1.

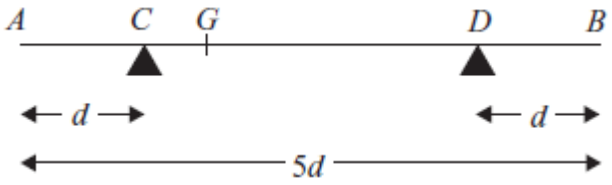

Figure 1

A non-uniform rod AB, of mass m and length $5d$, rests horizontally in equilibrium on two supports at C and D, where $AC = DB = d$, as shown in Figure 1. The centre of mass of the rod is at the point G. A particle of mass $\frac{5}{2}m$ is placed on the rod at B and the rod is on the point of tipping about D.

(a) Show that $GD = \frac{5}{2}d$. **(4)**

The particle is moved from B to the mid-point of the rod and the rod remains in equilibrium.

(b) Find the magnitude of the normal reaction between the support at D and the rod. **(5)**

Answer (b) $\frac{17}{12}$mg

2.

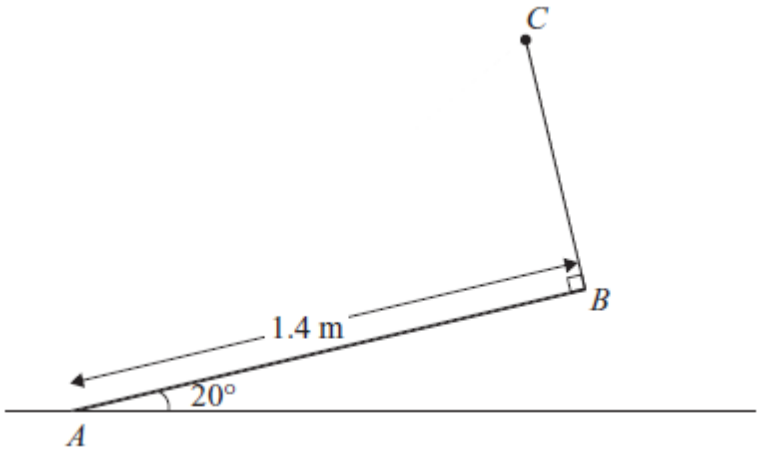

Figure 2

A uniform rod AB has mass 4 kg and length 1.4 m. The end A is resting on rough horizontal ground. A light string BC has one end attached to B and the other end attached to a fixed point C. The string is perpendicular to the rod and lies in the same vertical plane as the rod. The rod is in equilibrium, inclined at 20° to the ground, as shown in Figure 2.

(a) Find the tension in the string. **(4)**

Given that the rod is about to slip,

(b) find the coefficient of friction between the rod and the ground. **(7)**

Answer (a) 18.4 N (b) 0.29

3. The length of time, L hours, that a phone will work before it needs charging is normally distributed with a mean of 100 hours and a standard deviation of 15 hours.

(*a*) Find P(L > 127). **(3)**

(*b*) Find the value of d such that P(L < d) = 0.10. **(3)**

Alice is about to go on a 6 hour journey. Given that it is 127 hours since Alice last charged her phone,

(*c*) find the probability that her phone will not need charging before her journey is completed. **(4)**

Answer a) 0.0359 b) d = 80.776 c) = 0.3871

4.

The probability that a certain type of rose bush will exceed 2 metres in height is 0.25.

Sixty such rose bushes are planted.

Using a distributional approximation, find the probability that 14 to 18 of these bushes, both ends inclusive, will exceed a height of 2 metres.

0.524