Write your name here

Surname	Other Names

AS/A Level Mathematics

Statics of Rigid Bodies

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

Instructions

• Use **black** ink or ball-point pen.
• If pencil is used for diagrams/sketches/graphs it must be dark (HB or B).
• **Fill in the boxes** at the top of this page with your name.
• Answer **all** questions and ensure that your answers to parts of questions are clearly labelled..
• Answer the questions in the spaces provided
– there may be more space than you need.
• You should show sufficient working to make your methods clear.
Answers without working may not gain full credit.
• Answers should be given to three significant figures unless otherwise stated.

Information

• The marks for **each** question are shown in brackets
– use this as a guide as to how much time to spend on each question.

Advice

• Read each question carefully before you start to answer it.
• Try to answer every question.
• Check your answers if you have time at the end.

1 A uniform ladder AB of mass 20 kg and length 5 m is at rest with one end A on rough horizontal ground and the other end B against a smooth vertical wall.
The coefficient of friction between the ladder and the ground is 0.4.
The ladder makes an angle θ with the ground.
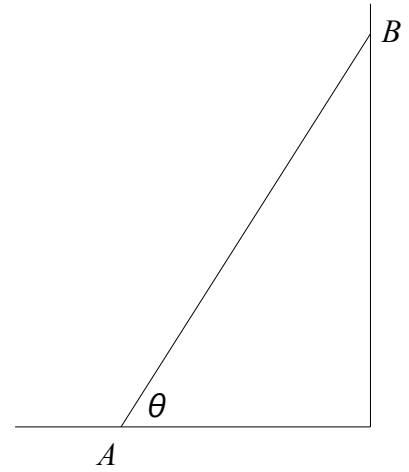
Given that the ladder is on the point of slipping.

(a) Find the magnitude of the frictional force of the ground on the ladder

(2)

(b) Find the value of θ, to 1 decimal place.

(5)

(Total for question 1 is 7 marks)

2 A uniform rod AB, of length 2 m and mass 3 kg, is smoothly hinged to a vertical wall at A.
The rod is held in equilibrium in a horizontal position by a light inextensible string BC, where $AC = 1.5$ m.
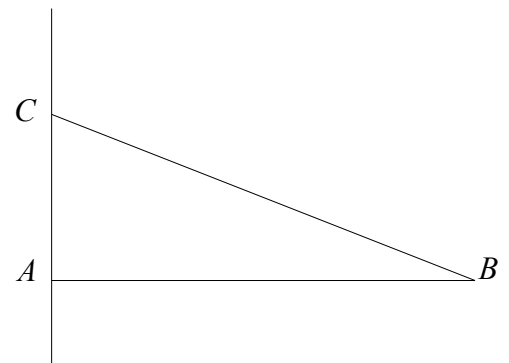
Find
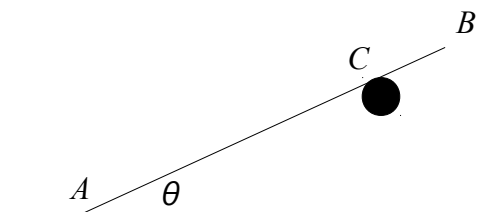
(a) The tension in the string BC **(3)**

(b) The magnitude and direction of the force exerted on the rod at A **(6)**

(Total for question 2 is 9 marks)

3 A uniform rod AB of mass 10 kg and length 6 m rests in equilibrium with A on rough horizontal ground.
The rod is resting on a smooth peg at C, where $AC = 4$ m.
The angle between AB and the ground is θ, where $\tan \theta = 0.4$

Given the rod is on the point of slipping.

Find the coefficient of friction between the rod and the ground.

(Total for question 3 is 9 marks)