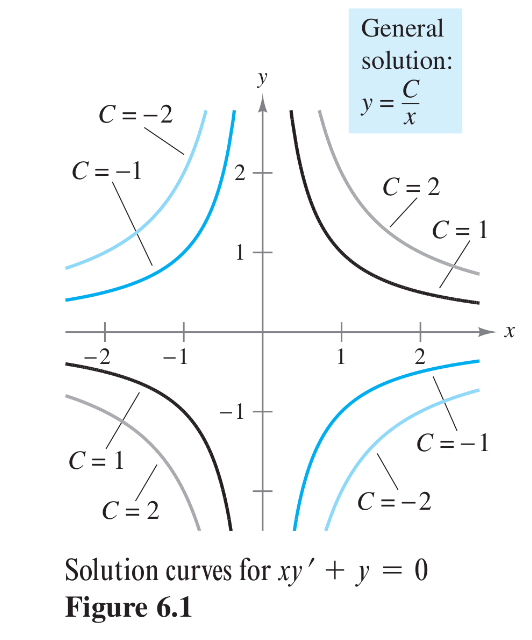
5B: Differential Equations

A **differential equation** (also known as a “diff EQ”, or an ODE for “ordinary differential Equation”) is a function of x, y, and derivatives of y. A differential equation has a **General solution** that represents a family of functions. We can use the general solution of a differential equation to find a **particular solution** using given **initial conditions**. The **order** of a differential equation is the highest order derivative in the equation.

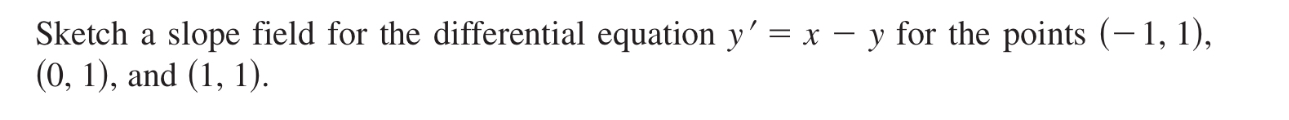
Some differential equations have a **Singular solution** that cannot be written as a special case of the general solution. However, we will not study these in this class.

Since the general solution of a differential equation represents a countless number of functions that differ by a constant, we often want to consider the graphs of all these functions. To do this, we make a graph of all the **solution curves** like the one to the right that shows the graph of the solutions for different constants.

