

## Lecture 7 Problems: Problem 1

Given

$Qx = 0$  ~~and~~, multiply each side by  $Q^T$ ;

$Q^T Qx = 0$  implies

$$Ix = 0$$

$$x = 0.$$

## Problem 2

Given

$$a = (1, -1, 0, 0)$$

$$b = (0, 1, -1, 0)$$

$$c = (0, 0, 1, -1)$$

Then set

$$A = a,$$

$$B = b - \frac{A^T b}{A^T A} A = \left(\frac{1}{2}, \frac{1}{2}, -1, 0\right)$$

and

$$C = c - \frac{A^T c}{A^T A} A - \frac{B^T c}{B^T B} B = \left(\frac{1}{3}, \frac{1}{3}, \frac{1}{3}, -1\right).$$

$a, b, c$  are orthogonal to each other, thus  $A, B,$  and  $C$  are.