U1 L4 Functions

Name: _____ HR: _____

Skills: Determine whether a relation is a function, use function notation, evaluate functions, find domains, and evaluate a difference quotient.

Review/Practice

1. Symmetry: check x, y, and origin	2. Symmetry: check x, y, and origin	3. Symmetry: check x, y, and origin
$y = x^3 + 3x$	$y = \frac{3}{x^4 - 2}$	$y = 3\lvert x + 2\rvert - 3$

• relation	any pairing of inputs (x) with outputs (y)
• function	a relation where <u>each</u> input has exactly <u>one</u> output
• domain	the set of all possible inputs (x-values)of a function
• range	the set of all possible outputs (y-values) of a function
• function notation	y = f(x); f is the function's name, x is the input, f(x) is the output

What Makes a Relation a Function?

A function assigns to each input exactly one output. If any input repeats with a different output, it is NOT a function.

Ex: Is this a function? Testing function definition with points

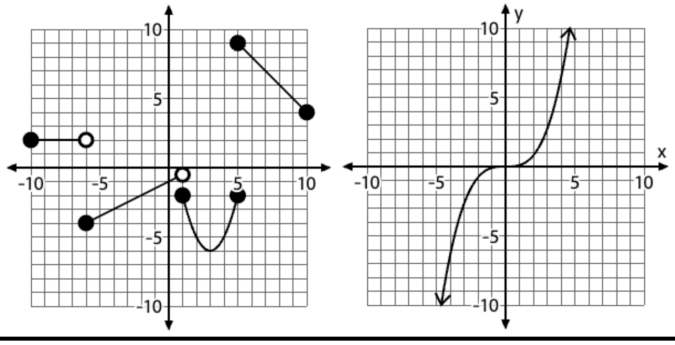
Input, x	2	2	3	4	5
Output, y	11	10	8	5	1

Ex: Is this a function? Testing function definition with equations.

a. $x^2 + y^2 = 8$

b. $2y - 4x^2 = 36$

Ex: Is this a function? Testing function definition Graphically



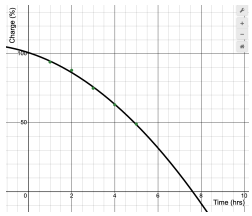
Function Notation & Evaluating Functions

Ex: f(x) = 3x – 5. Find f(1), f(–3), and f(x + 2).

You try: f(x) = x² + 1. Find f(2), f(–4), and f(t + 1).

You try: f(x) = $g(x) = -x^2 + 4x + 2$. ***Find*** $f(x + h)$

Four Ways to Represent a Function

1. Verbally	***2. Numerically***	***3. Graphically:*** Points on a coordinate plane.	***4. Algebraically***
A sentence describing how input relates to output.	A table or list of ordered pairs.		An equation in two variables.
Ex. Energy consumption on your phone as a function of time using the internet.	t in hrs: 1, 2, 3, 4, 5 $E(t)$ in %: 94, 88, 75, 63, 49		$E = -1.1t^2 - 5.1t + 100$ $E(t) = -1.1t^2 - 5.1t + 100$

Finding the Domain of a Function

Unless stated otherwise, the domain is all real numbers EXCEPT values that make a denominator zero or a square root negative.

Domain: A description of the x values that can be used in an function or is used by the function.

Ex: $f(x) = x^2, x \geq 0.$

Ex: $f(x) = \begin{cases} x+2 & \text{if } x < 1 \\ 3x-1 & \text{if } x > 1 \end{cases}$

Graphically: The domain is all the x-values that are used to make the entire graph.

Why would any x-values NOT be allowed?

1. Physics/science/reality of the physical world:
2. Math

a. You can't divide by _____

b. You can't take _____ roots

of _____ numbers

c. You can't take the logarithm of _____ or _____ numbers.

d. The Problem your trying to solve requires it.

Ex $f(x) = \sqrt{2x-9}$

Domain:

Ex $f(x) = \sqrt{25-x^2}$

Domain:

Ex $f(x) = \dfrac{x-8}{x-3}$

Domain:

$h(x) = \dfrac{x}{x^2-x-6}$

Domain:

Finding Values for Which $f(x) = 0$

$f(x) = 4x - 15$, find all real values of x for which $f(x) = 0$

$g(x) = x^2 - 5x + 6$, find all real values of x for which $g(x) = 0$

Finding Values for Which $f(x) = g(x)$

Ex $f(x) = x^2$, $g(x) = 2x^2 - 4x + 3$	***Ex*** $f(x) = 2x - 1$, $g(x) = x^2$

The Difference Quotient

This ratio measures average rate of change over a tiny interval — it's a key building block for calculus.

$$\frac{f(x+h) - f(x)}{h},\ h \neq 0$$

Ex: f(x) = x² − 4x + 7	***You try: f(x) = x² + 2x − 3***

Application: Velocity of a Ball

The velocity of a ball thrown upward is

$v(t) = -32t + 48$, where t is time (sec) and v is velocity (ft/sec).

a. Find the velocity when t = 1.

b. Fnd t when v(t) = 0 (the moment of max height).

c. Find the time it takes for the velocity to reach zero.

Section 1.4 Summary — Can you...

☐ Decide whether a relation is a function?

☐ Use function notation to evaluate f(x)?

☐ Find the domain of a function?

☐ Evaluate and simplify a difference quotient?

Domain: exclude 0 denominators & square roots of negatives

y=f(x)

$$\frac{f(x+h) - f(x)}{h}$$