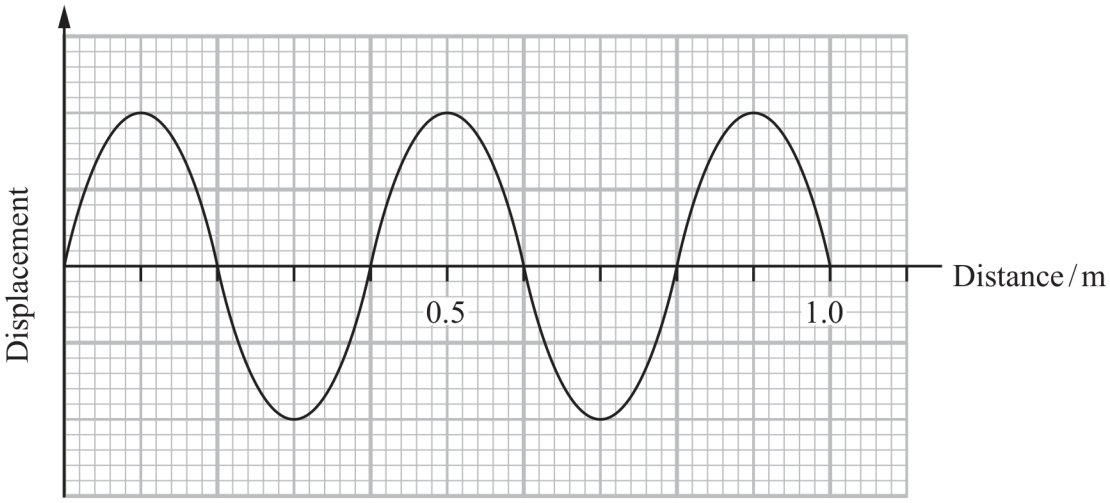
13 Active Noise Reduction (ANR) is a system used to reduce unwanted noise. In ANR a second sound wave is produced that cancels the first. ANR is used in aircraft to reduce the noise heard from the engine.

(a) On a particular flight, the noise from the engine has a frequency of 0.85 kHz. The graph shows a possible second wave.

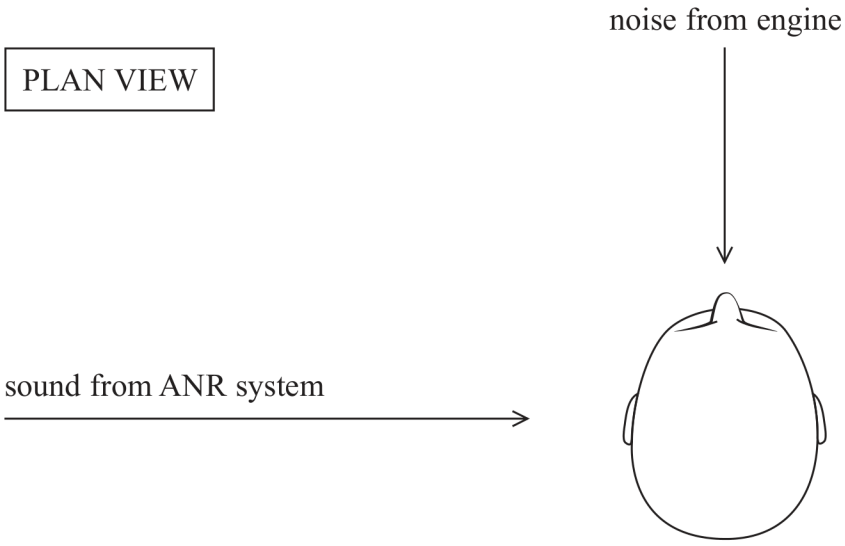


Determine whether this wave could be suitable to cancel the noise from the engine.

speed of sound in air = 340 m s^{-1}

(3)

*(b) For a particular passenger in an aircraft, the noise from the engine travels as a wave towards the passenger from the front. An ANR system creates a second sound wave that is directed towards the passenger from the side, as shown.



Explain how this can lead to the sound being cancelled for one ear but louder for the other ear.

(6)

(Total for Question 13 = 9 marks)