Solutions by Integrating Factors: Introduction

Our goal in this session is to derive formulas for solving both homogeneous and inhomogeneous first order linear ODE's. For the inhomogeneous equations we will use what are called *integrating factors*.

The method of integrating factors is a beautiful technique for solving the general first order linear equations as well as some other types of DE's. In later sessions we will learn other techniques that are easier and apply to higher order equations, but only apply in specific cases.

The main example in this session will be about the diffusion of heat. This is an interesting physical application and we will return to it several times in the course.

Finally we will connect the formula for the solution to the inhomogeneous equation with the superposition principle. The main point here will be to write the general solution to the inhomogeneous equation as the sum of a *particular* solution to that equation and the *general* solution to the corresponding homogeneous equation. In symbols,

$$x = x_p + C\, x_h.$$

A word of advice: pay special attention to what we mean by the phrase *particular solution*. The meaning differs slightly from the standard English sense and can be a little confusing at first.

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