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Styles of Mathematical Explanation. Why do Elliptic Functions have Two Periods?

In recent years, philosophers have devoted significant attention to the topic of explanation as a phenomenon within mathematics. There appear to be both differences and similarities in the patterns characteristic of mathematical explanations of mathematical events and causal explanations of physical events, but more study is needed to ascertain precisely what the differences are. This talk will present a historical case study illustrating that, among other things, mathematical explanations can exhibit the same interest-relativity and context-dependence that are found in explanations of physical events. The example is the explanation of the fact that elliptic functions are doubly periodic. (This way of describing the case involves seeing the elliptic functions in a nineteenth-century way via inverting elliptic integrals; today double periodicity is part of the definition of “elliptic function”.) Two ways to address the fact – one using techniques characteristic of Bernhard Riemann (develop the Riemann surface then integrate on a torus) and another in the style of Karl Weierstrass (represent via the Weierstrass P-function and its derivative) reveal strikingly different mathematical virtues. The explanations are both “good ones”, but for incommensurable reasons.