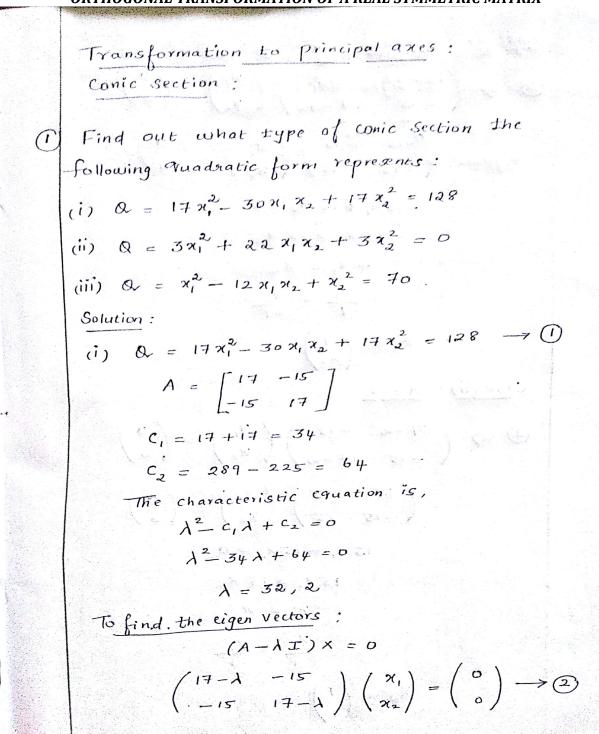


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UNIT II ORTHOGONAL TRANSFORMATION OF A REAL SYMMETRIC MATRIX







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Case (i):
$$\lambda = 32$$

$$2 \Rightarrow \begin{pmatrix} 17 - 32 & -15 \\ -15 & 17 - 32 \end{pmatrix} \begin{pmatrix} \chi_1 \\ \chi_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \\
\begin{pmatrix} -15 & -15 \\ -15 & -15 \end{pmatrix} \begin{pmatrix} \chi_1 \\ \chi_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \\
-15 \chi_1 + 15 \chi_2 = 0 \\
-15 \chi_1 = 15 \chi_2 \\
-\chi_1 = \chi_2 \\
\frac{\chi_1}{1} = \frac{\chi_2}{-1} \\
\vdots \times \chi_1 = \begin{pmatrix} 1 \\ -1 \end{pmatrix} \\
Case (ii): \lambda = 2$$

$$2 \Rightarrow \begin{pmatrix} 17 - 2 & -15 \\ -15 & 17 - 2 \end{pmatrix} \begin{pmatrix} \chi_1 \\ \chi_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \\
\begin{pmatrix} 15 & -15 \\ -15 & 15 \end{pmatrix} \begin{pmatrix} \chi_1 \\ \chi_2 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \\
\begin{pmatrix} 15 \chi_1 - 15 \chi_2 = 0 \\ 15 \chi_1 = 15 \chi_2 \end{pmatrix} \\
\chi_1 = \chi_2 \\
\chi_2 = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$$





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The modal matrix,

$$M = \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}$$
The normalized matrix,

$$N = \begin{pmatrix} 1/\sqrt{2} & 1/\sqrt{2} \\ -1/\sqrt{2} & 1/\sqrt{2} \end{pmatrix} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}$$

$$N^{T} = \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & -1 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} 17 & -15 \\ -15 & 17 \end{pmatrix} \frac{1}{\sqrt{2}} \begin{pmatrix} 1 & 1 \\ -1 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 32 & 0 \\ 0 & 2 \end{pmatrix} = D$$

$$N^{T}AN = D$$

$$NOW \quad Y^{T}DY = \begin{pmatrix} 4 \\ 4 \\ 4 \end{pmatrix}$$

$$= (y_{1} \quad y_{2}) \quad y_{2} \quad$$





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