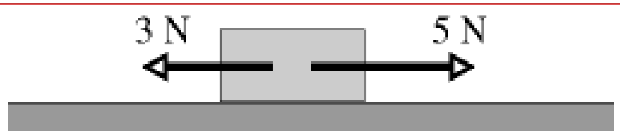
The figure here shows two horizontal forces acting on a block that is on a frictionless floor.
Assume that a third horizontal force $\vec{F}_3$ also acts on the block.
What are the magnitude and direction of $\vec{F}_3$ when the block is

(a) stationary and (b) moving to the left with a constant speed of 5 m/s?



The figure shows *overhead* views of four situations in which two forces accelerate the same block across a frictionless floor. Rank the situations according to the magnitudes of (a) the net force on the block and (b) the acceleration of the block, greatest first.

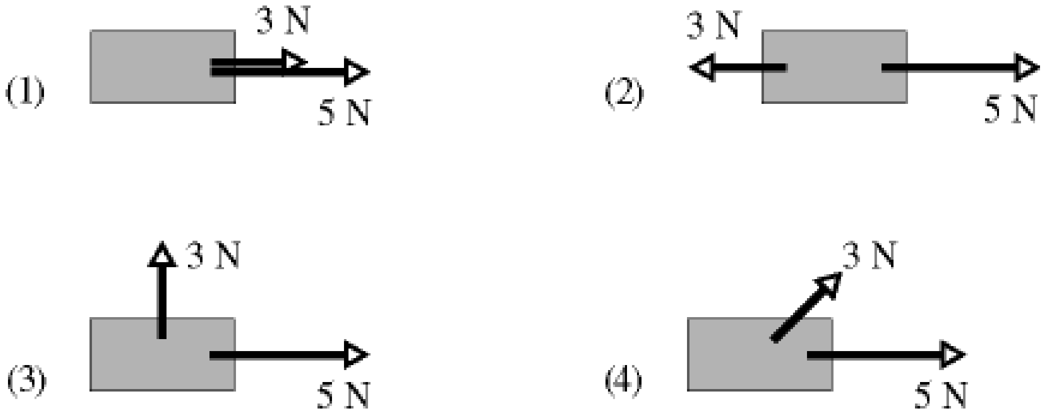
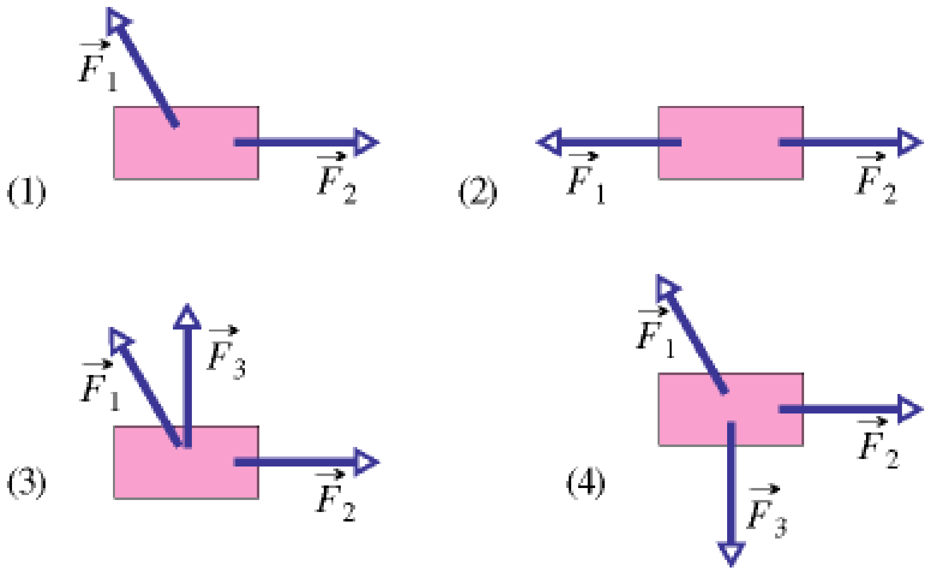
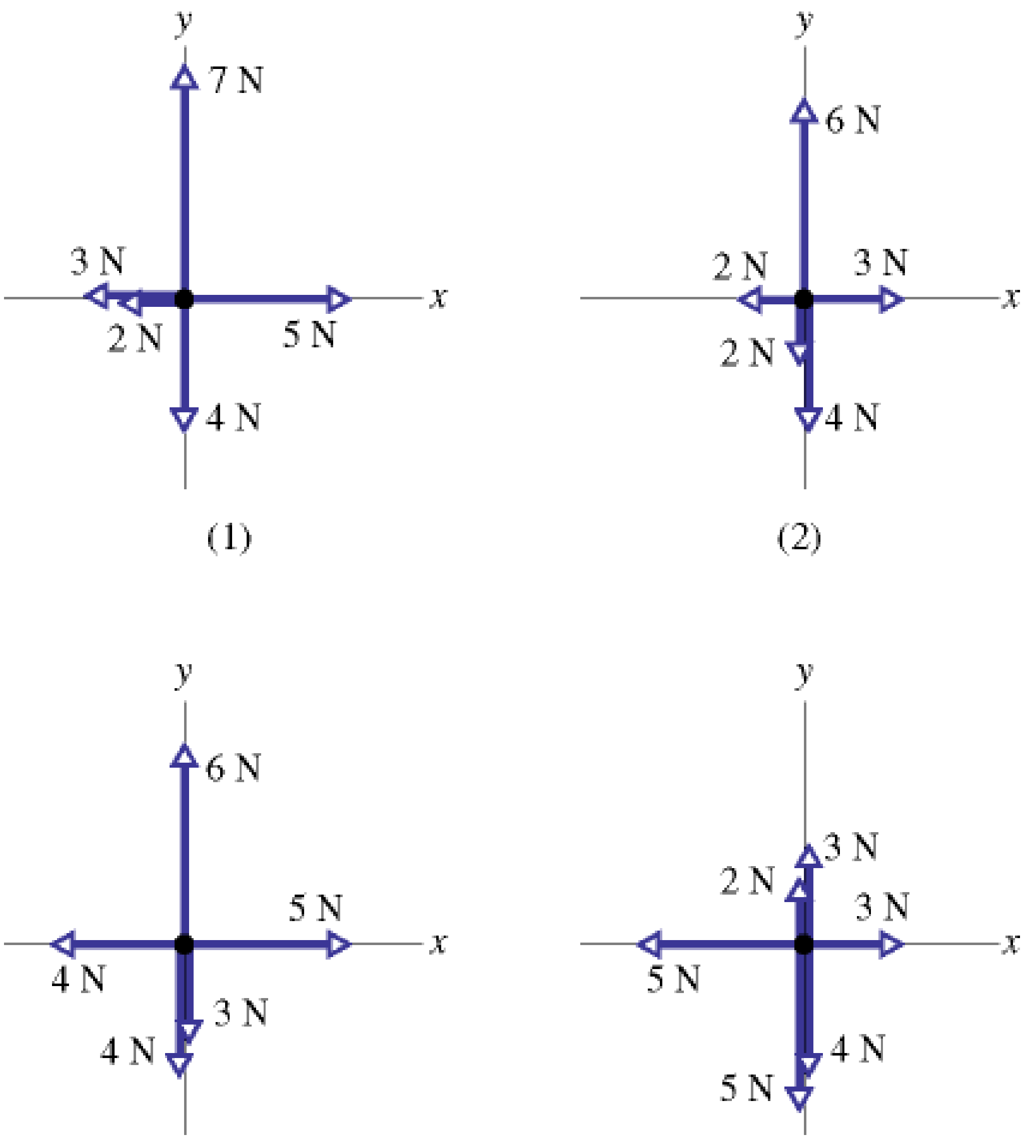


Figure 5-22 shows overhead views of four situations in which forces act on a block that lies on a frictionless floor. If the force magnitudes are chosen properly, in which situations is it possible that the block is (a) stationary and (b) moving with a constant velocity?



Rjesenje a) 2 i4 b)2 i 4

Figure 5-24 gives the free-body diagram for four situations in which an object is pulled by several forces across a frictionless floor, as seen from overhead. In which situations does the object's acceleration $\vec{a}$ have (a) an *x* component and (b) a *y* component? (c) In each situation, give the direction of $\vec{a}$ by naming either a quadrant or a direction along an axis. (This can be done with a few mental calculations.)

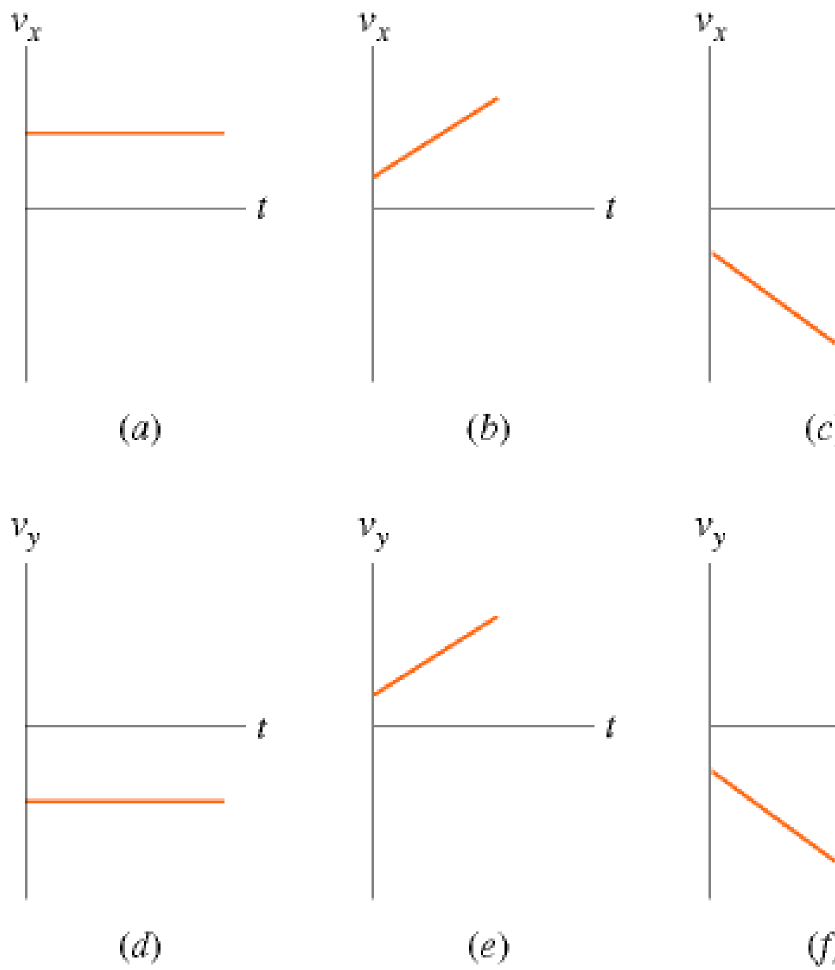


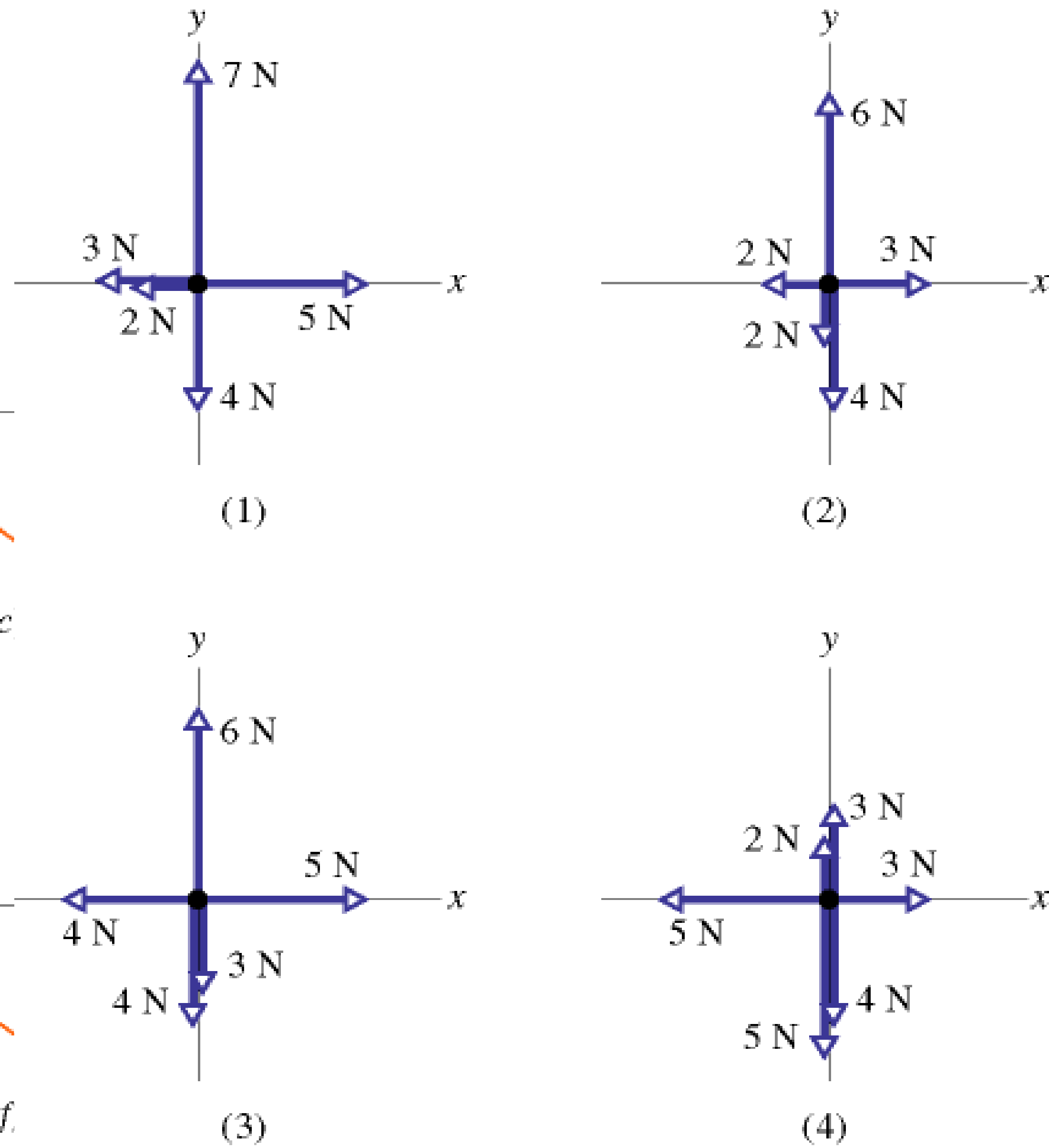
Rjesenje a)2,3,4   b)1,3.4 c)

Fig. 5-24 Question 5.

