CS & IT ENGINEERING

DISCRETE MATHS
SET THEORY

Lecture No. 07

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TOPICS TO BE COVERED

01 Composition of Function

02 Theorems in Composition of function

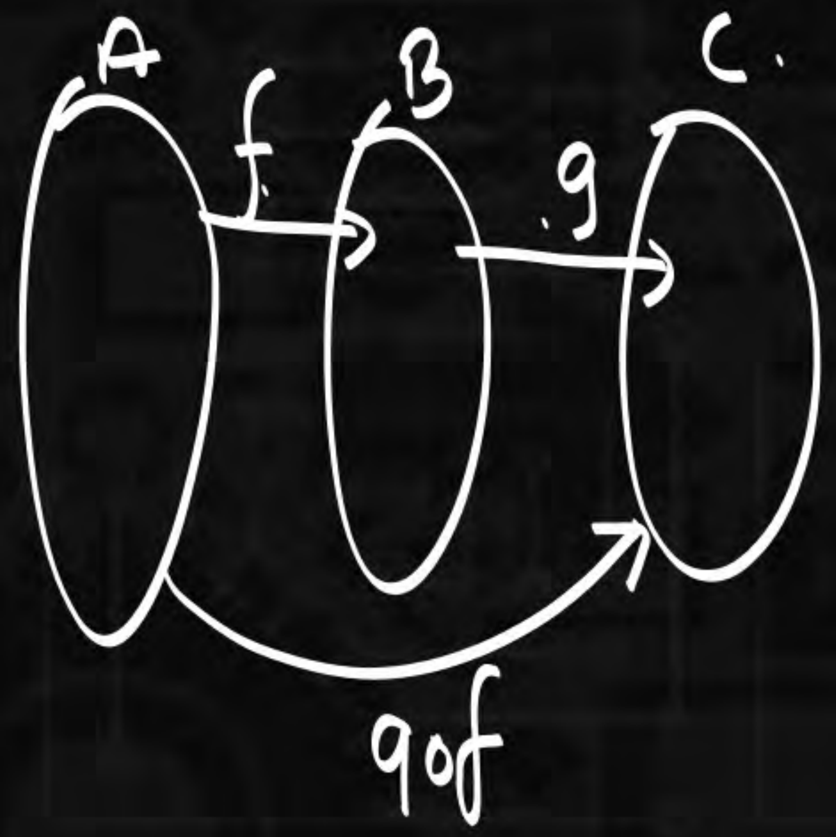
03 Examples in Composition of function

Functions

Composition of function :

$$\boxed{g \circ f \neq f \circ g}$$

$f : A \to B \quad g : B \to C \quad g \circ f : A \to C$



Functions

$\{$ Composition of function is associative in nature.

