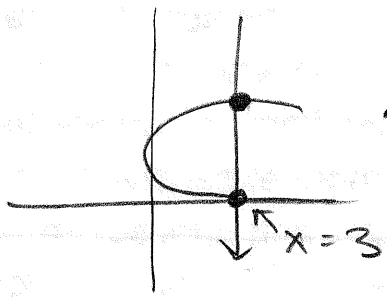
Sec 10.1 Inverse Functions

Recall what a function is:

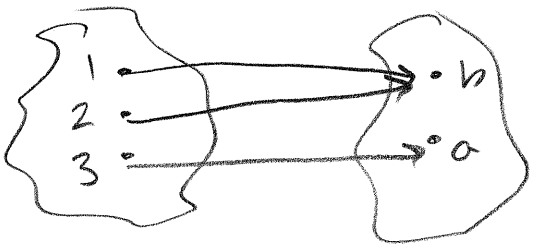
- passes Vertical line test
- takes each input and assigns to an output



2 outputs = fail function test

A function is <u>one-to-one</u> if each x-value corresponds to only one y-value and each y-value corresponds to only 1 x-value

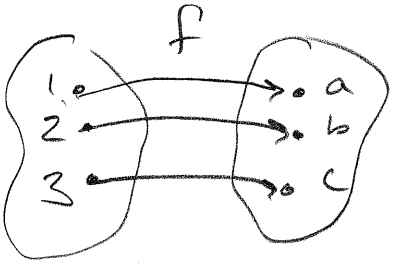
Mapping



Domain Range

function: yes

one-to-one: NO



function: yes

one-to-one: yes

11/19/2012 Sec 4.1

Math 1040

Defn

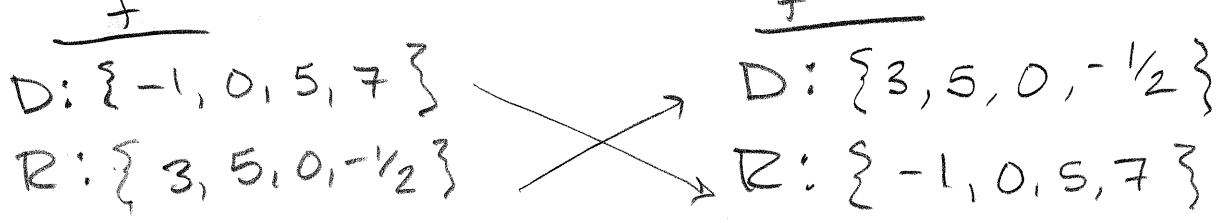
The inverse of a one-to-one function f, written f^{-1}, is the set of all ordered pairs of the form (b,a) where (a,b) belongs to f.

Since the inverse is formed by interchanging x and y the domain of f becomes the Range of f^{-1} and the Range of f becomes the domain of f^{-1}

#10 $f: \{(-1,3), (0,5), (5,0), (7,-\frac{1}{2})\}$

one-to-one ✓

$f^{-1}: \{(3,-1), (5,0), (0,5), (-\frac{1}{2},7)\}$



#11 $f: \{(-1,3),(2,7),(4,3),(5,8)\}$

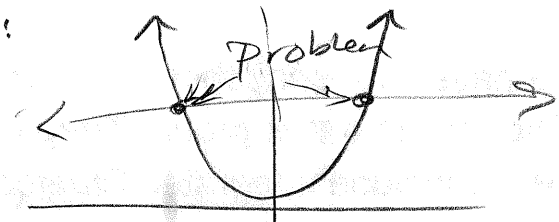
Not one-to-one

has NO inverse function

Graph test for function: Vertical Line test

Graph test for one-to-one: Horizontal Line test

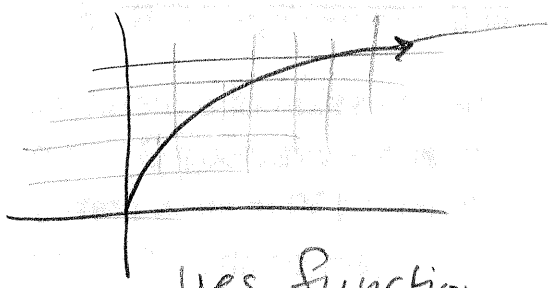
Ex:



