GATE 2018 - AEROSPACE ENGINEERING, MECHANICAL ENGINEERING AND ENGINEERING SCIENCE

(1) Three forces acting on a particle are given as

$$\boldsymbol{F}_1 = (5\mathbf{i} + 6\mathbf{j})\,\mathrm{N}, \quad \boldsymbol{F}_2 = (-\mathbf{i} + 4\mathbf{k})\,\mathrm{N} \quad \text{and} \quad \boldsymbol{F}_3 = (\mathbf{i} + 6\mathbf{j} + 16\mathbf{k})\,\mathrm{N},$$

where **i**, **j**, **k** are the unit vectors along Cartesian coordinate axes. Which one of the following statements is true?

(A) Forces are coplanar and the particle is in equilibrium
(B) Forces are coplanar but the particle is not in equilibrium
(C) Forces are not coplanar but the particle is in equilibrium
(D) Forces are not coplanar and the particle is not in equilibrium

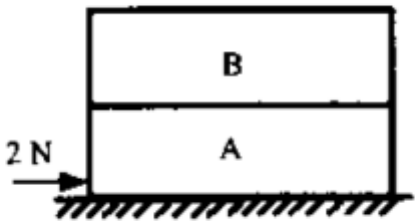
(2) A bullet of mass m having a horizontal velocity of 500 m/s hits a stationary block of mass 6.15 kg. The block breaks into two parts *viz.* Q (mass of 3 kg) and R (mass of 3.15 kg), with the bullet embedded in R. The parts Q and R travel in the direction of initial velocity of the bullet. If the velocity of Q is 3 m/s and the velocity of R is 5 m/s, the mass of the bullet m is

(A) 5 kg (B) 0.5 kg (C) 0.05 kg (D) 0.005 kg

(3) Two particles, P and Q, are initially at two ends of a circular arc which subtends an angle of 120° at the arc-center. The radius of the arc is r. The particles P and Q are moving along the arc towards each other with constant tangential velocities of v_P and v_Q respectively. The distance travelled by the particle P when it meets the particle Q is

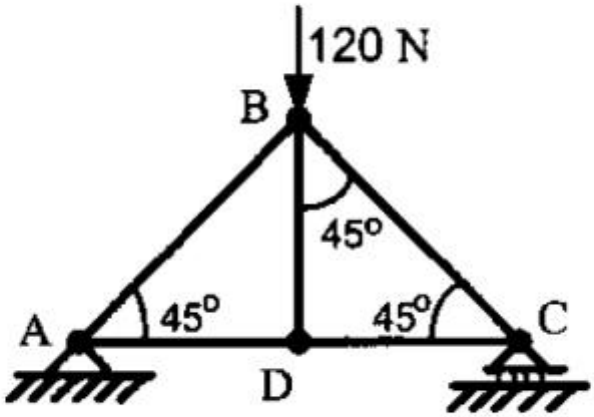
(A) $\frac{2\pi}{3}\frac{r\left(v_P + v_Q\right)}{v_P}$ (B) $\frac{2\pi}{3}\frac{r\left(v_P + v_Q\right)}{v_Q}$ (C) $\frac{2\pi}{3}\frac{rv_P}{\left(v_P + v_Q\right)}$ (D) $\frac{2\pi}{3}\frac{rv_Q}{\left(v_P + v_Q\right)}$

(4) Two rigid bodies A and B are each weighing 30 N. Body A is kept on a floor and body B is kept on body A as shown in the figure. The coefficient of friction between two bodies, and between body A and the floor is 0.1. If a horizontal force of 2 N is applied on body A, the friction force at the interface of body A and body B will be



(A) 0 (B) 1 N (C) 2 N (D) 3 N

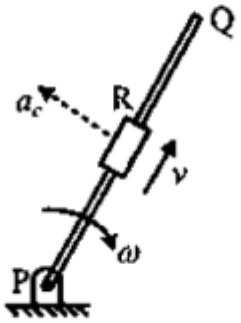
(5) A truss consisting of members AD, DC, AB, BD and BC is subjected to a vertical force of 120 N at joint B as shown in the figure. The members AD, DC and BD are each of 1 meter length. The magnitude of force in the member BD is



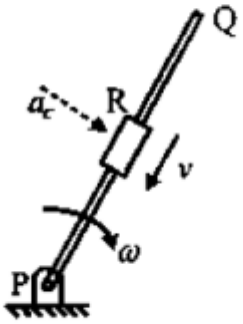
(A) 0 (B) $20\sqrt{2}$ N (C) 40 N (D) 120 N

(6) A rigid link PQ is rotating about a revolute joint at P with a uniform angular velocity ω. A slider R is sliding on the link with a relative velocity v. Which one of the following figures represents the correct direction of the Coriolis acceleration a_c?

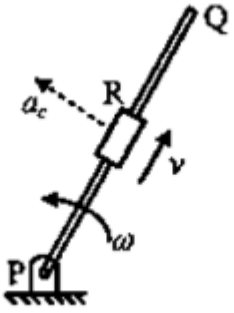
(A)



(B)



(C)



(D)