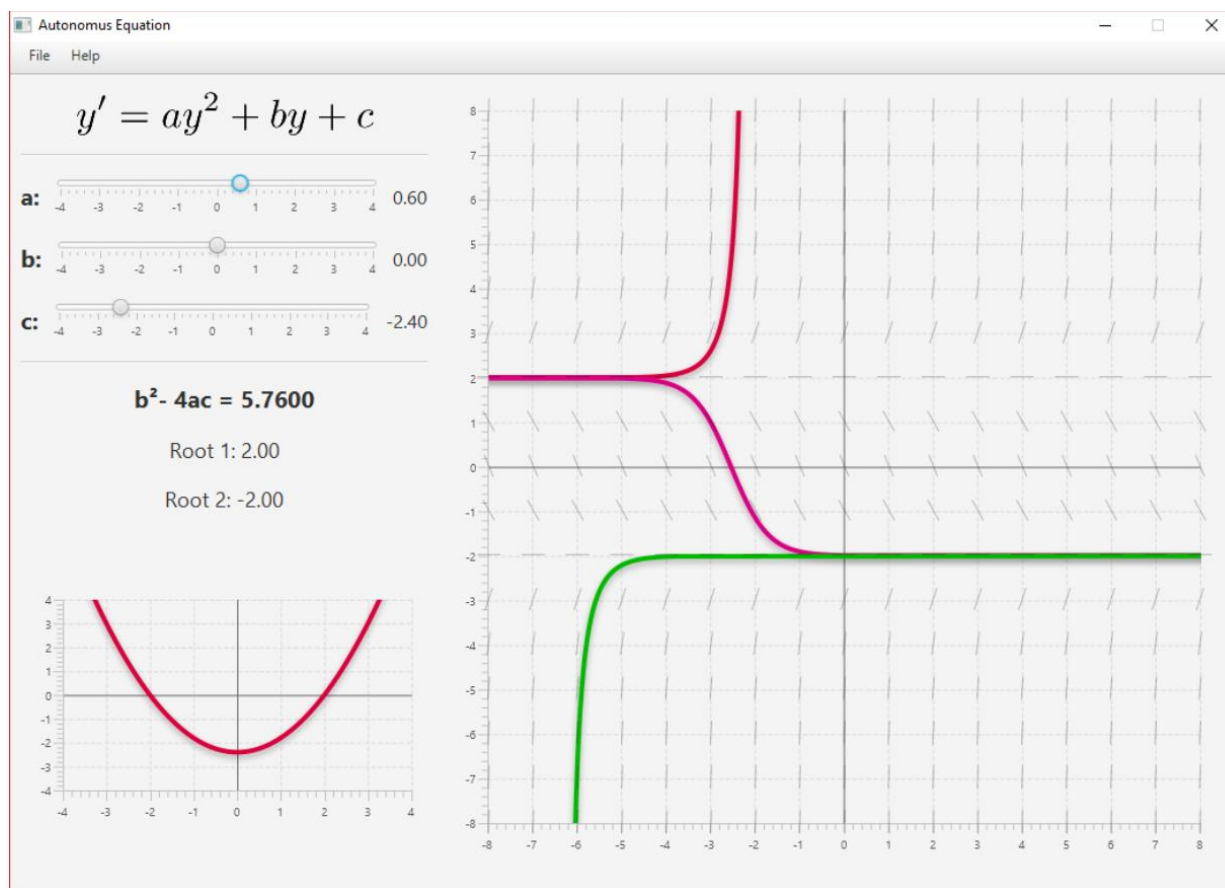


Autonomous Equation User Guide



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I. How To Install JRE

For running this application on your desktop computer, you must install JRE (Java Runtime Environment) on your computer.

1. Follow the following steps to install JRE:
2. [download](#) the JRE installer.
3. choose appropriate installer for your operating system.
Then install JRE.

II. About Application

We will use [Displaying Private Solutions](#) for autonomous differential equations.

