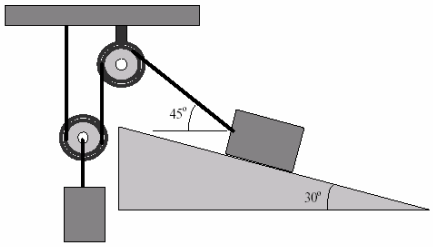
King Saud University
College of Engineering
Mechanica1 Engineering Department
GE 210 Engineering Mechanics
Final Exam, Second Semester 1423/1424 H
Date: 8/4/1424 H (8.6.2003 AD)

Instructions: Answer all problems **Time allowed: 3hours**

Problem (1)

Block A of mass m_A=100 kg rests on the fixed 30º-slope where μ_s=0.4 and μ_k=0.2. Block A is connected by two frictionless pulleys and a rope to a hanging second block B as shown. Find:

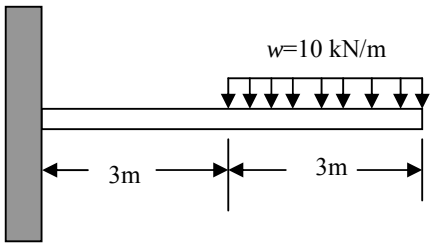


a) The mass m_B of block B required to make block A on the verge of sliding up the incline.

b) The magnitude and direction of the friction force F acting on block A.

Problem (2)

The figure shows a cantilever (overhung) beam ACB of 6 m length and negligible own weight. The outermost half CB of the beam is loaded with a distributed load of uniform intensity w=10 kN/m. Find:



a) The external reaction components at the fixed support at A.

b) The equations describing the shear force V(x) and bending moment M(x) along the entire length of the beam.

Problem (3)

A rocket of mass m=300 kg follows a trajectory in the vertical plane and is tracked by a radar at A. At the instant shown the radar records the following:

$$r = 10000 \text{ m}, \quad \dot{r} = 480 \text{ m/s}, \quad \ddot{r} = 5 \text{ m/s}^2$$
$$\dot{\theta} = 0, \quad \ddot{\theta} = -0.008 \text{ rad/s}^2$$

For the instant shown, find:

a) The components F_r and F_θ of the resultant force acting on the rocket.

b) The radius of curvature ρ of the path.

Hint: $a_r = \ddot{r} - r\dot{\theta}^2, \qquad a_\theta = r\ddot{\theta} + 2\dot{r}\dot{\theta}$

Problem (4)

At the instant shown in Figure, crank OA of the slider-crank mechanism makes an angle $\theta=45°$ and rotates about the fixed center O with an angular velocity $\omega_{OA}=200$ rad/s in counterclockwise sense. For this instant, find:

a) The velocity v_B of the slider B.
b) The angular velocity ω_{AB} of the connecting rod AB.

Problem (5)

The rod AB in Figure is attached at its ends to two collars A and B of negligible masses. Collar A slides without friction on a horizontal fixed rod, while collar B slides without friction on a vertical fixed rod. A vertical upward force *P* is applied to collar B when $\theta=25^{o}$, causing it to start from rest with an upward acceleration $a_B=12$ m/s^2. Find:

a) The force *P*.
b) The total reaction force at A.