Note 9.1 - Exponential Growth and Decay

1 Introduction

The functions e^x and $\ln x$ play central roles on quantities/phenomenon whose rate of change are highly dependent on themselves. In this note, we study some basic examples. They are the prototypes of a profound area in mathematics called *differential equations* - equations that involve a (some) function(s) and its (their) derivatives.

2 The Derivation

We start with a simple idea that the rate of change of a quantity is *proportional* to itself:

$$\frac{dy}{dt} = ky.$$

3 Examples

4   Half Life and Double Time

The half life (double time) is the time required for a quantity to decay (grow) to half (double) its original size. It can be derived very easily: