01-29-25 MTH 161-C06N

1.2 Relations

1.2.2 Exercises

page 29: 1, 3, 7, 18, 21, 22, 27, 37, 41, 50

1.3 Introduction to Functions

1.3.1 Exercises

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1.2: 3

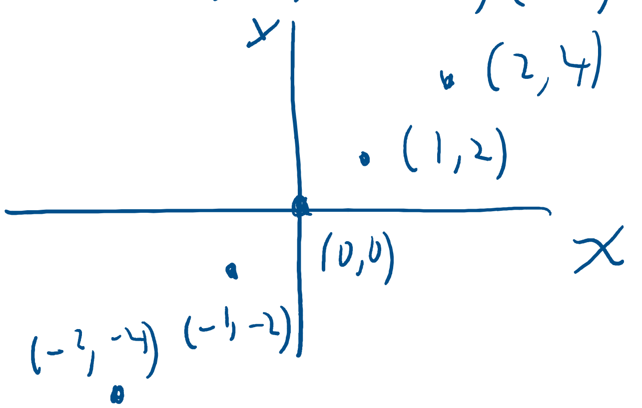
1.2.2 Exercises

In Exercises 1 - 20, graph the given relation.

3. $\{(m, 2m) \mid m = 0, \pm 1, \pm 2\}$

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

$= \{(0,0), (1,2), (-1,-2), (2,4), (-2,-4)\}$



$y = 2m$

$x = m$

$\Rightarrow \boxed{y = 2x}$

1.2:50

For each equation given in Exercises 41 - 52:

- Find the x- and y-intercept(s) of the graph, if any exist.
- Follow the procedure in Example 1.2.3 to create a table of sample points on the graph of the equation.
- Plot the sample points and create a rough sketch of the graph of the equation.
- Test for symmetry. If the equation appears to fail any of the symmetry tests, find a point on the graph of the equation whose reflection fails to be on the graph as was done at the end of Example 1.2.4

50. $x^2 - y^2 = 1$

x - intercept
let $y = 0$, solve for x

$x^2 - 0^2 = 1$

$x^2 = 1$

$\boxed{x = \pm 1}$

$(-1, 0), (1, 0)$

y - intercept
set $x = 0$, solve for y

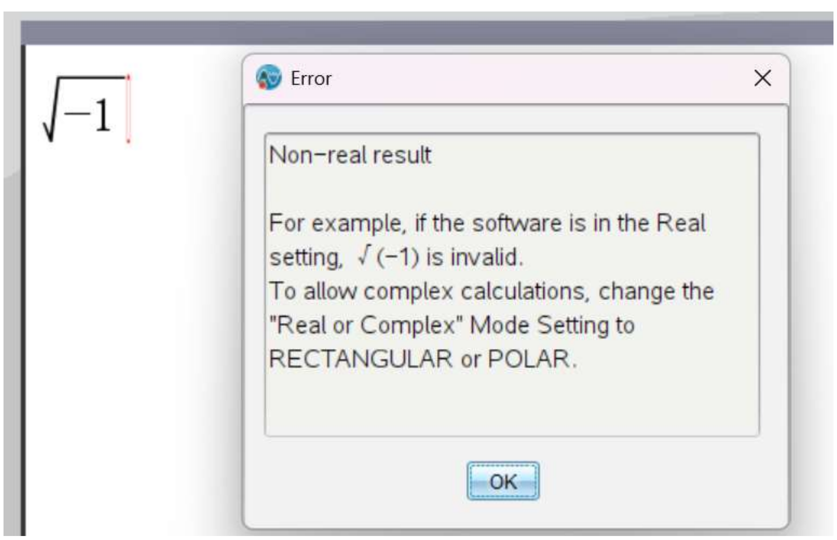
$0^2 - y^2 = 1$

$-y^2 = 1$

$y^2 = -1$

$y = \pm\sqrt{-1} = \pm i$ (non-real)