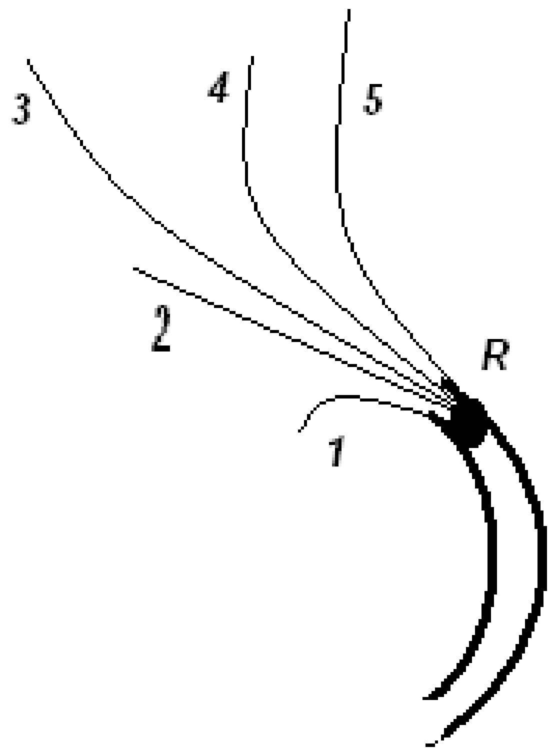
Figure 5-25 gives three graphs of velocity component $v_x(t)$ and three graphs of velocity component $v_y(t)$. The graphs are not to scale. Which $v_x(t)$ graph and which $v_y(t)$ graph best correspond to each of the four situations in Question 5 and Fig. 5-24 ?

Rjesenje 1e) 2b)3fb)4cf

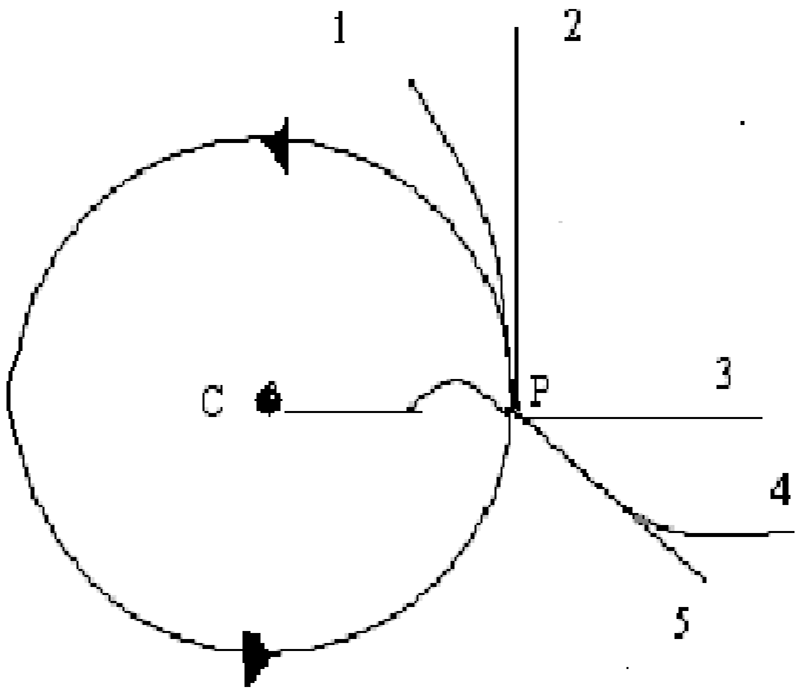


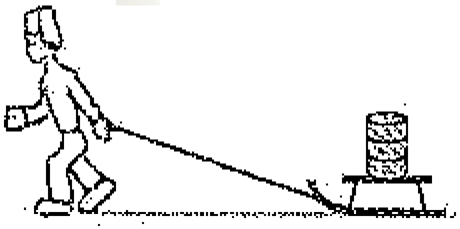


Kojim od naznačenih puteva će se kretati kuglica kada napusti žljeb i nastavi da se kreće po stolu bez trenja?



Željezna kugla je prikačena za žicu. Čovjek zavrti kuglu po kružnoj putanji koja je data na slici. U tački P se kugla istrže od žice. Koja od naznačenih putanja nabolje opisuje kretanje kugle poslije odvajanja ako je posmatramo odozgo.

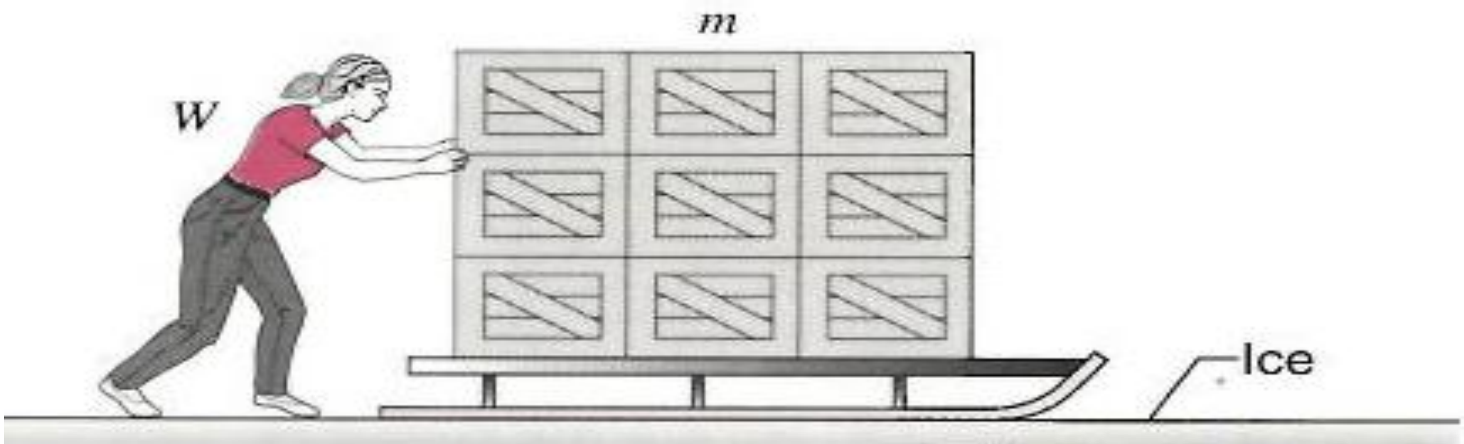




Слика 141

Пример. Дечак вуче санке на којима је неки терет. Уже за које су санке везане заклапа угао 30^0 са хоризонталом (слика 141). Маса санки са теретом је m, а сила трења је F_{tr}. Коликом силом треба дечак да вуче уже да би се санке кретале равномерно? Колика је сила нормалне реакције подлоге?

