# Introduction

I have an introverted personality, and music helps me block out the noises from the outer environment while bringing enjoyment from immersing in its beautiful melody. To help with the idea of “immersing into the music”, many earphones now-a-day come with the function of active noise canceling (ANC). Despite many of my friends praising the ANC technology, I never really liked it. When I listen to music with ANC on, it creates a pressured feeling, which is itself distracting from the experience itself while not blocking out much sound from the outside world relative to when it is turned off. To find out why this is happening, I have decided to investigate the mathematics behind the ANC technology to find an explanation of its poor performance in my daily life.

# Background

Sound is a propagating pressure wave, with alternating rarefaction and compression. Since sound is a pressure wave, different sound waves can interfere with each other to form a new wave.

The relationship between two sound waves modeled by f(x) and g(x) interfering is visualized above in graph 1. When f(x) and g(x) interfere to form a new wave g(x), they fallow the formula:

This can be identified in the viasualization of the soundwaves, as when both waves are at points of compression (points with above average sound pressure boxed in green), the two waves interefere constructively to create a point in the graph with higher amplitude. The same can be said for when both waves are at points of rarefraction. (points with below average sound pressure boxed in red) However, when one of the sound wave is at a point of compression while the other sound wave is at a point of rarefraction, the two sound wave interfere destructively, and decreases the amplitude of the final sound.

This principal his what ANC uses to cancel sound. ANC headphones uses microphones to detect the sound, and uses the spearkers inside the headphone to emit a wave opposite of the outside sound. The emitted soundwave by the speakers interfere with the outside sounds destructively, and cancels out the noise.

# Theory

# Evaluation

# Conclusion