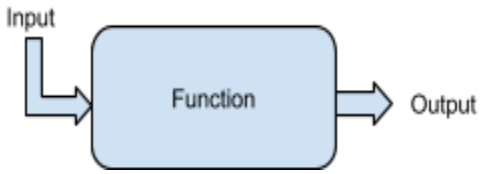
AP Calculus AB
Chapter 1, Prerequisites for Calculus

Lesson 1.2 Notes (Functions and Graphs)

Function: relation in which for every *x*-value, there is exactly one *y*-value



↳ **Domain**: inputs or *x*-values (independent variable)

↳ **Range**: outputs or *y*-values (dependent variable)

Function Notation: $y = f(x)$ is read "*y* equals *f* of *x*"

↳ $f(a)$ is what the function outputs when $x = a$, i.e. $f(a)$ is a *y*-value

Natural Domain: the largest set of *x*-values for which a formula gives real *y*-values

↳ Domain could be restricted by the context of the problem or by the formula itself.

↳ In Calculus, this matters, because we spend a lot of time worrying about the **endpoints** or **boundary points** of functions.

Intervals describe the domains of functions. They may be open, half-open, or closed. In **interval notation**, the domain is indicated by using either parentheses ( ) or brackets [ ].

1. **Open Interval**: contains no endpoints; is indicated by *parentheses.*

$\boldsymbol{a < x < b}$ **or** $\boldsymbol{(a, b)}$

2. **Half-Open Interval**: contains one endpoint; is indicated by one *parenthesis* and one *bracket.*

$\boldsymbol{a \leq x < b}$ **or** $\boldsymbol{[a, b)}$

or

$\boldsymbol{a < x \leq b}$ **or** $\boldsymbol{(a, b]}$

3. **Closed Interval**: contains both endpoints; is

indicated by *brackets.*

$a \le x \le b$ **or** $[a, b]$

Viewing and Interpreting Different Families of Functions

1. **Linear** **Ex.** $f(x) = 2x + 1$
2. **Quadratic** **Ex.** $f(x) = 2x^2 + 1$
3. **Cubic** **Ex.** $f(x) = x^3 + 1$
4. **Piecewise-Defined** **Ex.** $f(x) = \begin{cases} 2x - 1 & x \le 0 \\ x^2 + 3 & x > 0 \end{cases}$
5. **Absolute Value** **Ex.** $f(x) = |3x - 2|$
6. **Square Root** **Ex.** $f(x) = \sqrt{x + 3}$
7. **Inverse** **Ex.** $f(x) = \frac{2}{x}$
8. **Fractional Exponential** **Ex.** $f(x) = x^{\frac{2}{3}} + 1$
9. **Composite** **Ex.** $f(x) = x^2 + 1$, $g(x) = 2x - 1$, Find $f(g(x))$.

Even Functions: $f(-x) = f(x)$; graphically the function is symmetric about the *y*-axis.

Odd Functions: $f(-x) = -f(x)$; graphically, the function is symmetric about the origin.

In Calculus this year, we are going to master how to do 4 tasks on graphing calculators:

1. Graph functions.
2. Find the zeros of functions.
3. Calculate numerical derivatives.
4. Calculate numerical integrals.

Assignment #2

L. 1.2 Homework (Due on August 17th, the 1st day of school)

1. Graph the following functions on paper. Before automatically getting out your graphing calculators, try first using your brains to graph these functions. You might be surprised!

↳If you would like some plain graph paper, here you go. Graph Paper (-9 to 9)

2. Try to identify the domain and range for each function using *interval notation*.

3. Try to identify which one of the 10 functions is an *even function*. (Only 1 of them is!)

(a) $\boldsymbol{f(x) = -2x + 4}$

Domain:

Range:

(b) $\boldsymbol{f(x) = -2x^3 + 4}$

Domain:

Range:

(c) $\boldsymbol{f(x) = \sqrt{x+7}}$

Domain:

Range:

(d) $\boldsymbol{f(x) = \sqrt{x+7} - 2}$

Domain:

Range:

(e) $\boldsymbol{f(x) = |x+3|}$

Domain:

Range:

(f) $\boldsymbol{f(x) = |x+3| - 5}$

Domain:

Range:

(g)

$$f(x) = \begin{cases} 1, x < 0 \\ \sqrt{x}, x \geq 0 \end{cases}$$

Domain:

Range:

(h)

$$f(x) = \begin{cases} -3, x < -2 \\ \sqrt{4 - x^2}, -2 \leq x \leq 2 \\ 3, x > 2 \end{cases}$$

Domain:

Range:

(i) $\boldsymbol{f(x) = \sqrt{4 - x^2}}$

Domain:

Range:

(j) $f(x) = \frac{1}{x+3}$

Domain:

Range: