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Coordinating Presentation
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GOAL: Have students predict what will happen to sounds if there is a parabolic disk surrounding the microphone.

Activity:

- **Materials:**
  - A small umbrella
  - Small microphone
  - Paint roller
  - Strong tape
  - Wooden dowel
- **Assembly:**
  - Remove the plastic from the paint roller and tape the wooden dowel onto the top metal piece. This will be the handle.
  - Insert the paint roller into the back side of the umbrella and secure with tape.
  - Attach microphone to the wooden dowel where you would think the focus would be located.
  - Run the microphone chord through the back of the umbrella and turn on.
- **Procedure:**
  - At home or in a classroom, ask someone to stand at one end of the room with a cell phone ready to play music at a set volume.
  - With the ordinary microphone on the other side of the room, ask the person to play the music while you record the audio.
  - Listen to the recording and allow students to predict what will happen to the volume when the parabolic microphone is used. Will the sound be clearer? Louder? Will the audio even change at all?
  - Ask someone to stand at the other end of the room with the cell phone ready to play music again at the SAME volume.
  - With the parabolic microphone, record the audio once again aiming it directly at the cell phone.
  - Listen to the new audio and discuss what happened… Allow the students to apply

the mathematics behind a parabola to the situation.

What is a Parabolic Reflector Microphone?

- It is a microphone that uses a parabolic reflector to collect and focus sound waves onto a transducer, in much the same way that a satellite dish does with radio waves.
- They have great sensitivity to sounds in one direction, along the axis of the dish, and can pick up distant sounds.
- Typical uses of this microphone include:
    - nature sound recording
    - field audio for sports broadcasting
    - eavesdropping on conversations, for example in law enforcement, military, or security

What Happens to the Sound?

- When multiple sound waves from a sound source strike the sloped inner wall of the dish, they bounce back to a focused position in front of the disk.
- When a barrage of sound waves hit the parabolic dish, the waves are collected together at the focal point. An ordinary microphone in the proper position can capture an amazing analog amplification of the sound source.
- Larger disks will be able to capture more sounds.

Math Behind It

- An underlying understanding of parabolas is needed in order to understand the concept of focal points, directrix, and locus points, which is why I tried to cover those details in the presentation before explaining how to find the focus point.
- If we know the dimensions of the dish, we can then find the focal distance which gives the position of the focus relative to the position of the dish.
- D is the diameter of the dish
- d is the depth of the dish
- f is the focal distance
- The focal length is found by equating the general expression for *y:*
    - $y=x^2/4f$
    - This gives you the focal length that tells you the location of the focus point, which

is where to position the microphone.