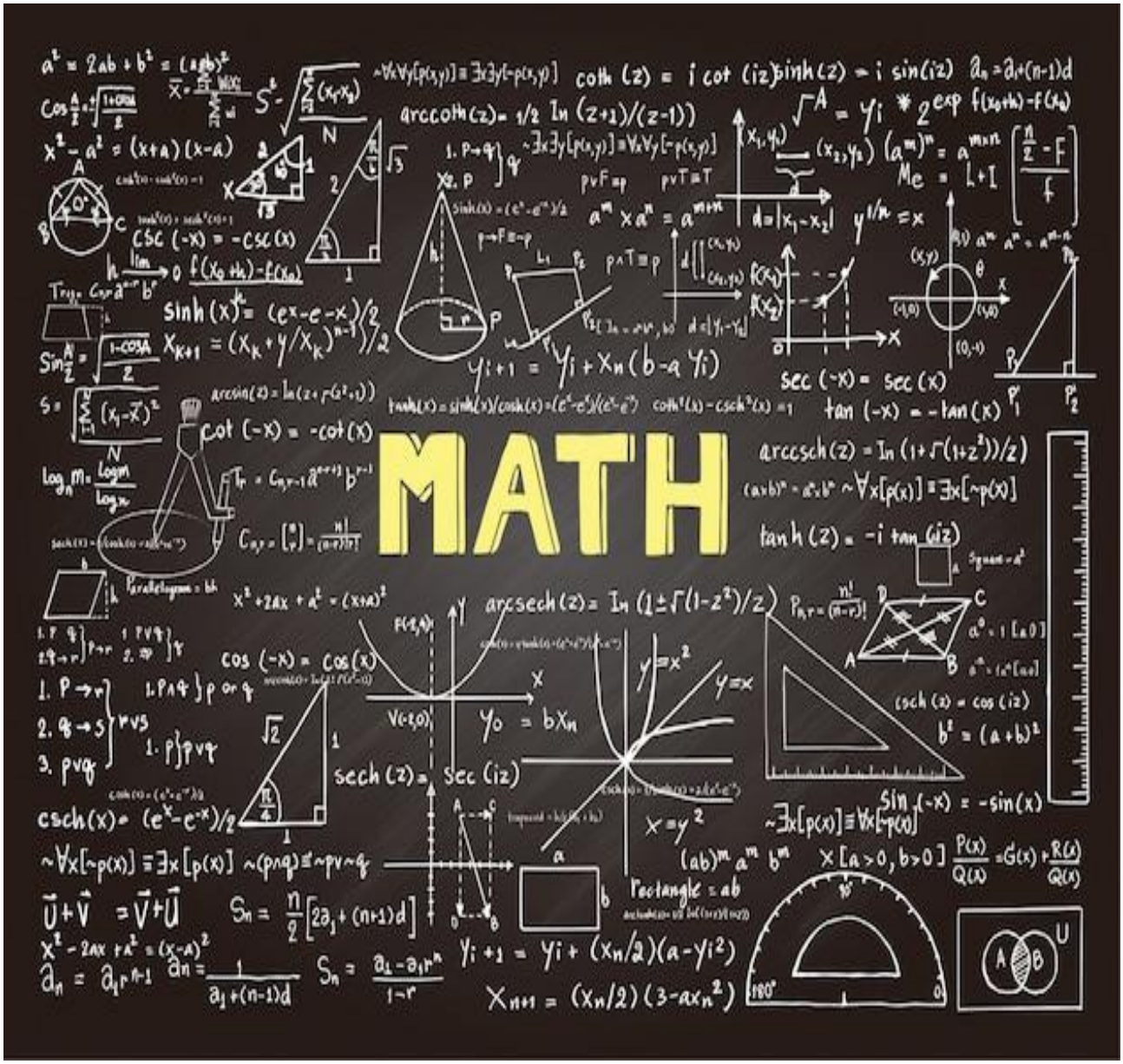
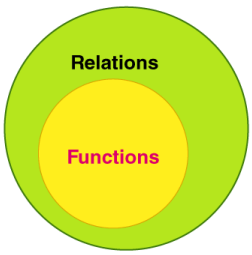


FUNCTIONS
GRADE 10

Functions & Relations

- **Relation:**
  - A mapping or pairing of input values with output values
  - Can be written as: ordered pairs, table, or graph
- **Function:**
  - A relation in which for every x-value there is only one y-value that corresponds with it
  - A relation in which members of the x-values do not repeat, y-values can be repeated
  - No two ordered pairs can have the same first component and different second component

Note: All functions are relations, but not all relations are functions.



