Influence of Geogebra on Academic Performance in Differential Equations of Separable Variable For Engineering Students From Antofagasta-Chile

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Abstract. The GeoGebra apps are presented here to give a constructivist learning and an academic motivation, for the engineering students in the differential equations course of the Universidad de Antofagasta, Chile. These apps are relevant, so for they could see the solutions of differential equations with separable variables, giving a different approach than the traditional one with a better understanding. This dynamic geometry software, called GeoGebra, was chosen for the creation of the applets, due to its free access and its dynamism with which Many authors have shown the great advantage of using this program, to carry out mathematics classes regardless of the level student.

Keywords: Differential equation, GeoGebra, Engineering education.

INTRODUCTION

In the present work, the application of GeoGebra will be performed with a constructivist methodology as given in Ref. [1].

According to this [2], it is textually commented that "The basic principle of constructivist theory is that human learning is constructed. The human mind elaborates new knowledge from previous ones. An equally basic assumption is that people learn when they can control their learning and that they are aware of this control".

Also thanks to various investigations carried out in recent years and endorsed in Ref. [2], the computer favors this constructivist learning, and also with the use of this technology, learning is motivated [3].

The main purpose of this work is to show, and to share the GeoGebra applets that were generated in the computer, and so to help the engineering students of the Differential Equations course in finding the solutions of these differential equations of separable variables, together with vector fields in a constructivist manner and with an improvement in their academic performance during the first semester of 2022 at the University of Antofagasta.

This work is a continuation and extension of Ref. [4].

SEPARABLE VARIABLES WITH GEOGEBRA APPLETS.

Next, the Geogebra applets of differential equations of separable variables will be shown along with their solutions and theirs respective vector fields.

These are available at https://www.geogebra.org/m/wfvp5ujv

Example 1:

Let the differentied equations $\frac{dy}{dx} = (x+a)^n$ and its associated vector field with shown with red color in Figure 1. Then the solution of this equation of separable variables is in blue

$$y = \frac{(x+a)^{n+1}}{n+1} + C,$$

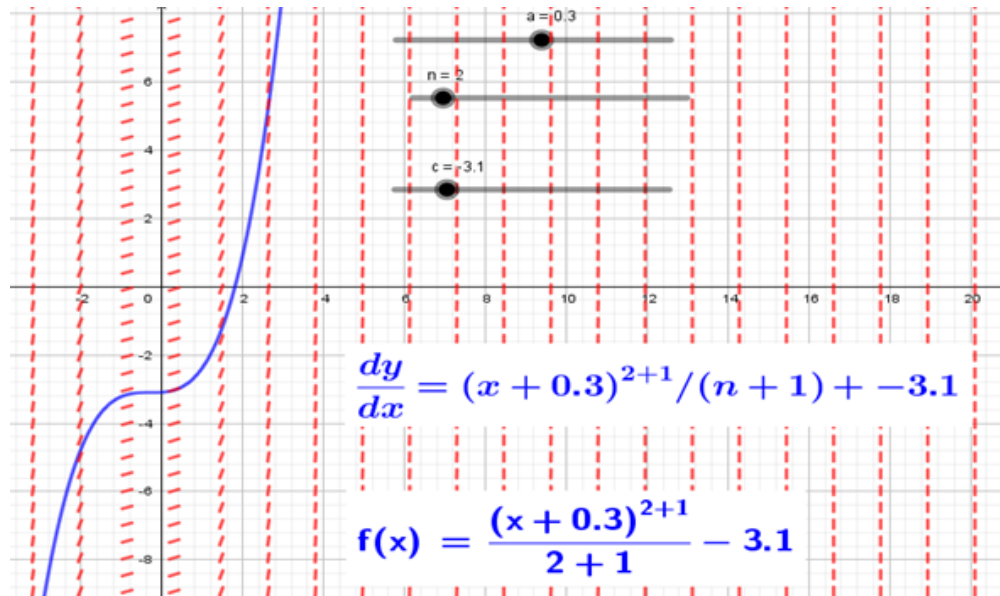where the values a, n and c are moved by means of sliders.

FIGURE 1. Vector field in red and trajectory in blue

Example 2:

Let the differential equation $\dfrac{dy}{dx} = \dfrac{-x}{y+n}$ and its associated vector field shown with red color in Figure 2.

