

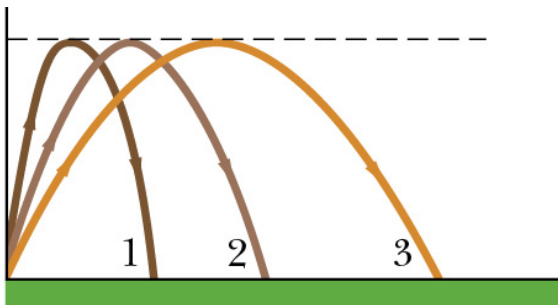
Midterm Celebration

Short Answer Questions (5 or 6 points each)

1) For the situation described below, draw a motion diagram **and** a free-body diagram.

You've slammed on the brakes and your car is skidding to a stop while going down a 20° hill. Air resistance *is not* negligible.

2) The figure shows three paths for a football kicked from ground level. Ignoring the effects of air resistance, rank the paths according to (a) time of flight, (b) initial vertical velocity component, (c) initial horizontal velocity component, and (d) initial speed.

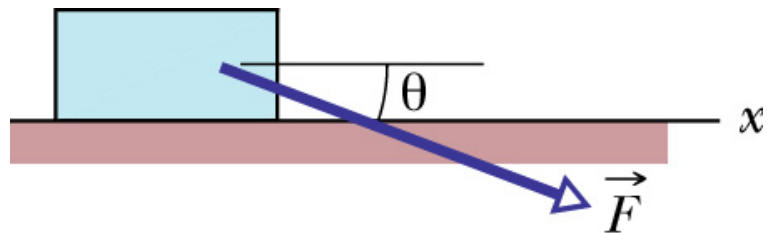


- a)
- b)
- c)
- d)

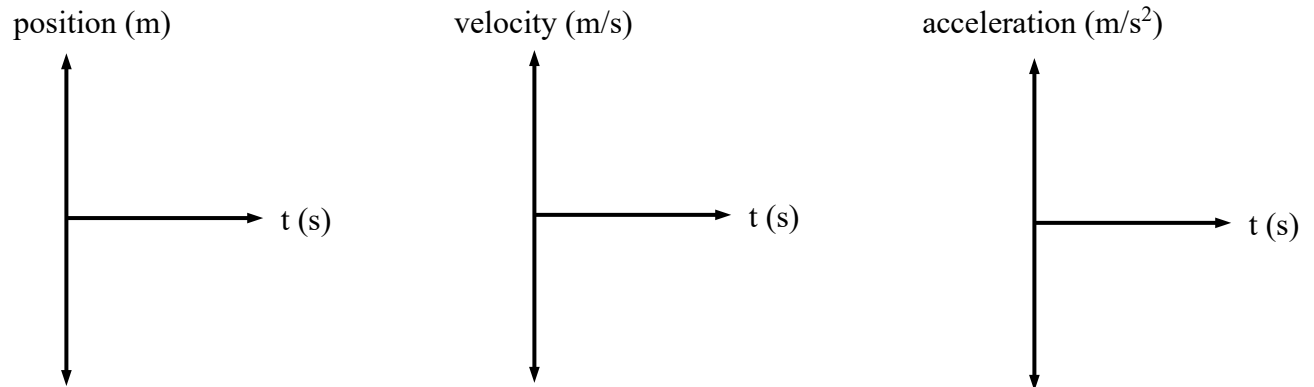
3) In the figure below, if the box is stationary and the angle θ of force \vec{F} is increased, do the following quantities increase, decrease, or remain the same:

a) f_s

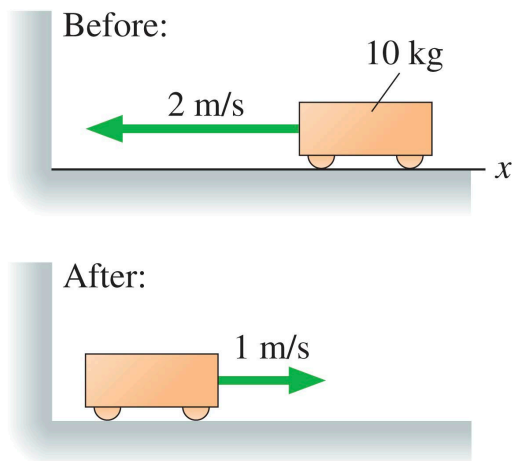
b) $f_{s,max}$?



