Math 60 8.3 Introduction to Functions (2 days)

Objectives 1) Determine if a relation is a function if given

a) a map or a list of ordered pairs
↳ check that each input value has only one output value

b) an equation using x and y.
↳ solve for y if necessary
↳ does one x value result in only one y value?

c) a graph
↳ Vertical line test
Does every possible imaginary vertical line cross the graph once?

— — — — — DAY 2 — — — — — — — — — — — — — — —

2) Find the value of a function
= "Evaluate a function"
↳ substitute given number for x
↳ use order of operations to simplify

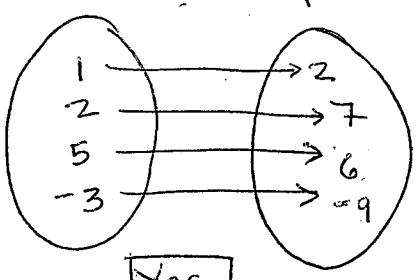
3) Find the domain of a function
- polynomials: all real numbers
- rational functions: all real numbers <u>except</u> those that make expression undefined.

<u>Definition</u>

A <u>function</u> is a relation where each input value has only one y-value.

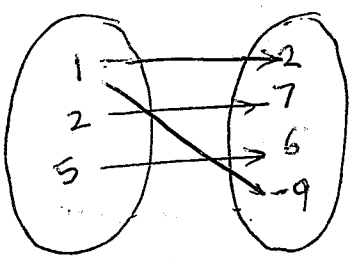
Determine if each of the following is a function.

(1) Each input has one output



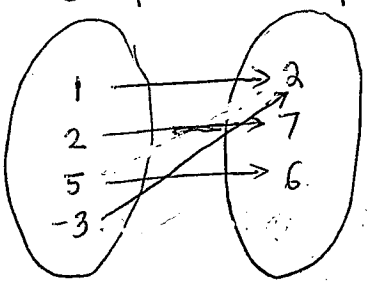
Yes.

(2) 1→2 but 1→-9
1 has two outputs



No

(3) Each input has one output. (Outputs can be equal.)



Yes

M60 8.3

Find the domain of each function in prerious example.

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① domain $\{1, 2, 5, -3\}$

② not a function. [Domain of the relation is $\{1, 2, 5\}$]

③ domain $\{1, 2, 5, -3\}$

Find the range of each function

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① range $\{2, 7, 6, -9\}$

② not a function. [Range of relation is $\{2, 7, 6, -9\}$]

③ range $\{2, 6, 7\}$

*** CAUTION *** Do not list duplicates in domain or range. Ex: not $\{2, 2, 6, 7\}$. Ex not $\{1, 1, 2, 5\}$

Determine if each is a function.
If it is a function, find its domain and range.

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

no inputs are repeated, function

domain $\{-3, -1, 1, 3\}$

range $\{2, -1, -3, -5\}$

⑤ $\{(-2, -2), (-1, 1), (0, 2), (1, 1), (2, -2)\}$

no inputs are repeated function

domain $\{-2, -1, 0, 1, 2\}$

range $\{-2, 1, 2\}$

⑥ $\{(-5,2), (0,2), (5,6), (6,5), (2,0), (2,-5)\}$

The input 2 is repeated. 2 has more than one output value

not a function

Determine if each equation gives y as a function of x.

⑦ $y = 3x + 5$

yes If we choose a value for x, that value can produce only one y value

ex: if $x = 2$, then $y = 3(2) + 5 = 11$

We can't put in $x = 2$ and <u>also</u> get some other y-value.

⑧ $y = \pm\sqrt{x}$ Read the symbol $\pm$ as "plus or minus".

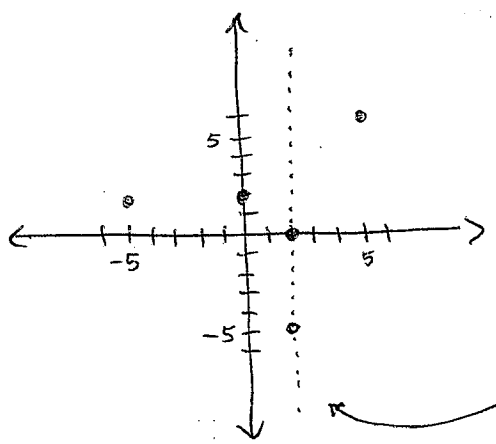
no If we choose a value for x, we get two y-values.

ex: if $x = 4$, then $y = +\sqrt{4} = 2$

and $y = -\sqrt{4} = -2$

or $y = \pm 2$

⑨ Graph the points in ex. ⑥ and identify the two points that made it <u>not</u> a function.



The points $(2,0)$ and $(2,-5)$ lie on the vertical line $x = 2$.

