# Homogeneous and nonhomogeneous DEs

We want to study (and solve!) linear differential equations. To do so, it will be useful to differentiate between two different sub-classifications of linear differential equations.

**Definition**

- A linear differential equation of the form

$$a_n(x)\frac{d^n y}{dx^n} + a_{n-1}(x)\frac{d^{n-1} y}{dx^{n-1}} + \cdots + a_1(x)\frac{dy}{dx} + a_0(x)y = 0$$

  is called **homogeneous**.

- A linear differential equation of the form

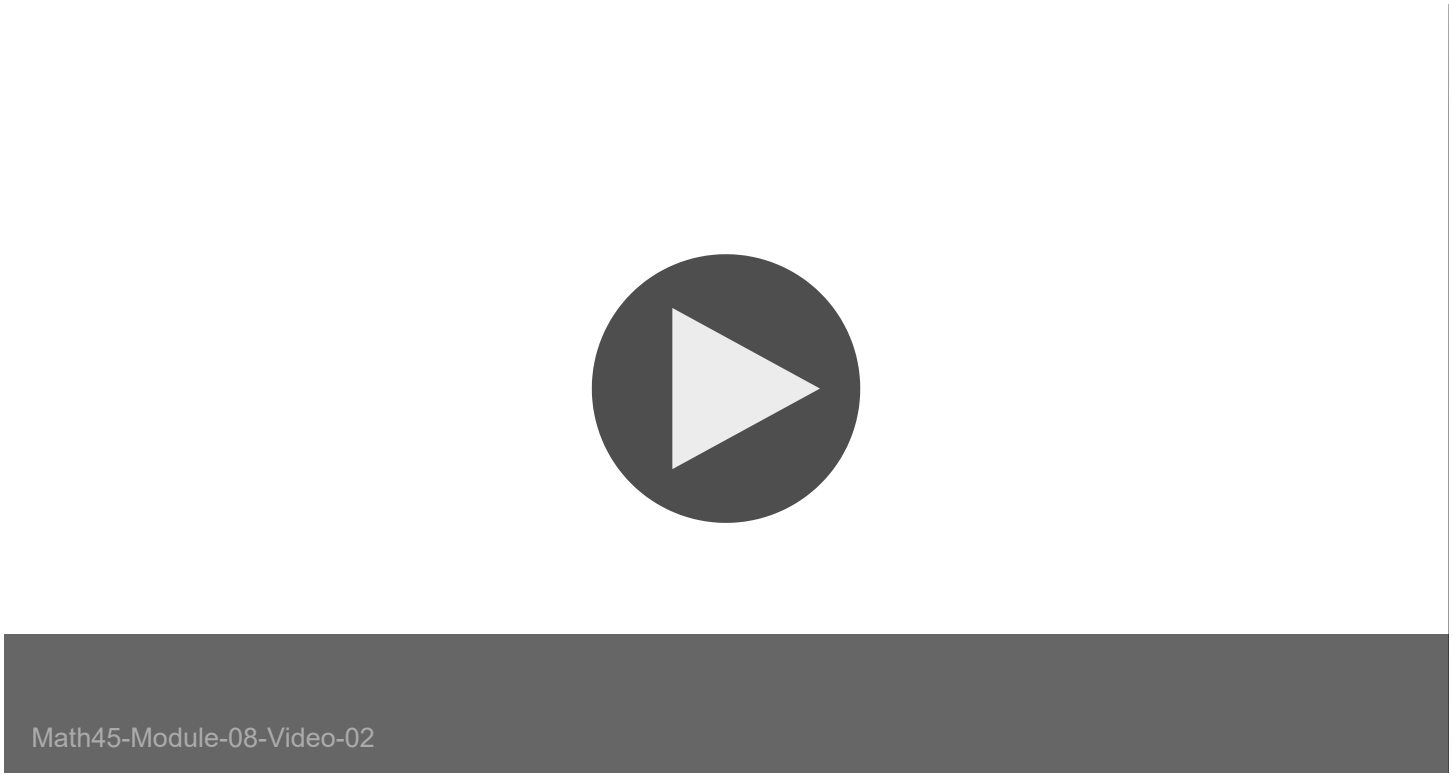
$$a_n(x)\frac{d^n y}{dx^n} + a_{n-1}(x)\frac{d^{n-1} y}{dx^{n-1}} + \cdots + a_1(x)\frac{dy}{dx} + a_0(x)y = b(x)$$

  with $b(x) \neq 0$ is called **nonhomogeneous**.

In other words, if a linear differential equation fails to be homogeneous, it is nonhomogeneous.

Note: Sometimes nonhomogeneous linear differential equations are called inhomogeneous.

### Discussion, comments, and examples:




### WeBWorK module 08 exercises:

- Problems 4

### Relevant Wikipedia articles:

- **Homogeneous linear differential equations (https://en.wikipedia.org/wiki/Homogeneous_differential_equation#Homogeneous_linear_differential_equations)**