4) A ball is thrown vertically upward, rises to its maximum height, and returns to the thrower's hand. Sketch three different graphs showing the position, velocity, and acceleration of the ball as a function of time. Take upward to be the positive direction and the release point of the ball to be the zero position.

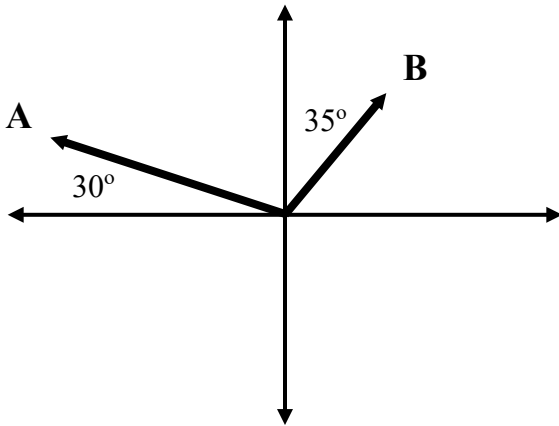


5) The figure below shows the collision of a cart with a wall. If the collision lasts for 3.25 ms, what is the average force that the wall exerts on the cart?

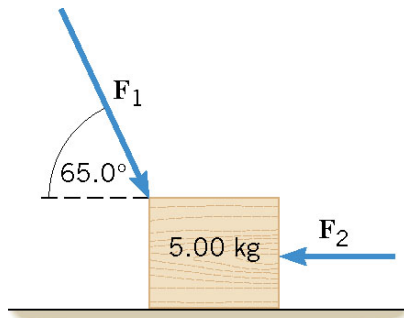


Problems (12 points each)

1) Two force vectors, \vec{A} and \vec{B} , are shown below. Force \vec{A} has a magnitude of 25.0 N and force \vec{B} has a magnitude of 17.50 N. Find the magnitude and direction of $\vec{A} - \vec{B}$.



2) Two forces \vec{F}_1 and \vec{F}_2 act on the 5.00 kg block as shown in the figure below. The magnitudes of the forces are $F_1 = 45.0$ N and $F_2 = 25.0$ N.

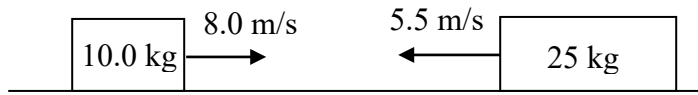


(a) What is the normal force on the block?

(b) What is the horizontal acceleration (magnitude and direction) of the block assuming the floor is frictionless?

3) A model rocket fired vertically from the ground ascends with a constant vertical acceleration of 15.50 m/s^2 for 12.50 s . Its fuel is then exhausted, so it continues upward as a free-fall particle and then falls back down. What is the maximum altitude reached by the rocket?

4) Two crates are sliding on a frictionless surface as shown in the figure below. The 10.0 kg crate is sliding to the right at 8.0 m/s and the 25 kg crate is sliding to the left at 5.5 m/s. After the collision, the two crates stick together. What is the speed of the two carts after the collision?



5) A golf ball rolls off a horizontal cliff with an initial speed of 11.4 m/s. The ball falls a vertical distance of 15.5 m into a lake below. **(a)** How far from the edge of the cliff does the ball land?
(b) What is the ball's velocity (magnitude and direction) right before it hits the lake?

6) A 25 kg child goes down a long, straight slide inclined at an angle of 32.5° above the horizontal. The coefficient of kinetic friction between the child and the slide is $\mu_k = 0.35$. If the child starts from rest, how far down the slide does she slide in 1.75 s?