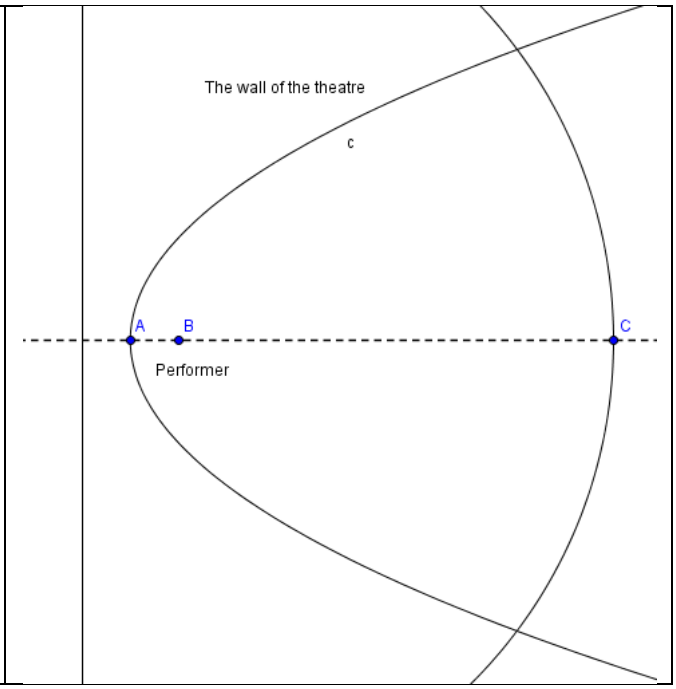
EVHS Algebra 2 Final Study Guide Unit 6

At Santa Clara Convention Center You will find a theatre with the shape of a parabola.



Point A(3, 2) is the vertex of the parabola. Directrix of the parabola located at $x = \frac{39}{16}$ is the partition of the theatre. A guitarist is going to perform at the focus of the parabola so that her voice can reach the audience with same intensity. (all coordinates measurement is in meters)

(1) How far away from A should the performer be?

(2) What is equation of the parabola?

Now, the end of theatre is a part of a circle centered at A with radius of 5 meters.

(3) What is the equation of the circle?

(4) Find the intersections between the parabolic and circular walls.

The Sound Sensitivity Level, Decibel. (dB)

The guitarist at the stage is playing a classical piece while a microphone is hanging right above him to record what he plays. In order to make the recording successful, a soundman has to choose an adequate microphone and how far above the player to locate the microphone. Here are some physical facts about sounds.

Sound is measured by the pressure produced from the source. However, when sound travels in air, it loses its power as it propagates away from its source. The relationship of how sound dissipate in air is called the energy dissipation formula, which is proportional to the inverse square of distance between two points.

$$\frac{E_2}{E_1} = \frac{k}{r^2}$$ (Energy dissipation formula)

Where E_1, E_2 are sound pressures (measured in μPa) of the same sound wave measured at two different locations. The distance between the measurements is r meters. k is a calibration constant.

On the other hand, acoustic sensitivity level is measured in decibel (dB), which is a logarithmic scale, defined below

$$sensitivity(dB) = 20\log\frac{E}{E_{ref}},$$

Where E_{ref} is the reference sound pressure = 20 μPa . E is the sound pressure to compare.

A microphone is rated by its sensitivity. If a microphone's sensitivity is -10 dB, this means when a sound pressure is less than -10 dB (when compare with the reference sound pressure), it cannot be recorded. Even though sound pressure is usually measured in μPa , it can be expressed in terms of sensitivity (dB) as well. Usually, dB is what you hear when people talk about how loud a sound is. For example, instead of saying the sound produces a pressure of 2×10^6 μPa , people in the sound industry will say the loudness of the sound is 100 dB.

Today, your task is to adjust the location of your microphone in the theatre to make recording successful.

(1) To start your task, you need to calibrate the energy dissipation formula. First, you ask the guitarist stand at point B and talk at the normal voice and measure the intensity level at sound panel which is at point C in the theatre. You measured -40 dB at point C(Normal conversation = 60 dB) What is k for the recording day?

(2) From the ceiling to the floor of the theatre is 10 m. During a concert a guitar produces sound pressure at 20 dB. How far down (from the ceiling) should the microphone be if your microphone's sensitivity is -60 dB? (round to the hundredth)