
Total points: 40. Total time: 1.5 hr. Show all your work.

You must write down your answers with units in the Ans. boxes

1. (6 pt) A Ferris wheel with radius 14.0 m is turning about a horizontal axis through its center. If it takes the wheel 2 min to rotate through one revolution, what is the radial acceleration (in m/s^2) a passenger on the rim?

Ans.

2. (6 pt) A diver running 2.7 m/s dives out horizontally from the edge of a vertical cliff and reaches the water below 4.8 m away from the base of the cliff. How high was the cliff?

Ans.

3. (6 pt) At $t = 0$ s, a particle starts from the origin of a coordinate system and moves in the xy plane with a velocity $\vec{v} = (7.9\hat{i} - 3.2\hat{j})$ m/s. Determine the x position of the particle at $t = 2.0$ s.

Ans.

4. (4 pt) In fighting forest fires, airplanes work in support of ground crews by dropping water on the fires. If the plane is flying in a horizontal path 90.0 m above the ground with a speed of 143 mi/h, at what horizontal distance from the location of the fire should the pilot release the water?

Ans.

5. (6 pt) A 15-kg crate is pushed across a frictionless horizontal floor with a force of 40 N, directed 12° above the horizontal, as shown in Fig. 1. Determine the acceleration of the crate



Figure 1: A Box and a Force

Ans.

6. (6 pt) The radius of curvature of a loop-the-loop roller coaster is 12.0 m. At the bottom of the loop, the force that the seat exerts on a passenger of mass m is $4.4mg$. Find the speed of the roller coaster at the bottom of the loop.

Ans.

7. (4 pt) A large box whose mass is 20 kg rests on a inclined ramp with a 15° slope. The coefficient of kinetic friction between the box and the ramp is $\mu^k = 0.2$. A mover begins to pull up on a rope attached to the box so that the box moves up the ramp at a constant velocity, as shown in Fig. 2. If the rope makes an angle 40° with the horizontal, determine the force that the mover exerts.

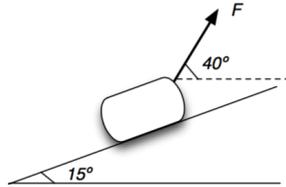


Figure 2: A Box Sliding up an Incline

Ans.

8. (2 pt) A block $m = 2.0$ kg sits on top of another with $M = 4.0$ kg. A force of $F = 10$ N is applied to the 4.0-kg block in the horizontal direction, as shown in Fig. 3. The two boxes slide across a horizontal floor, but there is no slipping between each of them. If the kinetic coefficient of friction between the 4.0-kg box and the floor is $\mu^k = 0.2$ and the coefficient of static friction between the two blocks is $\mu^s = 0.4$, determine the acceleration of the boxes.

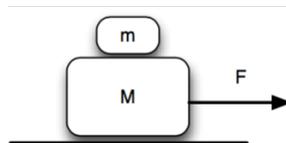


Figure 3: Two blocks on Top of Each Other

Ans.