18.06 (Fall '11) Problem Set 10

This problem set is due Monday, November 28, 2011 at 4pm. The problems are out of the 4th edition of the textbook. For computational problems, please include a printout of the code with the problem set (for MATLAB in particular, `diary("filename")` will start a transcript session, `diary off` will end one.)

1. Do problem 20 from 6.5.
2. Compute the *cube* root (i.e. find D such that $D^3 = A$) for the positive definite symmetric square matrix $A = \begin{pmatrix} 5 & 4 \\ 4 & 5 \end{pmatrix}$.
3. Do problem 5 from 6.6.
4. Do problem 17 from 6.6.
5. Do problem 22 from 6.6.
6. What are the singular values of an n by n Jordan block with eigenvalue 0? In MATLAB `A = gallery('jordbloc', n, e)` creates a Jordan block of size n and eigenvalue e.
7. Do problem 6 from 6.7.
8. Do problem 7 from 6.7.
9. Let V be the function space of polynomials with basis $1, x, x^2, x^3, x^4$. What is the matrix M_t (it should depend on t) for the operator that sends $f(x)$ to $f(x+t)$? Show that M_t and M_{-t} are inverses.
10. Let V be the function space with basis $\sin(x), \cos(x), \sin(2x), \cos(2x)$. What is the matrix of the derivative operator in this basis? What is its determinant? Why is the determinant what you get (you don't have to turn this part in, but do the mental exercise)?

18.06 Wisdom. Try to think about everything you've learned in other classes, especially those without the number 18 in them, as a linear transformation. How many can you name? Once this clicks – congratulations. That's the wizard behind the curtain.