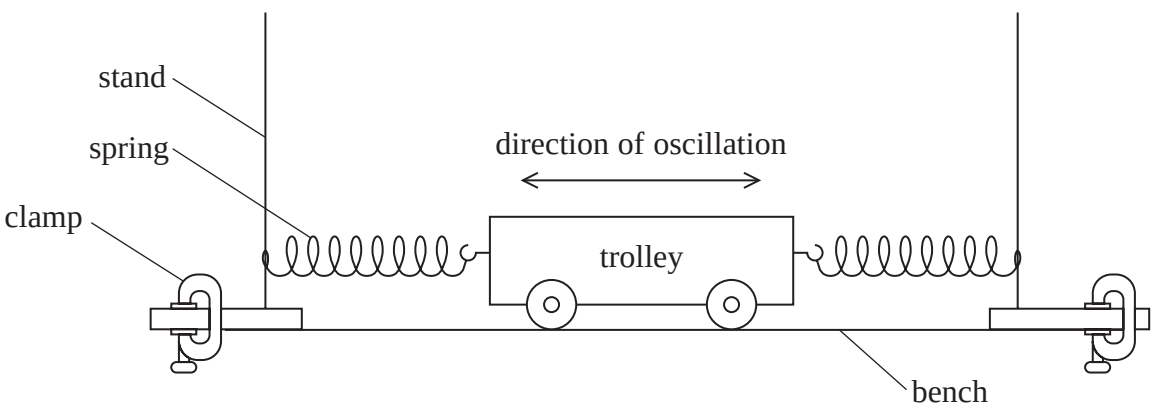
6 A student investigated the horizontal oscillations of a trolley between two springs, using the apparatus shown.



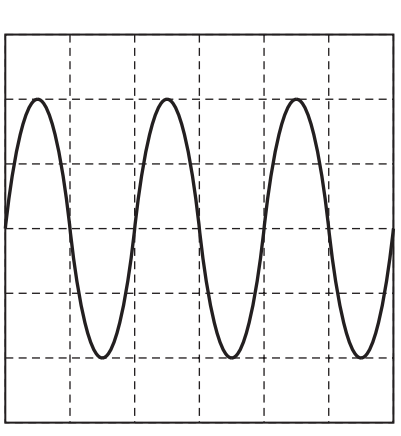
The student displaced the trolley from its equilibrium position. She then released the trolley and started a stopwatch. She stopped the stopwatch when the trolley had completed one oscillation.

(a) Describe how the method used by the student could be improved to determine a more accurate value of the time period.

(4)

(b) The student displaced the trolley 6.0 cm from the equilibrium position.
She recorded the velocity of the oscillating trolley using a sensor connected to a data logger.

The output from the data logger is shown below.



The time-base of the data logger output was set to 250 ms div^{-1}.

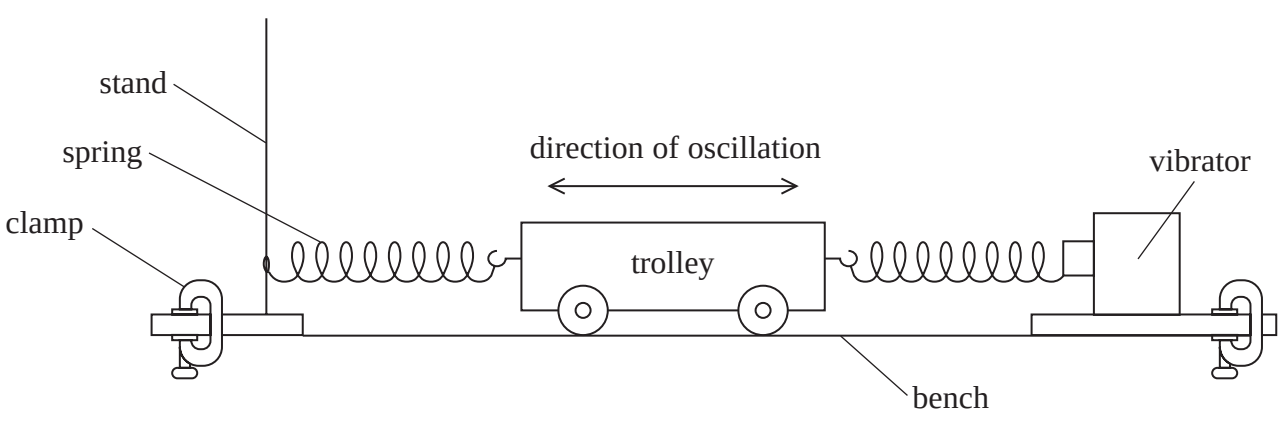
Determine the maximum velocity of the trolley.

