

Math 309 Final Exam, Due 3pm, Dec. 17, 2009

You must show all your work IN DETAILS to earn credits. By "IN DETAILS" I mean each step must be spelled out in a convincing way before you implement Matlab calculation when the problem comes with an $[M]$ (you must calculate by hand when the problem is not marked with an $[M]$). Each characteristic polynomial, all eigenvalues, eigenspaces and o.n. bases must be calculated and found explicitly. Write legibly. The total is 50 points to be projected to 100 points.

(1) Read p419 for the terminology, and p421 for The General Linear Model and Example 2. Then work on Section 6.6, #8, p425. (5 points for each part. No graph is needed.)

(2) Section 6.7, #26, p436. (10 points)

(3) (a) Let $f(t) = t^2/2 - \pi t + \pi^2/3, 0 \leq t \leq 2\pi$. Use a table of integrals, if you will, to establish that the Fourier series of $f(t)$ is $2 \sum_{n=1}^{\infty} \cos(nt)/n^2$. (10 points)

(b) Conclude that $\sum_{n=1}^{\infty} 1/n^2 = \pi^2/6$. (5 points)

(4) Section 7.1, #20, p454. (10 points) (Why is 1 an eigenvalue?)

(5) Find the new cartesian coordinates in which the conic section $9x^2 - 8xy + 3y^2 = 11$ assumes the standard form. Find the standard form. (5 points)