

More general comments

At the end of last class, I gave a rough description of what the differential equation

$$\frac{dy}{dt} = f(t, y)$$

is and what it means to solve an **initial-value** problem. I have four more general comments:

2. Be careful about notation:

Example 1. $\frac{dy}{dt} = kt$

The solutions to this equation are

$$y(t) = k\frac{t^2}{2} + c,$$

where c is an arbitrary constant.

Example 2. $\frac{dy}{dt} = ky$

The solutions to this equation are

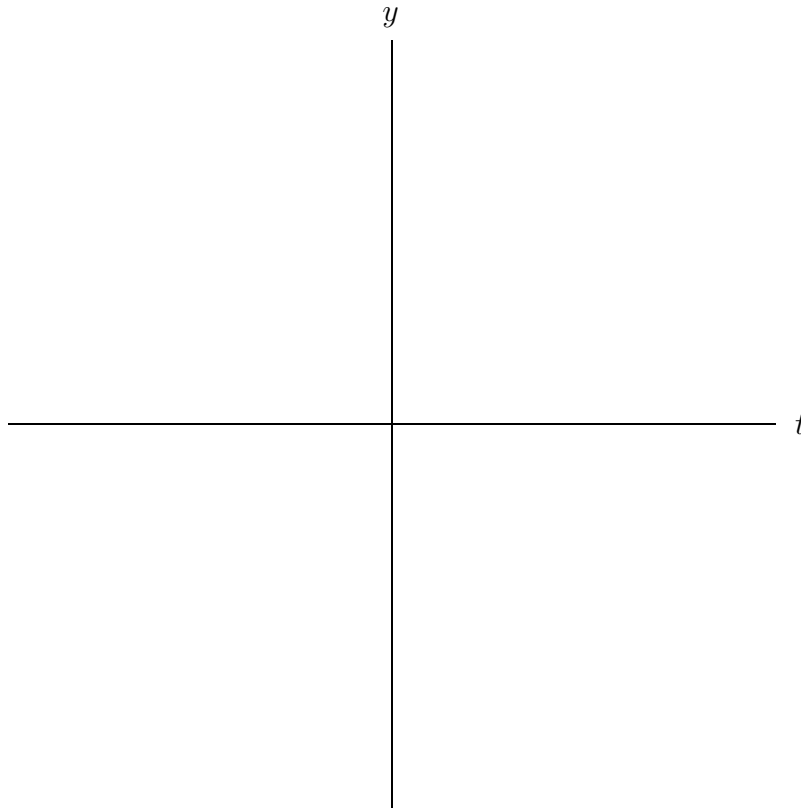
$$y(t) = y_0 e^{kt},$$

where y_0 is an arbitrary constant.

3. What does the term **general solution** mean?

4. Why you should never get a wrong answer in this course.

5. Even relatively simple looking differential equations can have solutions that cannot be expressed in terms of functions that we already know and love.



Our general approach in this course:

We will study differential equations

1. using the theory and
2. various techniques:
 - (a) analytic techniques
 - (b) geometric/qualitative techniques, and
 - (c) numerical techniques.

Separable Differential Equations (an analytic technique)

First let's recall the method of substitution for calculating integrals (really antiderivatives):

A differential equation

$$\frac{dy}{dt} = f(t, y)$$

is **separable** if it can be written in the form

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

Two Examples:

1. $\frac{dy}{dt} = -2ty^2$

2. $\frac{dy}{dt} = y^3 + t^2$

Let's go back to the first example

Example. $\frac{dy}{dt} = -2ty^2$

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We turn to `FirstOrderExamples` to get a sense of the graphs of these solutions:

