Data Analysis and Graphing

Data from Measurements

Physical Information (*qualitative or quantitative*) collected about matter or the change in matter in a chemical system

Quantitative Measurements

Measurements where data is collected using a measuring tool to compare to other measurements of the same type

Qualitative Measurements

Measurements where no data is collected but comparisons are made using the main human senses (*sight, smell, touch, sound, taste*)

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Analyzing Quantitative Data with Graphs

Systematic Data Collection

Data is collected using measuring devices based on quantitative sources (*mass, volume, length, etc*) The way data is collected is based on data relationships with variables and how variables change

Graphing and Data Analysis

Graphing is a method for showing relationships (*how data changes*) between variables when one or more variables change.

Beach Visitors
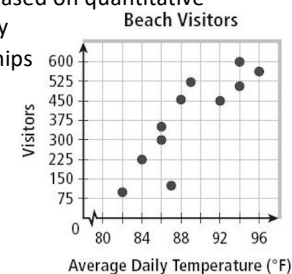
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Understanding X/Y Graph Plots
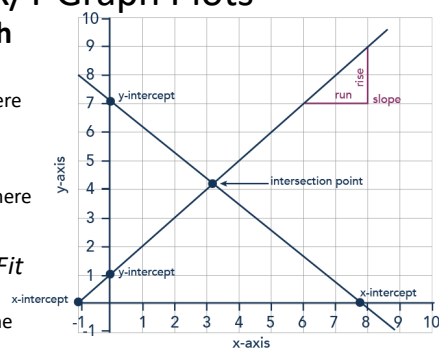
Main Parts of a Graph

Axis

The main sides of the graph where data is plotted on grid lines

Grid Lines

The main layout of the graph where the points are placed

Plot Lines / Line of Best Fit

The main connection point between data points, straight line through the average of the data

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Understanding X/Y Graph Plots

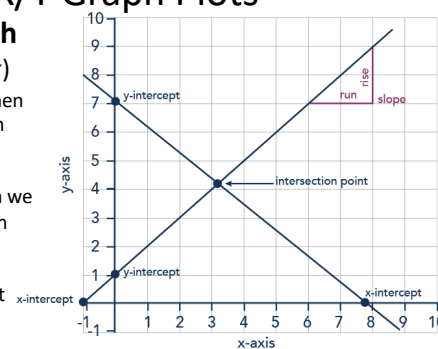**Main Parts of a Graph**

Independent Variable (x)

The variable that we control when we create the data set for graph

Dependent Variable (y)

The variable that changes when we create the data set for the graph

Intercepts (x and y)

The place where the line of best fit crosses the x and y axis lines on an x/y graph plot

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Understanding X/Y Graph Plots
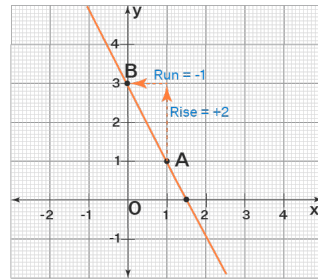### Main Parts of a Graph

Slope
The *steepness* of a graph, the change in the y-axis relative to the x-axis (*shown -*)

Signs of the Slope
+ (*positive*) Slope: Y and X axis both increase or decrease
+ Slope = *Direct Relationship*

- (*negative*) Slope: Y and X axis move in opposite directions
- Slope = *Indirect Relationship*

B
Run = -1
Rise = +2
A

$$\text{Slope} = \frac{\text{Rise}}{\text{Run}} = \frac{+2}{-1} = -2$$

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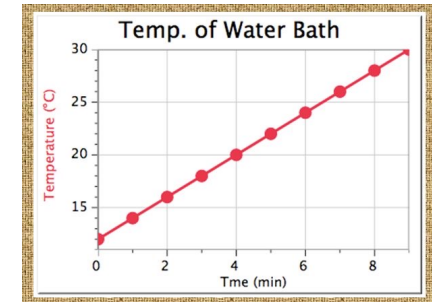## Understanding X/Y Graph Plots
Variable Relationships in Graphing

Direct Relationship
The dependent variable (*y*) changes in the same direction as the independent variable (*x*)

Slope (*m*) = positive (*+*)
X and Y on opposite sides of eqn

$$X = A \cdot Y$$

Temp. of Water Bath
Temperature (°C)
Time (min)

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Understanding X/Y Graph Plots
Variable Relationships in Graphing

Indirect Relationship
The dependent variable (*y*) changes in the opposite direction as the independent variable (*x*)

Slope (*m*) = negative (-)
X and Y on same side of equation

$$A = X \cdot Y$$

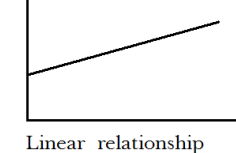**Change in Pressure over Time**
Pressure (atm)
Time (sec)
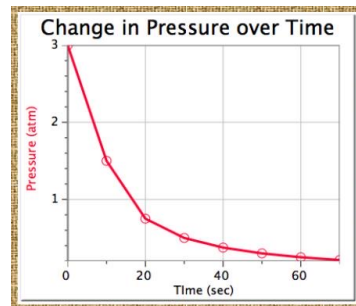
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Linear and Non-Linear Relationships
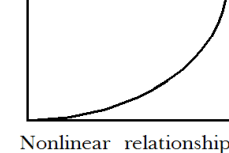Linear – Variables change at same rate (*speed*) to each other
Non-Linear – Variables change at rates that change over time

Slope (*m*) constant
(*does not change*)

Slope (*m*) variable
(*changes*)

Linear relationship

Nonlinear relationship

Science prefers linear over non-linear relationships for data analysis

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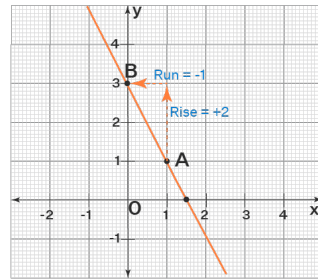## Calculating Slope of a Graph

Point Point Slope Method

$$m = \frac{Rise}{Run} = \frac{Y_2 - Y_1}{X_2 - X_1}$$

A = (X_1, Y_1) B = (X_2, Y_2)

Slope $= \dfrac{Rise}{Run} = \dfrac{+2}{-1} = -2$

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