

## CS480 Linear Algebra Exercises

For this activity, your goal is to complete the exercises below, *and* to develop a Python-based answer key using numpy. After you complete each exercise by hand, update your Python script to print the key for that question.

1. Assuming that

$$B = \begin{bmatrix} 1 & 2 & -3 \\ 3 & 4 & -1 \end{bmatrix}, A = \begin{bmatrix} 2 & -5 & 1 \\ 1 & 4 & 5 \\ 2 & -1 & 6 \end{bmatrix}, y = \begin{bmatrix} 2 \\ -4 \\ 1 \end{bmatrix}, z = \begin{bmatrix} -15 \\ -8 \\ -22 \end{bmatrix}$$

calculate each of the following:

(a)  $BA$

(b)  $AB^T$

(c)  $Ay$

(d)  $y^T z$  (This is the inner product, or dot product, of  $y$  and  $z$ .)

(e)  $yz^T$  (This is the outer product of  $y$  and  $z$ .)

2. Given that  $A = \begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix}$ , and  $b = \begin{bmatrix} 4 \\ 6 \end{bmatrix}$

(a) Find  $A^{-1}$ .

Check your answer by computing  $AA^{-1}$ .

(Hint: let  $B = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$  and solve  $AB = I$  for  $a, b, c$  and  $d$  by solving a set of four equations in four unknowns. You would learn better ways to accomplish this in a linear algebra course, but this approach only requires high-school algebra. )

(b) Use  $A^{-1}$  to solve  $Ax = b$  for  $x$ .

Check your answer by computing  $Ax$ .