- **Graph**: an accurate drawing of a function which is much easier to read than a list of numbers
- **Cartesian plane**: the plane in which graphs are drawn, consisting of an x-axis(horizontal) and y-axis (vertical)
- **Ordered Pair: An ordered pair consists of two objects or elements in a given fixed order.**
- **An ordered pair is represented as (INPUT, OUTPUT)**
- **Coordinate**: Gives the position of a specific point in two-dimensional space. The first number is the x-value and the second number is the y-value

Properties of Functions

- **Increasing function**: a function whose algebraic value increases as the input value increases i.e. a function that is going "**uphill"** when looking at it from left to right
- **Decreasing function**; a function whose algebraic value decreases as the input value increases i.e. a function that is going **"downhill**" when looking at it from left to right
- **Asymptotes**: a straight line that a curved graph gets closer and closer to but never touches it.
- **Symmetry**: a line that cuts the function exactly in half. **It is in the form y = mx + c**
- **Maxima/Minima:** a point at which the graph is changing its increasing or decreasing behavior
- **Domain:** the set of all possible input values for the function (x *values*)
- **Range:** the set of all possible output values (y *values*)

Function Notation

- We use the notation: ***y = f (x)***
- ***f* (*x*)** *does not* indicate "*f* times *x*," but represents the *y*-value for the indicated *x*-value.
- The letter *f* stands for the name of the function
- *x* indicates the variable that is being used (input)
- Note that ***f* (*x*) *is just another name for the dependent variable y*.**

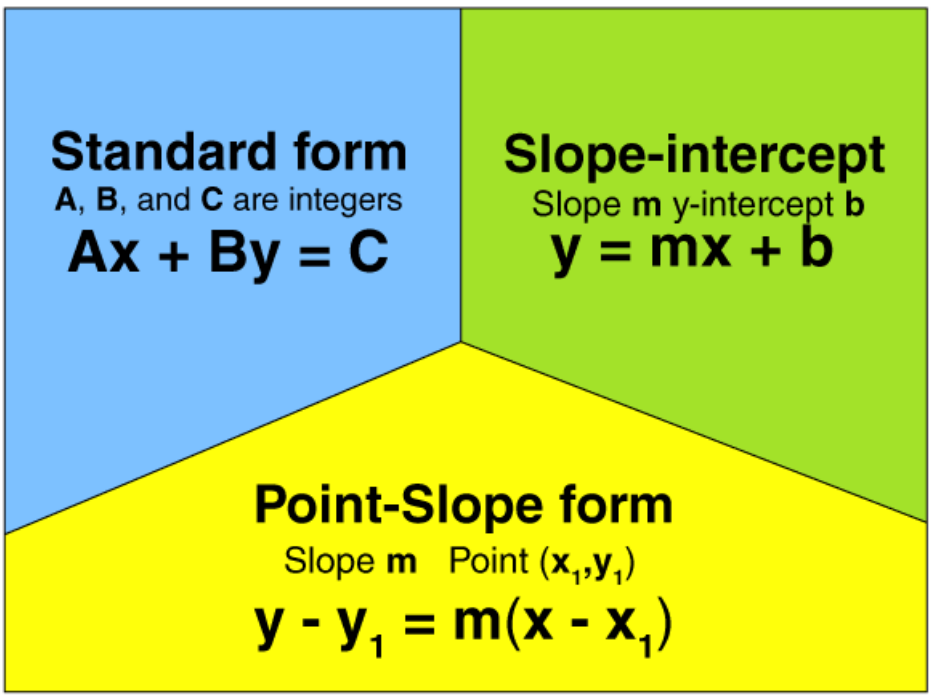
Parameters

- $h(x) = f(x) + k$: vertical shift k units up
- $h(x) = f(x) - k$: vertical shift k units down
- $h(x) = -f(x)$: reflection about the *x*-axis, the values of x remain the same, while the y-values change the sign only.
- $h(x) = f(-x)$: reflection about the *y*-axis, the values of y remain the same, while the *x*-values change the sign only.

