

204: Swift Functional Programming

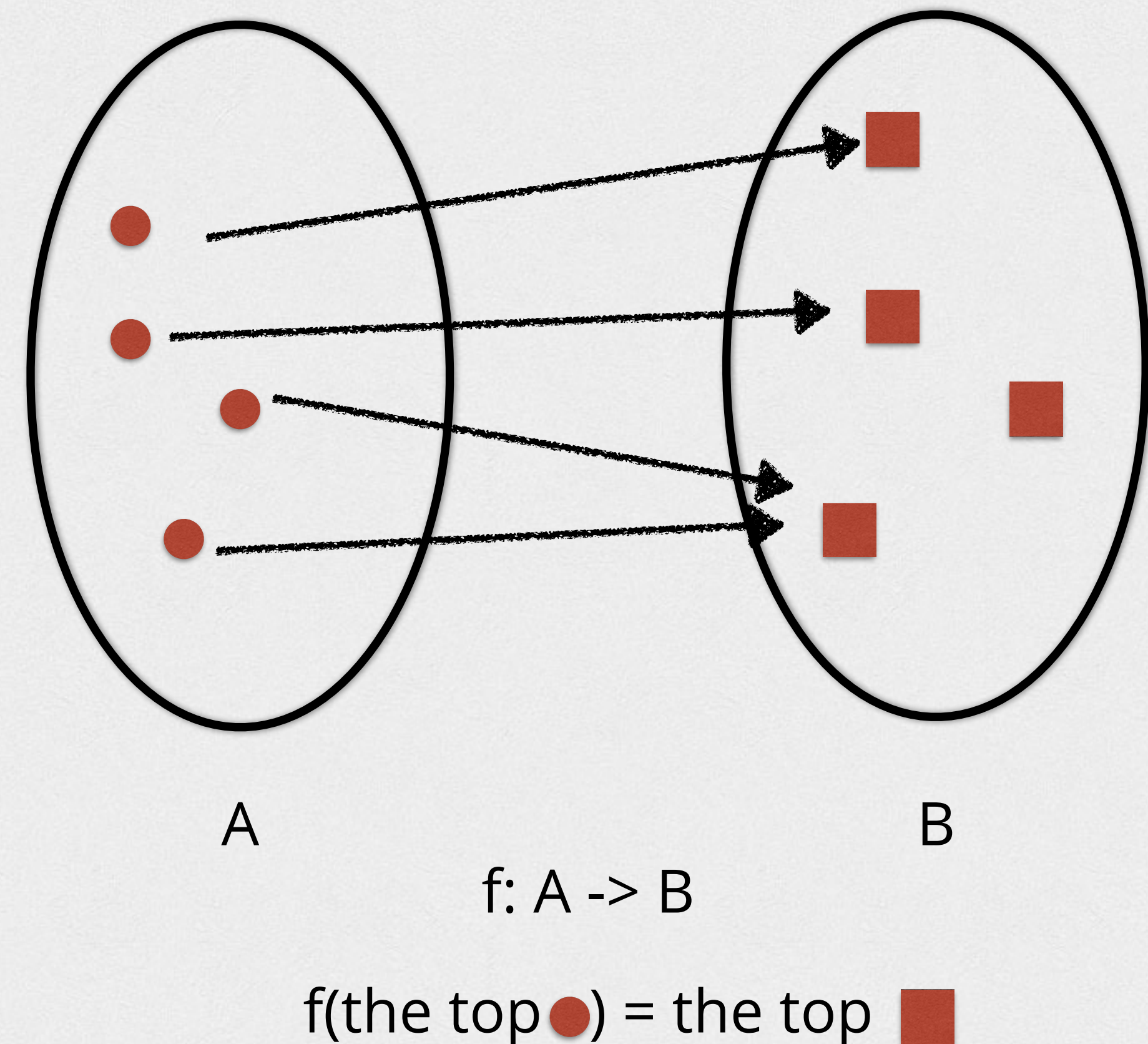
Part 1: Overview

Functional Programming

- ⚙️ A *style* of programming
(like OOP is a style) ...
- ⚙️ ... treating the *mathematical function* as the
primary unit of abstraction
(instead of an object, or a procedure)

