Answer all questions in the blue notebook provided. Show all your work and indicate your reasoning in order to receive most credit.

1. In a local bar, a customer slides an empty beer mug down the counter for a refill. The bartender is momentarily distracted and does not see the mug, which slides off the counter with the velocity 2 m/s and strikes the floor 1.0 m from the base of the counter.

   (a) What is the height of the counter? (Assume $g = 10.0\,\mathrm{m/s^2}$.)

   (b) What was the magnitude of the mug's velocity just before it hit the floor?

2. A camper hangs a 20 kg pack between two trees, using two pieces of rope of 3 m and 4 m in length. The "other" ends of the ropes are attached to the trees at the same hight, the angle between the ropes is 90°. What is the tension in each rope? (Assume $g = 10.0\,\mathrm{m/s^2}$.)

3. A woman at an airport is towing a 10.0 kg box at constant speed by pulling on a strap at an angle θ above the horizontal. She pulls on the strap with a 50.0 N force, $\cos\theta = \frac{4}{5}$, $\sin\theta = \frac{3}{5}$.

   (a) What is the magnitude of normal force that the ground exerts on the suitcase? (Assume $g = 10.0\,\mathrm{m/s^2}$.)

   (b) What is the magnitude of friction force on the box?

   (c) What is the coefficient of kinetic friction between the box and the floor?

4. Grace is playing with her dolls and decides to give them a ride on a merry-go-round. She places one of them on a record player and sets the frequency of rotations at 60 rotations per minute.

   (a) If the doll sits without sliding 10 cm from the center of the spinning turntable platform, how fast (in m/s) is the doll moving?

   (b) What is the acceleration of the doll?

5. An astronaut on a strange planet finds that she can jump a maximum horizontal distance of 12.5 m if her initial speed is 2.5 m/s. What is the free-fall acceleration on the planet?

6. A toolbox is located in the middle of the flat bed of a pickup truck as the truck negotiates an unbanked curve in the road. The curve may be regarded as an arc of a circle of radius 20.0 m. If the coefficient of static friction between toolbox and truck is 0.5, how fast can the truck be moving without the box sliding? (Assume $g = 10.0m/s^2$.)