$f, g, h : R \to R$

$f(x) = x^2 \quad g(x) = x + 5$

$h(x) = \sqrt{x^2 + 2}$

$((hog)of)x = ho(gof(x))$

$(hog)of(x)$

$hog(x^2)$

$ho(x^2+5)$

$\sqrt{(x^2+5)^2+2}$

$ho(g(f(x)))$

$ho(g(x^2)) \to \sqrt{(x^2+5)^2+2}$

$ho(g(x^2))$

$h((x^2+5))$

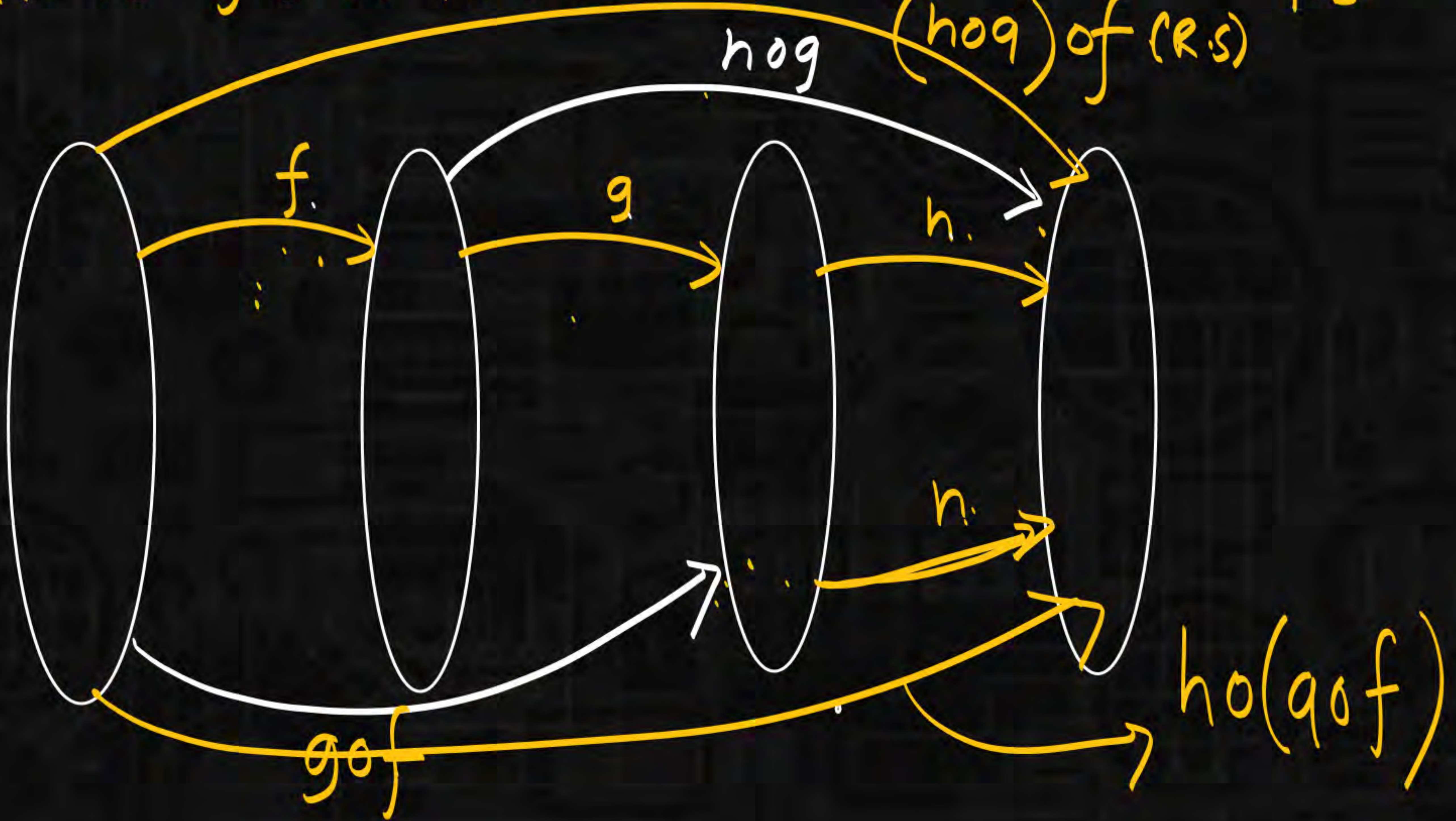
Functions

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

L.S   R.S

$f: A \to B \quad g: B \to C \quad h: C \to D$

$(h \circ g) \circ f$ (R.S)



