

# Gödel's Incompleteness Theorems

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## Notes to the instructor

The project is designed for an upper level undergraduate course in mathematical logic. It is more suited for a second semester course in mathematical logic. The project assumes that students are familiar with basics of first-order logic, including its syntax and semantics, completeness, Löwenheim-Skolem, and compactness theorems. The whole course may be designed around the project. Since Gödel's incompleteness theorems are rather challenging, the project is designed so that it first explains the informal ideas behind self-referential statements and paradoxes, then treats Peano Arithmetic on formal basis, and finally tackles Gödel's incompleteness theorems. The proofs of incompleteness theorems are also mostly done from an informal point of view. Instructors may wish to discuss how to convert them into purely formal statements. After the completion of the project, instructors may wish to discuss Tarski's theorem on undefinability of truth, as well as Henkin sentences and Löb's theorem. If there is enough time left, it would also be fitting to cover the Church-Turing theorem on undecidability of first-order logic. There are plenty of exercises in the project, some of them quite challenging. Instructors may wish to pick and choose the exercises they find relevant for their needs. They may also want to spend some class time on guiding students through some of them.

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