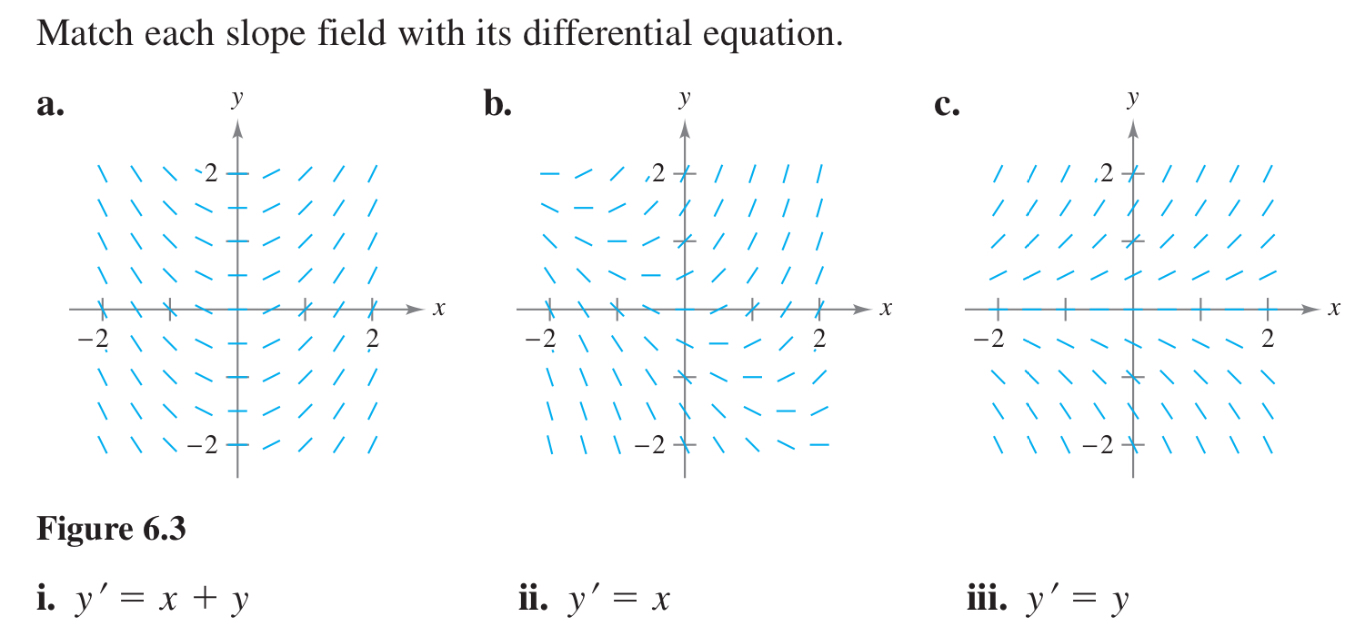
*Try These:*

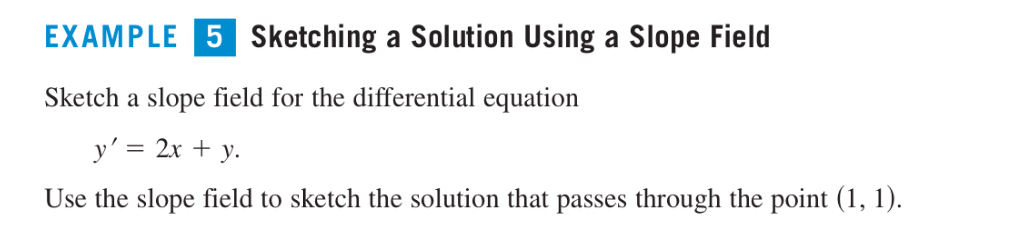
1. Show that is a general solution of .
2. For the differential equation , verify that is a solution.  
     
     
     
     
   Now find the particular solution determined by the initial condition wen .

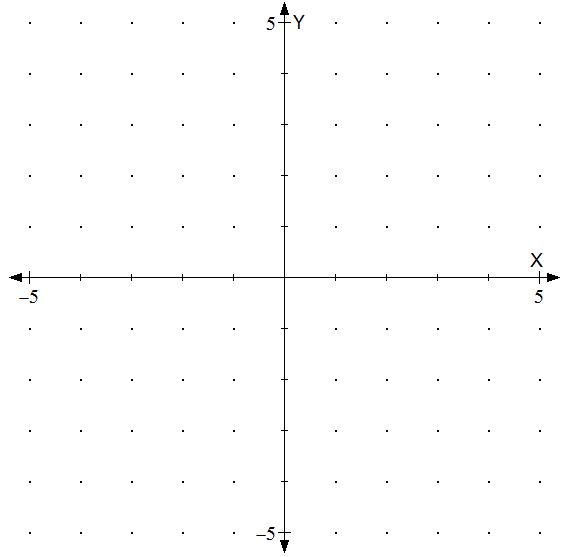
## Slope Fields

*Example*

*Exmaple*



*Example*



# Seperable Differential Equations

A **Separable Differential Equation** is one in which the and the can be separated from the and .

A **first-order separable differential equation** is one that has the form . In this equation, the right side is just a product of a function of and a different function of .

When we are separating the variables, we must show this factorization, then we will treat and as infinitesimal variables that can be separated and moved about the equation.