SAMPLE PROBLEM 3-1. A worker W pushes a loade
S whose mass m is 240 kg for a distance d of 2.3 m over th
face of a frozen lake. The sled moves with negligible frict
the ice. The worker exerts a constant horizontal force I
130 N (= 29 lb) as she does so; see Fig. 3-7a. If the sled
from rest, what is its final velocity?



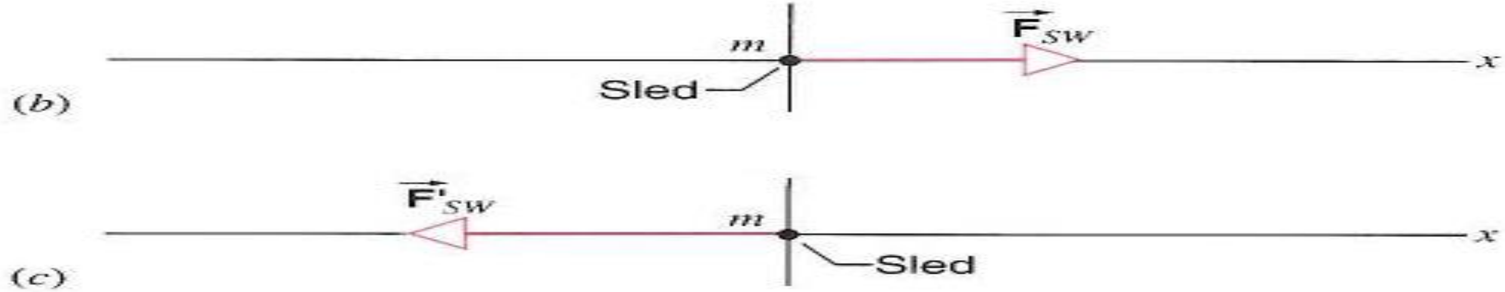


FIGURE 3-7. Sample Problems 3-1 and 3-2. (*a*) A worker pushing a loaded sled over a frictionless surface. (*b*) A free-body diagram, showing the sled as a "particle" and the force acting on it. (*c*) A second free-body diagram, showing the force acting when the worker pushes in the opposite direction.

the sled as a particle. Figure 3-7*b* is a *partial* free-body diagram. In drawing free-body diagrams, it is important always to include *all* forces that act on the particle, but here we have omitted two vertical forces that will be discussed later and that do not affect our solution. We assume that the force F_{SW} exerted by the worker is the only horizontal force acting on the sled, so that $\sum F_x = F_{SW}$. We can then find the acceleration of the sled from Newton's second law, or

$$a_x = \frac{\sum F_x}{m} = \frac{F_{SW}}{m} = \frac{130 \text{ N}}{240 \text{ kg}} = 0.54 \text{ m/s}^2.$$

With this acceleration, we can find the time necessary to move a distance d using Eq. 2-28 ($x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2$) with $x - x_0 = d$ and $v_{0x} = 0$). Solving, we obtain $t = \sqrt{2d/a_x} = 2.9$ s. Equation 2-26 (with $v_{0x} = 0$) now gives the final velocity

$$v_x = a_x t = (0.54 \text{ m/s}^2)(2.9 \text{ s}) = 1.6 \text{ m/s}.$$

The force, acceleration, displacement, and final velocity of the sled are all positive, which means that they all point to the right in Fig. 3-7*b*.

Note that to continue applying the constant force, the worker would have to run faster and faster to keep up with the accelerating sled. Eventually, the velocity of the sled would exceed the fastest speed at which the worker could run, and thereafter she

Kolikom silom treba da djeluje da bi okrenula sanke tokom 4.5 sekundi ?

Solution If she exerts a constant force, then the acceleration of the sled will be constant. Let us find this constant acceleration, using Eq. 2-26 ($v_x = v_{0x} + a_x t$). Solving for a gives

$$a_x = \frac{v_x - v_{0x}}{t} = \frac{(-1.6 \text{ m/s}) - (1.6 \text{ m/s})}{4.5 \text{ s}} = -0.71 \text{ m/s}^2.$$

This is larger in magnitude than the acceleration in Sample Problem 3-1 (0.54 m/s^2), so it stands to reason that the worker must push harder this time. We find this (constant) force F'_{SW} from

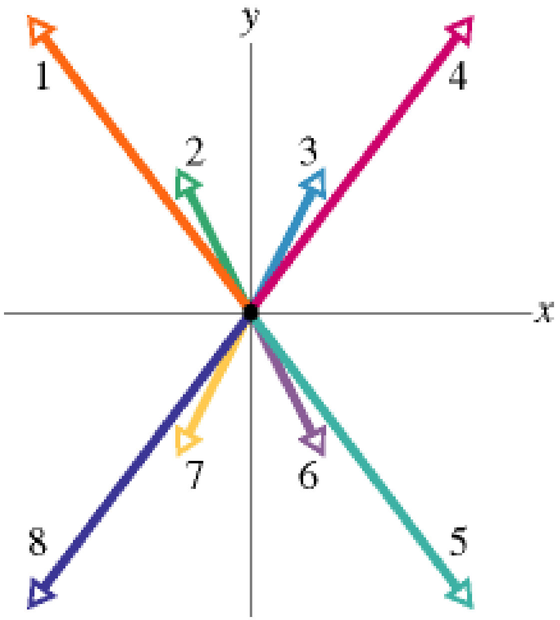
$$F'_{SW} = ma_x = (240 \text{ kg})(-0.71 \text{ m/s}^2)$$
$$= -170 \text{ N } (= -38 \text{ lb}).$$

The negative sign shows that the worker is pushing the sled in the direction of decreasing x—that is, to the left as shown in the free-body diagram of Fig. 3-7*c*.

Two horizontal forces,

F1=3i-4j   F2=-1i-2j

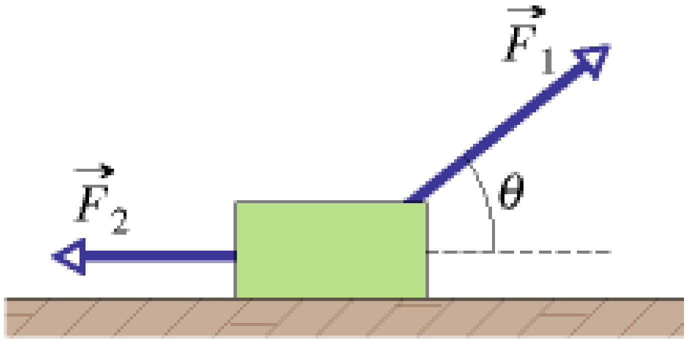
pull a banana split across a frictionless lunch counter. Without using a calculator, determine which of the vectors in the free-body diagram of Fig. 5-21 best represent (a) F1 and (b) F2. What is the net-force component along (c) the x axis and (d)the y axis? Into which quadrants do (e) the net-force vector and (f) the split's acceleration vector point?



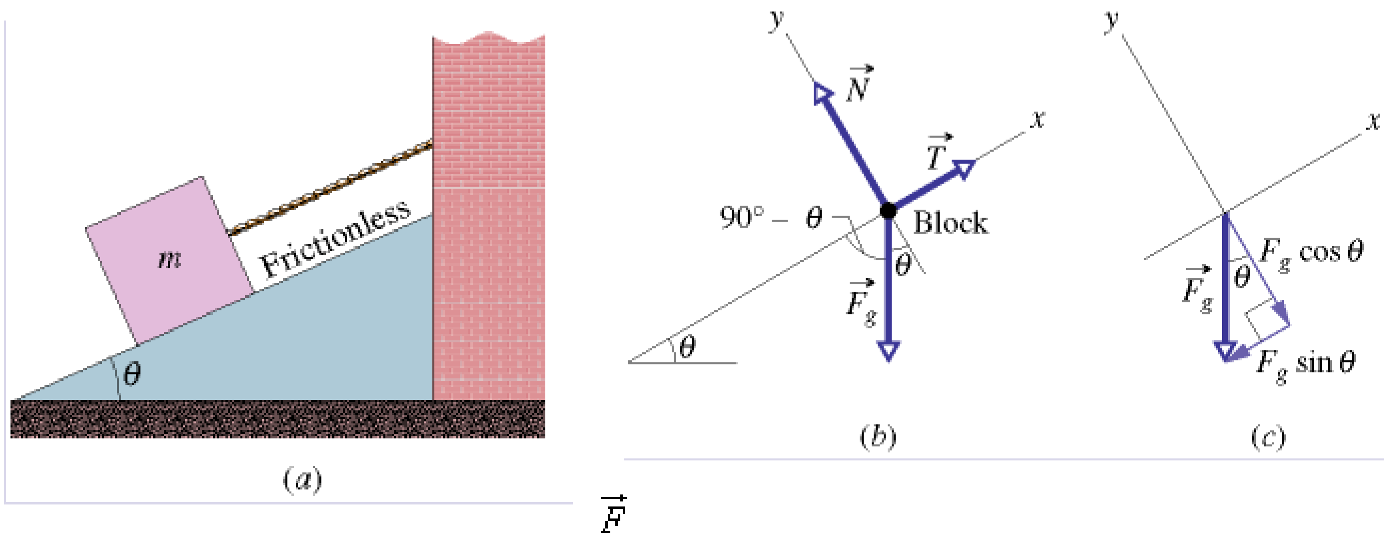
At time t = 0, a single force of constant magnitude begins to act on a rock that is moving along an x axis through deep space. The rock continues to move along that axis. (a) For time t > 0, which of the following is a possible function x(t) for the rock's position: (1) x = 4t - 3, (2) x = -4t2 + 6t - 3, (3) x = 4t2 + 6t - 3? (b) For which function is F directed opposite the rock's initial direction of motion?

- Fig. 5-23 , two forces 1 and 2 act on a “Rocky and Bullwinkle” lunch box as the lunch box slides at constant velocity over a frictionless lunchroom floor. We are to decrease the angle q of F1 without changing the magnitude of F1. To keep the lunch box sliding at constant velocity, should we increase, decrease, or maintain the magnitude of F2?

-



In Fig., a cord holds stationary a block of mass m = 15 kg, on a frictionless plane that is inclined at angle $\theta = 27°$.

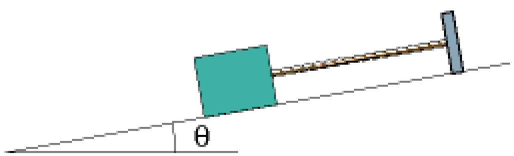


(a) What are the magnitudes of the force $\vec{T}$ on the block from the cord and the normal force $\vec{N}$ on the block from the plane?

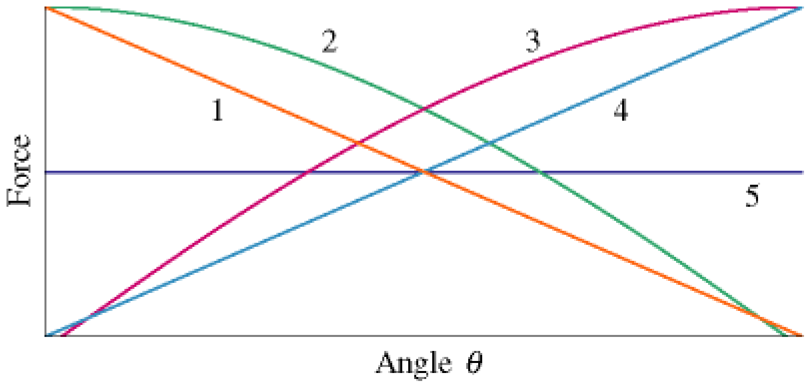
(b) We now cut the cord. As the block then slides down the inclined plane, does it accelerate? If so, what is its acceleration?

In Fig. 5-29a , a block is attached by a rope to a bar that is itself rigidly attached to a ramp. Determine whether the magnitudes of the following increase, decrease, or remain the same as the angle q of the ramp is increased from zero: (a) the component of the gravitational force g on the block that is along the ramp, (b) the tension in the cord, (c) the component of g that is perpendicular to the ramp, and(d) the normalforce on the block from the ramp. (e) Which of the curves in Fig. 5-29b corresponds to each of the quantities in parts (a) through (d)?

- A)raste b)raste c)opada d)opada e)ab 3 cd2



(a)



(b)

A vertical force is applied to a block of mass m that lies on a floor. What happens to the magnitude of the normal force on the block from the floor as magnitude F is increased from zero if force is (a) downward and (b) upward?

Пример. На тело које мирује у тренутку $t_0 = 0$ почне да делује сила сталног прав и смера. Нацртати график зависности силе од времена и наћи промену импулса те у временском интервалу од $t_1 = 5\,\mathrm{s}$ до $t_2 = 10\,\mathrm{s}$, ако:

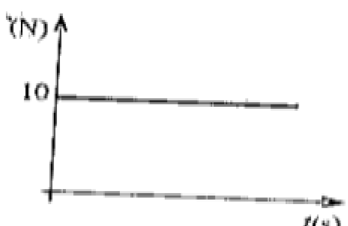
а) сила има константан интензитет $F = 10\,\mathrm{N}$;

б) интензитет силе се мења са временом по закону $F = k \cdot t$, где је $k = 1\,\mathrm{N/}$

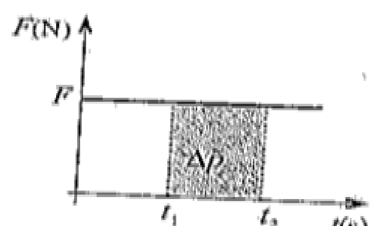
Решење.

