

## **Anit-van der Waerden Numbers on Graph Products**

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Ramsey Theory is a branch of mathematics whose main questions are of the form: If a system is chaotic or random and we partition the system into smaller pieces can we guarantee that the smaller pieces are no longer chaotic or have some nice structure? Anti-Ramsey Theory type problems ask the opposite questions: If a system is structured and we partition the system into smaller pieces can we guarantee that the smaller pieces break the structure? The open question that we focused on looked at was an anti-Ramsey type question. We wanted to find out exactly how much structure we could give a system before we could guarantee that a smaller piece of our system must break the structure. Our structure breaking pieces are called rainbow 3-term arithmetic progression. We developed tools (theorems) to study the system of graphs called grid graphs (think of an array or a well-planned city with a Google maps view). We eventually answered the open question for all  $m$  by  $n$  grid graphs and found an upper bound for any graph product!

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