Name: Date:

4C.2: Integrals and Differential Equations

An Ordinary Differential Equation (ODEs) is an equation involving a function and its derivatives. Now that we have the ability to find antiderivatives, we can solve ODEs using this inverse operation.

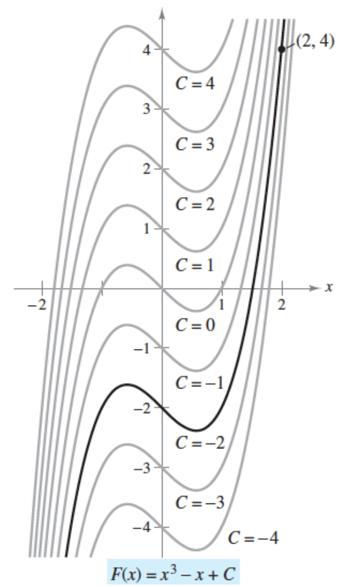
Ordinary Differential Equation: $\frac{dy}{dx} = f(x, y)$

General Solution of an ODE

As we have seen, when we integrate a function, we get a coefficient of integration because the original function could have had any constant added to it. We will run into the same thing here, and we will call the result the **general solution** because it will contain a unknown constant.

Example Find the general solution to this differential equation.

$$\frac{dy}{dx} = 3x^2 - 1$$



There are infinite solutions, and we can represent these using the curves in the graph to the right.

Particular Solution

To get one specific – or *particular solution* to an ODE, we must know the **initial conditions**.

Example

1. Find the particular solution of the differential equation $\frac{dy}{dx} = 3x^2 - 1$, with initial conditions $f(2) = 4$

2. Solve the differential equation $f''(x) = 6x$, with initial conditions $f'(1) = 4, f(2) = 5$