Manipulating symbolic expressions on a computer

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I present preliminary work on Shoreline, an application that allows high school math students to manipulate symbolic expressions on a computer as an alternative to paper. A computer-based method for working with symbolic expressions has the ability to control how a user solves certain problems, which could offer the user insight into the problem that they might have missed while solving the same kind of problem on paper. Prior attempts at achieving this, such as the iOS application Algebra Touch [1][2] have been limited in scope, but their strengths and weaknesses were compared to Shoreline's design during its development.

Shoreline presents its user with a symbolic expression and a list of identities that can be applied to that expression. The user can match an identity to the expression by selecting different parts of the expression. Identities that match the selection can be clicked by the user to transform the selected parts of the expression into another form. This method of interaction stresses that the user learns when an identity can be applied and how exactly to apply the identity. This can't be stressed to a student solving the same problems on paper without significantly slowing down the problem-solving process.

Shoreline currently works with basic algebraic expressions. Future work will explore the extent to which this system can represent different kinds of symbolic manipulations within mathematics.

Keywords
Education, Symbol-manipulation, Mathematics, Alternative to paper, Computer Science

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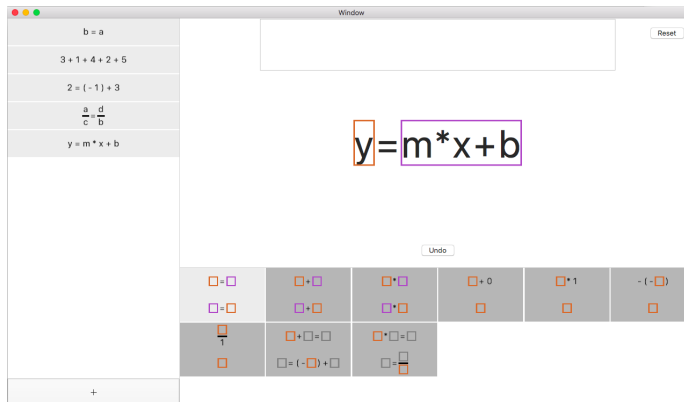
Figure 1: Shoreline with an example selection of the main expression