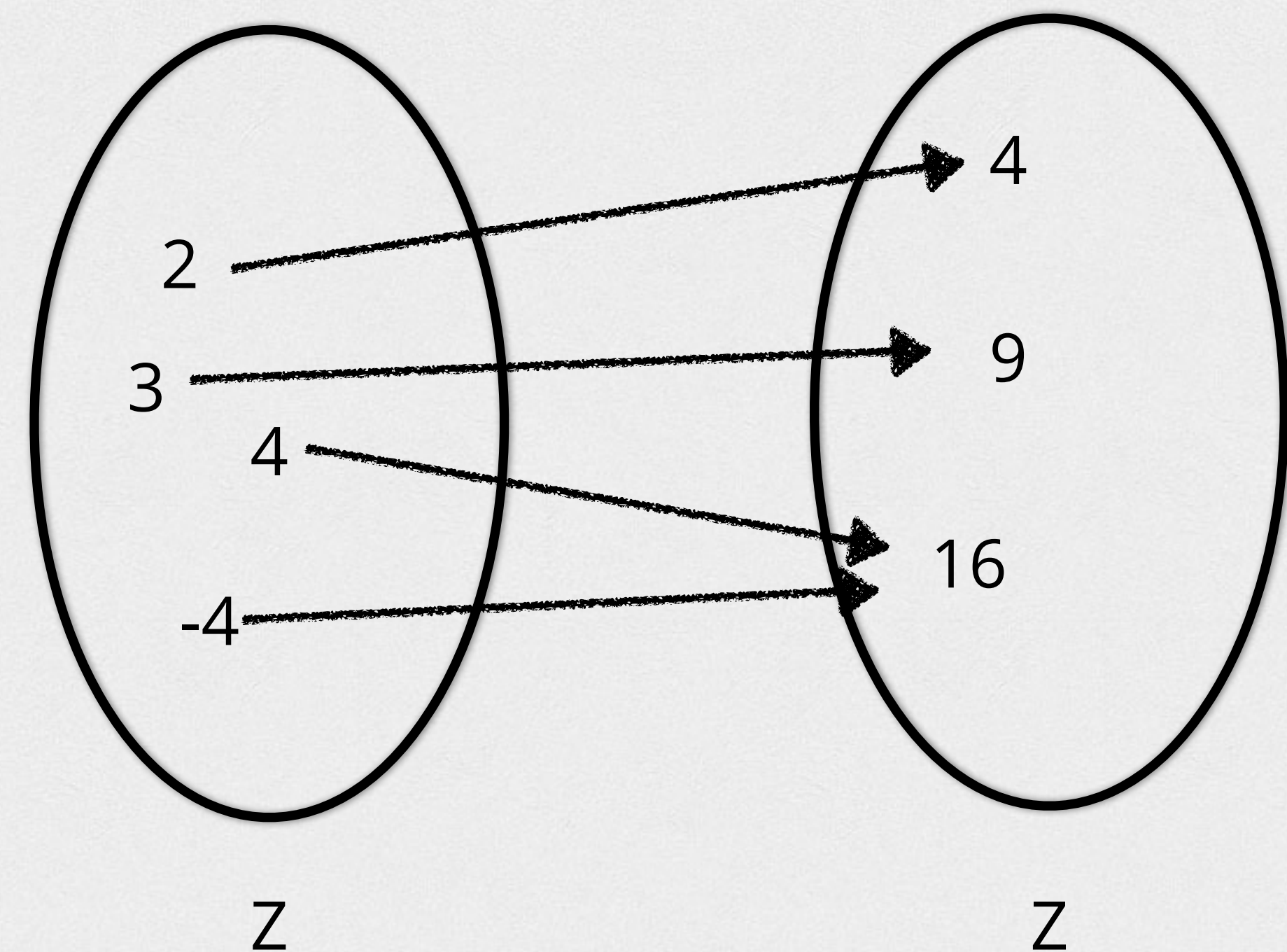
Mathematical function

- ⚙ mathematical function
- ⚙ map values to values
- ⚙ a value is just an element in a set
(.e.g, set of integers,
of strings, etc.)



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$$f: Z \rightarrow Z$$

$$f(3) = 9$$

$$f(x) = x * x$$

mathematical functions

establish true relations
which remain true

$$t_0 = 5$$

$$f(t_0) = 50$$

$$f(t_0) = 50$$

computational functions

do things

```
NSNumber * t0 = @5;
```

```
NSNumber * pos = f(t0);  
pos; // => 50
```

```
pos = f(t0);  
pos; // => 100;    (surprise!)
```

mathematical variables

are names
we give to values

$$t_0 = 5$$

$$t_0 = 5$$

~~$$t_0 = 6$$~~

computational variables

are like names for places,
whose contents can change

```
NSNumber * five = @5;
```

