14.5 Collect and Model Trigonometric Data

TEKS a.5, a.6, 2A.1.B; P.3.B

MATERIALS • musical instrument • Calculator Based Laboratory (CBL) • CBL microphone • graphing calculator

QUESTION How is music related to trigonometry?

Sound is a variation in pressure transmitted through air, water, or other matter. Sound travels as a wave. The sound of a pure note can be represented using a sine (or cosine) wave. More complicated sounds can be modeled by the sum of several sine waves.

EXPLORE Analyze the sound of a musical instrument

Play a note on a musical instrument. Write a sine function to describe the note.

STEP 1 Play note

Play a pure note on a musical instrument. Use the CBL and the CBL microphone to collect the sound data and store it in a graphing calculator.

STEP 2 Graph function

Use the graphing calculator to graph the pressure of the sound as a function of time.

STEP 3 Find characteristics of graph

Use the graph of the sound data to calculate the note's amplitude and frequency (the number of cycles in one second).

STEP 4 Write function

Write a sine function for the note.

DRAW CONCLUSIONS Use your observations to complete these exercises

1. Choose a note to play and have a classmate also choose a note. Find two sine functions $y = f(x)$ and $y = g(x)$ that model the two notes. Then play the notes simultaneously and use the CBL and a graphing calculator to graph the resulting sound wave. *Compare* this graph with the graph of $y = f(x) + g(x)$. What do you notice?
2. The pitch of a sound wave is determined by the wave's frequency. The greater the frequency, the higher the pitch. Which of the notes in Exercise 1 had a higher pitch?
3. When you change the volume of a note, what happens to the graph of the sound wave?
4. *Compare* the sine waves for different instruments playing the same note.