

# Table of Activities

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## Part 1: Making Waves (3 sessions)

Students are introduced to the physics of sound and to unit circle trigonometry, connecting these concepts through the idea of waves.

### Activity 1A: Exploring Sound (1 session)

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Students explore the nature of sound as it travels through air. Through a computer simulation, students learn how the volume and pitch of a sound can be adjusted. This exploration sets the stage for understanding parallels between changes in the graph of a sound wave and the resulting sound effects.

### Activity 1B: Generating Sine and Cosine Graphs (2 sessions)

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Students learn that sine and cosine waves can be used to represent tones. Students connect their prior knowledge of trigonometric ratios of acute angles within right triangles to the waveforms that result from graphing  $y = \sin(x)$  and  $y = \cos(x)$  on a coordinate system, using angle measure as the independent variable and the value of the trigonometric ratio in question as the dependent variable. Students create a cosine wave by hand, which allows them to focus on how the graph of the function is cyclical and appears as a wave and to better understand how the graph can model a sound wave.

## Part 2: Making Changes (3 sessions)

Students work with transformations of functions to determine the effect of multipliers and added constants on the graphs of the functions. They start with algebraic functions and then extend their conclusions to the sine function.

### Activity 2A: Transforming Functions (2 sessions)

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To prepare for the kinds of changes they will apply to the equations in Activity 2B, students revisit the graphs and equations of known functions and explore how changes in the coefficients of a function's equation affect its graph. Types of changes explored include horizontal shifts (also called *phase shifts* with trigonometric functions), horizontal stretches (period adjustments), vertical stretches (changes in amplitude), and vertical shifts.

### Activity 2B: Changing Sine (1 session)

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Students apply the same transformations they used in Activity 2A to their graph of the sine function. Using graphing calculators, students observe how changing coefficients in the equation  $y = \sin(x)$  affects the graph.

## Part 3: Generating Sound (1 session)

Students use sound editing software to turn sine equations into sounds. They begin by determining the period, frequency, and amplitude of the waves represented by the equation. Next, they compare equations and their resulting sounds, making predictions about how the sounds and graphs will be different. Finally, they experience how changes in the waveforms affect the sounds they hear.