Functions

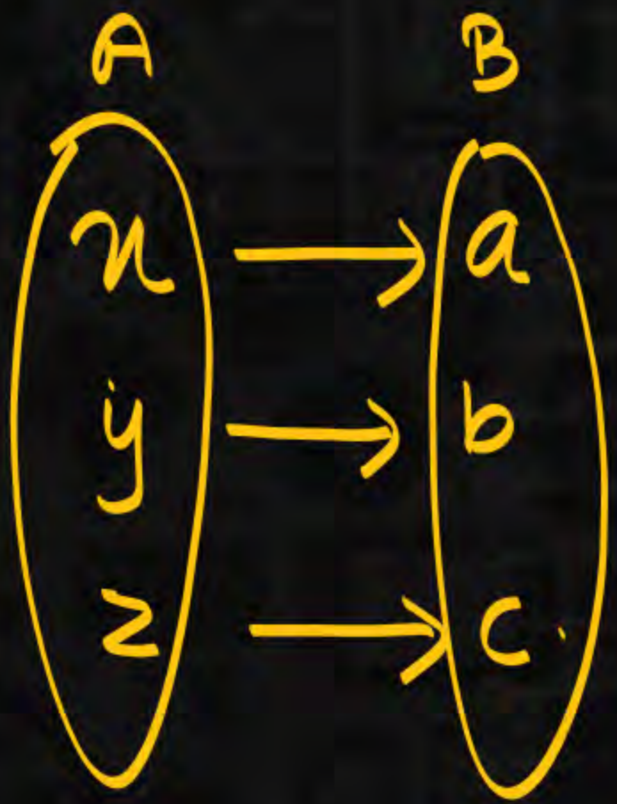
$f^{-1}(x) \neq \frac{1}{f(x)}$ ✓

$f : A \to B$ f is 1:1 correspondance.

$f(x) = a$

$f(y) = b$

$f(z) = c$



Inverse function : $f^{-1} : B \to A$

B		A
a	$\longrightarrow$	x
b	$\longrightarrow$	y
c	$\longrightarrow$	z

$f^{-1}(a) = x$

$f^{-1}(b) = y$

$f^{-1}(c) = z$

Functions

1:1 Function.

$a \to x$

$b \to y$

z

~~Inverse~~

$f: A \to B$

$f^{-1}: B \to A$

$x \to a$

$y \to b$

z

onto:

$a \to x$

$b \to x$

$f^{-1}: B \to A$

$x \to a$

$x \to b$

not function

~~Inverse~~

Functions

$f: x \to y$

$a \to x$

$b \to y$

$e \to z$

$\underbrace{\hphantom{e \to z}}_{1:1C}$

$\underbrace{(1:1C)}$

$f^{-1}: y \to x$

$x \to a$

$y \to b$

$z \to c$

Inverse of function will only exist when it is 1:1 correspondence.

→ Inverse exist:

Invertible function

Functions

$f(x) = x+1$. $f : Z \to Z$.

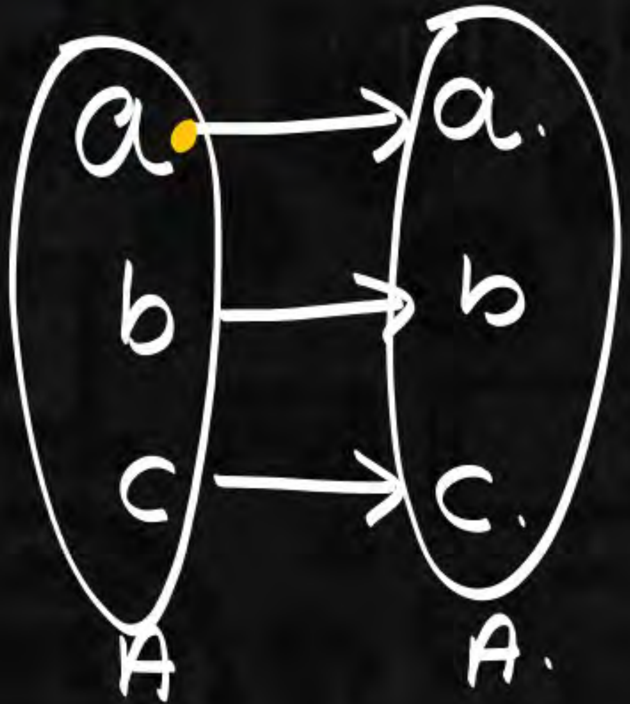
$1:1$ ✓

onto ✓

Functions

identity function:

$i_A : \underline{A} \to \underline{A}$ $\quad i_A : A \to A$

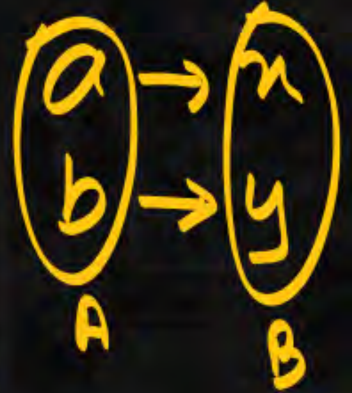


1:1C

$f : A \to B$ (it is 1:1C) ✓

f^{-1}

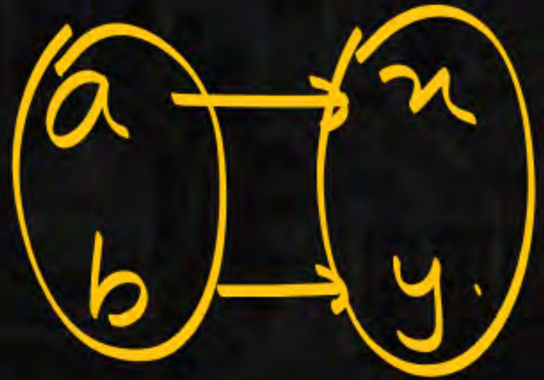
it will exist.



