

- 5 (a) Use the definitions of speed  $v$ , frequency  $f$  and wavelength  $\lambda$  to derive the wave equation

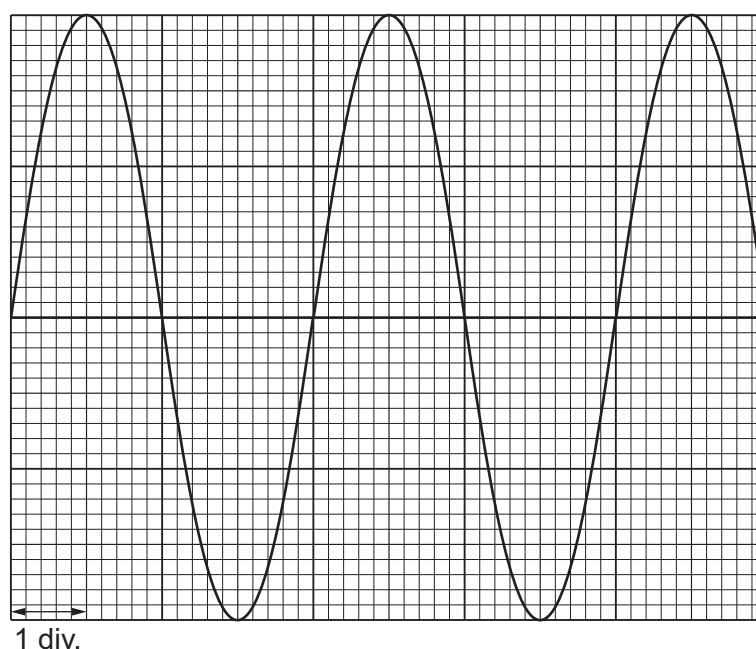
$$v = f\lambda.$$

[2]

- (b) A source of sound waves of frequency 236 Hz is travelling at a constant velocity of  $20 \text{ m s}^{-1}$ .

A stationary observer has a microphone connected to a cathode-ray oscilloscope (CRO). The microphone detects the sound waves as the source moves directly towards the observer.

The resulting trace on the CRO is shown in Fig. 5.1.



**Fig. 5.1**

The time-base on the CRO is set to  $1.0 \text{ ms div}^{-1}$ .





- (i) Calculate the frequency of the sound waves detected by the microphone.

frequency = ..... Hz [2]

- (ii) Determine the speed of the sound in air.

speed of sound = .....  $\text{ms}^{-1}$  [2]