



MEEG 4703

Name: _____
(Underline your last name.)

Test II

ID#: _____

1. (20%) Reduce the determinant of order 3, as shown, to a triangular form (by using properties of determinants) and show that

$$\begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ x^2 & y^2 & z^2 \end{vmatrix} = (y-x)(z-x)(z-y)$$

2. (20%) Using orthogonal matrix and diagonalization, *identify* and *graph* (to scale) the conic section

$$9x^2 + 24xy + 16y^2 - 80x + 60y = 300$$

3. (30%) In an experiment performed on a thin wire, the following correspondence was found between the applied force F (in N) and the elongation δ (in mm):

F	0	2	3	4	5
δ	0	1.5	3	4.5	5

Using matrix algebra, find the least square line (line of best fit)

$$\delta = aF + b$$

Use this line to estimate the value of δ for $F = 1$ N.

4. (30%) It is known that the eigenvalues for the matrix \mathbf{A} shown are $\lambda_1 = 6.25$, $\lambda_2 = 4$, $\lambda_3 = 1$. For this matrix \mathbf{A} , find (a) the eigenvectors \mathbf{K}_1 , \mathbf{K}_2 , \mathbf{K}_3 (using simplest integers for its entries), (b) the modal matrix \mathbf{M} , (c) a square root $\sqrt{\mathbf{A}}$.

$$\mathbf{A} = \begin{bmatrix} 22 & -4.5 & 2.25 \\ 0 & -5 & -7.5 \\ -63 & 13.5 & -5.75 \end{bmatrix}$$