TI-Nspire as a technological support in learning conics: the case of ellipse

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Introduction

We will talk about how students react when they involve in Mathematical Modelling (MM) tasks, and about their performance with the aid of CAS calculators.

This will be illustrated with one example from an Analytical Geometry student-based course at the South Campus of the Colegio de Ciencias y Humanidades (CCH)-UNAM.

We focus on a MM activity concerning the concept of ellipse as a locus.

Student Centered Approach

Learning Mathematics, Doing Mathematics **teaching model served as theoretical background as well as a methodological support.**

It is based on the theoretical assumptions of Vigotsky, Dewey and Brousseau (among others).

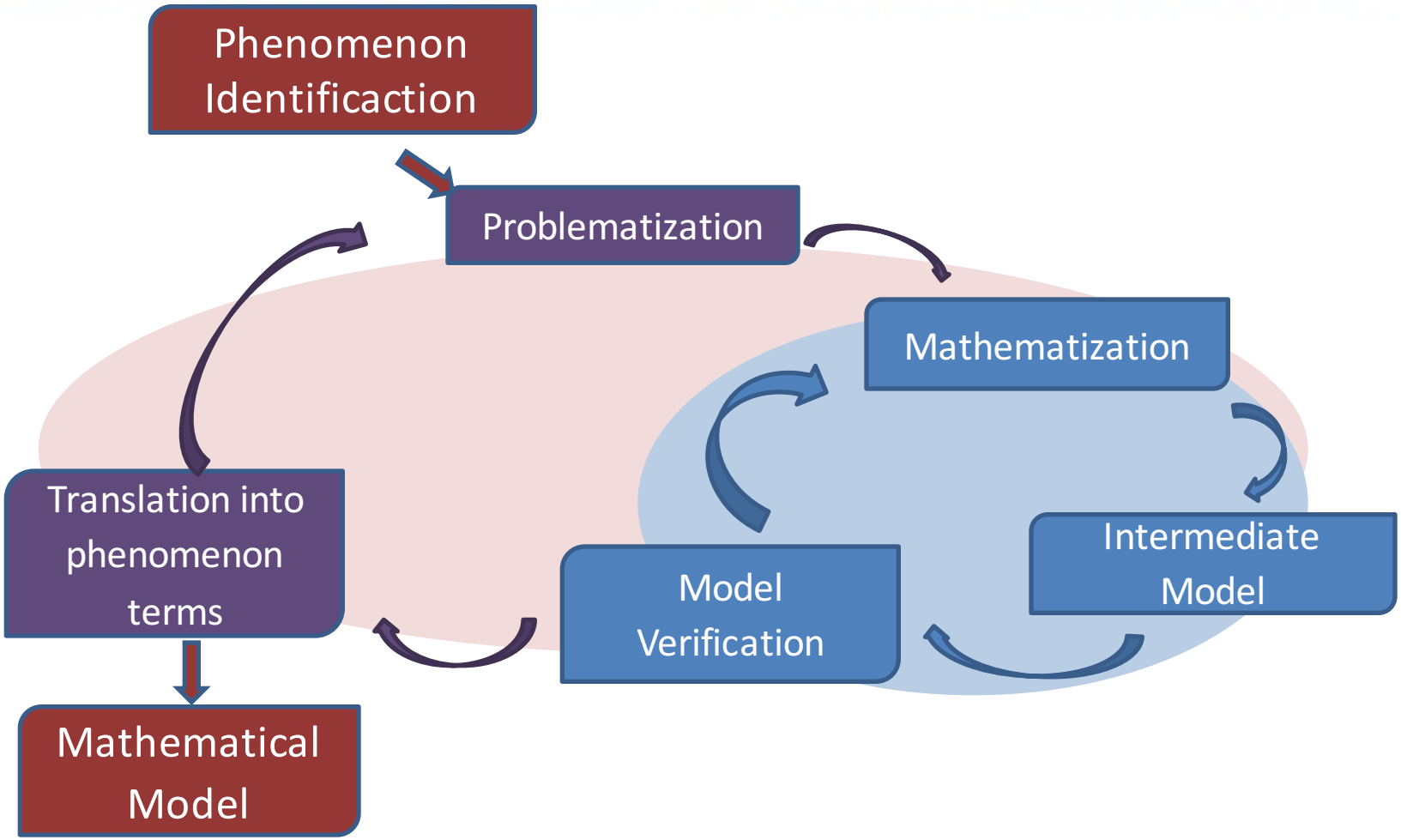
Student Centered Approach

Students' learning is achieved through exploring, and problem solving activities.

Learning activities are developed in a teaching-learning environment immersed in a formative assessment context.

These activities are taken as teaching experiments and formative assessment tools are used as research tools.

Modelling in a Student Centered Math Course



Modelling in a Student Centered Math Course

Modelling math activities could be addressed from two standpoints: think and act perspective, and fitting curve perspective

Context and Development

We did the study with three third semester classes at CCH (ages between 16-17).

One of the classes did not use CAS calculators.

Students solved the problems working in 2-3 members teams; the information of the solving process was gathered on work sheets.

Context and Development

Assessment, and thus research, information was taken from three Mathematical Modelling problems :
The Table: where students should use ellipse's definition in order to solve the problem.
The Bridge: in which there is the need to find an ellipse equation and do some calculations.
Whispers: where students explore some characteristics of ellipses concerning the two foci and sound waves.

The table I

If you want to make an ellipsoidal table and you wanted to cut it from a rectangular wooden sheet, 1.5m x 3m, as to have the maximum area possible on the table.

How can we draw the ellipse on the wooden sheet using a string?

Where should we locate the foci and what length should our string have?

Explain your answers.

Give an equation for such an ellipse.

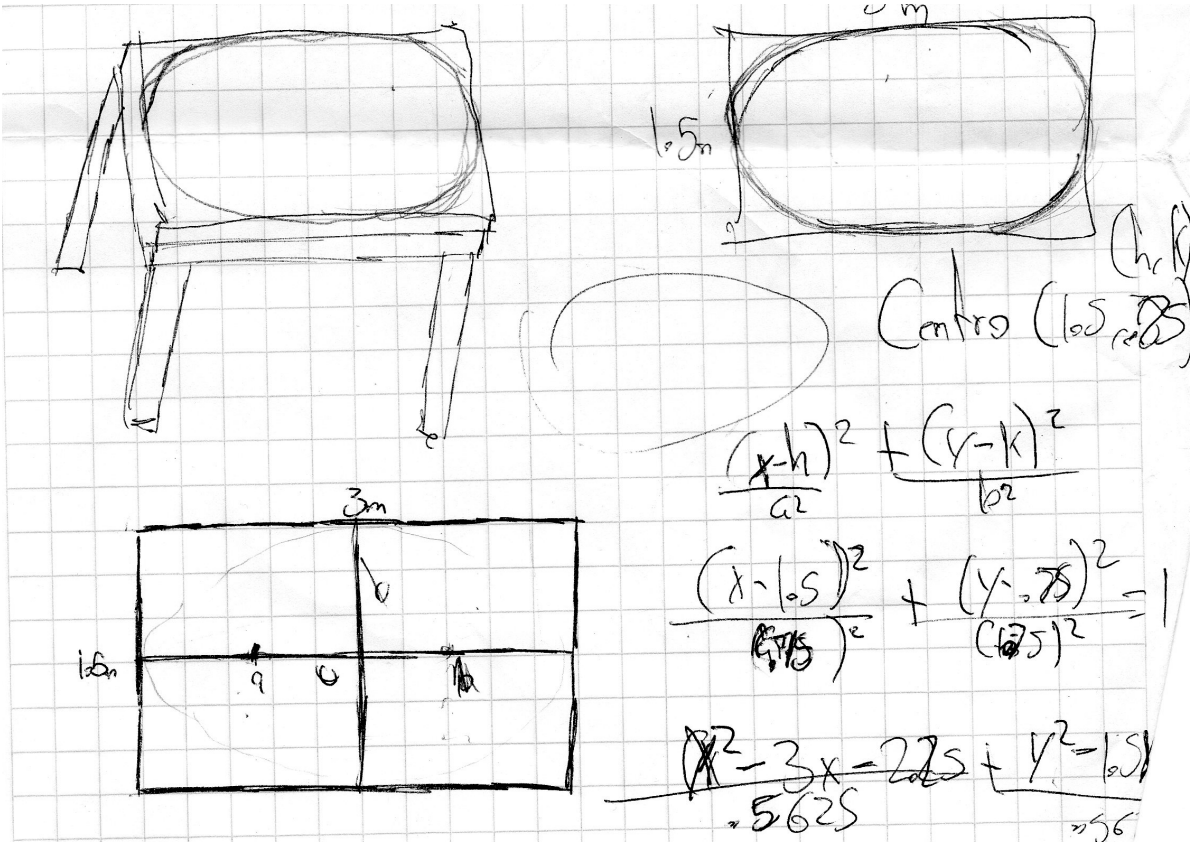
The table II

If you want to cut an ellipsoidal table out of a rectangular wooden sheet (1.5 m x 3 m) in such a way that you have the maximum table area, how can you draw the ellipse on the sheet using a string? What's the length of the string?

What's the equation of your ellipse?

Explain your answers.

Development 1



Development 2

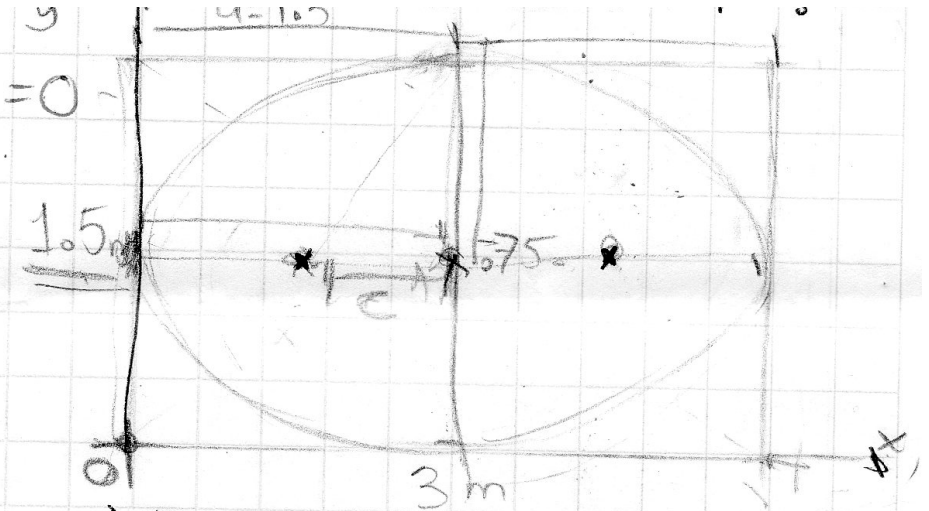
$ax^2 + by^2 + cx + dy + e = 0$

$\frac{(x-h)^2}{a^2} + \frac{(y-K)^2}{b^2} = 1$

(h, K) centro

a = semieje mayor

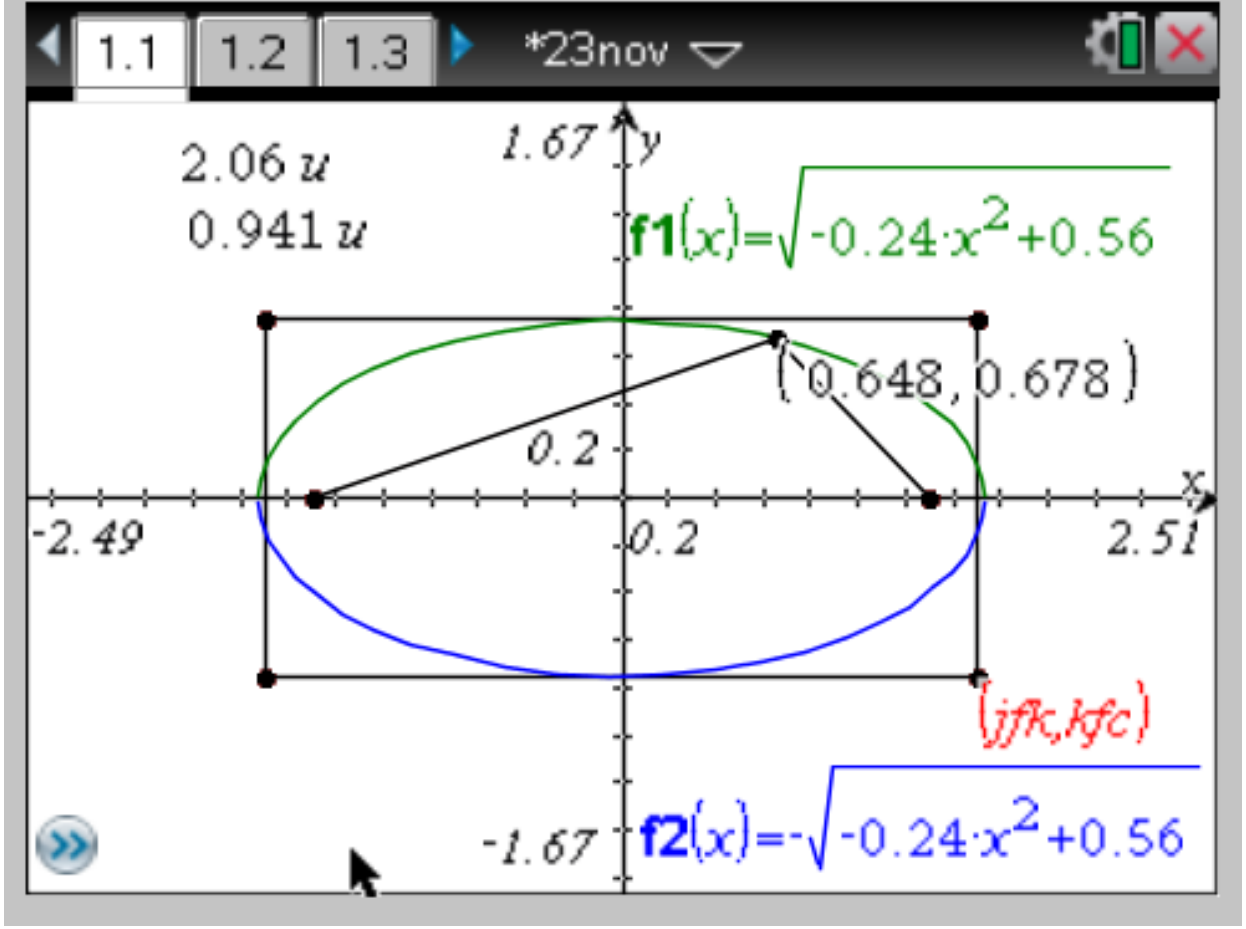
b = semieje menor



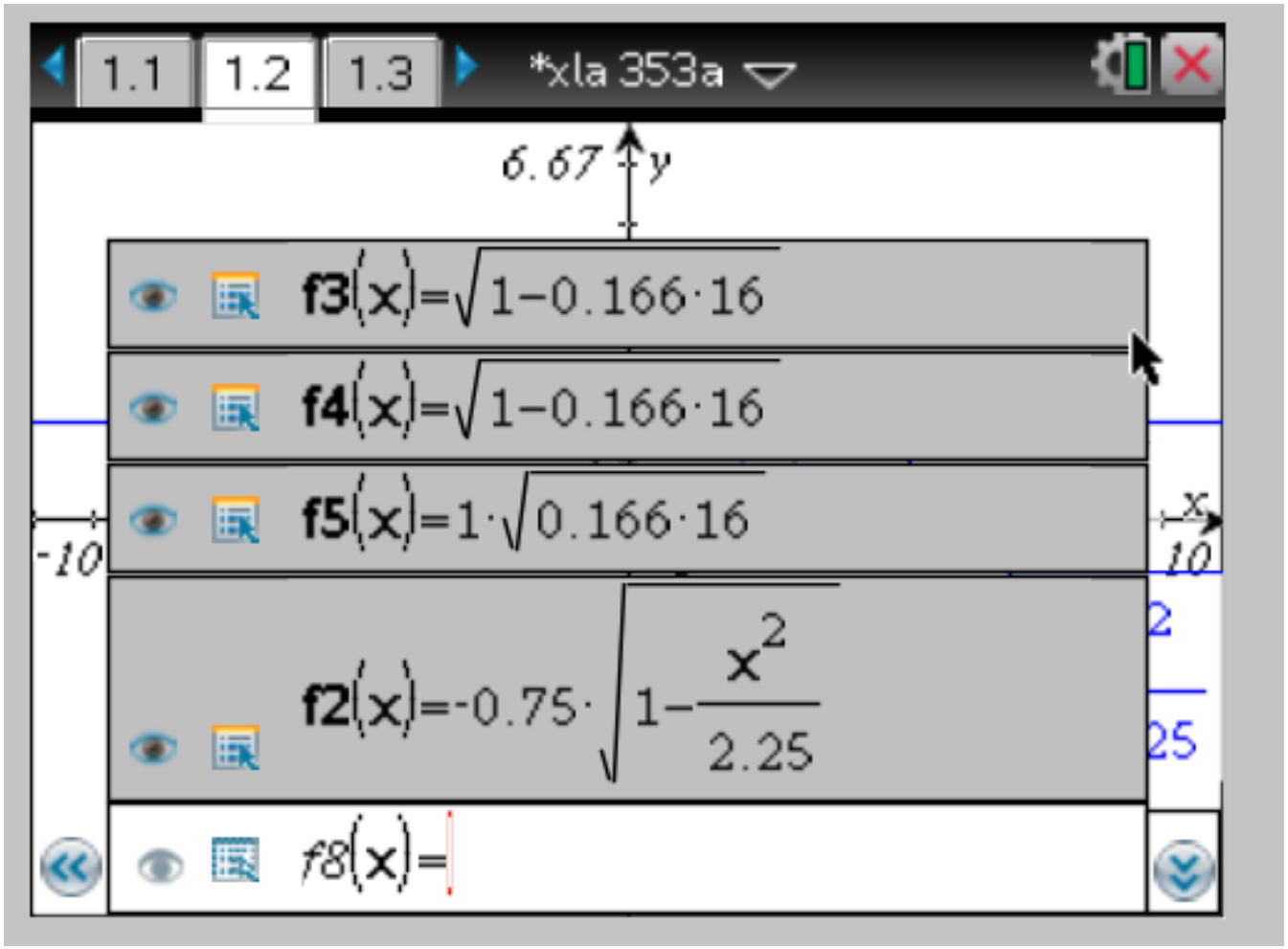
1.-) Amarras tu cadel a tus focos y le das la medida a tu elipse.
(1.5, .75)

2.-) Teniendo la distancia final, puedo usarla para colocar mis focos.

Development 3



Development 4



Results

Concerning the performance of our students we can highlight three aspects:

a) **The conceptions that teachers have on their ability to understand and solve this kind of problems; this lead us to deliver two versions of the same problem.**
b) **The performance was better when using a CAS calculator. We think that this is so because calculators allow a faster and more accurate verification of problem results.**
c) **Students have to do more algebra and practice their algebra skills.**

Results

Concerning the reactions on the use of CAS calculators our students were more motivated than when they use only paper, pencil and a scientific calculator (not CAS).

Some students manifested their enthusiasm by calling them "the little magical machines".

Students felt motivated developing math modelling activities.

Some conclusions

The use of CAS technology is a better way to explore mathematical modelling problems, because it fosters a more elaborated manipulation of algebraic expressions.

CAS technology allows students to quickly verify the correctness of their solutions and a better understanding of the problem at hand.

CAS technology in mathematical modeling activities motivates students on the learning of mathematics.

That’s all folks

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