STACK + JSXGraph

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1. What is STACK? (Pekka Alestalo)
2. Introduction to bind_point commands (video by Miko Karjalainen)

What is STACK?

- STACK = the System for Teaching and Assessment using a Computer algebra Kernel
  - https://www.ed.ac.uk/maths/stack
  - STACK Documentation
- Created by Chris Sangwin in 2004 (formerly University of Birmingham, now University of Edinburgh)
- Main developers: Sangwin, Matti Harjula (Aalto University, Finland), Tim Hunt (Open University, UK)
  - https://www.maths.ed.ac.uk/~csangwin/stack/2018-STACK.pdf

STACK at Aalto University

- We started using STACK at Aalto University in 2009, initiated by Antti Rasila.
- Today used in practically all basic math courses, but also in Physics and Economy courses.
- Fall term 2020: circa 200 000 STACK problems solved by Aalto students.
- Jan-Feb 2021: Calculus MOOC course with materials and exercises using STACK and JSXGraph
  within the ITEMS project lead by Alfred Wassermann:
  - https://itemspro.eu/

Properties of STACK

- Producing Math and Science exercises with
  - algebraic input (numbers, formulas, expressions)
  - (mostly) familiar syntax for typing expressions
  - syntax validation before answer is submitted
  - SI units possible in answers
  - randomized parameters so that every (?) student has a different but equivalent problem
  - automatic checking and immediate feedback
  - model solution adapted to the parameters of each student
  - automatic recording of points and statistics
  - students' input saved for the teacher
  - exercises and sets of exercises that adapt to the students' progress (stateful problems)

Why STACK?

- STACK is free!
- Automatic checking with MAXIMA can handle equivalent expressions.
- Randomized problems give more pedagogical freedom; e.g. it is possible to give more weight to the exercises in grading the course.
- Randomized problems move students' discussion from the correct answer to the solution method.
- Large groups of students can be handled as easily as small.
- Students can do the exercises wherever they have internet access.
- Abacus network for sharing STACK problems (and other materials)
  - https://abacus.aalto.fi/