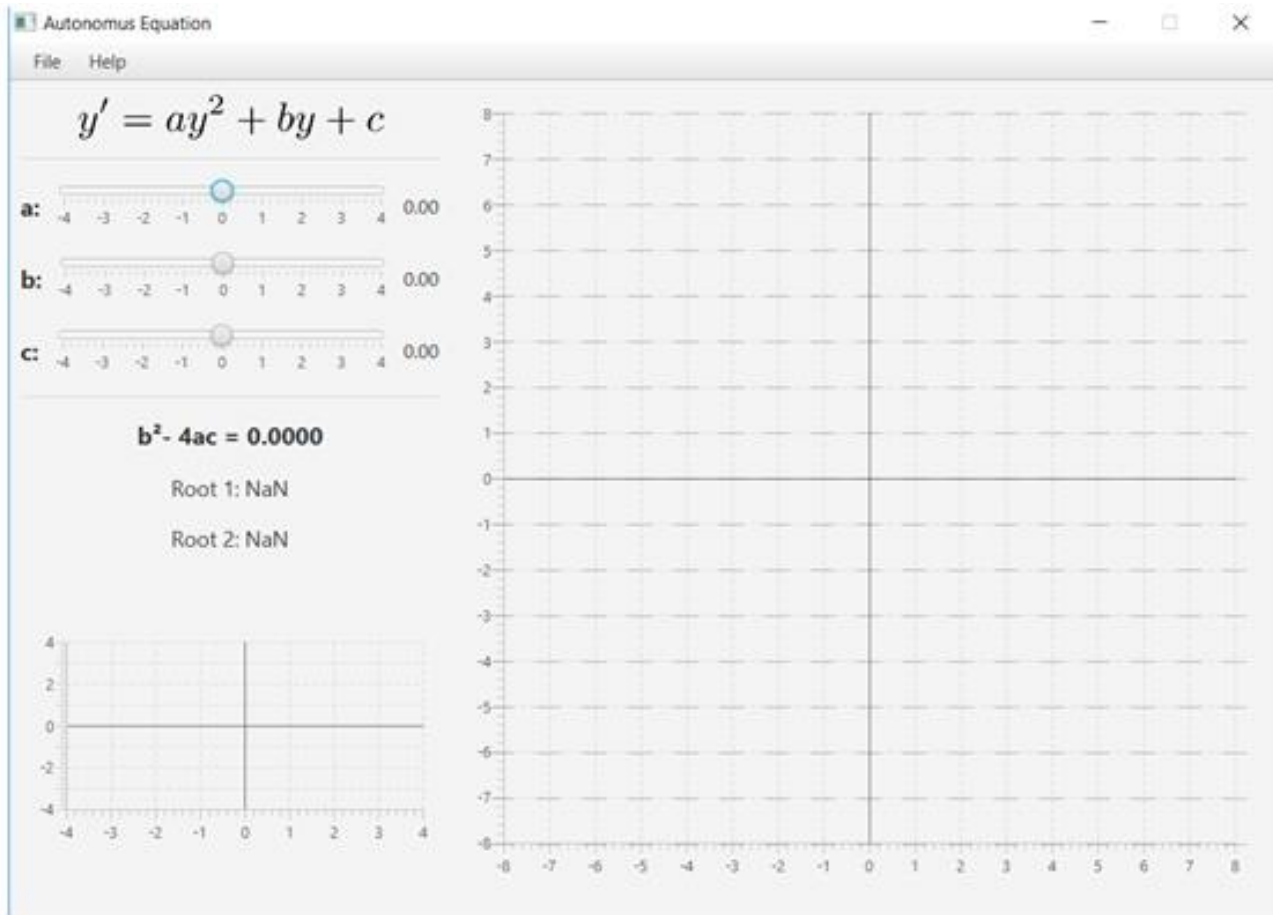
In mathematics, an autonomous system or autonomous differential equation is a system of ordinary differential equations which does not explicitly depend on the independent variable. When the variable is time, they are also called time-invariant systems.

Many laws in physics, where the independent variable is usually assumed to be time, are expressed as autonomous systems because it is assumed the laws of nature which hold now are identical to those for any point in the past or future. Autonomous systems are closely related to dynamical systems. Any autonomous system can be transformed into a dynamical system and, using very weak assumptions, a dynamical system can be transformed into an autonomous system.

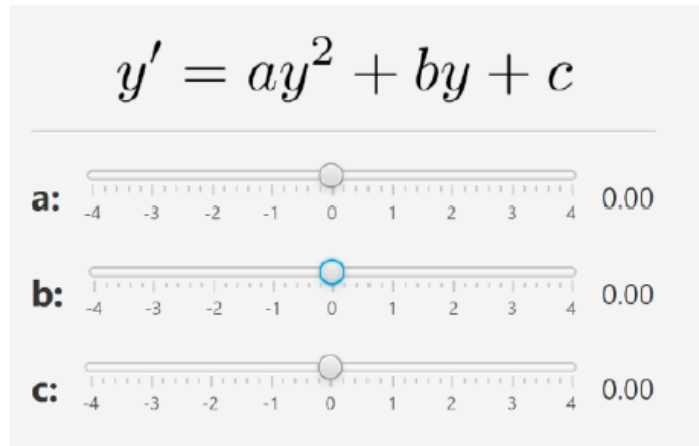
III. How To Use The Application

This program takes equations in form of $y' = ay^2 + by + c$ from user and displays the private solutions on diagrams.

