Short lecture

Students' Comparison of Their Trigonometric Answers with the Answers of a Computer Algebra System in Terms of Equivalence and Correctness

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Abstract

The answer offered by computer algebra systems (CAS) can sometimes differ from those expected by the students or teachers. Such answers could serve as a catalyst for rich mathematical discussion (see (Pierce and Stacey, 2010)). An important topic is the equivalence/non-equivalence of the students' answers with the CAS answers. It is also relevant in case of equations and could be particularly helpful when working with trigonometric equations, which can often have quite sophisticated answers. Are students able to ascertain equivalence/non-equivalence? How do they understand correctness of the answers? Are there any differences in this regard between different types of equations and answers?

The paper is based on the lessons of a course in elementary mathematics to first-year students who had very limited experience with CAS. The students worked in pairs and their discussions were audio-recorded. They had worksheets with trigonometric equations and questions. The equations to be solved were in a prescribed order. For each equation there was a particular CAS that gave a different answer from the expected answer of the students.

Initially, the students solved an equation (correctly or not) without a CAS. Then they solved the same equation with a particular CAS. They were given questions, guiding them to analyze the differences, equivalence and correctness of their own answers and CAS answers.

Ca 200 instances of equation-solving by ca 50 pairs of students were analyzed. The data consists of the students' worksheets and audio records of their discussions. The worksheets provide information on equivalence/non-equivalence of the students' and CAS answers. It is determinable through mathematical reasoning by researchers. The second dimension is the students' opinion about the equivalence/non-equivalence. That is based on an analysis of the worksheets and audio data. Different types of equations can be associated with different obstacles to clarification of equivalence/non-equivalence. For example, there seems to be quite a high degree of confusion about the meaning of n in the answers to trigonometric equations, even if it is used correctly in solutions.

It seems that comparing their answers with CAS answers was an interesting task for the students. In most cases this led to active discussions on trigonometry. The productivity of the discussions is a subject matter for another study but some points are also briefly mentioned in this paper.

Pierce, R. and Stacey, K. (2010). Mapping pedagogical opportunities provided by mathematics analysis software. International Journal of Computers for Mathematical Learning, 15(1), 1–20.