Linear Algebra Exercises

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.

3. (No need to include solutions to this question in your Python code.) Given the following matrices:

$A = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} -2 & 0 \\ 0 & 2 \end{bmatrix}$, $C = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$, $D = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$

Draw and label each of the following:

Ax, Bx, Cx, Dx