(5)

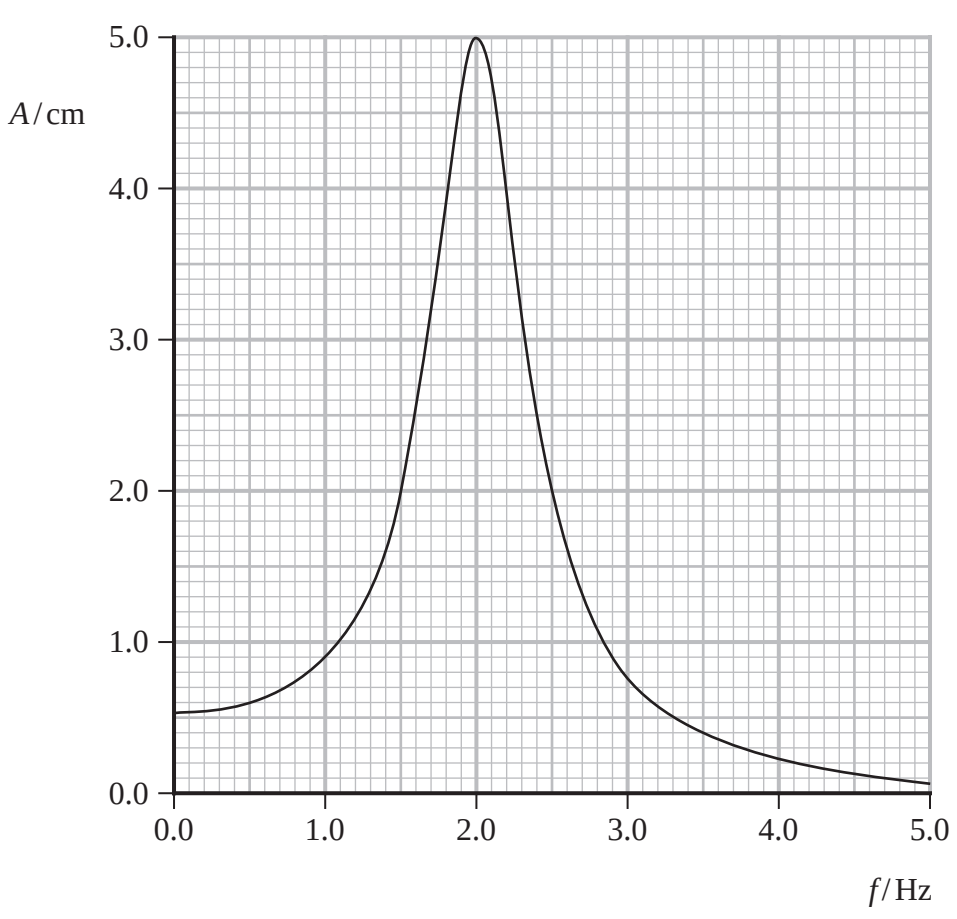
Maximum velocity of trolley = ...

(c) The student modified the apparatus so that the trolley was driven into oscillation by a vibrator, as shown.

A sensor connected to a data logger recorded the amplitude A of the oscillations.



The graph shows how A varied as the student increased the frequency f of the oscillations.



(i) Explain the shape of the graph.

(4)

(ii) Determine the effective spring constant k of the oscillating trolley system.

mass of trolley = 0.87 kg

(2)

k = ...

(Total for Question 6 = 15 marks)