M60 8.3

Vertical Line Test: (VLT)

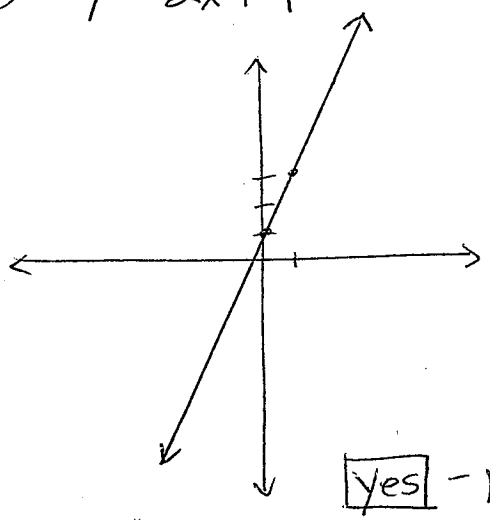
If a vertical line could be drawn so it passes through two or more points on the graph, we say

- the graph fails the VLT
- the graph is not a function

If every possible imaginary vertical line crosses the graph once or not at all, we say

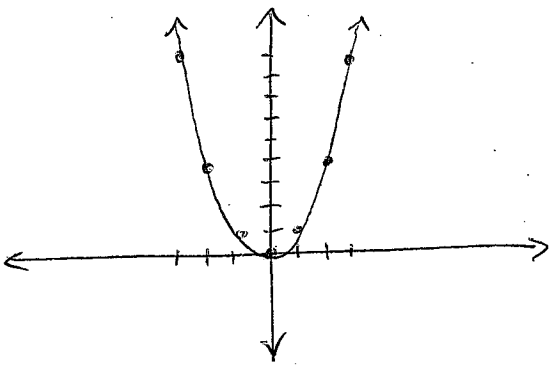
- the graph passes the VLT
- the graph is a function.

(10) $y = 2x + 1$



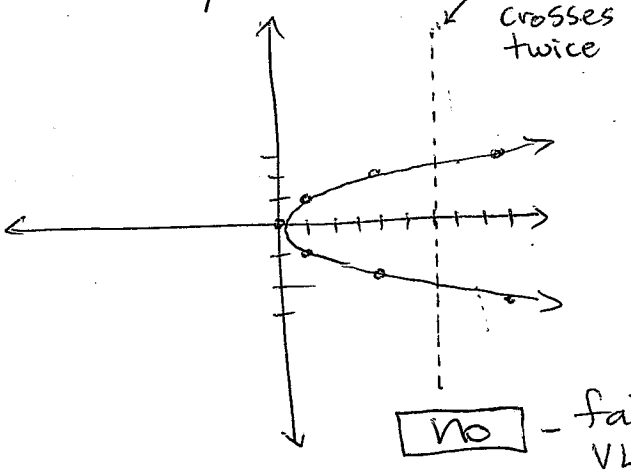
yes - passes VLT

(11) $y = x^2$



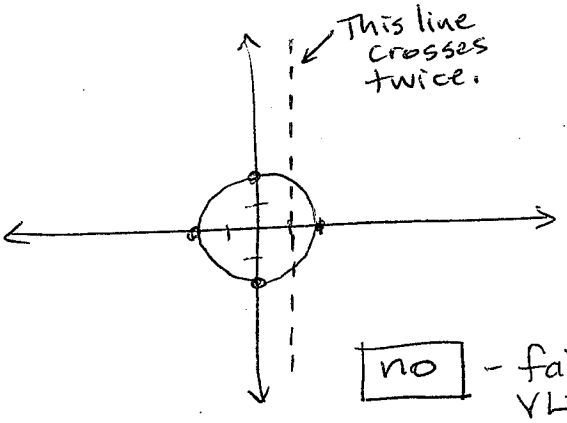
yes - passes VLT

(12) $x = y^2$



no - fails VLT

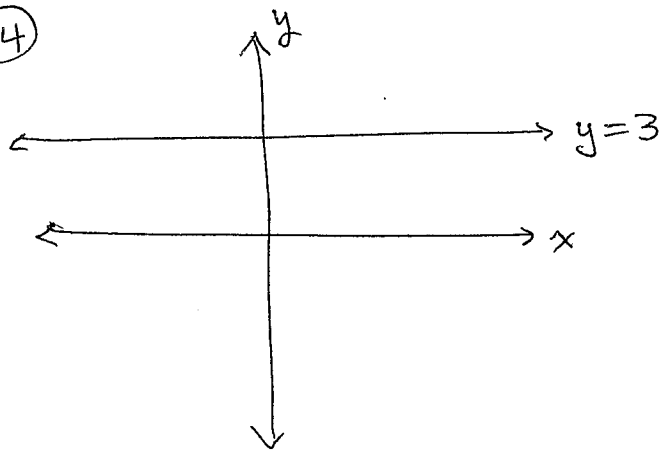
(13) $x^2 + y^2 = 4$



no - fails VLT

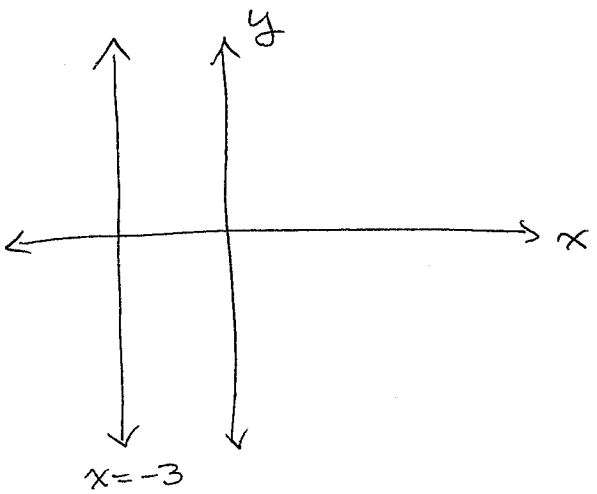
Math 60 8.3

(14)



Yes - passes V.L.T.

(15)



no - fails V.L.T.

Every point on the vertical line $x=-3$ has x-coord -3.
So -3 has infinitely many y-coordinates