3 A cyclist is moving up a slope that has a constant gradient. The cyclist takes 8.0 s to climb the slope.

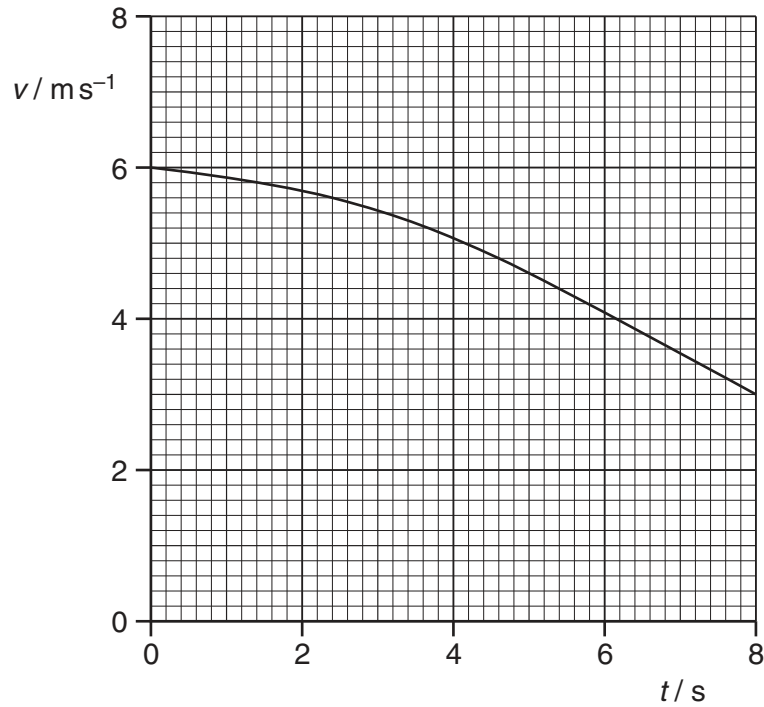The variation with time t of the speed v of the cyclist is shown in Fig. 3.1.

Fig. 3.1

(a) Use Fig. 3.1 to determine the total distance moved up the slope.

distance = ... m [3]

(b) The bicycle and cyclist have a combined mass of 92 kg.
The vertical height through which the cyclist moves is 1.3 m.

(i) For the movement of the bicycle and cyclist between $t = 0$ and $t = 8.0$ s,

1. use Fig. 3.1 to calculate the change in kinetic energy,

change = ... J [2]

2. calculate the change in gravitational potential energy.

change = ... J [2]

(ii) The cyclist pedals continuously so that the useful power delivered to the bicycle is 75 W.
Calculate the useful work done by the cyclist climbing up the slope.

work done = ... J [2]

(c) Some energy is used in overcoming frictional forces.

  (i) Use your answers in **(b)** to show that the total energy converted in overcoming frictional forces is approximately 670 J.

[1]

  (ii) Determine the average magnitude of the frictional forces.

average force = ...N [1]

(d) Suggest why the magnitude of the total resistive force would not be constant.

....

....

....[2]