

EE5120 Linear Algebra: Tutorial Test 2, 23.08.17B

Give your answers in the space provided. No calculators or smartphones allowed.

Roll: No: \_\_\_\_\_

NAME: \_\_\_\_\_

Time: 20 mins

1. Given a subset of  $\mathbb{R}^2$  defined as  $W_p = (p/\alpha, mp + c)$ , where  $p, m, c, \alpha \in \mathbb{R}$  and  $m, c, \alpha$  are non-zero constants. Further, given a vector  $v = (0, c^3) \in \mathbb{R}^2$ . Answer with reasons.

(a) Is  $W_p$  a subspace of  $\mathbb{R}^2$ ?

(b) Is a subset  $U$  defined as  $U = W_p - v : \{w - v | w \in W_p\}$  a subspace of  $\mathbb{R}^2$ ?

**Solution:** (2+3)

(a) No, since it is a line not passing through the origin.

(b) Yes if  $c = \pm 1$ . In that case  $U = (p/\alpha, mp)$  which is a subspace.

2. Given the row reduced echelon form of a  $m \times n$  matrix as  $\begin{pmatrix} P & Q \\ R & S \end{pmatrix}$ , with the additional information that: All the  $p$  pivots appear in the first  $p$  columns, and the sub-matrix  $P$  below is  $p \times p$ :

(a) What can be said about the contents of  $P, Q, R, S$ ?

(b) Can you work out the null space matrix  $N$  in this case? Recall that the columns of  $N$  span the null space.

**Solution:** (2+3)

(a)  $P = I, R = 0, S = 0$ , nothing can be said about  $Q$ .

(b)  $N = [-Q \ I]^T$ .