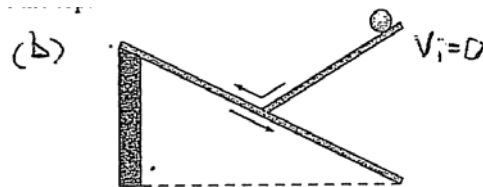
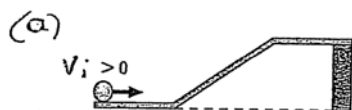


## Kinematics Assignment #1

1. Give an example of a moving object that has a velocity vector and an acceleration vector in the same direction and an example of one that has velocity and acceleration vectors in opposite directions.
2. A rifle fires a bullet exactly horizontally at height  $h$  above a horizontal field. At the exact instant the bullet is fired, a second bullet is simply dropped from height  $h$ . Which bullet hits the ground first?
3. A ball rolls along the frictionless track shown. Each segment of the track is straight, and the ball passes smoothly from one segment to the next without changing speed or leaving the track. Draw three vertically stacked graphs showing position, velocity, and acceleration versus time. Each graph should have the same time axis. Assume that the ball has enough speed to reach the top.



4. Two stones are thrown from a cliff at the same time with the same speed, one upward and one downward. Which stone, if either, hits the ground first? Which, if either, hits with the higher speed?
5. A quarterback takes the ball from the line of scrimmage, runs backwards for 5.00 m, then runs sideways parallel to the line of scrimmage for 15.00 m. At this point, he throws a 40.0 m forward pass straight down the field. What is the magnitude and direction of the football's resultant displacement?
6. A small fish is dropped by a pelican that is rising steadily at 0.50 m/s.
  - a) After 2.50 s, what is the velocity of the fish?
  - b) If it takes 10.0 s for the fish to hit the water, how high was the pelican when it dropped the fish?
7. A car is parked on a cliff overlooking the ocean on an incline that makes an angle of  $24.0^\circ$  below the horizontal. The negligent driver leaves the car in neutral, and the emergency brakes are defective. The car rolls from rest down the incline with a constant acceleration of  $4.00 \text{ m/s}^2$  and travels 50.0 m to the edge of the cliff. The cliff is 30.0 m above the ocean.
  - a) What is the car's position relative to the base of the cliff when the car lands in the ocean?
  - b) How long is the car in the air?
  - c) What is the car's velocity when it enters the ocean?
8. A plane has an airspeed of 200 mph. The pilot wishes to reach a destination 600 miles due east, but a wind is blowing at 50 mph in the direction  $30^\circ$  north of east.
  - a) In what direction must the pilot head the plane in order to reach her destination? How long will the trip take?
9. While driving north at 25 m/s during a rainstorm you notice that the rain makes an angle of  $38^\circ$  with the vertical. While driving back home moments later at the same speed but in the opposite direction, you see that the rain is falling straight down. From these observations, determine the speed and angle of the raindrops relative to the ground.
10. A rubber ball is dropped onto a ramp that is tilted at  $20^\circ$ . A bouncing ball obeys the "law of reflection", which says that the ball leaves the surface at the angle it approached the surface. The ball's next bounce is 3 m to the right of its first bounce. What is the ball's rebound speed on its first bounce?

