Mrs. Parker

Unit 1 Notes / Secondary 3 Honors

Day 1: FUNCTIONS

FUNCTION: *a relation that assigns to each element (x)* ***exactly one*** *element (y)*

- each x (input value) is used once.

DOMAIN: Set of all x-values (input)

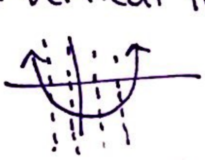
RANGE: Set of all y-values (output)

TESTING FOR FUNCTIONS:

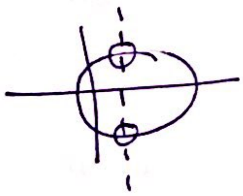
We can determine if a relation is a function by looking at *graphs, lists of coordinates, and equations.*

* To determine if a relation is a function by looking at its GRAPH:

* Vertical line Test



Function ✓



not a function

* To determine if a relation is a function by looking at a list of its COORDINATES:

* are all the x's different?

(1, 2) (3, 4) (5, 6) (6, 4)

yes

(1, 2) (1, 3) (1, 6)

NO

* To determine if a relation is a function by looking at its EQUATION:

* Do I get more than one value for y when I plug in x's?

$x + 2 = y^2$

$\pm\sqrt{x+2} = y$ → if plug in $x = 2$, $y = 2$, $y = -2$

Not a function

$\Longrightarrow$ if y^2 then not a function

Examples: Determine whether the relation represents *y* as a function of *x*.

1) {(2,11), (2,10), (3,8), (4,5), (5,1)}

No

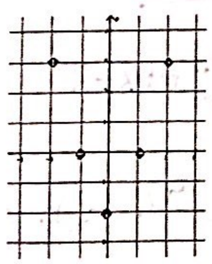
2) {(a,2), (b,3), (c,4)}

Yes

3) {(4,2), (3,2), (1,2)}

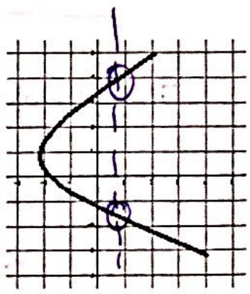
Yes

4)



Yes

5)



No

Which of the equations represent(s) y as a function of x? Explain.

6) $x^2+y=1$

Yes

7) $-x+y^2=1$

NO

8) $x^2+y^2=1$

NO

FUNCTION NOTATION

For equations where y is written in terms of x; $y=$ (some equation) are often given names such as f or g if they are functions. For example $y=3x^2-2$ could be written as $f(x)=3x^2-2$. This is known as function notation where $f(x)=y$. Function notation can also be used to indicate values for x: $f(3)$ means the value of f when $x=3$.

Examples: Evaluate $g(x)=-x^2+4x+1$ at the following points:

9) $g(2)$

$= -(2)^2+4(2)+1$

$= -4+8+1$

$= \boxed{5}$

10) $g(m)$

$= \boxed{-m^2+4m+1}$

11) $g(x+2)$

$= -(x+2)^2+4(x+2)+1$

$= -(x^2+4x+4)+4x+8+1$

$= -x^2-\cancel{4x}-4+\cancel{4x}+8+1$

$= \boxed{-x^2+5}$

12) Find all real values of x such that $f(x)=0$: $f(x)=5x+1$

$0=5x+1$

$\boxed{x=-1/5}$

DIFFERENCE QUOTIENT

→ Plug $(x+h)$ in for x

The formula for the difference quotient is $\frac{f(x+h)-f(x)}{h}$. It is related to the slope equation.

EX) Find the difference quotient and simplify the answer:

13) $f(x)=2x-1$

$= \frac{2(x+h)-1-(2x-1)}{h}$

$= \frac{\cancel{2x}+2h\cancel{-1}-\cancel{2x}\cancel{+1}}{h}$

$= \frac{2h}{h} = \boxed{2}$

14) $g(x)=x^2-4x+7$

$= \frac{(x+h)^2-4(x+h)+7-(x^2-4x+7)}{h}$

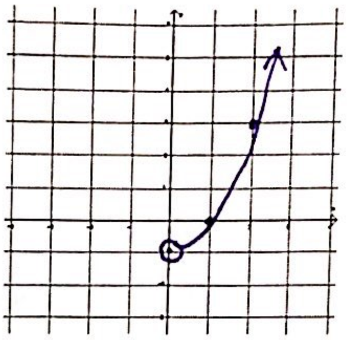
$= \frac{\cancel{x^2}+2xh+h^2-\cancel{4x}-4h\cancel{+7}-\cancel{x^2}+\cancel{4x}-\cancel{7}}{h}$

$= \frac{h^2+2xh-4h}{h} = \frac{\cancel{h}(h+2x-4)}{\cancel{h}} = \boxed{h+2x-4}$

DOMAIN RESTRICTIONS: Sometimes the domain of a function will be included with the equation:

EX) $f(x)=x^2-1,\quad x>0$ Sketch this graph

Domain: $X>0$



→ Values of x you can't use in the function

Two reasons for domain restrictions are:

➡ Fractions:

Can't have 0 in denominator

➡ Even radicals: $\sqrt{\ }$, $\sqrt[4]{\ }$, $\sqrt[6]{\ }$, ...

Can't have a negative value under even radicals.

EX) Find the domain of each example:

16) $f(x)=\sqrt{x}$

$X \geq 0$

17) $h(x)=\dfrac{1}{x+5}$

all $\mathbb{R}$, $x \neq -5$

18) $g(x)=\dfrac{1}{x^2-4}$

$x^2-4=0$

$x^2=4$

$x=\pm 2$

all $\mathbb{R}$, $x \neq 2, -2$

19) $h(x)=\sqrt{x^2-4}$

$x^2-4 \geq 0$

$\cancel{x^2 \geq 0}$

$\boxed{x \leq -2 \quad x \geq +2}$

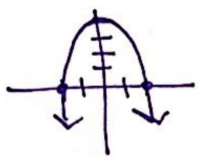
20) $p(x)=\sqrt{x+3}$

$X+3 \geq 0$

$\boxed{X \geq -3}$

21) $k(x)=\sqrt{4-x^2}$

$4-x^2 \geq 0$



$\boxed{-2 \leq x \leq 2}$