

本試題是否可以使用計算機：可使用，不可使用（請命題老師勾選）

1. (20%) The system shown in Fig 1 is called Russell's traction. If the sum of the downward forces exerted at A and B by the patient's leg is 15 kg, what is the weight W?

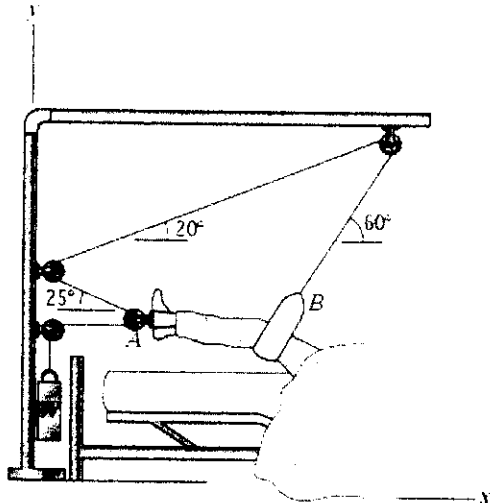


Fig. 1

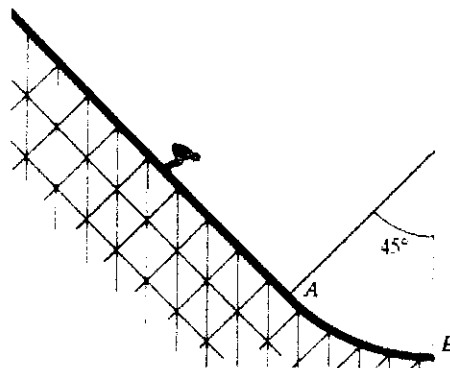


Fig. 2

2. (25%) The skier passes point A going 17 m/s. From A to B, the radius of his circular path is 6 m (Fig. 2). By using Newton's second law in terms of polar coordinates, determine the magnitude of the skier's velocity as he leaves the jump at B. Neglect tangential forces other than the tangential component of his weight.
3. (25%) At the instant shown, the 60-kg vaulter's center of mass is 2.5 m above the ground, and the vertical component of his velocity is 1.2 m/s (Fig.3). As his pole straightens, it exerts a vertical force on the vaulter of magnitude $800 + 12y^2$ N where y is the vertical position of his center of mass relative to its position at the instant shown. This force is exerted on him from $y = 0$ to $y = 1.2$ m, when he releases the pole. What is the maximum height above the ground reached by the vaulter's center of mass?

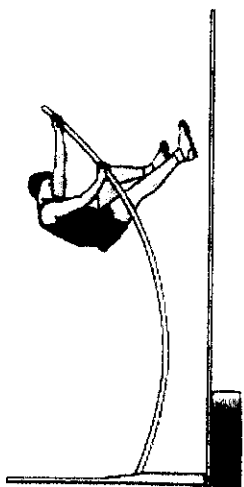


Fig. 3

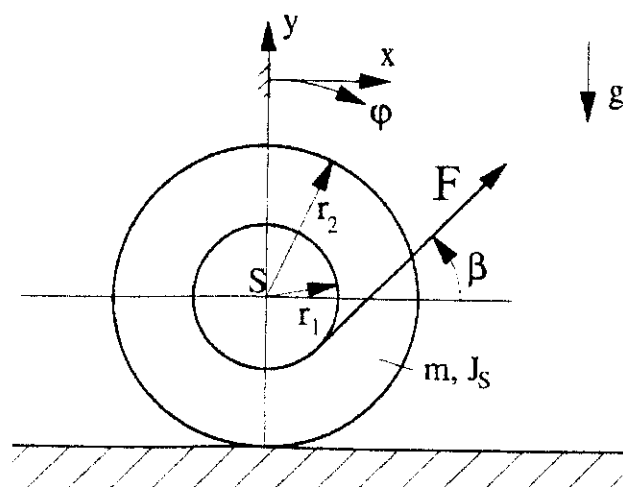


Fig. 4

4. (30%) A spool of mass m and mass moment of inertia J_S with respect to its center of mass S has rolled beneath a locker and shall be retrieved by pulling the free end of the massless yarn with a force F . (Fig.4)

(背面仍有題目,請繼續作答)

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科目：工程力學

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- a) Assuming pure rolling, determine the acceleration \ddot{x}_G of the center of mass using the kinetic principles of planar rigid-body motion
- b) Which condition has the angle β to fulfill, in order to cause the spool rolling to the right?
- c) Determine the position of the instantaneous center of rotation. Outline the velocity distribution of the spool.