Proofs & Dynamics in Geometry

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Abstract:

Given its formal, logical, and spatial properties, geometry is well suited to teaching environments that include dynamic geometry systems (DGSs), geometry automated theorem provers (GATPs), and repositories of geometric problems. These tools enable students to explore existing knowledge in addition to creating new constructions and testing new conjectures.

Dynamic geometry programs give users an initial visual validation of a geometric property. Instead of producing a fixed example, these programs produce a large set of examples that reinforce confidence in the truth of a statement. Although these manipulations are not formal proofs because only a finite set of positions is considered and because visualisation can be misleading, they provide a first clue to the truthfulness of a given geometric conjecture. It can be said that DGSs provide an initial non-formal link between theories and models of geometry.

Geometry automated theorem provers similarly enhance learning. They can be used to validate a given conjecture about a geometric construction or, better, to produce a formal proof of it.

Efficiency is important because, in a learning situation, it is not viable to wait more then a couple of seconds to get an answer. This opens the door to GATPs implementing algebraic methods and also the discussion about taxonomies and measures of complexity for proofs.

Readability is important because, without it, the "why" would be lost. This opens the door to GATPs implementing synthetic and semi-synthetic methods and also to the rendering of proofs in natural languages and, important in geometry, visual languages.

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