$\therefore$ No y-intercept



$\sqrt{-1}$	"Error: Non−real result"
i^2	$^-1$

$x^2 - y^2 = 1$

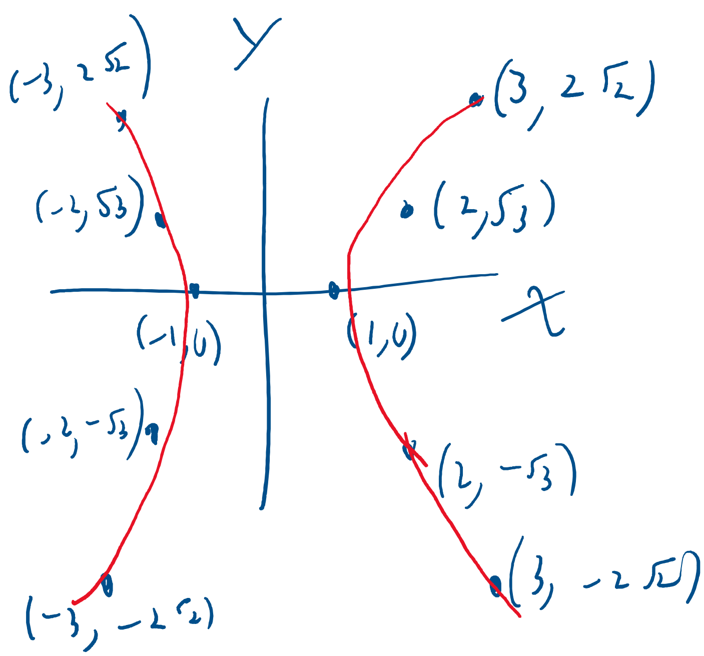
solve for y

$-y^2 = 1 - x^2$

$y^2 = x^2 - 1$

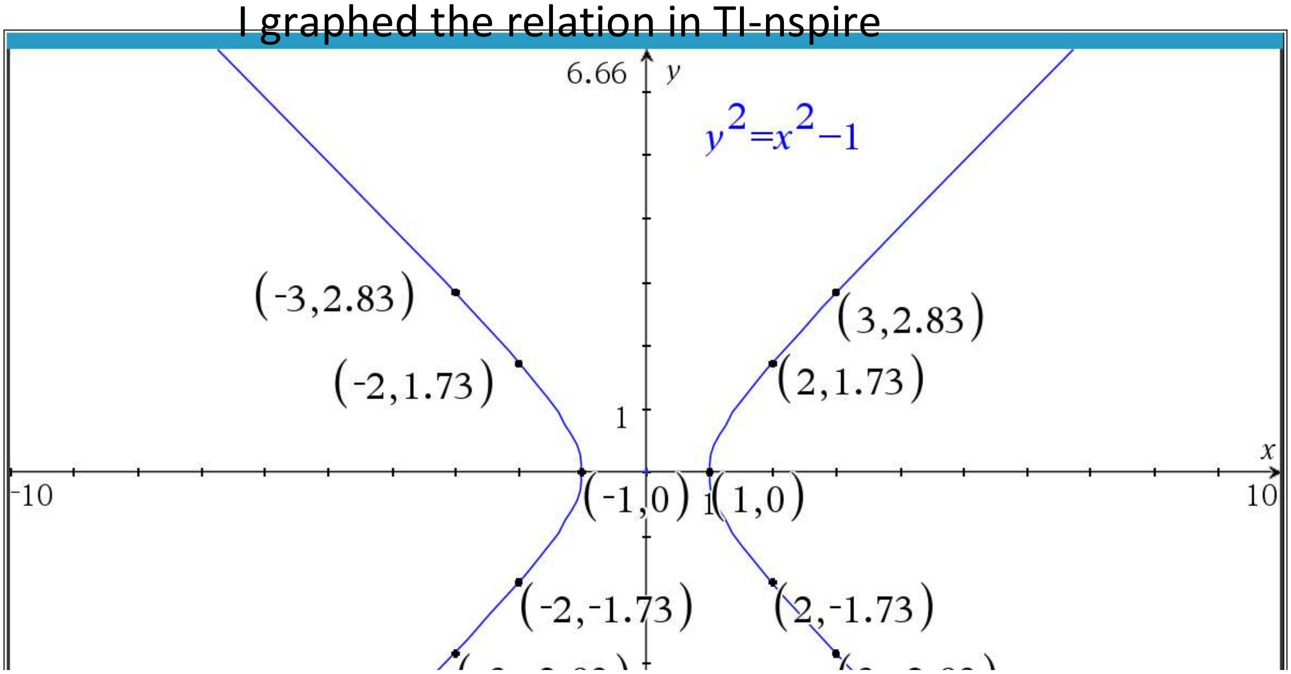
$y = \pm\sqrt{x^2-1}$

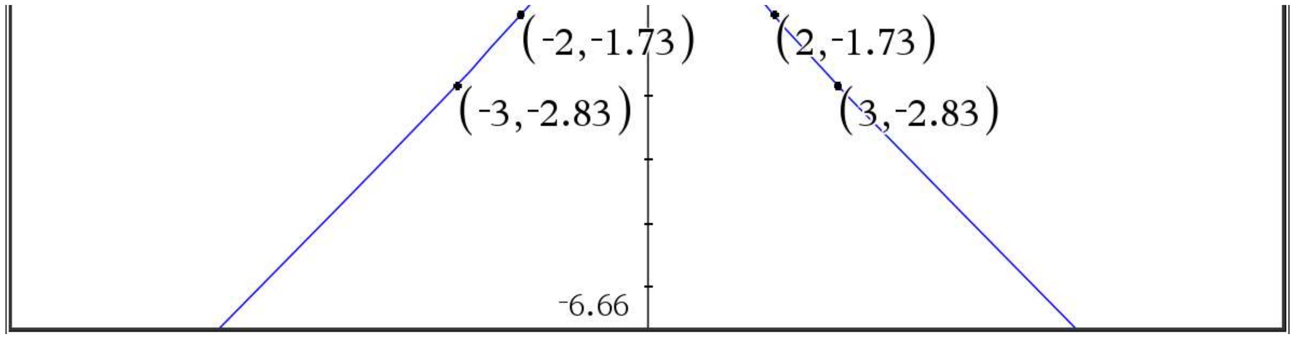
x	y
0	non-real
1	0
-1	0
2	$\sqrt{3}, -\sqrt{3}$
3	$\pm 2\sqrt{2}$



test for symmetry: all 3 types

I graphed the relation in TI-nspire





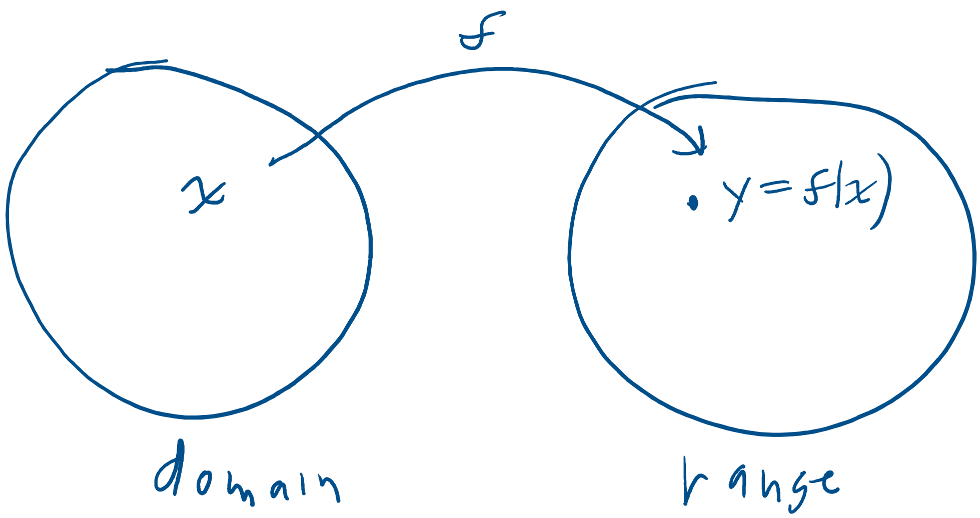
1.3

Memorize

Definition 1.6. A relation in which each x-coordinate is matched with only one y-coordinate is said to describe y as a **function** of x.

General definition for all math

A function is a rule that associates to each element of one set, called the domain, a unique element in another set (which could be the same),called the range.



Memorize

Theorem 1.1. The Vertical Line Test: A set of points in the plane represents y as a function of x if and only if no two points lie on the same vertical line.

