If A is an $m \times n$ matrix, then $A^T A$ is an $m \times m$ matrix

(a) True, and I can explain why

(b) True, but I am unsure why

(c) False, and I can explain why

(d) False, but I am unsure why

(e) Hmmmmm. . .

If A is an $m \times n$ matrix, then $A^T A$ is an $n \times n$ symmetric matrix

(a) True, and I can explain why

(b) True, but I am unsure why

(c) False, and I can explain why

(d) False, but I am unsure why

(e) Hmmmmm. . .

If $\vec{\mathbf{u}} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ and $\vec{\mathbf{v}} = \begin{bmatrix} -2 \\ 3 \\ 1 \end{bmatrix}$ then $\vec{\mathbf{u}}^T \, \vec{\mathbf{v}} =$

(a) $\begin{bmatrix} -2 & 3 & 1 \\ -4 & 6 & 2 \\ -6 & 9 & 3 \end{bmatrix}$

(b) 7

(c) $\begin{bmatrix} -2 & -4 & -6 \\ 3 & 6 & 9 \\ 1 & 2 & 3 \end{bmatrix}$

(d) Is undefined

(e) None of the above

If $\vec{\mathbf{u}} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ and $\vec{\mathbf{v}} = \begin{bmatrix} -2 \\ 3 \\ 1 \end{bmatrix}$ then $\vec{\mathbf{v}}\,\vec{\mathbf{u}}^T =$

(a) $\begin{bmatrix} -2 & 3 & 1 \\ -4 & 6 & 2 \\ -6 & 9 & 3 \end{bmatrix}$

(b) 7

(c) $\begin{bmatrix} -2 & -4 & -6 \\ 3 & 6 & 9 \\ 1 & 2 & 3 \end{bmatrix}$

(d) Is undefined

(e) None of the above

If $P = \begin{bmatrix} 1 & 4 \\ 2 & 5 \end{bmatrix}$ and $D = \begin{bmatrix} -2 & 0 \\ 0 & 3 \end{bmatrix}$ then $DP =$

(a) $\begin{bmatrix} -2 & 12 \\ -4 & 15 \end{bmatrix}$

(b) $\begin{bmatrix} -10 \\ 21 \end{bmatrix}$

(c) $\begin{bmatrix} -2 & -8 \\ 6 & 15 \end{bmatrix}$

(d) Is undefined

(e) None of the above

If $P = \begin{bmatrix} 1 & 4 \\ 2 & 5 \end{bmatrix}$ and $D = \begin{bmatrix} -2 & 0 \\ 0 & 3 \end{bmatrix}$ then $PD =$

(a) $\begin{bmatrix} -2 & 12 \\ -4 & 15 \end{bmatrix}$

(b) $\begin{bmatrix} -10 \\ 21 \end{bmatrix}$

(c) $\begin{bmatrix} -2 & -8 \\ 6 & 15 \end{bmatrix}$

(d) Is undefined

(e) None of the above

Let $A = \begin{bmatrix} -2 & 0 & 0 \\ 0 & 1 & -4 \\ 0 & -4 & 1 \end{bmatrix}$

1. Find an orthogonal diagonalization $A = PDP^T$

2. Write $P = \begin{bmatrix} \vec{\mathbf{u_1}} & \vec{\mathbf{u_2}} & \vec{\mathbf{u_3}} \end{bmatrix}$ and let $\lambda_1, \lambda_2, \lambda_3$ be the entries on the diagonal of D
   (a) Compute $\lambda_1 \vec{\mathbf{u_1}}\, \vec{\mathbf{u_1}}^T$, $\quad \lambda_2 \vec{\mathbf{u_2}}\, \vec{\mathbf{u_2}}^T$, $\quad$ and $\quad \lambda_3 \vec{\mathbf{u_3}}\, \vec{\mathbf{u_3}}^T$
   (b) Sum the three matrices from part (a)