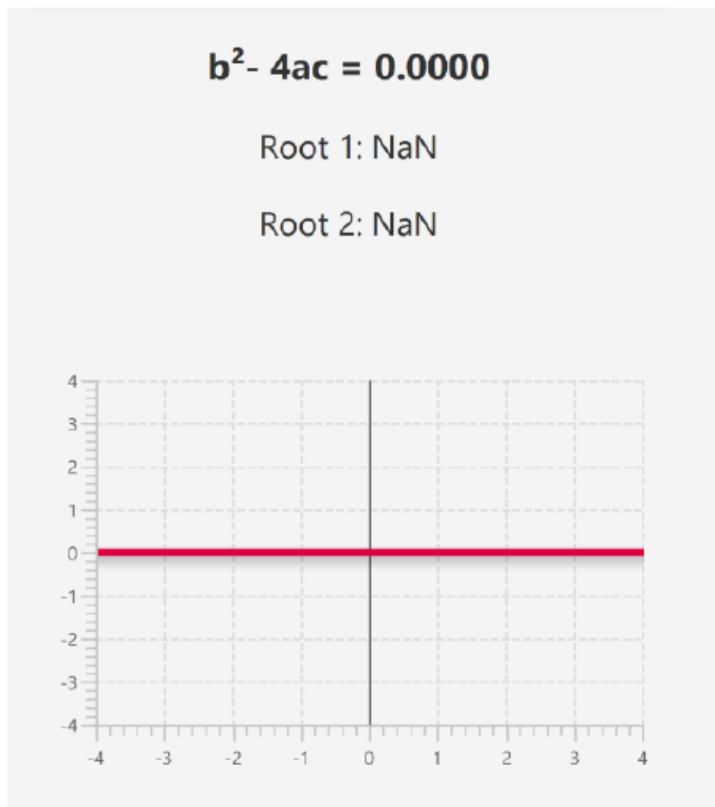
When you run the application, the following figure will be showed to you on the screen.



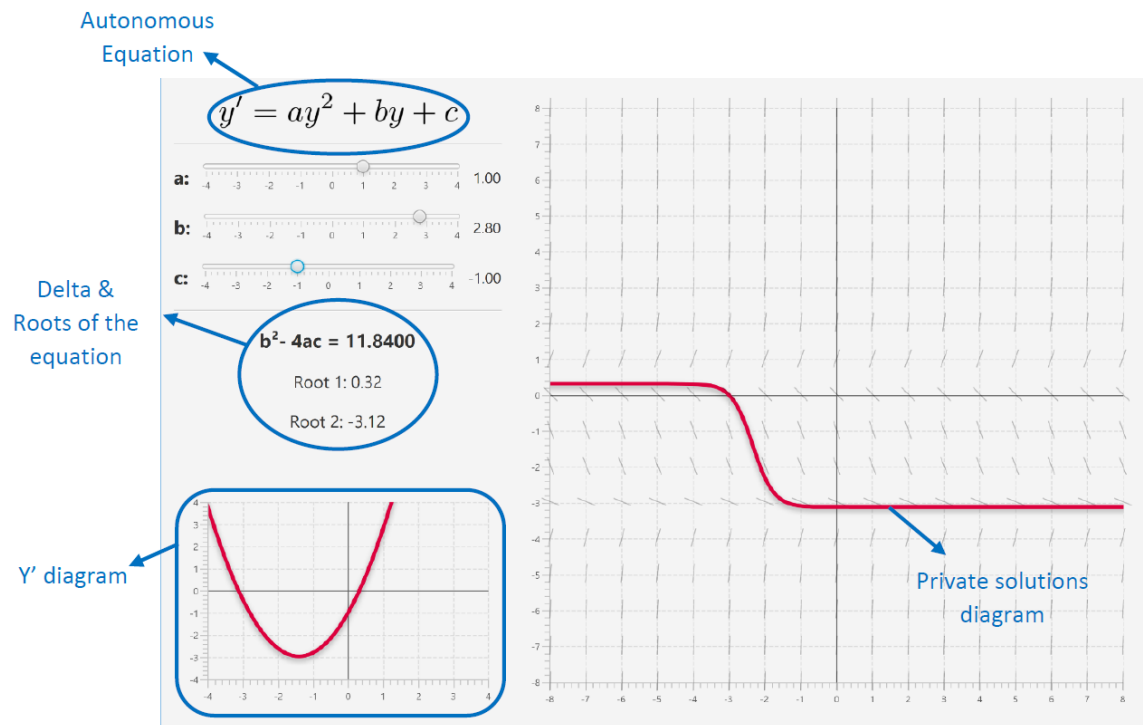
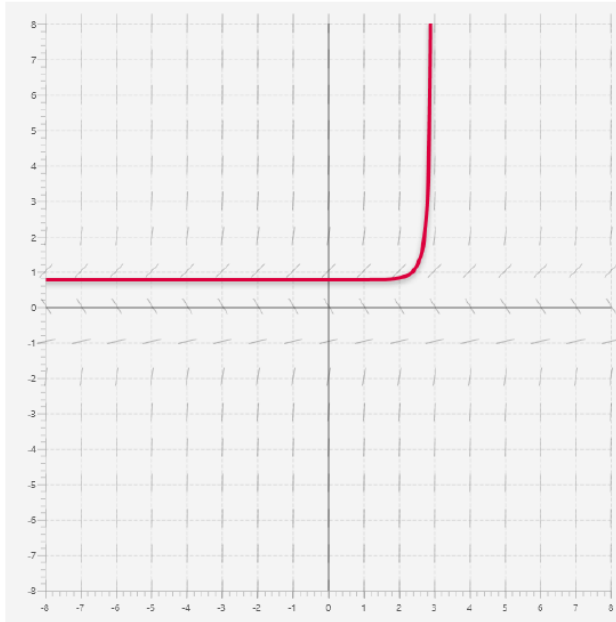
The values of a, b & c are determined by the user. Then by clicking on the right diagram, a private solution is displayed.



