MAT123

Functions - Introduction

Domain/Range I

xy-Plane

Plot ordered pairs on the ***xy*-plane**:

format: (x,y)

y-coordinate

x-coordinate

$A\ (-3,5)$

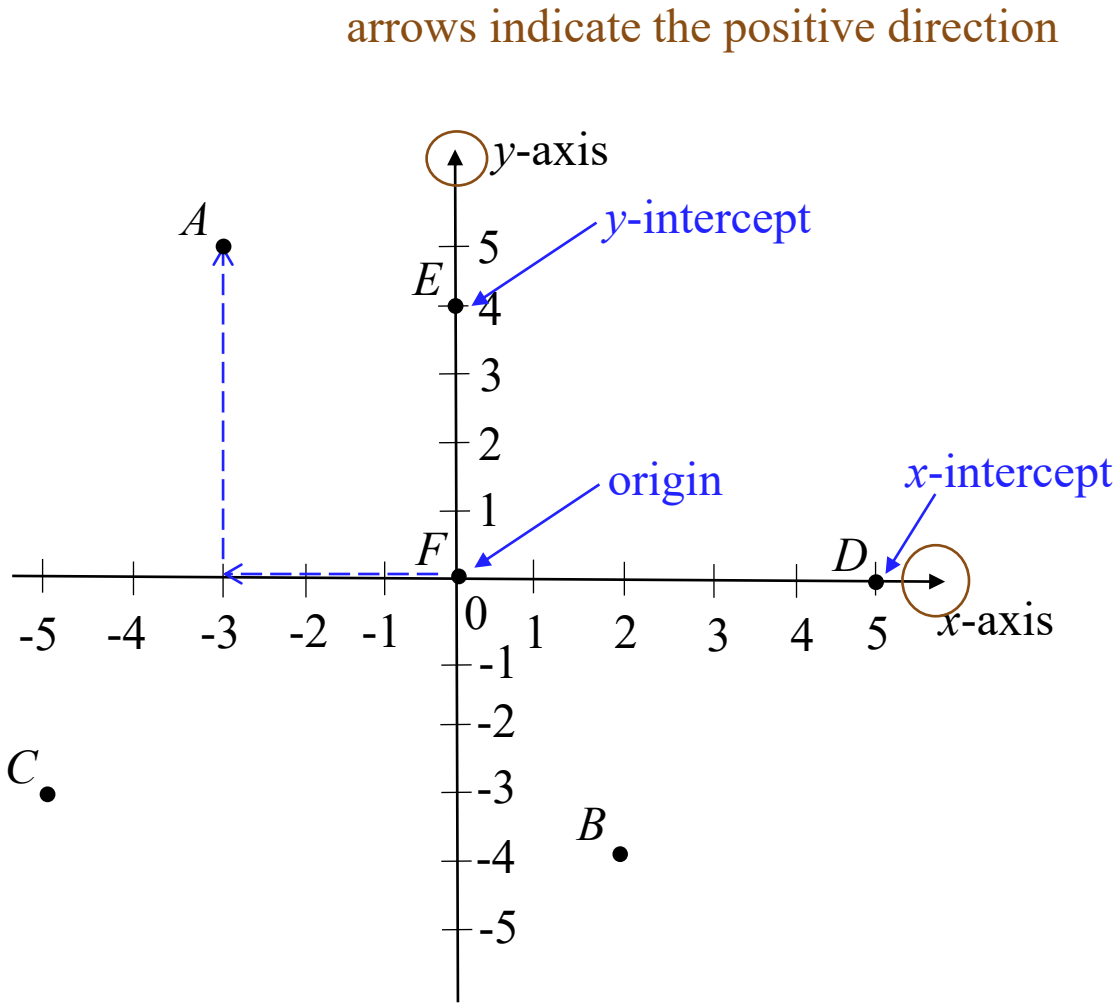
$B\ (2,-4)$

$C\ (-5,-3)$

$D\ (5,0)$

$E\ (0,4)$

$F\ (0,0)$



Domain/Range

"is defined as"

Domain:= all the x values in a set

Range:= all the y values in a set

Below is a relation of ordered pairs:

denote a set with curly braces

(x,y)

$\{(A,1),\ (B,12),\ (C,5)\}$

domain: $\{A\ ,\ B\ ,\ C\}$

range: $\{1\ ,\ 5\ ,12\}$

order smallest to largest

$\{(A,1),\ (B,8),\ (C,1),\ (A,5)\}$

domain: $\{A\ ,\ B\ ,\ C\}$

range: $\{1\ ,\ 5\ ,\ 8\}$

eliminate repeated values

Do: State the domain and range of $\{(0,9.1),\ (10,6.7),\ (30,13.2),\ (24,10.8)\}$

domain:

range:

Relations/Functions

Function:= a relation such that an x-value in its domain has **exactly** one y-value

recall sets from previous slide:

$\{(A,1),\ (B,12),\ (C,5)\}$ is a function

$\{(A,1),\ (B,8),\ (C,1),\ (A,5)\}$ is not a function:

A maps to 1

A also maps to 5

note: okay to have repeated y-values

not onto

Do: Determine whether each relation is a function:

$\{(1,2),\ (3,4),\ (5,6),\ (5,8)\}$

$\{(1,2),\ (3,4),\ (6,5),\ (8,5)\}$

Function Notation

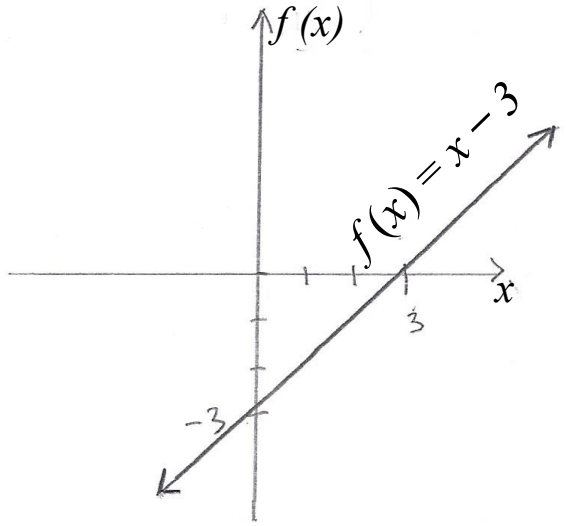
once a relation is determined to be a function, use the notation:

$y = f(x)$ say "f of x"

$y = mx + b$:)

example: ~~y~~ $= x - 3$ graphs as a ~~line~~ linear function

$f(x) = x - 3$



then just plug in an x-value to get the other coordinate of an ordered pair

process is called "**evaluating a function**"

Evaluating a Function

given $f(x) = x^2 + 3x + 5$

"f of 2"

then $f(2) = 2^2 + 3(2) + 5$

$= 4 + 6 + 5 = \boxed{15}$ substitute value for x and simplify

and $f(0) = \cancel{0^2} + \cancel{3(0)} + 5 = \boxed{5}$

you can also plug in a different variable…

$f(z) = \boxed{z^2 + 3z + 5}$

$(x+3)^2 = (x+3)(x+3)$

$= x^2 + 6x + 9$

distribute

$f(x+3) = (x+3)^2 + 3(x+3) + 5$

$= x^2 + 6x + 9 + 3x + 9 + 5$

combine like terms

$= \boxed{x^2 + 9x + 23}$

$+ \cdot - = -$

$f(-x) = (-x)^2 + 3(-x) + 5$

$= \boxed{x^2 - 3x + 5}$

$(-x)^2 = (-x)(-x) = x^2$

$- \cdot - = +$

$(x^a)^b = x^{ab}$

$f(x^2) = (x^2)^2 + 3(x^2) + 5$

$= \boxed{x^4 + 3x^2 + 5}$

Evaluating a Function: Do

If $f(x) = x^2 - 2x + 7$ then evaluate:

$f(-5) =$

$f(-x) =$

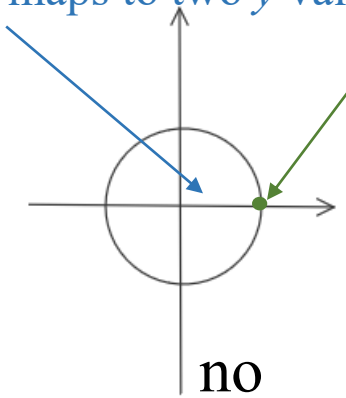
$f(x-4) =$

Vertical Line Test

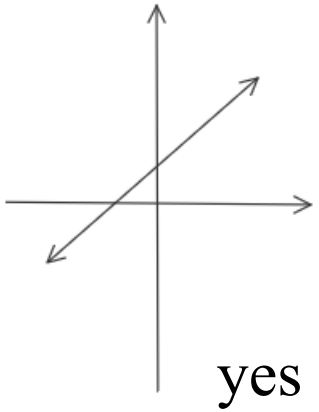
Vertical Line Test - use to determine if a graph represents a function

