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Notes on Teaching-Learning at Eleventh Scolar Lever

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Summary: *The study of the numerical function of a real variable already begins as early as the 4th grade (i.e. 13 or 14 old). In this paper, we will study the numerical functions of a real variable in first class. Many types of functions are already studied in 1st class, what interests us here is the function of the type* $f(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$. *On the teacher side, " how to have a function* f*, derived from the function* f'*, such that the numerator of* f' *has an obvious root discriminant? This article will attempt to answer them.*

Keywords : Study of a function, obvious root.

I. INTRODUCTION

Weprovideeducation, whileweteachmathematics, weaimwithout stop drawing attentionfromstudents to focus on the study. We are all trying to persuade children to beinterested in mathematics(G. POLYA, 1965), (Kevin Houston, 2009), (O. Zaslavsky, 2008), (ÉduSCOL, 2009). Even if theyfindthatmathematicsis the mostdifficult discipline, wewill have to convincethem how muchthey areuseful in life.Wewill have to reassurethem by demonstrating the ease and necessity of this(Kolette E., Albert, I. Calin 1993), (S. Maury, 1994), (Jules Payot, 1913), (Cabassut Richard, 2005), (Gérard Dumont, 2004). Everyoneisawarethatmathematicsis a subject to betaughtobligatorilyfrom the first class fromprimary to final, whatever the series or technicalspecialty. It is an unavoidable basic subject in the formation of a future citizen and in education. Afterwards, we are interested in thispaper, more precisely to the basic numericalfunctions of a real variable of the levelfrom the class of first. Amongchapters of mathematics, the study of numericalfunction of a real variable isalreadystartedfrom the 4th grade, according to the schoolcurriculum in force. This studyhas alsobecomeafundamentaltool of the mathematical discipline modern and development of human intelligence (Gilles ALDON, 2011), (UNESCO, 2011), M. (Wambst Y. Genzmer, 2008), (André Totohasina, 2011). The learning of the functionsis one of the chapterswhich pose difficulties of comprehension, to know for example, determining the set of definition, findingmeaning of variation and graphicrepresentation, for first-yearstudents. Wewereinterested in the study of numericalfunction of a real variable in class of 1st. Many types of functions are alreadystudied in 1st class, whatinterests us hereis the function of the type $(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$, where$a \neq 0$, $\alpha \neq 0$ and$x \neq -\frac{\alpha}{\beta}$. It is a kind of inverse problemthat a teacheroften poses to makeexercisesconcerning the provisions of the functions fractions rational f0derivedfrom the function$f$ such that the numerator of f' has a root discriminant obvious ? "

In the following, westudy the function f under the conditions $a \neq 0$, $\alpha \neq 0$ and $x \neq \frac{\alpha}{\beta}$. In whatfollows, ourworkisdividedintothree sections. Section IIdiscusses the problemstudyclassic (on the side of the students). Section IIIconcerns the construction of a fractionalfunctionrational whosenumerator of itsderivative has obviousrootdiscriminator. The section IV, makesa conclusion.

II- STUDY OF A FUNCTION OF THE TYPE $f(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$

In this section, wewillsee "what are weused to do for the study of a function of this type in first class ? ".

❖ Classical problem (on the side of students)

Let $f$be a numericalfunction of a real variable defined by: $(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$.We notice by($\mathscr{C}$) the graphicalrepresentation of $f$in aneuclideanplan $\mathcal{P}$providedwith an orthonormalgraft$(O, \vec{\imath}, \vec{\jmath})$ of unityequal to 1cm.

1. Determine the set of definition of the function$f$.
2. Calculate the limits of $f$at the limits of itsdefinition set and interpret all resultsobtained.
3. a- Show that the function$f$canbewritten in the form: $f(x) = Ax + B + \frac{D}{\alpha x+\beta}$ where$A, B, C$are constants to bedetermined.

   b- Deducethat the line of equation$y = Ax + B$is an oblique asymptote of ($\mathscr{C}$).

4. a- Determine the function f' derivedfrom the function f and studyitssigns as a wholedefinition.
   b- Show that the function f isderivablefrom a derivednumber to bedetermined at the abscissa x_0 and deduce the equation of the tangent at this point, for all x_0 as a wholedefinition.
   c- Deducefrom the question 4.a - the variations of the function f and draw up its table ofvariation.
5. Draw all the asymptotes to ($\mathscr{C}$), the equation of the tangent and the shape of($\mathscr{C}$) in the same mark.

III- ON THE TEACHER SIDE

This time, we propose to construct a function f of the type $f(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$ whosederivative f' issuchthat $f'(x) = \frac{\alpha a x^2+2a\beta x+b\beta-\alpha c}{(\alpha x+\beta)^2}$, sothat the root of the discriminant$(\Delta)$of the quantity $\alpha a x^2 + 2a\beta x + b\beta - \alpha c$ isobvious.
It isthus a question of looking for the real ones αa, $2a\beta, b\beta - \alpha c$ sothat the real $\Delta = (2a\beta)^2 - 4\alpha a(b\beta - \alpha c)$ aperfect square.
Hence the theoremthatfollows.

