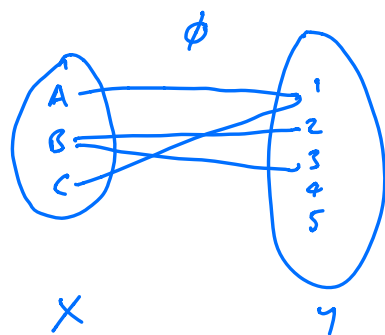


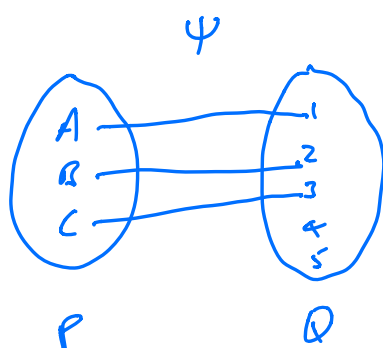
Mappings



$$\phi: X \rightarrow Y$$

many to many
mapping

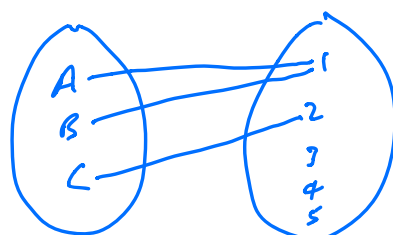
(*)



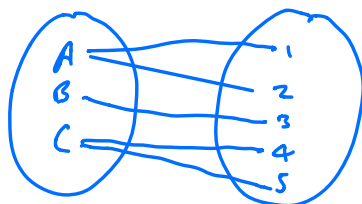
$$\psi: P \rightarrow Q$$

1 to 1
mapping

(*)



many to 1
mapping



1 to many
mapping

A function must be a '1 to 1' or a
'many to 1' mapping

Examples $f: \mathbb{R} \rightarrow \mathbb{R}^+ \cup \{0\}$

$$f(x) = x^2$$

$$f(2) = 4$$

$$f(-2) = 4$$

many to 1
mapping

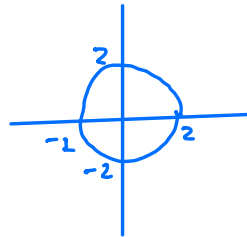
$$f: \mathbb{R} \rightarrow \mathbb{R}$$

$$f(x) = x^3$$

1 to 1
mapping

There are useful relationships which are
not functions

Ex $x^2 + y^2 = 4$



many to many
mapping

Composite Functions

Let $f(x) = x^2$

$$g(x) = x + 4$$

$$h(x) = 2x$$

fg

$$fg(x) = f(x+4) = (x+4)^2$$

$$gf(x) = g(x^2) = x^2 + 4$$

ghf

$$ghf(x) = gh(x^2) = g(2x^2) = 2x^2 + 4$$

Exercise Find

1) hg $hg(x) = h(x+4) = 2(x+4)$

2) gfh $gfh(x) = g(f(2x)) = g(4x^2) = 4x^2 + 4$

3 hhg $hhg(x) = hh(x+4) = h(2(x+4)) = 4(x+4)$

Exercise 2C Page 34 Blue Textbook

1) $p(x) = 1 - 3x$ $q(x) = \frac{x}{4}$ $r(x) = (x-2)^2$

a) $pq(-8) = p(-2) = 1 - 3(-2) = 7$

or $pq(x) = p\left(\frac{x}{4}\right) = 1 - \frac{3x}{4}$

$$pq(-8) = 1 - \frac{3(-8)}{4} = 1 + \frac{24}{4} = 7$$

Do Q1, Q2

Homework Exercise 2C Q3 \rightarrow Q10
but not Q5
