

**Instructions.** Work with your group to answer the questions to the best of your ability. Please do not use any electronics while in class. Whatever you do not finish, you should spend some time thinking about to both refresh your memory about linear algebra and to get yourself in the right mindset for this class.

**Question 1.** Let  $A$  be the set consisting of the three elements  $a$ ,  $b$ , and  $c$ : this is written as  $A = \{a, b, c\}$ . Using this notation, let  $B = \{w, x, y, z\}$  and  $C = \{1, 2, 3\}$ .

(1) What is meant by a *function* from  $A$  to  $B$ ? More generally, what is the data required to define a function?

(2) Give an example of a function  $f$  from  $A$  to  $B$ . (We write  $f: A \rightarrow B$ ).

(3) What does it mean for a function to be *injective* (also called *one-to-one*)? Was the function  $f$  you wrote down injective?

(4) Can you give an example of an injective function from  $C$  to  $B$ ? Explain.

(5) Can you give an example of an injective function  $B$  to  $C$ ? Explain.

- (6) What does it mean for a function to be *surjective* (also called *onto*)? Were any of the functions you defined so far surjective?
- (7) Can you give an example of a surjective function from  $B$  to  $A$ ? Explain.
- (8) Can you give an example of a surjective function from  $A$  to  $B$ ? Explain.
- (9) A function is *bijective* if it is both surjective and injective. Can you give a bijection between  $A$  and  $B$ ? What about between  $A$  and  $C$ ? Explain.
- (10) What does it mean to compose two functions? Is the composition of two surjective functions surjective? Is the composition of two injective functions injective? Is the composition of an injective function and a surjective function injective or surjective?