UNIVERSITY of ARKANSAS
1871

MEEG 4703 **Name:** _____

(Underline your **last name**.)

Test II **ID#:** _____

1. (20%) Find the value of $\det \mathbf{A}$ for the matrix **A** shown.

$$\mathbf{A} = \begin{bmatrix} 2 & 2 & 0 & 0 & 2 \\ 1 & 1 & -6 & 0 & -5 \\ 2 & 0 & -4 & 3 & 2 \\ 2 & 0 & -1 & 3 & -3 \\ 0 & 4 & 0 & 0 & -4 \end{bmatrix}$$

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

$$9x^2 + 24xy + 16y^2 - 4x + 3y = 10$$

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

F	1	2	3	4	5
δ	1	1.5	3.3	4.5	5.5

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

$$\delta = a F + b$$

Use this line to estimate the value of δ for F = 2.5 N.

4. (30%) It is known that the eigenvalues for the matrix **A** shown are $\lambda_1 > \lambda_2 > \lambda_3 = 1$. For this matrix **A**, determine *(a)* the values of λ_1 and λ_2, *(b)* the eigenvectors $\mathbf{K}_1$, $\mathbf{K}_2$, $\mathbf{K}_3$ (using simplest integers for its entries), *(c)* the modal matrix **M**, *(d)* a square root $\sqrt{\mathbf{A}}$.

$$\mathbf{A} = \begin{bmatrix} -11 & 6 & 0 \\ 30 & 16 & 20 \\ 60 & -18 & 9 \end{bmatrix}$$