а) График зависности силе од времена приказан је на слици 144 (а). Како је интензитет константан, то је:

$$F = \frac{\Delta p}{t_2 - t_1}, \quad \text{односно} \quad \Delta p = F(t_2 - t_1) = 10\,\mathrm{N} \cdot 5\,\mathrm{s} = 50\,\frac{\mathrm{kg \cdot m}}{\mathrm{s}}.$$



(а)



(б)

Слика 144

Nacrtati sile koje djeluju na konja i kola koje vuce i oznacite par akcija i reakcija.Ako je sila kojom konj djeluje na kola ista kao sila kojom kola djeluju na konja zasto kola idu u smjeru vucne sile konja?

Решење. У кретању коња и кола нису битне само силе њиховог [illegible] собног деловања, него и силе којима подлога делује на коња и [illegible] Коњ потискује копитама тло уназад, па на њега подлога делује [illegible] толиком силом напред. Знамо да на свако тело делује подлога неком сило[illegible] трења, па тако и тло делује на кола у супротном смеру од смера [illegible] кретања. Нека је:

F_{12} — сила којом коњ делује на кола;
F_{21} — сила којом кола делују на коња;
F_{13} — сила којом коњ делује на тло;
F_{31} — сила којом тло делује на коња;
F_{23} — сила којом кола делују на подлогу;
F_{32} — сила којом тло делује на кола.

Према II Њутновом закону за кретање коња важи: $m_1 a = F_{31} - F_{21}$.
За кретање кола важи: $m_2 a = F_{12} - F_{32}$.
Сабирањем ових једначина добија се: $(m_1 + m_2)a = F_{31} - F_{21} + F_{12} - F_{32}$.
Како је $F_{12} = F_{21}$, следи: $(m_1 + m_2)a = F_{31} - F_{32}$.

Дакле, убрзање не зависи од међусобног деловања коња и кола; да није [illegible] којима подлога делује на њих, не би ни било кретања. (Сем тога, ако би [illegible] којом тло делује на коња била јача од силе којом тло делује на коња, тј. од [illegible] којом коњ потискује тло, коњ не би могао покренути кола).

Трећи Њутнов закон не важи баш за све интеракције и у свим [illegible] системима [illegible]

In Fig. 5-20a , a constant horizontal force Fap of magnitude 20 N is applied to block A of mass mA = 4.0 kg, which pushes against block B of mass mB = 6.0 kg.

The blocks slide over a frictionless surface, along an x axis. (a) What is the acceleration of the blocks? (b) What is the force F_{AB} on block B from block A (Fig. 5-20c)?

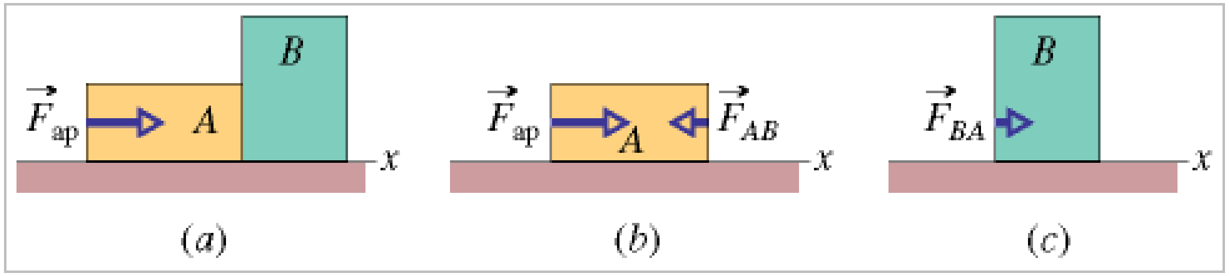
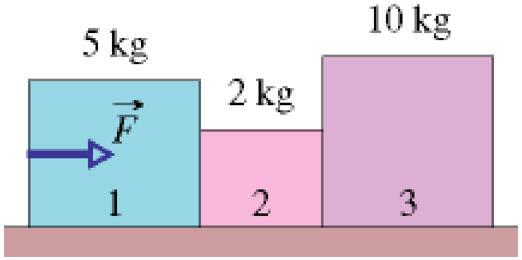


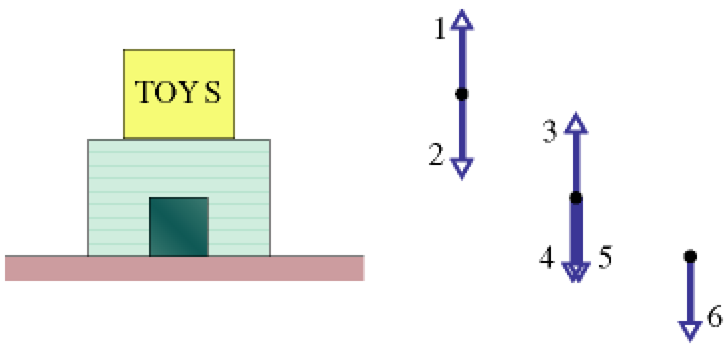
Figure 5-27 shows a group of three blocks being pushed across a frictionless floor by horizontal force .What total mass is accelerated to the right by (a) force F , (b) force F_{21} on block 2 from block 1, and (c) force F_{32} on block 3 from block 2? (d) Rank the blocks according to the magnitudes of their acceleration, greatest first. (e) Rank forces F , F_{21} and F_{32} according to their magnitude, greatest first.

(Warm-up for Problem 31)



In Fig. 5-28a , a toy box is on top of a (heavier) dog house, which sits on a wood floor. In Fig. 5-28b , these objects are represented by dots at the corresponding heights, and six vertical vectors (not to scale) are shown. Which of the vectors best represents (a) the gravitational force on the dog house, (b) the gravitational force on the toy box, (c) the force on the toy box from the dog house, (d) the force on thedog house from the toy box, (e) the force on the dog house from the floor, and (f)the force on the floor from the dog house? (g) Which of the forces are equal in magnitude? Which are (h) greatest and (i) least in magnitude?

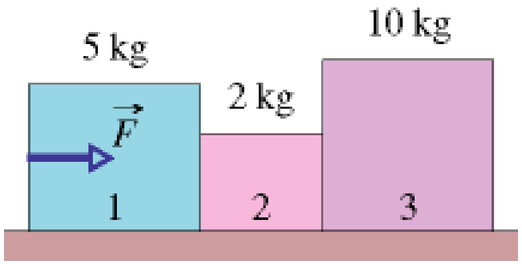
Koje od njih čine par akcija-reakcija?



