Problem 1. Compute the magnitude $v$ of the velocity required for the spacecraft $S$ to maintain a circular orbit of altitude 320 km above the surface of the earth.

Problem 2. Two smooth disks, A and B with masses $m_A = 2 \text{ kg}$ and $m_B = 4 \text{ kg}$, respectively, are sliding on a smooth horizontal surface and collide as indicated in the figure below. The coefficient of restitution is $e = 0.850$. What are the final velocities of A and B?

Problem 3. Determine the differential equation of motion for the damped vibratory system shown. What type of motion occurs? Take $k = 100 \text{ N/m}$, $c = 200 \text{ N} \cdot \text{s/m}$, $m = 25 \text{ kg}$.

Problem 4. The 20-g bullet is fired horizontally at $(v_B)_1 = 1200 \text{ m/s}$ into the 300-g block which rests on the smooth surface. Determine the distance the block moves to the right before momentarily coming to rest. The spring has a stiffness $k = 200 \text{ N/m}$ and is originally unstretched.

Problem 5. The skier starts from rest at A and travels down the ramp. If friction and air resistance can be neglected, determine his speed $V_B$ when he reaches B. Also, compute the distance $s$ to where he strikes the ground at C, if he makes the jump traveling horizontally at B. Neglect the skier’s size. He has a mass of 70 kg.
**Problem 6.** At the instant shown car A is traveling with a velocity of 30 m/s and has an acceleration of 2 m/s² along the highway. At the same instant B is traveling on the trumpet interchange curve with a speed of 15 m/s, which is decreasing at 0.8 m/s². Determine the relative velocity and relative acceleration of B with respect to A at this instant.

**Problem 7.** The 2-kg disk shown in Fig. 15-26a rests on a smooth horizontal surface and is attached to an elastic cord that has a stiffness $k_c = 20$ N/m and is initially unstretched. If the disk is given a velocity $(v_D)_h = 1.5$ m/s, perpendicular to the cord, determine the rate at which the cord is being stretched and the speed of the disk at the instant the cord is stretched 0.2 m.

**Problem 8.** Each of the three balls has a mass $m$ and is welded to the rigid equiangular frame of negligible mass. The assembly rests on a smooth horizontal surface. If a force $F$ is suddenly applied to the one bar as shown, determine (a) the acceleration of point O and (b) the angular acceleration of the frame.