3 A bungee jumper of mass 64 kg secures one end of an elastic rope to a bridge. The other end is attached to the bungee jumper. The jumper falls from rest from the bridge and descends into the valley below, as shown in Fig. 3.1.

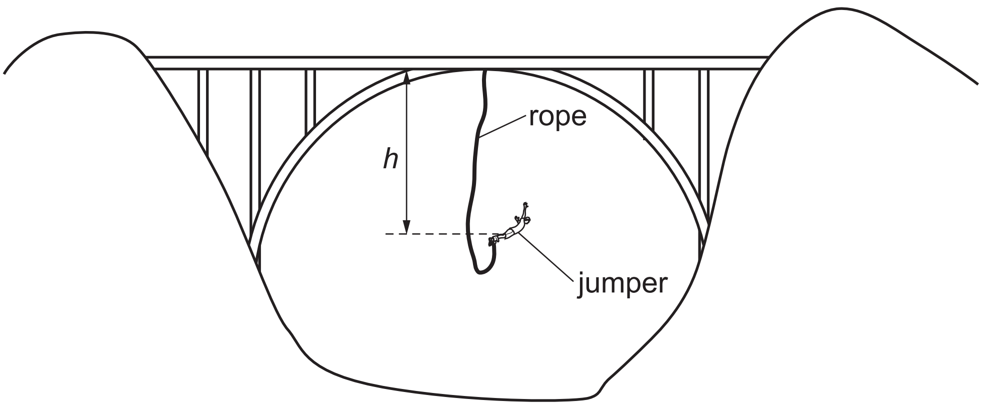

Fig. 3.1 (not to scale)

Fig. 3.2 shows the variation of the tension T in the rope with the vertical distance h of the jumper below the level of the bridge.

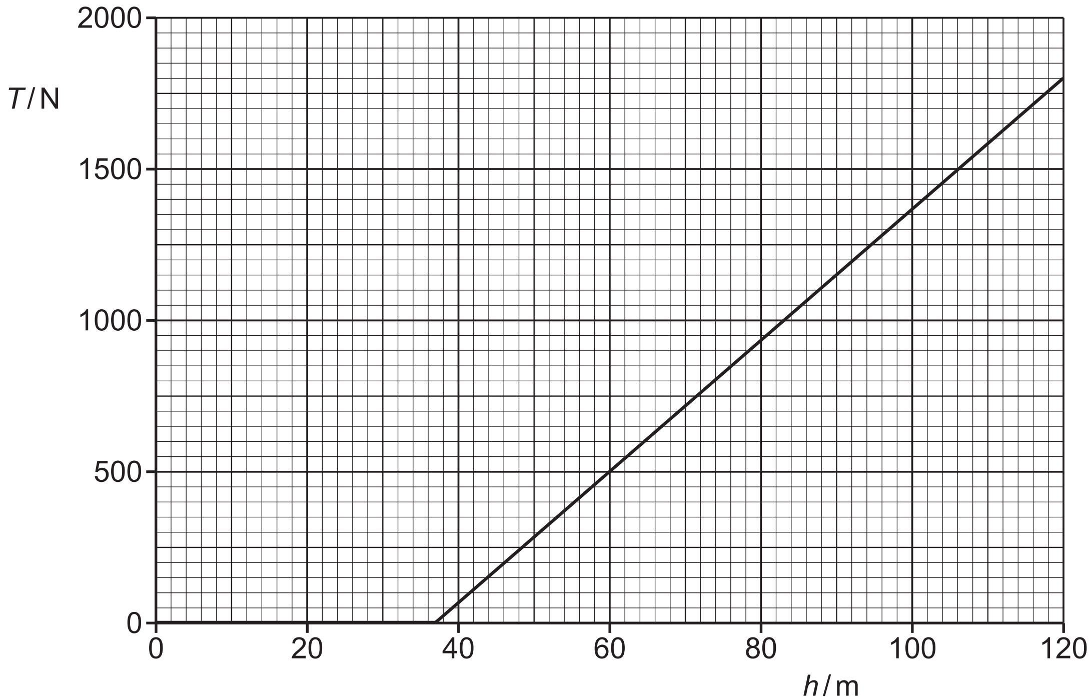

Fig. 3.2

(a) The rope obeys Hooke's law.

State Hooke's law.

....

.... [1]

(b) **(i)** Determine the unstretched length of the rope.

length = ... m [1]

(ii) Determine the spring constant k of the rope.

k = ... $N\,m^{-1}$ [2]

(c) For the position of the bungee jumper at a distance of 120 m below the bridge:

(i) show that the loss of gravitational potential energy since leaving the bridge is 75 kJ

[2]

(ii) show that the elastic potential energy in the rope is 75 kJ.

[2]

(d) Explain what can be deduced from the information in **(c)** about the speed of the bungee jumper when at a distance of 120 m below the bridge.

....

....

.... [2]

[Total: 10]