Then the solution of this equation of separable variables is in blue

$$c = \frac{x^2}{2} + \frac{1}{2}[(y+n)^2 - n^2],$$

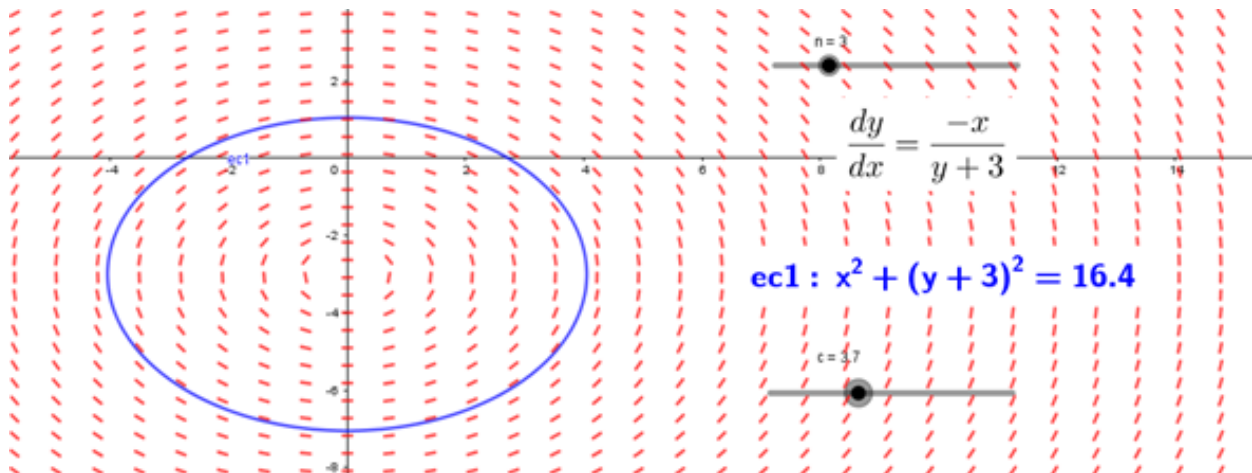where the values n and c are moved by means of sliders.

FIGURE 2. Vector field in red and trajectory in blue

Example 3:

Let the diffeerential equation $\dfrac{dy}{dx} = xy^n$ and its associated vector field shown with red color in Figure 3.

Then the solution of this equation of separable variables is in blue

$$y^{1-n} = (1-n)\left[\frac{x^2}{2} + c\right],$$

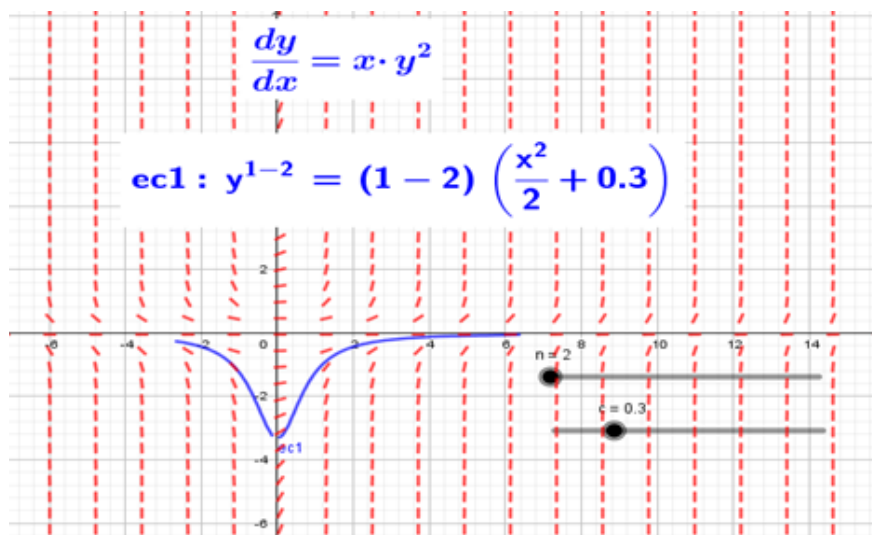where the values n and c are moved by means of sliders.

FIGURE 3. Vector field in red and trajectory in blue

Example 4:

Let the diffeerential equation $\dfrac{dy}{dx} = yx^n$ and its associated vector field shown with red color in Figure 4.