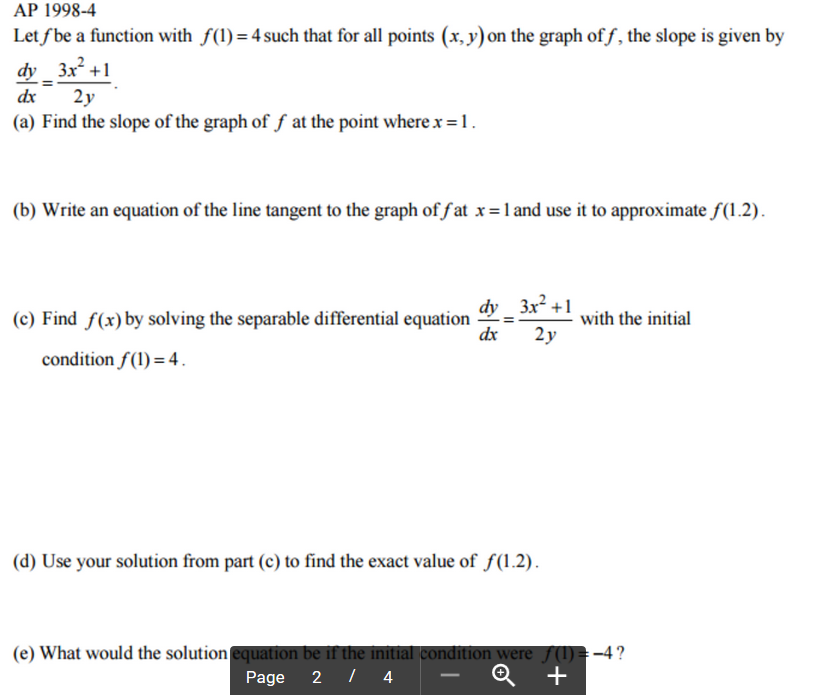
*Example*

Solve the equation by separating the variables, then find the particular solution that satisfies the given initial conditions below.



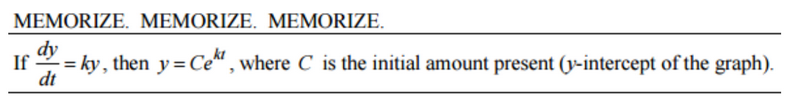
*Example*

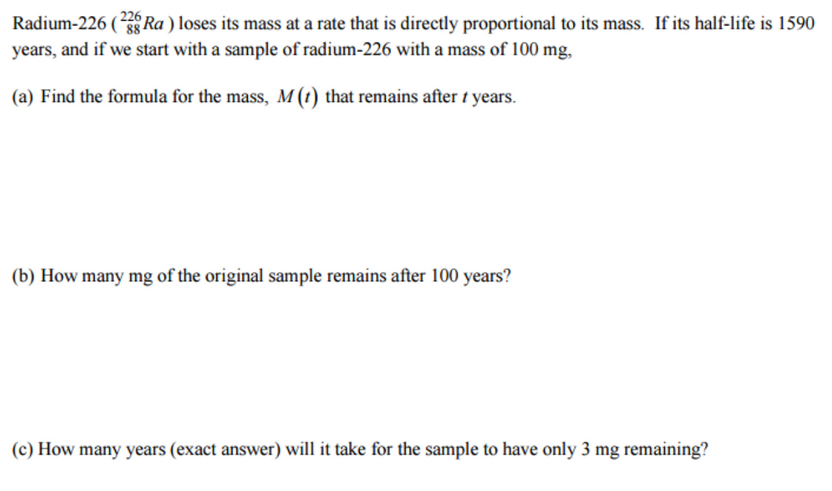
Find the general and particular solution to the seperable differential equation given the initial conditions given

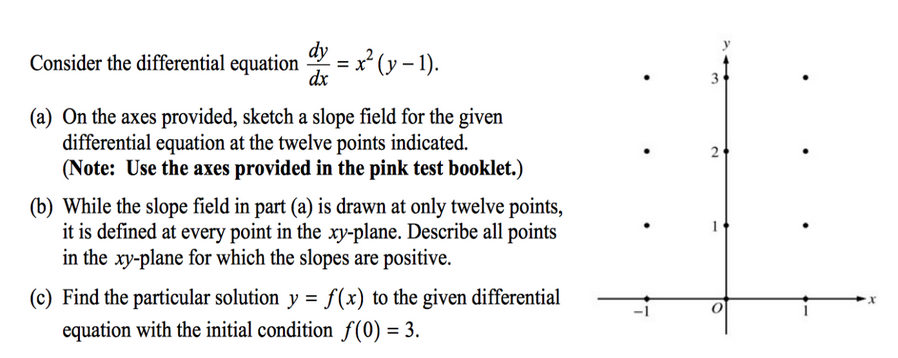




**AP Example**



**AP Example**

**AP Example**