- Calculus Part.

  1. You should be familiar with differentiating and integrating power series "term by term" (Theorems 11.8.2 and 11.8.3).
  2. You should know the properties of the binomial series. For instance, you should be able to write down the series expansion of $(1-2x)^{-1/3}$ and its radius of convergence.
  3. You should know what a first order linear differential equation is. Remember that the unknown you are solving for is a *function* not a number.
  4. You should know how to solve an equation of the form,
     $$y' + p(x)y = q(x)$$
     using the integrating factor $e^{\int p(x)dx}$.
  5. Recall what is a *general solution* and what is a *particular solution*. You should know how to obtain particular solutions from a the general solution using the given initial values.
  6. Do not skip the important example of Netwon's law of cooling.
  7. You should know when a first-order differential equation is separable. If it is not immediately separable, you should be able to manipulate the equation to put it in separable form if possible. What does separability buy you ? What are integral curves ?
  8. Be sure to understand the important example of the *logistic equation*.

- Linear Algebra Part.

  1. You should be able to associate a matrix to a given linear transformation and vice-versa. For example, what is the matrix corresponding to the linear transformation of "differentiation" which a polynomial of degree at most four to one of degree at most three, where the polynomials are represented by usual column vectors ? Make sure you understand that composition of linear transformations corresponds to matrix products.
  2. You should know the basic definitions of matrix-vector, matrix-matrix products.
  3. You should know the definition of the dot product and its geometric significance (in terms of the angle between two vectors).
  4. What is the length of a vector in terms of the dot product ?
  5. You should know and be in a position to apply the Schwartz, Minkowski and the triangle inequalities.

6. You should know the definition of an isometry. What is the characterizing property of a matrix corresponding to an isometry ?
7. What effect does a linear transformation $\mathbb{R}^2 \to \mathbb{R}^2$ have on areas ? What are the area preserving linear transformations ?
8. You should know how to represent systems of linear equations in matrix notation, using augmented matrices. When are two such systems equivalent ?
9. You should be able to solve linear systems of equations using row reductions and back substitutions. In particular, you should know the row reduction algorithm (Section 3.4) and be able to use it.
10. What is the kernel of a matrix ? You should be able to compute a parametrization of the kernel using row reductions.
11. What is the importance of the pivotal columns ? How are they related to the rank of a matrix ?
12. Make sure you understand *thoroughly* the statement *as well as* the proof of Theorem 7 (page 121) and its corollary (page 122). In particular, you should be able to use the corollary to prove that a given square matrix is invertible by showing that is kernel is $\{0\}$ (cf. next two items).
13. Why is a square isometry invertible ? What is its inverse ?
14. When is a Vandermonde matrix invertible ? The proof is included.
15. You should be able to compute inverses of matrices using an extension of the row reduction algorithm.
16. What is the LU factorization of a matrix ? (This item is included only if we finish discussing it before the test).

If you know all of the above you will do fine in the test. GOOD LUCK!