List of topics and problems for the Final. The following is a list of topics that are included in the final. All final questions will be similar to those in the list below, so be sure you cover all of them!

(1) Methods of integration.
   (a) Integration by substitution. (Problems of the type 43-54 in the notes. Be sure to know all standard derivatives, including arctangent and arcsine.)
   (b) Integration by parts and reduction formulas. (Do not assume I will write a reduction formula. I might or I might not. Problems of the type 71-84.)
   (c) Integration of rational functions. (This includes completing the square if needed and using partial fractions decomposition effectively. Problems of the type 94-112.)

   The miscellaneous problems 117-144 are good to know if you are really getting it and to practice.

(2) Taylor’s polynomials and series.
   (a) Know the standard Taylor series (given in page 27) and how to manipulate them to form new series (by substituting different powers of $x$, differentiating them or integrating them). (Problems 168-186 in the notes and also 211,212,213,215, 216, 220 and the practice and exams problems).
   (b) Learn how to use little oh to find Taylor polynomials of products and quotients. (Problems 184,214,217,221,222 and practice and exam problems.) There are worked out examples in 16.11.
   (c) Learn Lagrange’s formula for the error and how to use it to estimate the reminder and errors done in estimation problems. (Pages 29 and 30 in the notes, problems 191-194 and the list of extra problems I sent.)
   (d) Convergence of Taylor series: for any function other than $\frac{1}{1-x}$ (and those similar to it), use Langrange’s formula for the remainder to do this. Be sure you get rid of $\xi$ before you take limits. (Problems 238-242, 250-251 using Lagrange’s formula, problems 244-247, 252-253 using the formula for the remainder of the geometric series.)

(3) Complex numbers.
   (a) Find polar forms of complex numbers and use them to find complex solutions of equations. (Problem 281.)
   (b) Know de Moivre’s formula (26.3) and use it to:
      (i) Find formulas for cosine and sine of multiples of $\theta$.
      (ii) Find powers of complex numbers (as in the make up exam).
      (iii) Find trigonometric integrals of two different types - those being the real or complex parts of a complex integral, and the integrals of $\sin nx \cos mx$ for different numerical values of $n$ and $m$.

   (Problems 263,283,284 and similar.)

(4) Differential equations.
   (a) First order equations: separable and linear using an integrating factor. (problems 293-301, 304.)
   (b) Second order linear equations with constant coefficients: homogeneous and non-homogeneous. Learn how to solve them, including initial value problems. (Problems 323-337, 338-344, 345.)
   (c) Applications: first order applications (Problems 347,348,350,351,352.) I will not use percentages, only total quantities, so please change those problems including percentages to the total amount. Second order applications (Problems 256-258, I will be giving the equation here.)

(5) Vectors
   Learn to do arithmetic with vectors and what $\hat{i}$, $\hat{j}$ and $\hat{k}$ are. You will also need to know what the product of a vector by a number or the sum is when we get to more complicated examples. I will not have a problem only on this part but you need to know this for what is coming. (Problems 361,362,363, etc. More if you need to practice.)
   (a) Parametric equations for lines and planes: learn how to find them and how to find intersections among them or with the axis. (Problems 371-373, more later with dot product.)
(b) Dot product: how to use it and orthogonal projection. Use it to find angles, the determining
equation of lines and planes, and the distance from a point to a line or a plane. Examples are
45.13-45.15. (Problems 376-378,381,383,384-386.)
(c) Cross product: learn how to find it and its geometric description (including 46.12). Apply it to
find the normal to a plane and the area of a parallelogram. Triple product: learn its definition
and how to use it to find volumes of parallelepiped. (Problems 287,390-393. 394 is long but
very good to practice.)
(6) Parametric curves
   (a) Find velocity, speed and acceleration for a parametric curve and use them to find tangent lines
       and planes.
   (b) Learn how to sketch parametric curves (including those in polar form).
   (c) Find the length of curves, including those of graphs and those of parametric curves given in
       polar form.
These topics are mixed in problems 415-420.