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Malcah Effron, Andreas Karatsolis, Suzanne Lane, Ari Nieh and Susan Ruff*
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Undergraduate research commonly occurs with undergraduates paired with faculty advisors in an apprentice model. When assigning undergraduate research in a class, the scaffolding provided by apprenticeship has to be abstracted across many different projects and topics. We have addressed this need by developing a mathematics “reasoning diagram” in order to demystify mathematics research for undergraduates. By interviewing mathematicians in diverse sub-disciplines of mathematics: number theory, geometry, PDE, physical applied mathematics, combinatorics, and quantum computation, we have identified similarities in research process and in reasoning patterns across sub-disciplines. Our reasoning diagram encompasses both “pure” and “applied” mathematics, and elaborates different parts of the iterative research process (e.g., choice of research question, building understanding, making a conjecture, attempting a proof, and adding to the body of knowledge of mathematics). After revising based on interviewee feedback (in progress), we will use the diagram to help undergraduates in the classroom to research and to communicate mathematics.

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