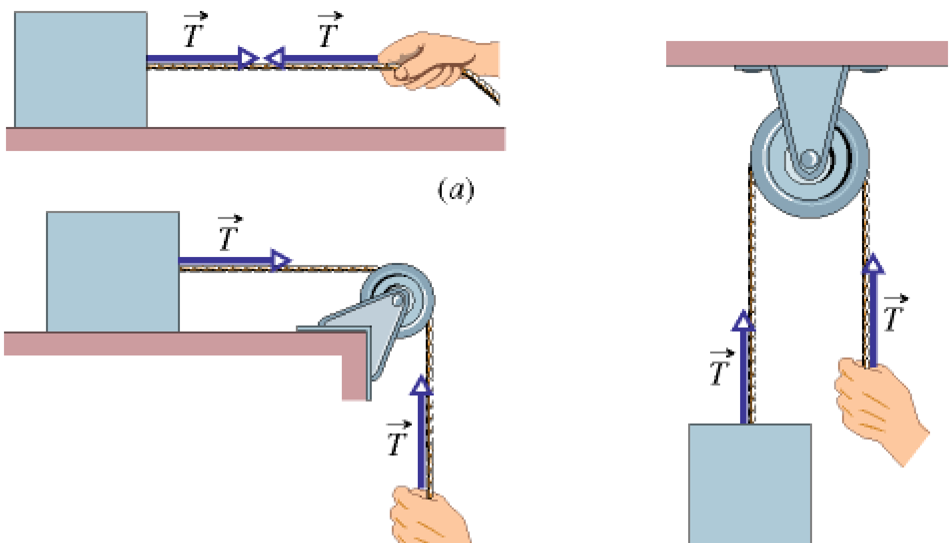
(a) (b)

(a) 4 or 5, choose 4; (b) 2; (c) 1; (d) 4 or 5, choose 5; (e) 3; (f) 6; (g) 3 and 6; 1, 2, and 5; (h) 3 and 6; (i) 1, 2, and 5

Figure 5-27 shows a group of three blocks being pushed across a frictionless floor by horizontal force $\vec{F}$. What total mass is accelerated to the right by (a) force $\vec{F}$, (b) force $\vec{F}_{21}$ on block 2 from block 1, and (c) force $\vec{F}_{32}$ on block 3 from block 2? (d) Rank the blocks according to the magnitudes of their acceleration, greatest first. (e) Rank forces $\vec{F}$, $\vec{F}_{21}$, and $\vec{F}_{32}$ according to their magnitude, greatest first. (Warm-up for Problem 31)

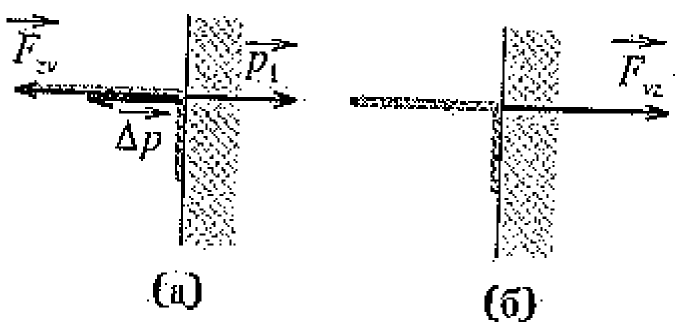


The body that is suspended by a rope in Fig. 5-10c has a weight of 75 N. Is T equal to, greater than, or less than 75 N when the body is moving downward at (a) increasing speed and (b) decreasing speed?



a) manje b) veće

Iz vatrogasnog smrka izlazi mlaz vode stalnom brzinom v I udara u vertikalni zid u blizini.Ako je protok vode iz smrka μ(kg/s), kolikom silom djeluje mlaz na zid. Voda se ne odbija od zida vec se zaustavi i sliva nazid.



Слика 150

Тај вектор усмерен је улево на слици 150 (а). До промене импулса воде дошло је зато што је зид деловао на воду одређеном силом. Правац и смер те силе исти је као правац и смер вектора промене импулса воде – дакле, зид делује на воду силом усмереном улево. Интензитет силе је:

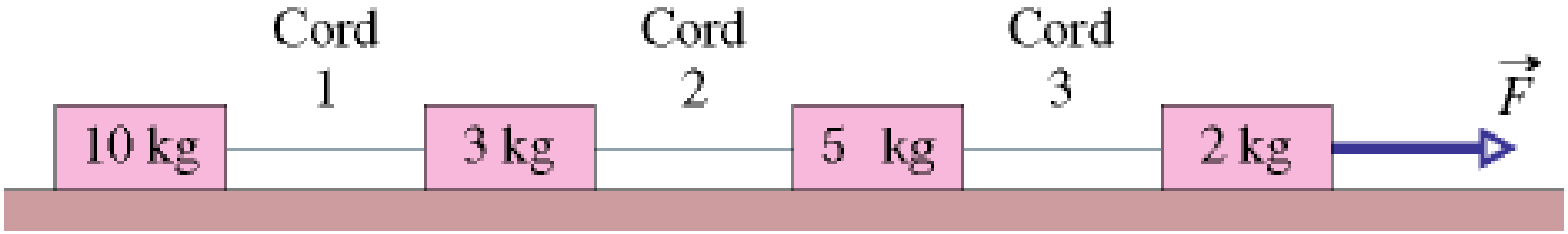
$$F_{zv} = \frac{\Delta p}{\Delta t} = \frac{\Delta m \cdot v}{\Delta t}, \quad \text{односно} \quad F_{zv} = \mu \cdot v.$$

Према закону акције и реакције вода делује на зид исто толиком силом у супротном смеру. Дакле, водени млаз делује на зид хоризонталном силом усмереном удесно (слика б) чији је интензитет:

$$F_{vz} = \mu \cdot v.$$

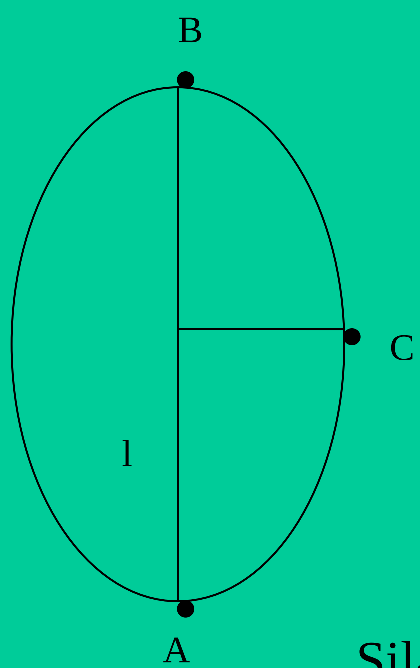
A vertical force is applied to a block of mass m that lies on a floor. What happens to the magnitude of the normal force on the block from the floor as magnitude F is increased from zero if force is (a) downward and (b) upward?

- Figure 5-26 shows a train of four blocks being pulled across a frictionless floor by force .What total mass is accelerated to the right by (a) force , (b) cord 3, and (c) cord 1? (d)Rank the blocks according to their accelerations, greatest first. (e) Rank the cords according to their tension, greatest first.



