1. **(1 pt) Library/Rochester/setLinearAlgebra18OrthogonalBases-/ur_la_18_11.pg**

Let $A = \begin{bmatrix} 1 & 0 & 0 \\ -1 & -3 & 1 \\ -1 & -6 & 2 \end{bmatrix}$.

Find an orthonormal basis of the column space of A.

$\begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \end{bmatrix}$.

2. **(1 pt) Library/Rochester/setLinearAlgebra18OrthogonalBases-/ur_la_18_7.pg**

Let $A = \begin{bmatrix} 4 & 1 & 12 & -3 \\ -1 & -1 & -3 & 3 \end{bmatrix}$.

Find an orthonormal basis of the kernel of A.

$\begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}$.

3. **(1 pt) Library/Rochester/setLinearAlgebra22SymmetricMatrices-/ur_la_22_6.pg**

The matrix $M = \begin{bmatrix} 1 & 0 & 0 & -1 \\ 0 & 1 & -1 & 0 \\ 0 & -1 & 1 & 0 \\ -1 & 0 & 0 & 1 \end{bmatrix}$.

has two distinct eigenvalues $\lambda_1 < \lambda_2$. Find the eigenvalues and an orthonormal basis for each eigenspace.

$\lambda_1 = \_\_\_\_$,

associated unit eigenvector = $\begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}$,

$\lambda_2 = \_\_\_\_$,

associated unit eigenvector = $\begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}, \begin{bmatrix} \_ \\ \_ \\ \_ \\ \_ \end{bmatrix}$.

The above eigenvectors form an orthonormal eigenbasis for M.

4. **(1 pt) Library/Rochester/setLinearAlgebra19QRfactorization-/ur_la_19_4.pg**

Find the QR factorization of $M = \begin{bmatrix} 9 & 15 \\ 9 & 9 \\ 9 & 15 \\ -9 & -9 \end{bmatrix}$.

$M = \begin{bmatrix} \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \end{bmatrix} \begin{bmatrix} \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ \end{bmatrix}$.

5. **(1 pt) Library/Rochester/setLinearAlgebra19QRfactorization-/ur_la_19_3.pg**

Find the QR factorization of $M = \begin{bmatrix} 6 & 4 & 1 \\ 6 & 1 & -11 \\ 3 & -1 & 2 \end{bmatrix}$.

$M = \begin{bmatrix} \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \end{bmatrix} \begin{bmatrix} \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \\ \_\_\_\_ & \_\_\_\_ & \_\_\_\_ \end{bmatrix}$.