$f^{-1} \circ f = i_A \qquad f \circ f^{-1} = i_B$

Functions

$f : A \to B$



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

$f(b) = y$ $\quad f^{-1}(y) = b$

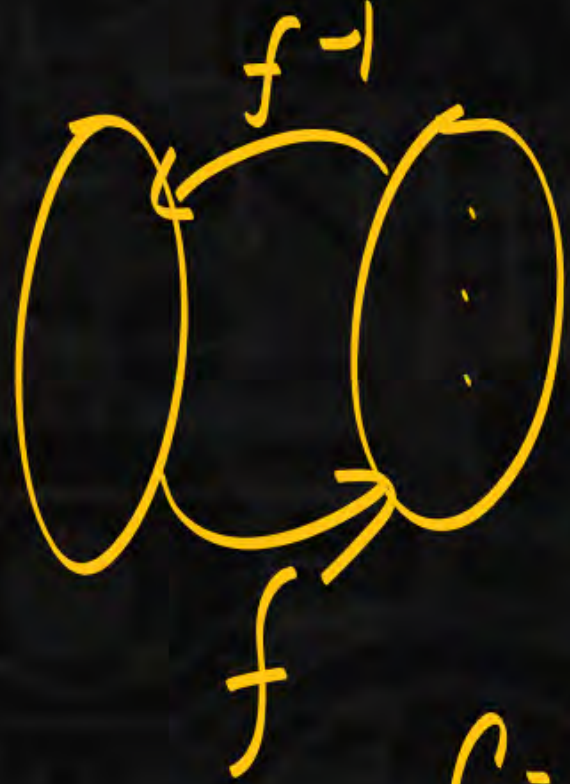
$f \circ f^{-1} = i_B$

$f(f^{-1}(x))$

$f(f^{-1}(x))$

$f(a)$

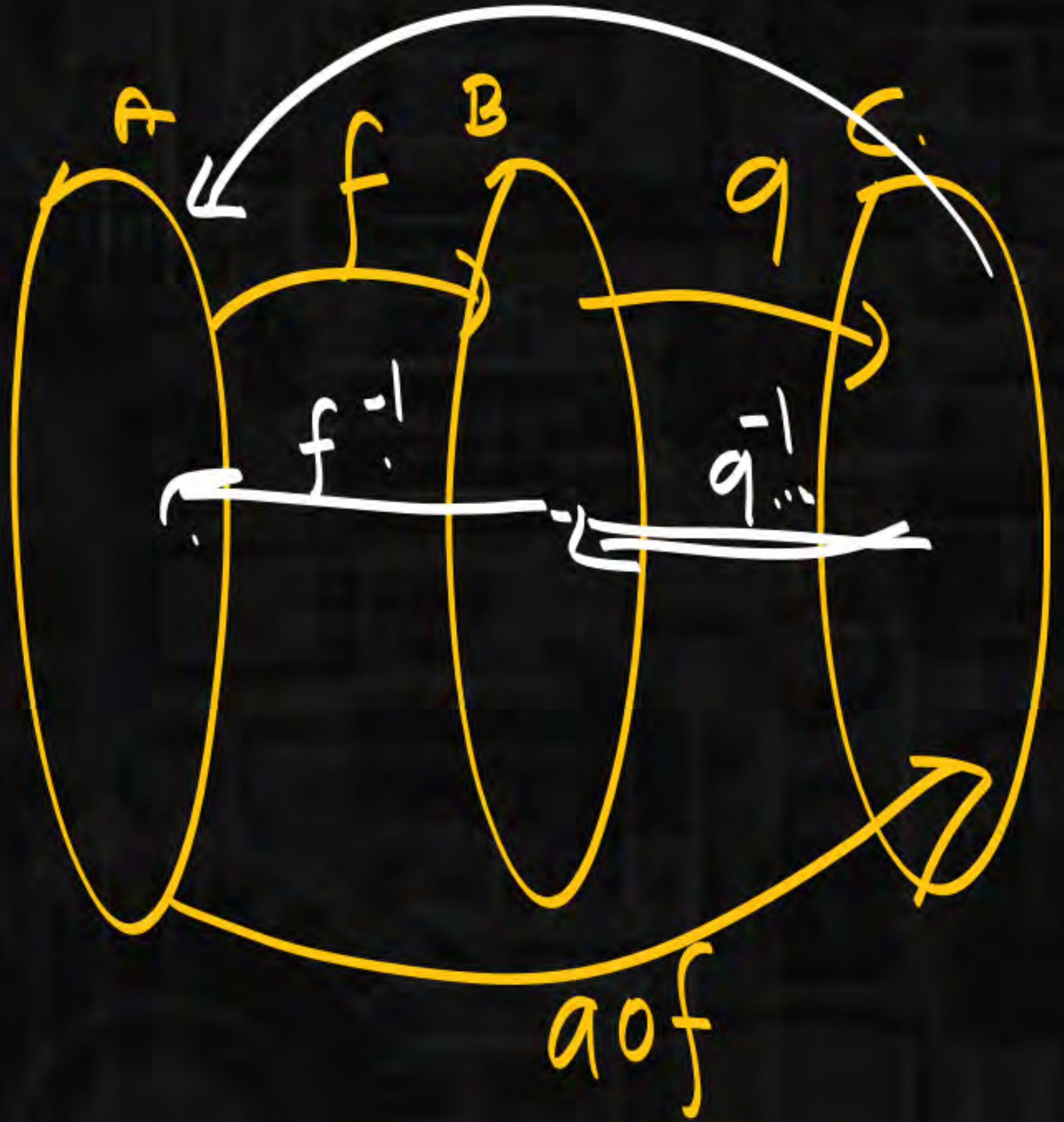
$= x$



$f^{-1} \circ f = i_A$

Functions

$f: A \xrightarrow{(1:1c)} B \quad g: B \xrightarrow{(1:1c)} C \quad gof: A \to C\ (1:1c)$



$$(gof)^{-1} = f^{-1} o\, g^{-1}$$

$$(gof)^{-1} = f^{-1} o\, g^{-1}$$

Functions

check?

$f: A \to B$

$B_1, B_2 \subseteq B$

$f^{-1}(B_1 \cup B_2) = f^{-1}(B_1) \cap f^{-1}(B_2)$

$f^{-1}(B_1 \cap B_2) = f^{-1}(B_1) \cap f^{-1}(B_2)$

$f, g: R \to R$

$g(x) = 1 - x + x^2$ $f(x) = ax + b$ determine a, b

$(g \circ f)(x) = 9x^2 - 9x + 3$


THANK YOU GW
SOLDIERS !