1. Linear Graph

A linear graph is a straight line graph which is drawn to represent a linear relationship between two variables and how this relationship changes over time. A linear graph is a function of the form f(x) = mx+c. A linear graph can be represented in four different ways:

1. Slope-Intercept Form: y = mx+ c, where the slope is m and c represent the y-intercept.
2. General Form: Ax + By = C, where A, B, and C are constants
3. Horizontal Lines: y = c. The graph of y = b, is a horizontal line passing through the point (0, b) on the y-axis.
4. Vertical Lines: x = a. The graph of x = a, is a vertical line passing through the point (a, 0) on the x-axis**. It is not a function.**



The gradient of a straight line

The gradient (or slope) of a straight line measures its steepness. It is represented by the letter $\boldsymbol{m}$.

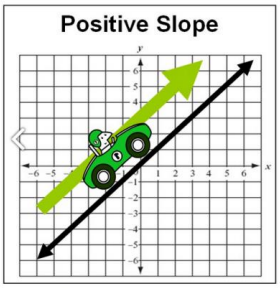
The gradient of a straight line in a graph can be calculated from any two points on the line, using the formula;

$$\boldsymbol{m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}}$$

4 Types of Slope:

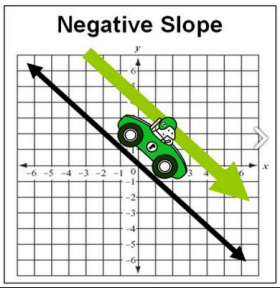
Positive Slope: Rises from left to right

- Examples: $\frac{3}{2}$ *or* 4
- Going up a hill



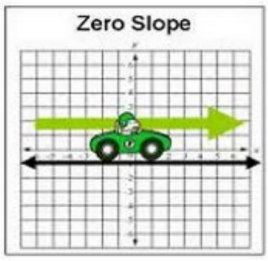
Negative Slope: Falls from left to right

- Examples: $-\frac{1}{2}$ *or* -4
- Going down a hill



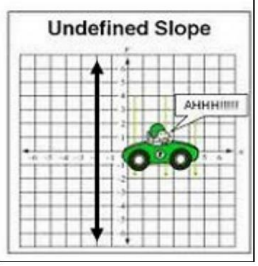
Zero Slope: Horizontal Line

- Y-values are the same
- Going in a straight line (No Vertical Change)



Undefined Slope: Vertical Line

- X-values are the same
- Falling off a cliff (No Horizontal Change)



Graphing a Linear Function

A. Point by Point plotting
- Make a t-chart
- Pick in 3-5 values for x. *Use (-2, 0, 2) to start unless it is a real life problem.
- Substitute each value for x and solve for y.
- Record ordered pairs in table.
- Graph the points and draw the line

B. Intercepts Method:
- The x-intercept is where the graph crosses the x-axis. The y-coordinate is always 0.
- The y-intercept is where the graph crosses the y-axis. The x-coordinate is always 0.
- Point by Point plotting

C. Using Gradient and Y-intercept:
- Identify the y-intercept (c) and plot the point (0, c)
- Use the slope (m) to find a second point
- Connect the points

Writing Equations of Lines

- Calculate the gradient using the given information
- Plug the gradient (m) into the equation y = mx+ c.
- Use the given point (x, y) to substitute the x- & y - coordinates into the equation y = mx+ c
- Solve equation for c.
- Write the equation

Practice Exercise

1. Complete the table for the values of y:
   1.1 y = f(x) = 2x + 5

x	-2	-1	0	1	2
y	1		5		

   1.2 y = g(x) = 2x – 3

x	-1	0	1	2	3	4
y			-1			5

   1.3 Draw, on the same system of axis the graph of f and g.
2. Write the equation in slope – intercept form using the given information
   2.1 m = 2 and passing through (-2; 8)
   2.2 m = $\frac{1}{3}$ and passing through (0; -3)
   2.3 passing through (3; 0) and (1; -8)
   2.4 passing through (2; -3) and (-2; 3)