Utilization of Algebrite in KeTLTS

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Abstract

This paper reports on the integration of algebrite, an online computer algebra system (CAS), into KeTLTS [4], a system developed by S. Takato using KeTCindyJS. Through this integration, we constructed a set of instructional materials that allow KeTLTS users to evaluate the validity of their answers before submission.

1 Introduction

KeTLTS[4] is a system developed by S. Takato using KeTCindyJS[3], which allows students to write and submit mathematical expressions using the KeTMath format[5]. Currently, answers submitted through KeTLTS are graded either manually or with the assistance of Maxima; however, Maxima cannot perform computations online, and KeTCindyJS lacks symbolic computation functionality. To address this limitation, we decided to incorporate Algebrite, a computer algebra system (CAS) that operates online, into KeTLTS. In this study, we developed instructional materials that enable students to check the correctness of their answers before submission by utilizing Algebrite.

2 Sample of teaching materials

As an example of the instructional materials, we present a problem that requires students to perform differentiation. In Question 1, since the given expression is "`y=x^(2)-1`", its derivative is "`2x`", which is the correct answer. The expressions shown in both the display and input fields are written using the KeTMath format. Between these fields, the same expressions are rendered in a two-dimensional format processed by TEX, allowing students to visually verify both the problem statement and their own responses. Figure 1 shows the interface after a student has entered their answer and pressed the [Rec] button (located at the lower left corner of the screen), as in previous implementations. In this example, the student has solved only Question 1 before pressing the [Rec] button. The field at the bottom of the screen contains a string that includes the student's ID and their responses (this field serves as the submission string). Furthermore, by pressing the [Jdg] button located above the [Rec] button, the system evaluates the correctness of each answer. The result is displayed in the field to the right of the submission field. As with the submission string, each question number is enclosed in brackets (e.g., "`[1]`") and entries are separated by "`;;`". In

the displayed example, since the answer "2x" for Question 1 is correct, "0" follows "[1]". The correctness is not determined by string matching, but through symbolic comparison using Algebrite. Because Questions 2 and 3 have not yet been answered, a "?" is displayed following their respective question numbers.

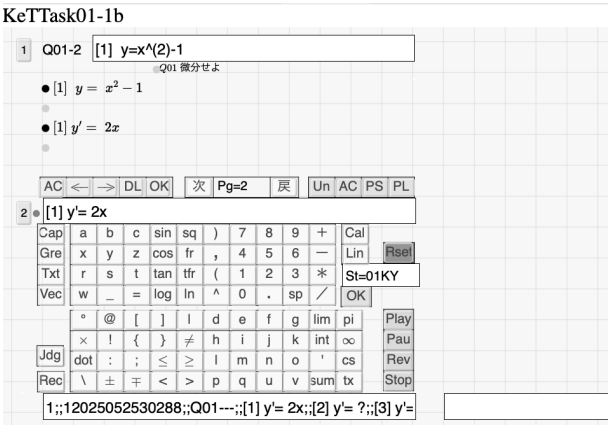

Figure 1: before judge

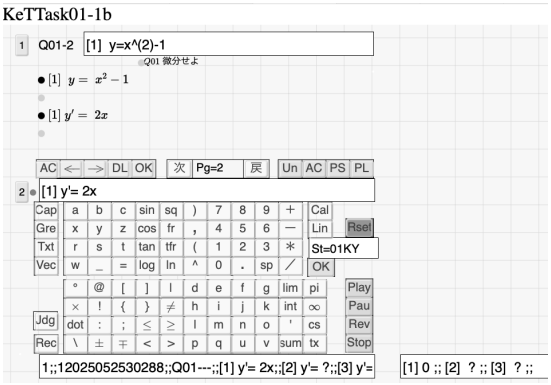

Figure 2: after judge

3 Educational Benefits of Pre-Submission Validation

We plan to investigate the educational benefits of having students evaluate their answers before submitting them.

References

[1] Algebrite official homepage : `http://algebrite.org/`

[2] Cinderella official homepage : `https://cinderella.de/`

[3] CindyJS official homepage : `https://cindyjs.org/`

[4] KeTCindy Home : `https://s-takato.github.io/ketcindyorg/indexj.html`

[5] KeTMath : `https://s-takato.github.io/specialclass/offline/ketmathvE.html`

[6] T. Kitamoto, M. Kaneko, S. Takato : E-learning system with Computer Algebra based on JavaScript programming language. *Proc. of ATCM 2018*, pp.123–133, Yogyakarta, 2018.

[7] T. Kitamoto, M. Kaneko, S. Takato : Standalone web application for teachers to create teaching materials on a browser. *Proc. of The 25th Asian Technology Conference in Mathematics*, pp.258–267, Bangkok, 2020.