Δ & roots of the equation are shown below inputs.



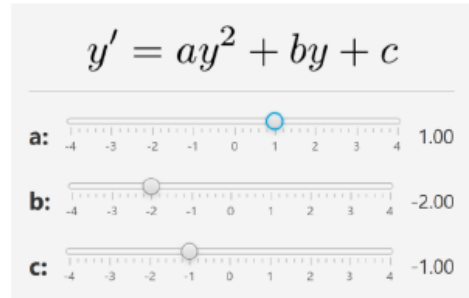
After specifying a point in diagram, a private solution is drawn. Field vectors are also shown on the diagram.



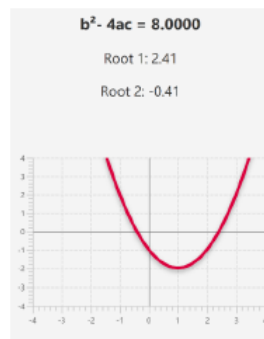
Example

Solve equation $y' = y^2 - 2y - 1$.

We first set a , b & c accordingly.



Note that values of Δ & roots are calculated and their diagram is drawn.



Then by specifying a point in diagram (e.g. 1.5, 0.5) a private solution is drawn.



TIP: To increase precision use coordinates shown on left panel below roots.

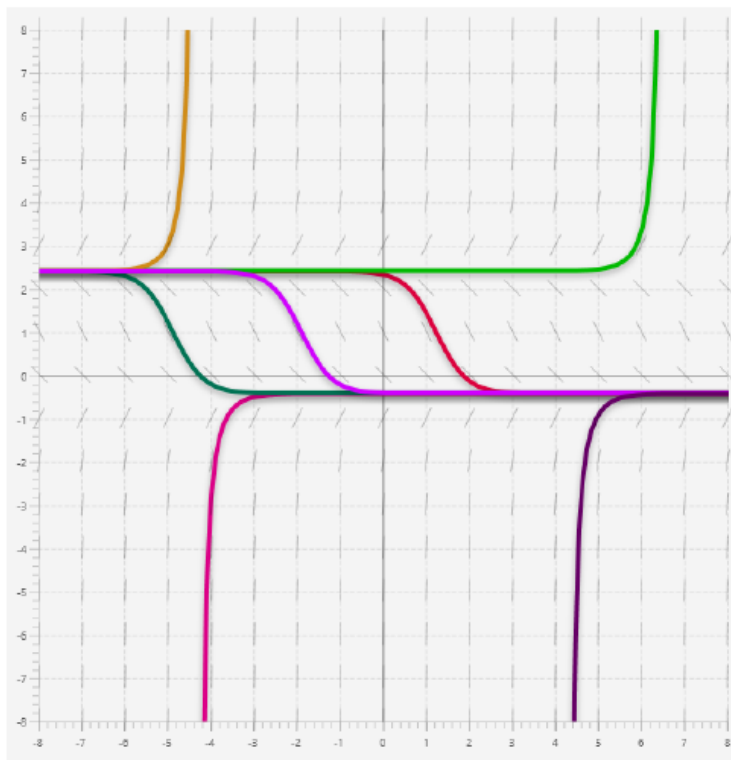
$b^2 - 4ac = 8.0000$

Root 1: 2.41

Root 2: -0.41

→ $(y, t) = (1.50, 0.50), m = -1.73$

Multiple solutions can be shown simultaneously by specifying different points on diagram.



By changing values of a , b or c previous solutions are cleared.

IV. About us

User guide written by [M. M. Kheirmand](#), Ramin Vasseghi & Danial Khoshkholg(updated July 15, 2019)

Application developed by [Mohammad Hossein Rimaz](#) on 17/6/2016

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