Online drills created by extended CindyJS and scoring them with Maxima

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KeTCindy is a system to produce various graphics for LaTeX documents easily and interactively. It uses dynamical geometry software Cinderella as its GUI, and outputs TeX graphical codes such as Tpic, pict2e and Tikz. Actually, KeTCindy is a collection of functions described by Cindy Script, a generic programming language. The first author developed KeTCindy to input fine figures easily in the printed materials to be distributed in Mathematics classes[1]. Actually, not only the first but the second author utilizes KeTCindy to produce various geometric figures appeared in 'wasan', Japanese mathematics which was developed in Japan during the Edo period. Anyone can dowload KeTCindy package freely from CTAN(Congressive TeX Archive Network)

        https://ctan.org/pkg/ketcindy,
or directly from

        https://github.com/ketpic/ketcindy,
which one can search with the keyword 'ketcindy'.

KeTCindy can produce various kind of figures. Moreover it can call Maxima, C and R from the inside, where C is used to speed up hidden line removal which is important to create figures of 3d surfaces for printed materials. In 2014, Prof. Richter Gebert's group in Technische Universität München developed CindyJS,

        https://cindyjs.org
which is a web framework almost compatible with Cinderella. CindyJS produces HTML files with small size, about 20KB or so, but it might be a little insufficient to create various kind of web materials used in mathematics classes. So we developed KeTCindyJS which supports the use of some functions of KeTCindy with those of CindyJS. The steps are as follows.
  1. Export the HTML from Cinderella with pressing the button.
  2. Press button 'KeTJS' in the KeTCindy file
The size of the body HTML file is only 150KB and the size of libraries of KaTeX and CindyJS are 1.5MB, so totally less than 2MB. One can see the various samples in

        https://s-takato.github.io/ketcindysample/.

During the pandemic, students and teachers were forced to web learning and teaching. In mathematics classes, to exchange questions and answers with formulae became a big prob-

lem. It would be rather easy for teachers to distribute questions, but it is much more difficult for students to send their answers and for teachers to collect/score them. The hard part for students is to write and send mathematical formulae with two-dimentional structure. So first, we set rules for one-dimensional expression.as follows:

$\quad$ `fr(a,b)` for $\dfrac{a}{b}$, `sq(a)` for $\sqrt{a}$, `sin(2,x)` for $\sin^2 x$, `log(10,x)` for $\log_{10} x$, ...

Next, we developed an HTML application `KeTMath` using KeTCindyJS. It shows two-dimentional expressions when students input one-dimentional ones.

$\quad$ Remark: KeTMath is available with student's smartphone.
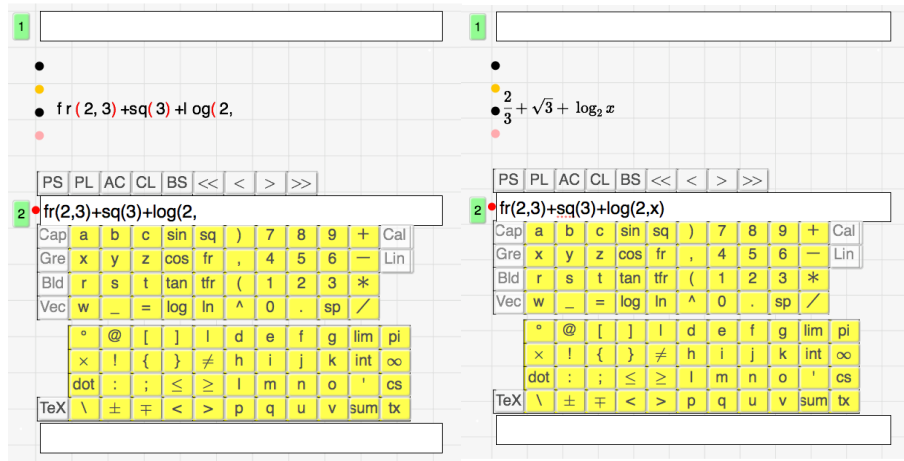
Moreover, we have developed KeTMath Learning Management System(KeTLMS). With this and with also a regular platform such as Google Classroom, Teams, Moodle and so on, teachers can send text-based questions, collect text-based answers and score them with Maxima.
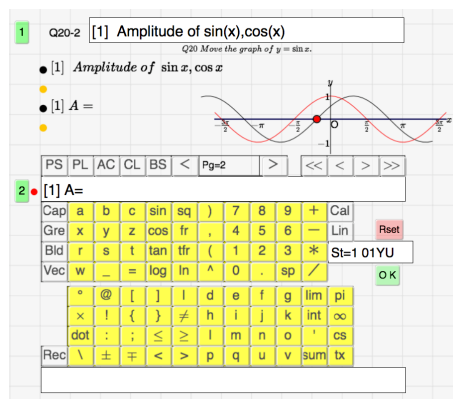
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References
[1] S. TAKATO; A. MCANDREW; J.A. VALLEJO; M. KANEKO,Collaborative use of KeTCindy and free Computer Algebra Systems. *Mathematics in Computer Science* **11**, 503–514 (2017).