Applied Mathematics APM01A1, 2017

May 15, 2017

Tutorial 10

Question 1

Prove the identity $\cos(\alpha - \beta) = \cos(\alpha)\cos(\beta) + \sin(\alpha)\sin(\beta)$ using the scalar product between two unit vectors in the XY-plane.

Question 2

Referring to figure (1), calculate the resultant force and the resultant moment of the two couples.

Question 3

A uniform ladder, length $13a$ and weight W, rests with one end against a smooth wall at a height $12a$ above the smooth horizontal floor and with its other end on the floor. The ladder is prevented from sliding by means of a horizontal rope, the one end of which is tied to the bottom of the ladder and the other end to the wall. A man, weighing $9W$, is climbing the ladder when the rope breaks as he reaches the middle rung. What is the maximum tension the rope can withstand?

Question 4

Figure (2) is a free body diagram of a uniform rod AB of weight 100N. The rod can rotate freely around A, by means of a pin. However, it is held in equilibrium, at an angle of 15° with the upward vertical, by means of a rope that is tied at B and forms an angle of 30° with the rod and is in the same vertical plane as the rod.

4.a) Calculate the tension T in the rope BC.

4.b) Calculate R, the magnitude of the reaction force, by the pin, at A.

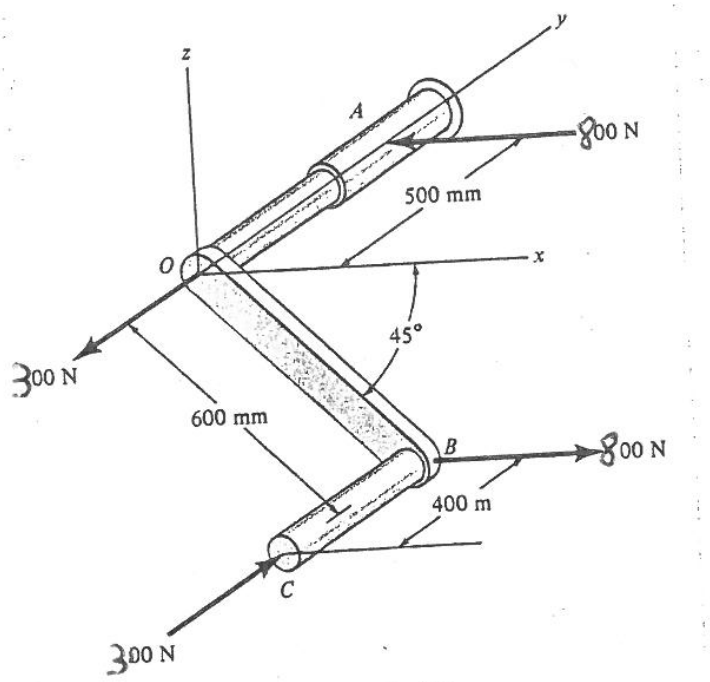

Figure 1:

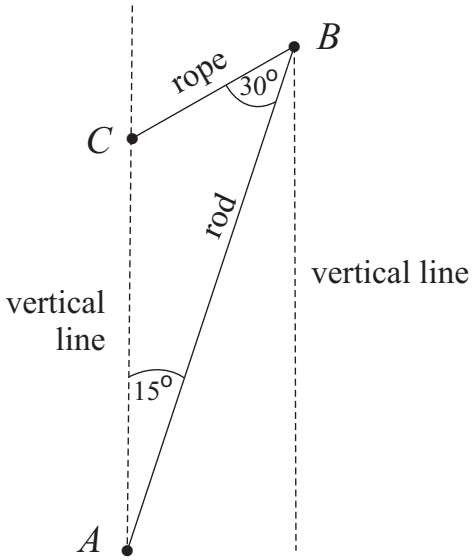

Figure 2: