

## Second Order Linear Differential Equations

$$y'' + p(x)y' + q(x)y = r(x)$$

The equation is called **homogeneous** if  $r(x) \equiv 0$  and **nonhomogeneous** if  $r(x) \not\equiv 0$ .

Superposition principle for homogeneous equations

If  $y_1$  and  $y_2$  are solutions to the equation

$$y'' + p(x)y' + q(x)y = 0, \quad (*)$$

then so is  $c_1y_1 + c_2y_2$ .

A pair of linearly independent solutions of (\*) is called **a basis of solutions** and in this case  $c_1y_1 + c_2y_2$  is called the **general solution** of (\*).

## Linearly independent functions

Two functions  $y_1$  and  $y_2$  are called **linearly independent** on the given interval  $I$  if the identity

$$k_1 y_1(x) + k_2 y_2(x) \equiv 0 \quad \text{on } I$$

implies  $k_1 = k_2 = 0$ .

Two functions that are not linearly dependent are called **linearly independent**.

In other words,  $y_1$  and  $y_2$  are linearly dependent if  $y_2 \equiv 0$  or  $y_1/y_2$  is constant on  $I$ .