2.1: Functions

- I can determine if a relation is a function
- I can state the domain and range of a relation or function
- I can evaluate function notation for numbers and expressions

VOCABULARY

Relation: A pairing of x and y coordinates.

- Ordered Pairs (x,y)
- Table
- Mapping
- Graph
- Equation

Function: A pairing in which every x has EXACTLY ONE y.

Domain: All of the x values. Called input or independent variable

Range: All of the y values. Called output or dependent variable

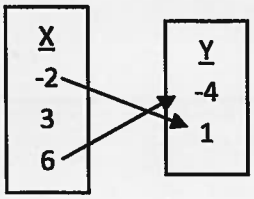
Is the relation a FUNCTION?

- Think people and places → Does every *person* (x) have one *place* (y)?
  - Can a person be nowhere? NO x must have a y
  - Can a person be in more than one place at a time? NO x can only have 1 y
  - Can multiple people be in the SAME place? Yes x's can pair with the same y
  - Can a place be empty? Yes A y can have no x.

- Graphs: **VLT – The Vertical Line Test**
  - If any vertical line crosses the graph NO MORE THAN ONCE, it is a function.

State the domain and range of the relations. Then determine whether or not they are functions.

Ex1:



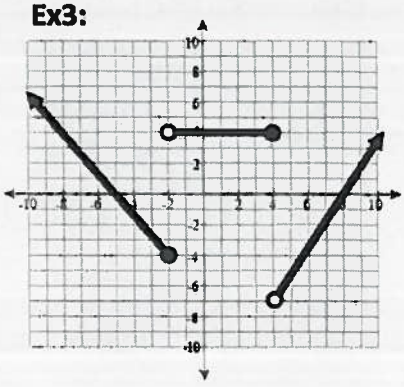
D: {-2, 3, 6}
R: {-4, 1}
NO - 3 has no y

Ex2:

{(-3,4), (1,5), (0,4), (-2,6), (7,-1)}

D: {-3, -2, 0, 1, 7}
R: {-1, 4, 5, 6}
Yes - each x has 1 y

Ex3:



D: all Real
R: y > -7

Yes - passes VLT

Ex4:

X	Y
-2	-4
-1	-2
0	0
-1	2
-2	4

D: {-2, -1, 0}
R: {-4, -2, 0, 2, 4}
NO - -2 + -1 have 2 y's

Function Notation: Instead of y = , we use f(x) =

- f(x) means the relation IS a FUNCTION with variable x.
- For multiple functions we tend to name functions: f(x), g(x), h(x), j(x), k(x)
- Evaluating: f(2) → "evaluate function *f* when x = 2" → Plug in 2 and follow order of operations

Quick Check:

$f(x) = 2x + 1 \quad g(x) = 4x^2 \quad h(x) = x^3 - 5x$

A. f(3)

$2(3)+1$
$6+1$
$\boxed{7}$

B. h(-2)

$(-2)^3 - 5(-2)$
$-8+10$
$\boxed{2}$

C. g(-6)

$4(-6)^2$
$4(36)$
$\boxed{144}$

Simplifying expressions in functions

1. Replace all x's with the expression (in parentheses)
2. Simplify by following order of operations
   - Exponents → do NOT distribute! Multiply times itself
   - Distributes & Combine Like Terms

Do & Discuss:

$f(x) = 2x + 1 \quad g(x) = 4x^2 \quad h(x) = x^3 - 5x$

D: f($-x^2-6$)

$2(-x^2-6)+1$
$-2x^2-12+1$
$\boxed{-2x^2-11}$

E: g(x+5)

$4(x+5)^2$
$4(x^2+10x+25)$
$\boxed{4x^2+40x+100}$

$(x+5)(x+5)$
$x^2+5x+5x+25 = x^2+10x+25$

F. h(-4a)

$(-4a)^3 - 5(-4a)$
$\boxed{-64a^3+20a}$

Simplifying a binomial squared: $(a+b)^2 = a^2+2ab+b^2$

- Rewrite as (a + b)(a + b) and multiply like normal (FOIL)
- Trick: "Square, Multiply – Double, Square" *Tune: "Lions, Tigers, Bears, Oh my!"

$(x-3)^2$: Sq. $-3x$ Sq. → $\boxed{x^2-6x+9}$

$(2x+7)^2$: Sq. $14x$ Sq. → $\boxed{4x^2+28x+49}$

Square 1st #
Multiply both together
Double that answer
Square 2nd #

Additional Resources:

- Textbook: Ch2.1 starts on pg.72