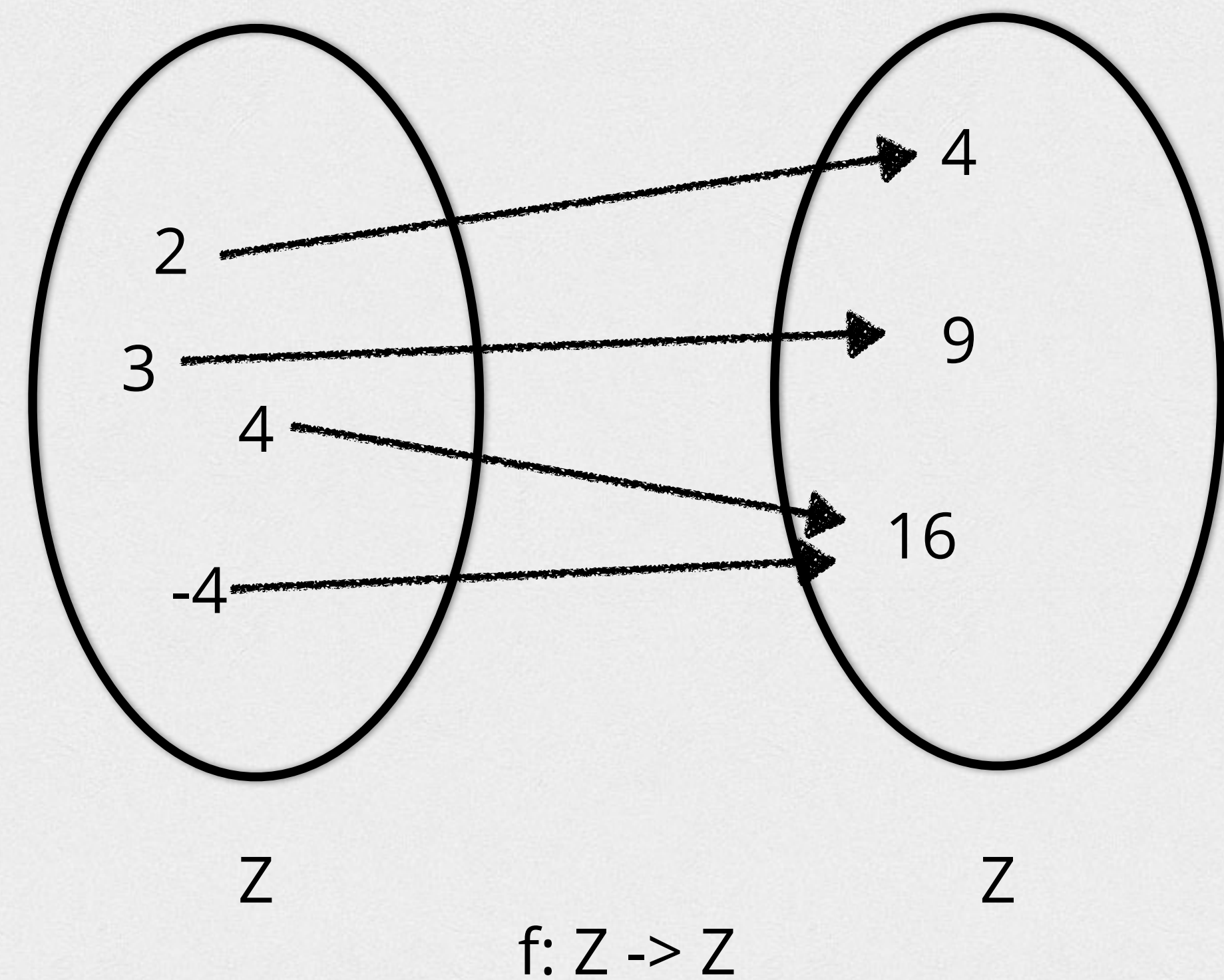
```
five = @6; // ?!
```

```
five = @7;
```

```
[five setIntegerValue:8]; // ?! ?!
```


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$$f(x) = x * x$$

Elements of FP style

- ⚙ Key practices to make programs “mathier”:
 - ⚙ immutable variables
 - ⚙ pure functions (no side-effects)
 - ⚙ higher-order functions

Swift's support for FP style

- ⚙️ Nicer functions:
 - ⚙️ consistent syntax for functions, closures, methods
- ⚙️ Can create more “mathy” variables:
 - ⚙️ Immutability attributes (Immutable, *just* like numbers)
 - ⚙️ Value types (Unaliased, a *bit* like numbers)
- ⚙️ Etc: complex enums, enum case patterns, generics, type inference, ...

Today's agenda

⚙ Values:

- ⚙ immutable vs mutable problem modeling

⚙ Functions:

- ⚙ elementary higher order functions
(map,filter,reduce)