yes function

NO one-to-one

NO inverse function



yes function

yes one-to-one

has inverse function

How to find the Equation of Inverse

1. Replace f(x) with y
2. switch x and y
3. Solve for y
4. Replace y with $f^{-1}(x)$

Ex

$f(x) = 2x+5$

$y = 2x+5$

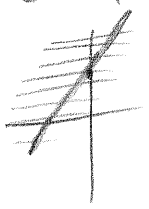
$x = 2y+5$

$-5 \quad -5$

$\frac{x-5}{2} = \frac{2y}{2}$

$\frac{x-5}{2} = y$

$f^{-1}(x) = \frac{x-5}{2}$



$f(x) = 2x+5$

Let $x = 3$

$f(3) = 2 \cdot 3 + 5$

$= 6 + 5$

$= 11$

$(3, 11)$

$f^{-1}(x) = \frac{x-5}{2}$

$f^{-1}(11) = \frac{11-5}{2}$

$= \frac{6}{2}$

$= 3$ ✓

$(11, 3)$

Recall

$(f \circ g)(x) = f(g(x))$

for Inverses

$(f \circ f^{-1})(x) = f(f^{-1}(x)) = x$

and

$(f^{-1} \circ f)(x) = f^{-1}(f(x)) = x$

$f(x) = (x-3)^2$ find inverse function

$y = (x-3)^2$

$\sqrt{x} = \sqrt{(y-3)^2}$

$\pm\sqrt{x} = y-3$

$+3 \qquad +3$

$3 \pm \sqrt{x} = y$ Not a function

So DOO inverse function

Graphing Inverses

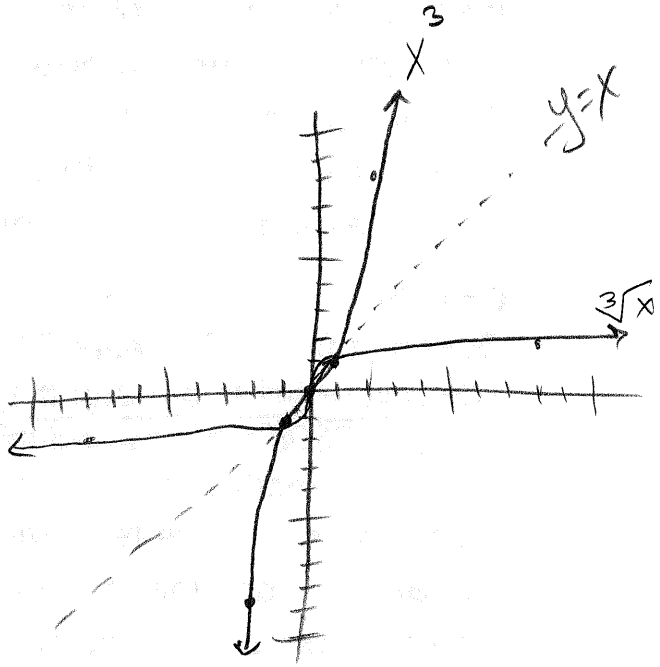
Since (a,b) on f is (b,a) on f^{-1} then the graphs have Relationship

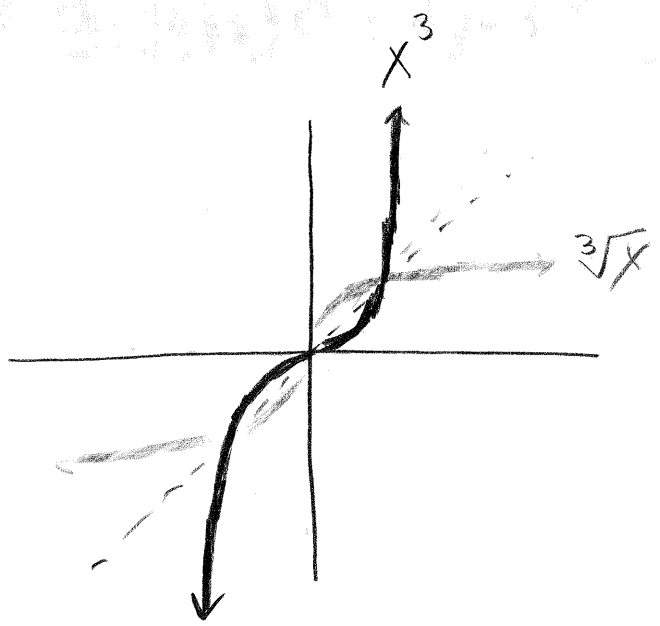
$f(x) = x^3$

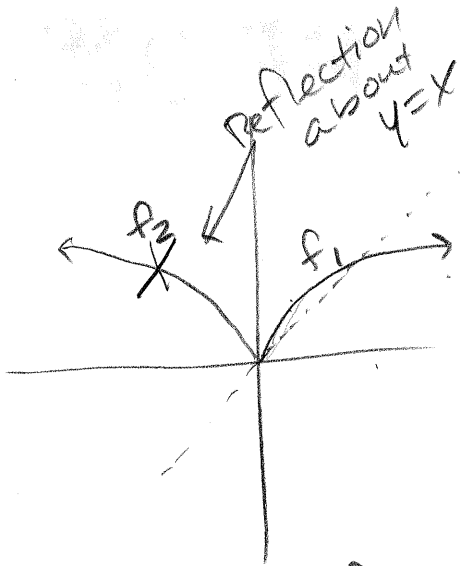
x	y
-2	-8
-1	-1
0	0
1	1
2	8

$f^{-1}(x) = \sqrt[3]{x}$

x	y
-8	-2
-1	-1
0	0
1	1
8	2







f_1 and f_2 are Not inverses

Inverse functions are Reflective about $y=x$

$[\![x]\!]$ ← by defn

do down to nearest integer