

# Notes for MA591U, Spring 2001

## (Symbolic Computation)

### Linear Differential Equations (Overview)

Suppose we have  $y^{(n)} + a_{n-1}(x)y^{(n-1)} + \cdots + a_0(x)y = 0$ , where  $a_i \in \mathbb{Q}(x)$  and  $y^{(i)}$  indicates the  $i$ th derivative of  $y$ . We would like to know when we can solve this in finite terms; that is, in terms of algebra, exp, ln, and integration.

**EXAMPLE:** It is known that there is no solution in finite terms for  $y'' + xy = 0$ .

We will discuss the following:

- (i) Rational solutions of LDEs.
- (ii) Galois theory of LDEs. To each LDE  $L(y) = 0$  there corresponds a group, and properties of the LDE will correspond to properties of the group.
- (iii) Applications. We will consider two applications:
  - (a) Solving in finite terms.
  - (b) Factoring multivariate polynomials.