LECTURE OUTLINE

Linear Differential Equations

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Math 15

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Goal

Differential Equations
The Power Series Method

A Differential Equations

If f satisfies

$$\sum_{n=0}^{N} a_n(z)\frac{d^n f}{dz^n} = 0,$$

then we say that f is a *solution* to this *differential equation*. An equation in the above special form is called a homogeneous ordinary linear differential equation, a *HOLDE*. N is called this HOLDE's *order*.

When we try to solve a HOLDE, we must specify *initial conditions*, namely $f(0) = b_0, \ldots, \frac{d^{N-1}f}{dz^{N-1}}(0) = b_{N-1}$

Example 1

Express the following as a HOLDE and solve it using power series:

$$\frac{df}{dz} = 2f$$

$$f(0) = 1$$

Do the same for

$$\frac{df}{dz} = cf$$

$$f(0) = b_0.$$

Example 2

Express the following as a HOLDE and solve it using power series (it is SHM):

$$\frac{d^2 f}{dz^2} = -\omega^2 f$$

$$f(0) = b_0$$

$$\frac{df}{dz}(0) = b_1$$