



## PROOF WITHOUT WORDS: EISENSTEIN'S DUPLICATION FORMULA

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### Abstract

We provide a proof without words about Eisenstein's duplication formula.

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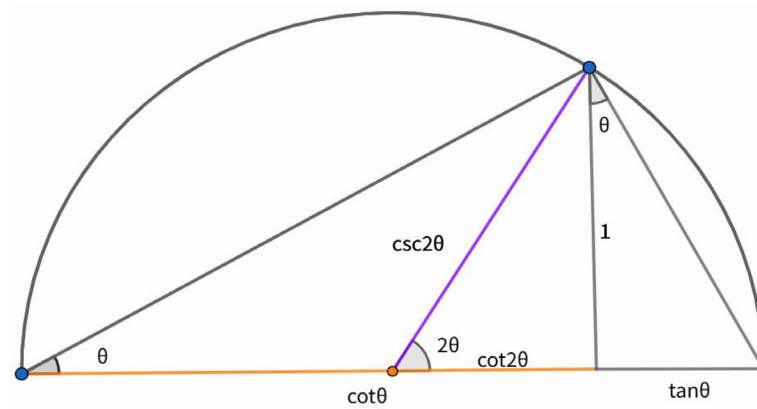
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## 1. Introduction



$$\csc 2\theta = \frac{\cot \theta + \tan \theta}{2} \quad \text{or} \quad \csc 2\theta = \cot \theta - \cot 2\theta$$

## 2. Summary

Eisenstein's duplication formula was first proved wordlessly in [1], but the picture is complicated. So, the proof was improved in [2]. Our proof was based on [2], but clearer and more concise.

## References

- [1] L. Tan, Proof without words: Eisenstein's duplication formula  $2\csc(2\theta) = \tan \theta + \cot \theta$ , *Math. Mag.* 71(3) (1998), 207. DOI: 10.2307/2691206.
- [2] Roger B. Nelson, Proof without words: A trigonometric proof of the arithmetic mean-geometric mean inequality, *The College Mathematics Journal* 46(1) (2015), 42. DOI: 10.4169/college.math.j.46.1.42.