#### What is a function?

**Quick Check** 

Name and give a description of a "machine" that takes an input and produces an output?

## **Function Machine**



 $f(x)=x^2+1$ 

# **Reading a Function Rule**

$$f(x) = 2x^2 - 4x + 1$$
 view as  $\rightarrow$   $f() = 2()^2 - 4() + 1$   
a.  $f(-2) =$   
b.  $f(2a) =$   
c.  $f(\frac{x}{2}) =$   
d.  $f(x^2 - 1) - f(2) =$ 

# Evaluate the function at the given input. [a, b, h are real numbers.]

1. For the function f defined by  $f(x)=x^2+7$ , evaluation each expression:

a. 
$$f(3a)$$
  
b.  $f(b-1)$   
c.  $\displaystyle rac{f(x+h)-f(x)}{h}$  where  $h
eq 0$ 

2. If  $f(x)=2x^2+5x+1$  and h
eq 0, evaluate  $\displaystyle rac{f(a+h)-f(a)}{h}$ 

#### Finding the domain $\rightarrow$



#### Find the domain of each function.

$$f(x)=rac{5}{x^2-x} \qquad \qquad g(x)=\sqrt{9-x^2} \qquad \qquad h(t)=rac{t}{\sqrt{t+1}}$$

What does it mean for a function to be defined or undefined?

# Mapping Function definition $\leftrightarrow$ graph

If f is a function with domain A, then the graph of f is the set of (input, output) pairs

 $\left\{\left( egin{array}{c} x,f(x) \end{array}
ight)\mid x\in A
ight\}$ 

The graph of the function f is the graph of the equation y = f(x). The outputs are assigned to the y - axis.



#### **Piece-wise defined functions**

Functions defined by different formulas in different parts of their domain.



What situations in life can be modeled with these functions?

#### $\textbf{Graph} \longleftrightarrow \textbf{Equation}$



Using the graph, write the definition for the function.

2. 
$$f(x) = egin{cases} x+3 & ext{if} \ -2 \leq x < 1 \ 5 & ext{if} \ x=1 \ -x+2 & ext{if} \ x>1 \end{cases}$$

Graph the piecewise-defined function.

#### **Evaluate Piece-wise Functions**

1. A function f is defined by

$$f(x) = egin{cases} 1-x & ext{if } x \leq -1 \ x^2 & ext{if } x > -1 \end{cases}$$

Evaluate f(-5), f(-1), f(0), f(100), and sketch the graph.

2. Given a piecewise defined function:

$$g(t)=egin{cases} t^2+2 & ext{if}\ t\leq 2\ t^2 & ext{if}\ t>2 \end{cases}$$

Find g(-2), g(0),  $g(s^2+2)$  where s is a real number.

How does the Vertical Line Test help us inspect if a graph shows a function?



#### Are these the equations of functions?

1. 
$$y^2 = x^2 - 4$$
  
2.  $(x^2 + y^2)^2 = 100(x^2 - y^2)$   
3.  $x^2 + y = 4$   
4.  $(x^2 + 4)y = 8$   
5.  $x^{2/3} + y^{2/3} = 5$ 

6. xy = 1

Use Desmos.com or your calculator as necessary. Develop a graphical or algebraic reasoning to explain your answer.

## Symmetry

A function is called an **even function** if

$$f(-x)=f(x)$$

A function is called an <mark>odd function</mark> if

$$f(-x)=-f(x)$$





arphi Why are we not talking about symmetry about the x-axis for functions?

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Determine whether f is even, odd, or neither algebraically. Use a graphing calculator to verify your result.

1. 
$$f(x) = rac{x}{x^2+1}$$
  
2.  $g(x) = 1 + 3x^3 - x^5$   
3.  $h(x) = x|x|$   
4.  $p(t) = rac{t^2}{t^4+1}$