Théorème. *For all real λ and γ fixed suchas $\lambda \neq \gamma$, if f is a functiondefined by:*
$f(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$ *has for derived function f' of expression : $f'(x) = \frac{\alpha a x^2+2a\beta x+b\beta-\alpha c}{(\alpha x+\beta)^2}$, with*

$$\begin{cases} a = 1 \\ \alpha = 1 \\ \beta = \frac{\lambda+\gamma}{2} \\ b = \frac{4\lambda\gamma}{\lambda+\gamma} \\ c = \lambda\gamma \end{cases} \qquad (1)$$

then the discriminant $\Delta = (2a\beta)^2 - 4\alpha a(b\beta - \alpha c)$ is a perfect square.

Recall in passing thatunderequality (1) λ and γ are two real checkingequality $\alpha a x^2 + 2a\beta x + b\beta - \alpha c = (x+\lambda)(x+\gamma)$ and weforbidthat $\lambda \neq \gamma$, because the correspondingderivedfunctionwouldbe constant.

Prove

Let f be the functiondefined by : $f(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$ for $a = 1,\ \alpha = 1,\ \beta = \frac{\lambda+\gamma}{2},\ b = \frac{4\lambda\gamma}{\lambda+\gamma}$, and $c = \lambda\gamma$ we have :

$$f(x) = \frac{x^2+\frac{4\lambda\gamma}{\lambda+\gamma}x+\lambda\gamma}{x+\frac{\lambda+\gamma}{2}} = \frac{2}{\lambda+\gamma}\,\frac{(\lambda+\gamma)x^2+4\lambda\gamma x+\lambda\gamma(\lambda+\gamma)}{2x+\lambda+\gamma} \qquad (2)$$

It isveryeasy to check that the function f' has for expression:

$$f'(x) = \frac{x^2+(\lambda+\gamma)x+\lambda\gamma}{\left(x+\frac{\lambda+\gamma}{2}\right)^2} \qquad (3)$$

Moreover, the quantity$(\lambda+\gamma)^2 - 4\lambda\gamma = (\lambda-\gamma)^2$. Hence the stated theorem.

Remark: *Wefindthatif $\lambda = \gamma$, then the expression (3) becomes:*

$$f(x) = x + \lambda \qquad (4)$$

f *andaccording to (4) or (5) we have : $f'(x) = 1(5)$*

Corollary. *For all real λ and γ fixed, with $\lambda \neq \gamma$, there are infinitely many fractional function $f(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$ suchthat $a = 1,\ \alpha = 1,\ \beta = \frac{\lambda+\gamma}{2},\ b = \frac{4\lambda\gamma}{\lambda+\gamma}$, and $c = \lambda\gamma$ which has the function f' of expression $f'(x) = \frac{x^2+(\lambda+\gamma)x+\lambda\gamma}{\left(x+\frac{\lambda+\gamma}{2}\right)^2}$.*

Wenow have a method to construct a rational fraction function of the type $f(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$ suchthat, $a = 1$,
$\alpha = 1$, $\beta = \frac{\lambda+\gamma}{2}$, $b = \frac{4\lambda\gamma}{\lambda+\gamma}$, and $c = \lambda\gamma$.

Example: *Wewant to have a rational fraction function of the type $f(x) = \frac{ax^2+bx+c}{\alpha x+\beta}$ such that its derivative f' has for expression: $f'(x) = \frac{x^2+(2+3)x+2*3}{(?)^2}$.*

Applying the previoustheorem, we have $a = 1, \alpha = 1, \beta = \frac{5}{2}, b = \frac{24}{5}$, *and* $c = \lambda\gamma$ *we have the expression of the function* f *defined by:* $f'(x) = \frac{2x^2+(48/5)x+6}{2x+5}$ *and weeasilyfunction check that the function* f' *derivedfrom* f *has for expression:* $f'(x) = \frac{x^2+5x+6}{\left(x+\frac{5}{2}\right)^2}$.

IV. CONCLUSION

In pedagogy, we must group together a set of scientific and practical knowledge, and a competence relational to design and implement an effective teaching strategy: this work allowed us to better control the construction of his own subject through the study of a digital function in first class. Whenever we are in class, let's have time to show them that a mathematician is a man with a minimum of audacity and always having the courage to face problems all his life. It is also important to train students to solve situations of various problems to be determined, sought, calculate and justify the subjects. We also tried to make some reflections didactics on the numerical functions of a real variable. We believe that this approach elementary functions starting from the general to the particular for each class of functions is more instructive than the opposite. It would facilitate the classification of mental images of reference functions with their respective representative curves. Moreover, this work allowed us mathematics teachers to leave the practice of doing the exercises routine for the study of a numerical function corresponding to the school curriculum.

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