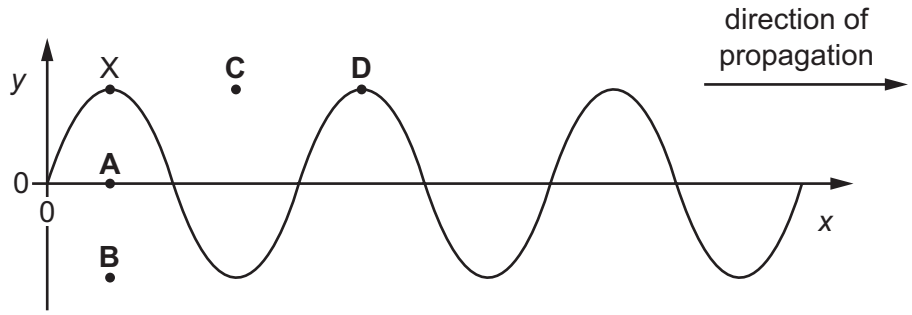
22 The variation with distance x of the displacement y of a transverse wave on a rope is shown at time $t = 0$.

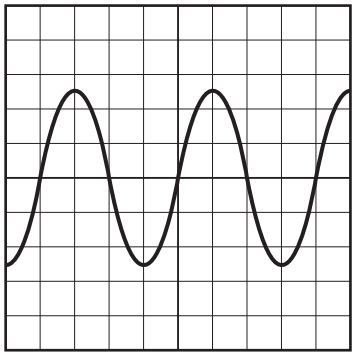
The wave has a frequency of 0.5 Hz.

A point X on the rope is marked. The diagram shows the original position of X and four new positions.

What is the position of X at time $t = 1$ s?



23 A sound wave is detected by a microphone. The output from the microphone is connected to the Y-input of a cathode-ray oscilloscope (c.r.o.). The trace on the c.r.o. is shown.



The time-base is set at 0.20 ms per division.

What is the frequency of the sound wave?

A 1000 Hz **B** 1250 Hz **C** 2000 Hz **D** 2500 Hz

24 A bat flies directly towards a fixed ultrasound detector at a speed of 25.0 $m\,s^{-1}$ emitting pulses of ultrasound of frequency 40.0 kHz.

The speed of sound in air is 330 $m\,s^{-1}$.

Which frequency does the ultrasound detector record?

A 37.0 kHz **B** 37.2 kHz **C** 43.0 kHz **D** 43.3 kHz