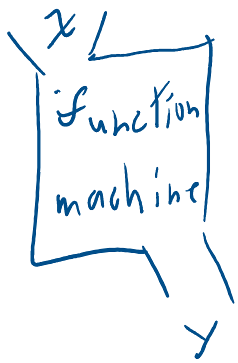
Memorize

Definition 1.7. Suppose F is a relation which describes y as a function of x.

- The set of the x-coordinates of the points in F is called the **domain** of F.
- The set of the y-coordinates of the points in F is called the **range** of F.

x-coordinates – inputs

y-coordinates – outputs



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

$f(0) = \sqrt{0} = 0$

$f(1) = \sqrt{1} = 1$

$f(-1) = \sqrt{-1}$ (not real)

$0 \in$ domain of f

$1 \in$ " " "

$-1 \notin$ " " "

Memorize: the implied or natural domain of a function is the largest possible set of numbers for which the function is defined.

domain of $f(x) = \sqrt{x}$

$= \{x \mid x \geq 0\} = [0, \infty)$

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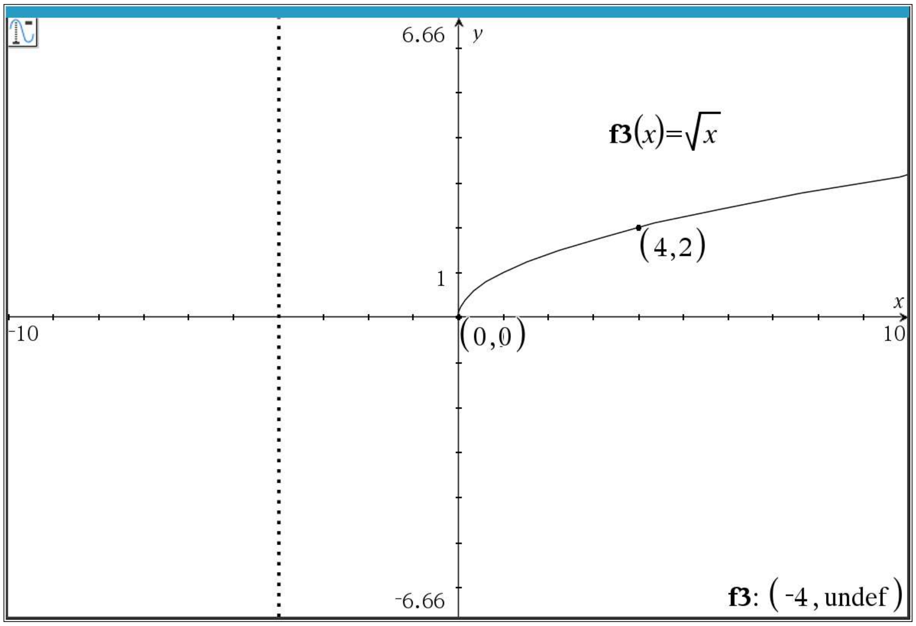

Non-numerical function
Let the domain = the set of students in MTH 161-C06N.
Let f(x) = the course grade the most recent math course taken by student x.
Range = {A,B,C,D,F,W}

1.3

1.3.1 Exercises

In Exercises 1 - 12, determine whether or not the relation represents y as a function of x. Find the domain and range of those relations which are functions.

1. $\{(-3,9),\ (-2,4),\ (-1,1),\ (0,0),\ (1,1),\ (2,4),\ (3,9)\}$

No input is repeated, so no input is repeated with different outputs, so the relation represents y as a function of x.

5. $\{(x,y) \mid x \text{ is an odd integer, and } y \text{ is an even integer}\} = R$

5. $\{(x,y)\,|\,x$ is an odd integer, and y is an even integer$\} = R$

$(1,1) \in R$ True or false?

$x=1$ odd integer
$y=1$ not even integer

$\therefore (1,1) \notin R$

$(1,2) \overset{?}{\in} R$

$x=1$ odd integer
$y=2$ even integer

$\therefore (1,2) \in R$

$(1,-2) \in R$
$(1,\ 2) \in R$

for $x=1$, $y=\pm 2$ in these examples
$\therefore$ y is not a function of x