

## Math 320 Linear Algebra Assignment # 6

Note: I don't know if these video links will work for you (they work for me but I am the owner of the videos). But they are on Canvas.

1. Suppose the  $X, Y$  and  $Z$  are sets (don't assume they are sets of vectors they are just sets). Let  $f : X \rightarrow Y$  and  $g : Y \rightarrow Z$ . Prove that  $g \circ f : X \rightarrow Z$  is onto then  $g$  is onto. If you are new to proving things are onto, this video should help:

[Proving Functions are Onto](#)

2. Suppose that  $B, C \in \mathbb{R}^{p \times m}$  and  $A \in \mathbb{R}^{m \times n}$ . Prove that:

$$(B + C)A = BA + CA$$

If you want to see an example of a proof like this, I recored one at:

[Matrix Multiplication Proof Video](#)

3. (a) Suppose  $X, Y$  and  $Z$  are sets (not necessarily of vectors) and  $f : X \rightarrow Y$  and  $g : Y \rightarrow Z$ . Show that if  $g \circ f : X \rightarrow Z$  is 1-1 (injection) then  $f$  is 1-1. (Hint: Suppose  $f(x_1) = f(x_2)$  for some  $x_1, x_2 \in X$  then prove  $x_1 = x_2$ .)  
(b) Clearly write the contrapositive of this statement.  
(c) Suppose  $A \in \mathbb{R}^{m \times n}$ , and  $B \in \mathbb{R}^{n \times p}$ . Show if the columns of  $B$  are linearly dependent then so are the columns of  $AB$ .

If you are new to proving things are 1-1, this video should really help:

[Proving Functions are 1-1](#)