Then the solution of this equation of separable variables is in blue

$$\ln y = \frac{x^{n+1}}{n+1} + c,$$

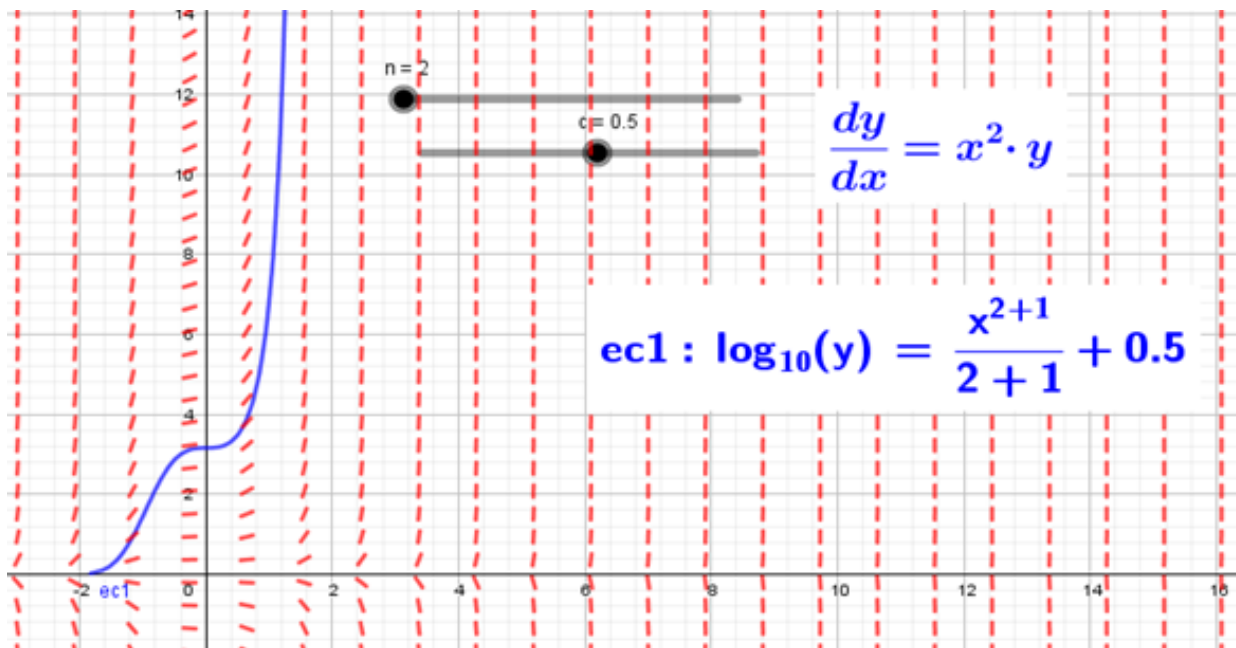where the values n and c they move by means of sliders.

FIGURE 4. Vector field in red and trajectory in blue

Example 5:

Let the diffeerential equation $\frac{dy}{dx} = \frac{\cos(ax)}{\sin(ay)}$ and its associated vector field shown with red color in Figure 5.
Then the solution of this equation of separable variables is in blue

$$\sin(ax) + \cos(ay) = c,$$

where the values a and c they move by means of sliders.
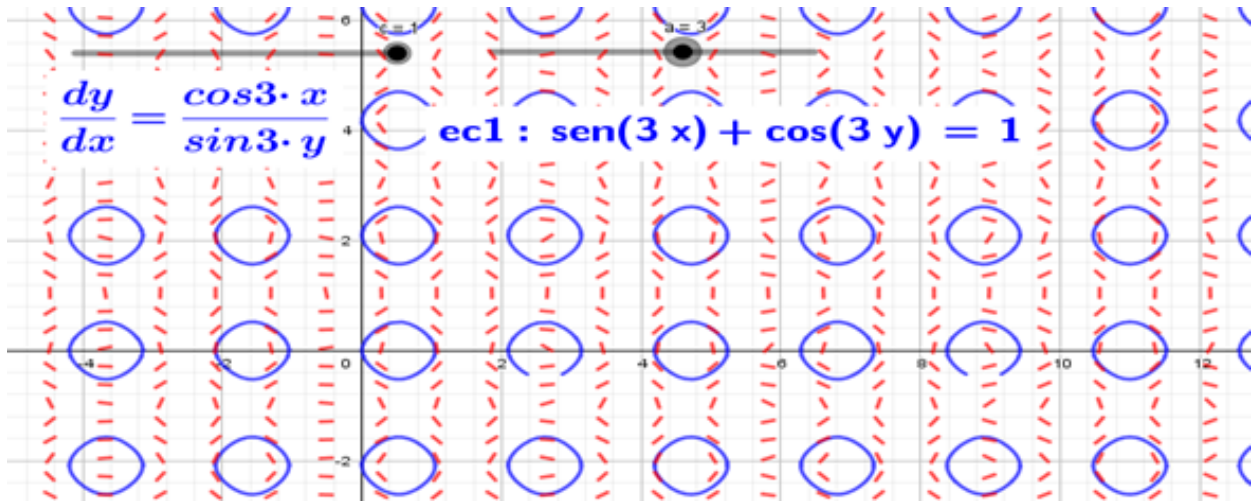

FIGURE 5. Vector field in red and trajectory in blue

CONCLUSIONS

By delivering this study material to the engineering students of the differential equations course at the Universidad de Antofagasta, they were found quite motivating for the construction of their learning, since they could see directly and simultaneously the animated solutions along with their vector field.

There are clearly other software that allow us to do this, but the advantage of Geogebra is that it is free and easy to access via smartphone, tablet or notebook.

Clearly the challenge we face as teachers, is that this same idea of educational and interactive materials. With Geogebra, be transmitted to other areas of mathematics from various universities, along with other disciplines, so that learning is a much more enjoyable and pleasant way for students in these difficult times of pandemic.

ACKNOWLEDGMENTS

REFERENCES

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