a graph is a function when EVERY value of x maps to exactly one y value

x value maps to two y values

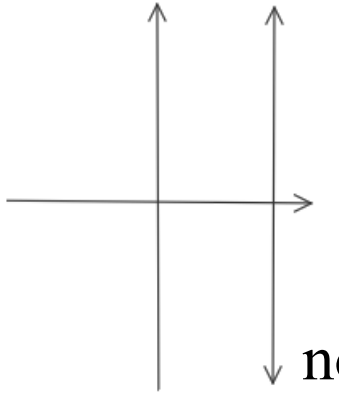


no



yes

vertical lines are
NOT functions



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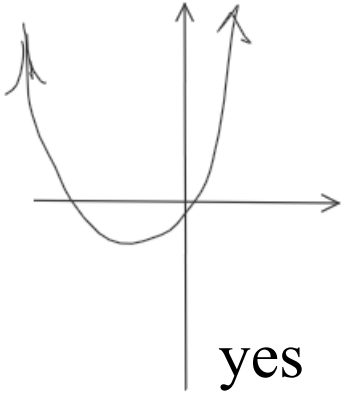
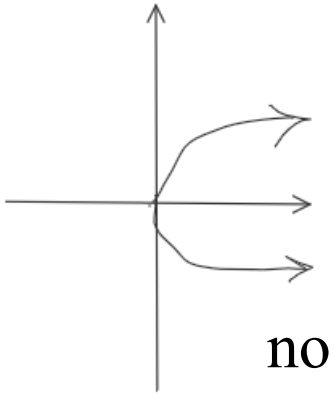


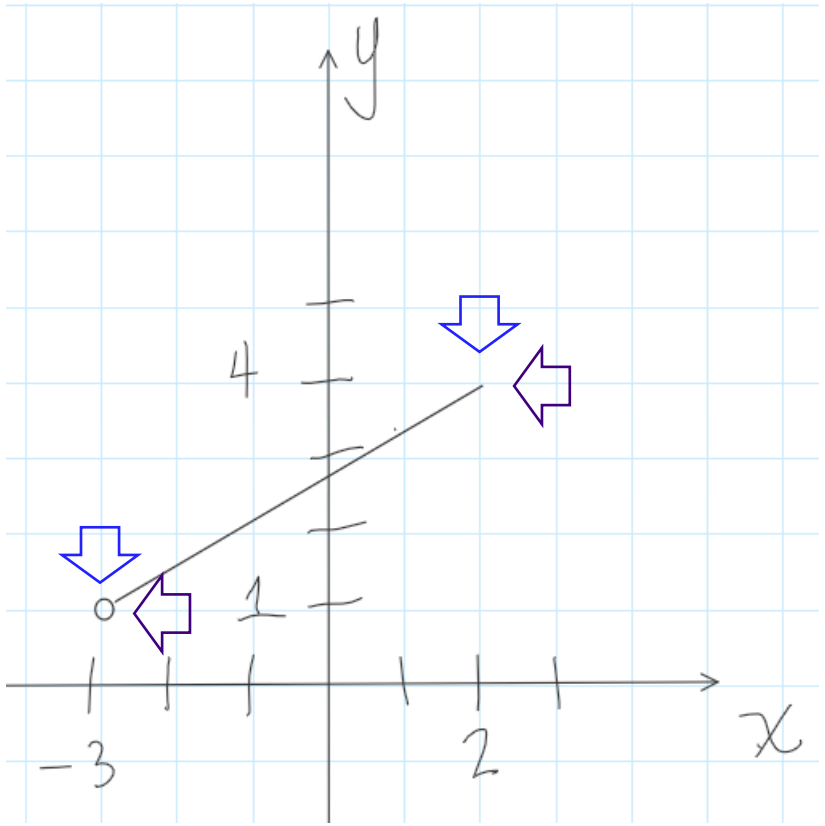
yes



no

MOST lines are functions

Identify Domain/Range from a Graph



Compound Inequality:

Interval Notation
use parentheses for open circle

don't include -3 include 2

domain: $-3 < x \leq 2$

x is between -3 and 2

$(-3, 2]$

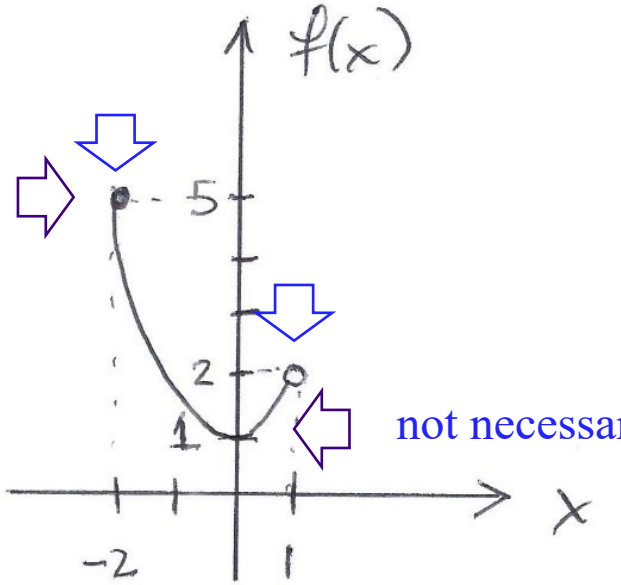
use bracket for closed circle

range: $1 < y \leq 4$

$(1, 4]$

y-values are between 1 and 4

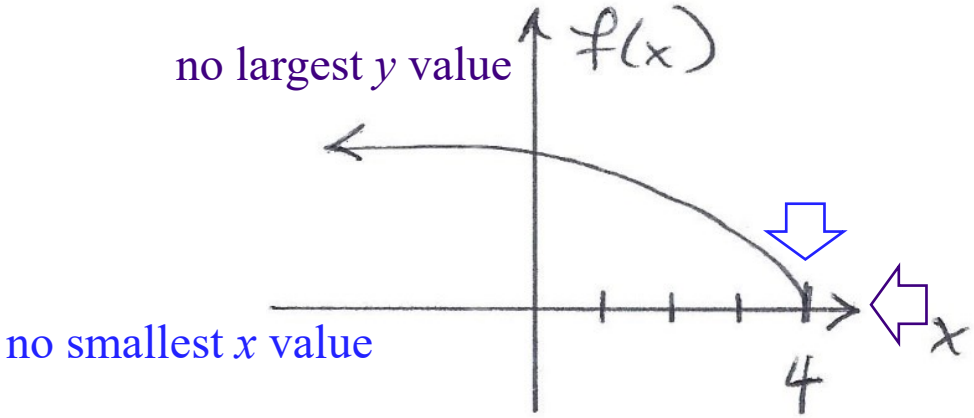
Identify Domain/Range from a Graph (cont'd)



not necessarily at an endpoint

domain: $[-2,1)$

range: $[1,5]$

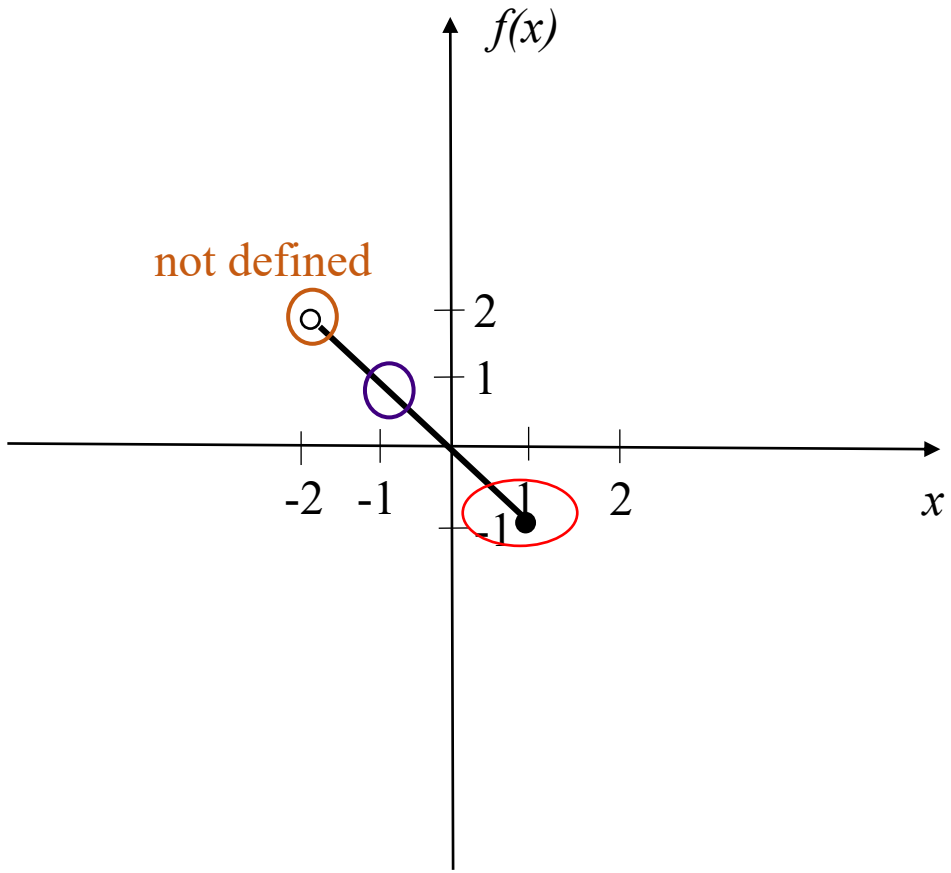


use parenthesis for either infinity

domain: $(-\infty, 4]$

range: $[0, \infty)$

Identify Values on a Graph



For what x-value is …

… $f(x) = -1$? $x = 1$

… $f(x) = 1$? $x = -1$

… $f(x) = 2$? none