18.03 Differential Equations: Week 7

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Progress Update

Over the past week we have covered:

1. Unit 1 Exam
2. Higher order linear DEs

Higher order linear DEs

We define the general linear differential equation of order n in the form of

$$a_n x^{(n)} + a_{n-1} x^{(n-1)} + \cdots + a_1 x + a_0 = q(t). \tag{1}$$

There are a few traits any differential equation can have, including

1. Constant coefficient - a_k are independent of t
2. Homogeneous - $q(t) = 0$

If both are present, we can solve for x by solving the characteristic polynomial

$$a_n r^n + \cdots + a_0 = 0 \tag{2}$$

for r and plugging into e^{rt}

Example problem

Consider this problem from the practice problems:

5. Let r denote a constant, which is perhaps complex valued. Suppose that e^{rt} is a solution to $\ddot{x} + kx = 0$. What does r have to be?