**Math 321 Differential Equations**

**C14 Extended Linearity Principle**

Consider a second-order linear non-homogeneous differential equation

and its corresponding homogeneous equation

If is a particular solution to the non-homogeneous equation and is a general solution to the homogeneous equation, then is the general solution to the non-homogeneous equation.

1. Proof that is a solution to the non-homogeneous equation:
2. Proof that if is a solution to the non-homogeneous equation, then for some and .

Notice first that is a solution to the homogeneous equation because

Since it is the general solution for the homogeneous equation,

for some choice of and . The result follows by adding to both sides.