Differential Equations (MAM2046W)

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Diff EQs
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Contents

Differential equations describe some kind of changing system that changes with some dependence on the value of the quantity of interest itself.

1 Separable Equations

First off, let's take a look at the most basic differential equation, what we call separable equations. They come in the form

$$\frac{dy}{dx} = f(x)g(y) \tag{1.1}$$

These are really easy to solve. We do this by separating the equation by terms of x and y and integrating both sides, like this

$$\int \frac{1}{g(y)}dy = \int f(x)dx \tag{1.2}$$

And that's it. Badabing, badaboom. Next up: AAAAAAAAAAFUCK

2 First Order Linear Equations

Next up, we have a look at a very important grouping of equations, which we'll further split into a few more subcategories, starting with Homogeneous equations:

2.1 Homogeneous Equations

Homogeneous equations are of the form

$$\frac{dy}{dx} + p(x)y = 0 \tag{2.1}$$

This is a subset of separable equations. The solution is the same, except in this case the integral on the left is easily solvable, leaving us with

$$y = Ae^{-\int p(x)dx} \tag{2.2}$$

where that A absorbs the positive and negative solutions.