GEOMETRIC INTERFERENCE QUESTIONS (with distances comparable to wavelength)

Two loudspeakers are on the stage of a large auditorium. They are 18 meters apart, from left to right, and they are both facing the audience. We will choose the point exactly halfway between them as the origin of our coordinate system, so one is located at the point x = -9.00 m, y = 0.00. The other is at the point x = +9.00 m, y = 0.00.

To test the acoustics in the room, both speakers are making sound with a frequency of 111 Hz and the speakers are completely in phase with each other. The speed of sound in the room that day was exactly 333 m/s.

a) A microphone is placed a distance of 7.50 meters in front of one of the speakers (at the point x = 9.00 m, y = 7.50 m). What kind of interference between the sound waves would there be at those two points?

b) The microphone is then moved to a distance of 13.5 meters in front of that same speaker. What kind of interference would there be at this point?

c) There is constructive interference at the point 24.0 meters in front of that same speaker. Somewhere between this point and the point 13.5 meters in front of that speaker there must be completely destructive interference. Where would that be?

d) Now imagine that we start at a point 24.0 meters in front of the stage but between the two speakers (at the point x = 0.00 m, y = 24.0 m). What kind of interference would there be at this point?

e) Now we move in the positive x direction to the point x = 2.15 m, y = 24.0 m. What kind of interference would there be at this point?