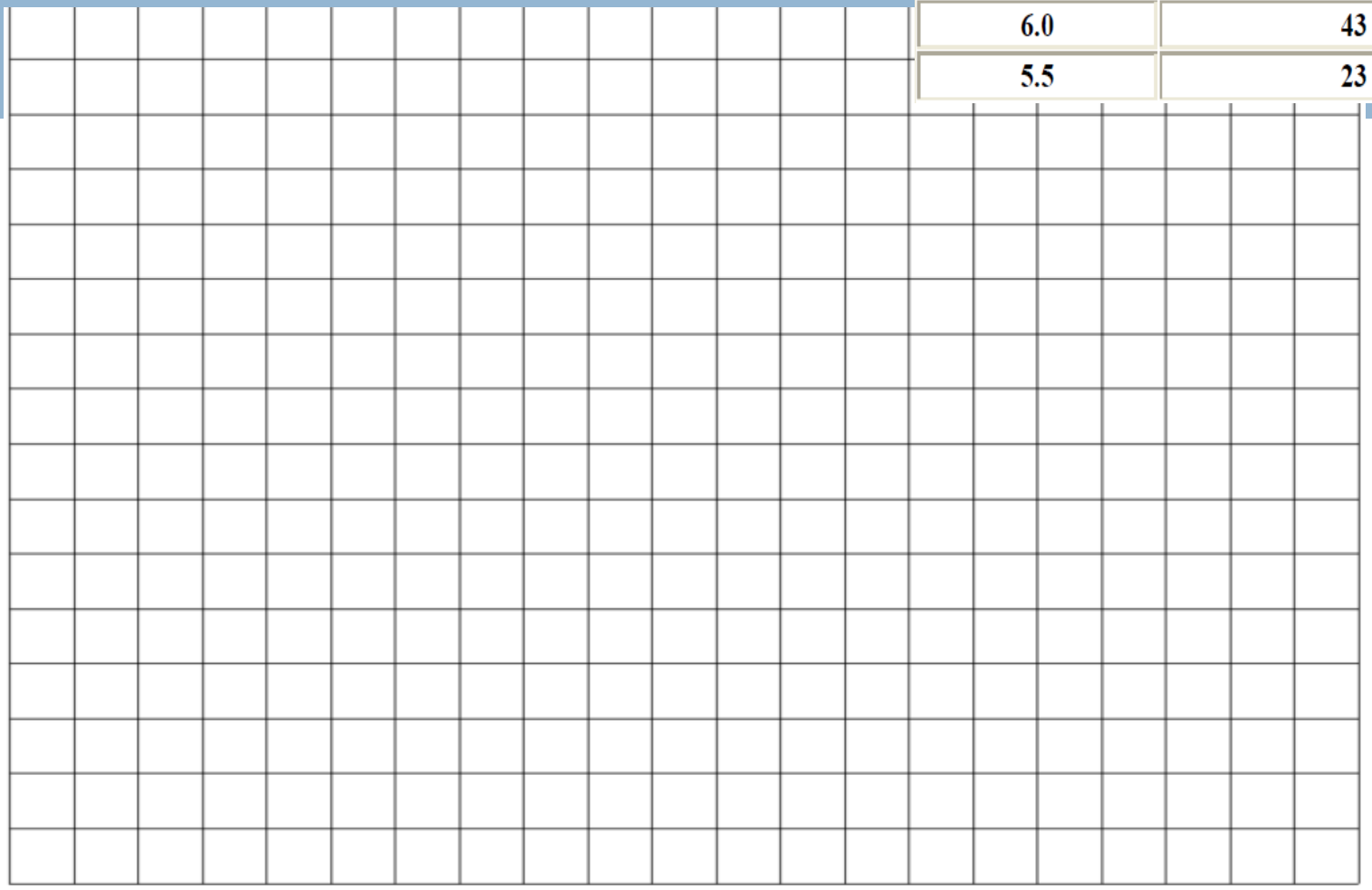
6.5	88
6.0	43
5.5	23



GRAPH ANALYSIS QUESTIONS

1. What kind of graph did you use to plot the data and why?
2. What is the I.V.?
3. What is the D.V.?
4. What is the OPTIMUM water pH for tadpole survival?

HOW DO I ANALYZE A GRAPH?

1. **Read the title and axis labels** for a graph or the title and all headings for a chart.
2. Try to identify the **independent and dependent variables**.
3. Some people choose to read the question before completing steps 1 and 2, and some people choose to complete steps 1 and 2 before reading the question.
4. Some terms you may want to know…
   - **Maximum / optimum** = the highest / best value
   - **Minimum** = the lowest value

PRACTICE PROBLEM #1

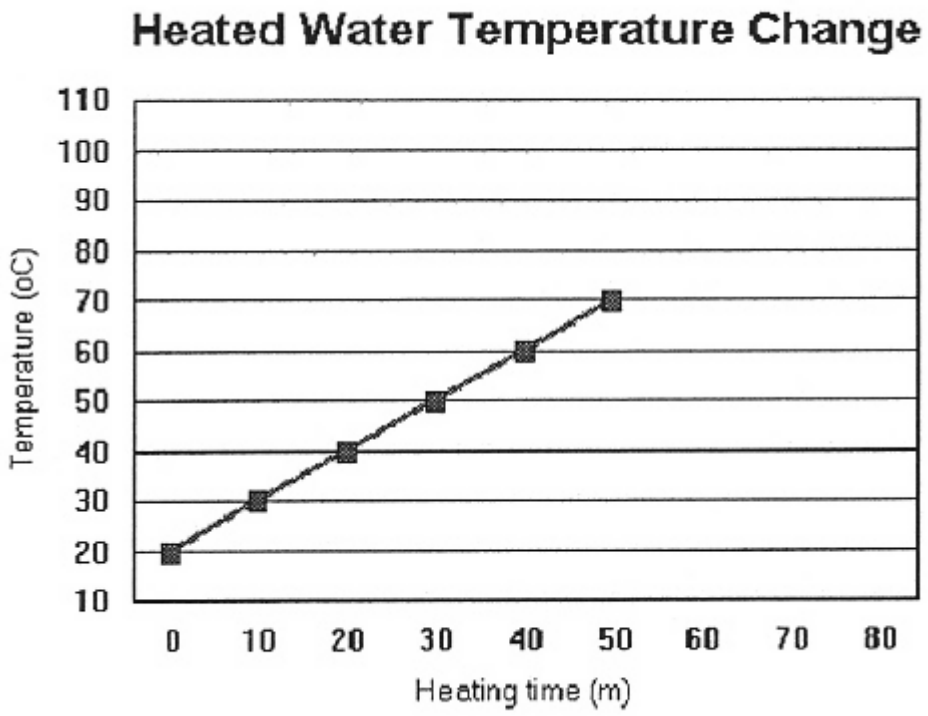
Based on the data in the graph to the right, the temperature of water at 25 minutes is

a) 15˚F

b) 15˚C

c) 45˚F

d) 45˚C



PRACTICE PROBLEM #2

The information to the right was collected in the field while studying the effect of pH on the growth of the duckweed plant. The data shows that duckweed has optimum growth at a pH of:

a) 4

b) 6

c) 8

d) 12

Field Data

Pond	pH of Pond Water	Number of Duckweed Plants
A	6	150
B	12	300
C	8	500
D	4	80