Kugla okacena o kanap duzine l rotira u vertikalnoj ravni. Odrediti silu zatezanja T u tri tacke date na slici

Sila zatezanja nema konstantnu vrijednost tokom ovog kretanja



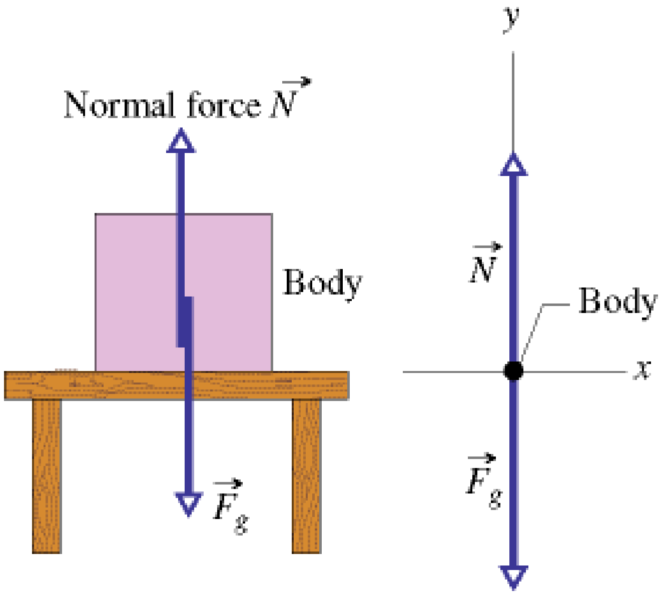
Koje sile u tackama A, B, C daju normalno a koje tangencijalno ubrzanje?

Sajla vuce teret mase m sa ubrzanjem a. Odrediti silu zatezanja.

Sila zatezanja raste sa povecanjem ubrzanja do maksimalne vrijednosti(odredjene elasticnim osobinama sajle), a zatim se sajla prekida.

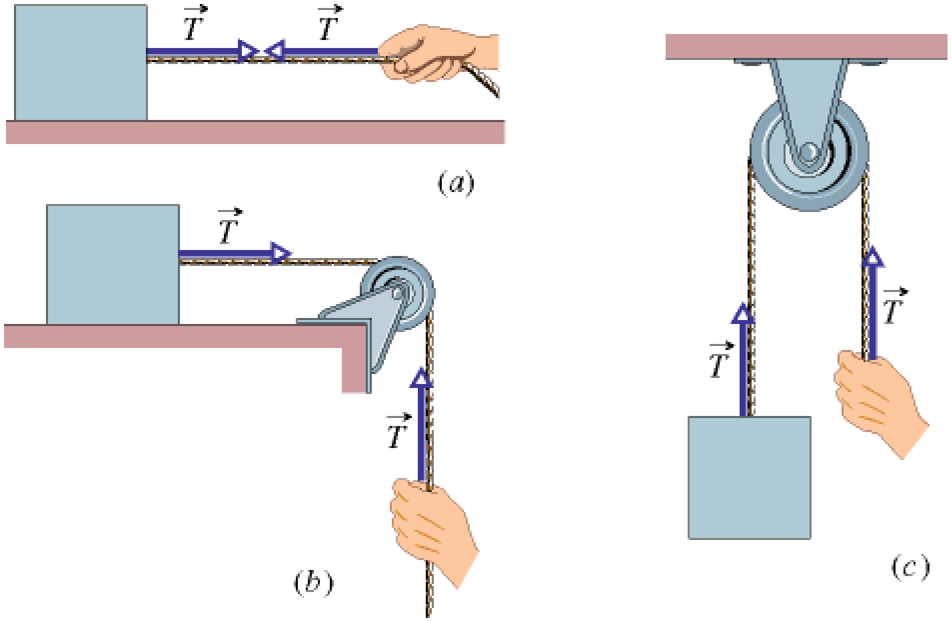
Inercijalne sile

In Fig. 5-8 , is the magnitude of the normal force greater than, less than, or equal to mg if the body and table are in an elevator that is moving upward (a) at constant speed and (b) at increasing speed?



(a) (b)

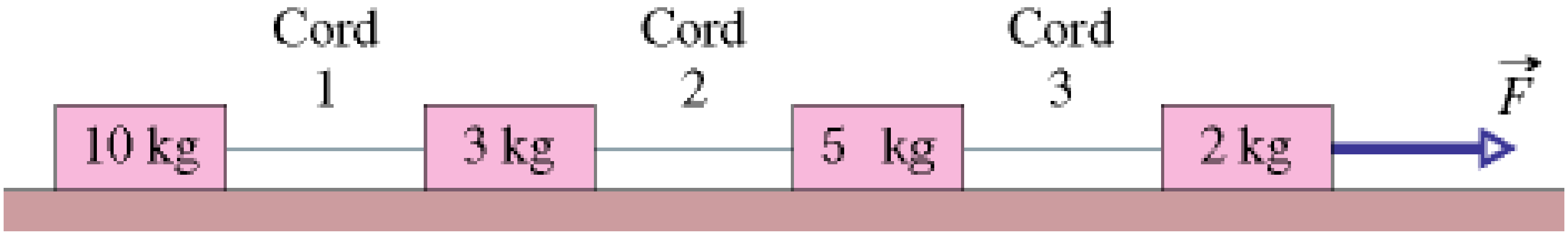
The body that is suspended by a rope in Fig. 5-10c has a weight of 75 N. Is T equal to, greater than, or less than 75 N when the body is moving downward at (a) increasing speed and (b) decreasing speed?



a) manje b) veće

Zasto se pri naglom trzaju (sila F impulsivna) kida nit 1 a pri laganom povecanju sile F kida nit 3?. Prije odgovora na ovo pitanje podsjetiti se dolje uradjenog zadatka.

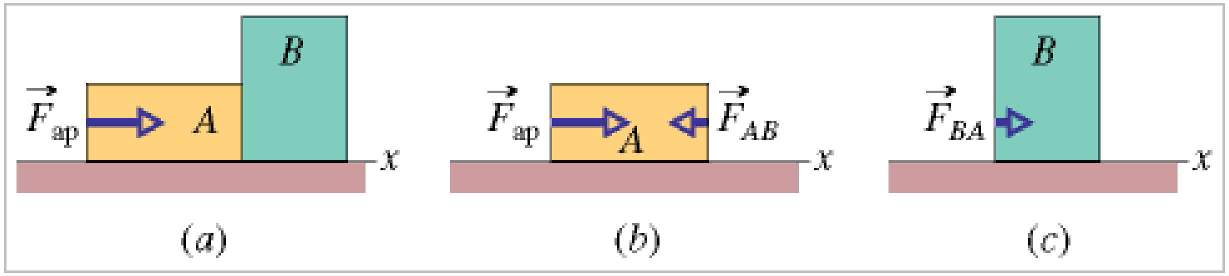
- Figure 5-26 shows a train of four blocks being pulled across a frictionless floor by force .What total mass is accelerated to the right by (a) force , (b) cord 3, and (c) cord 1? (d)Rank the blocks according to their accelerations, greatest first. (e) Rank the cords according to their tension, greatest first.



Sila zatezanja T3 je najveca a sila T1 najmanja sila zatezanja. Pri naglom trzaju ubrzanje je veliko pa razlika izmedju inercijalne sile i T1 je veca nego razlika inercijalne i T3. U drugom slucaju sila F polagano raste inercijalna je zanemarljiva Dok sila T3 prati rast F i posto je najveca prije ce narasti do maximuma.

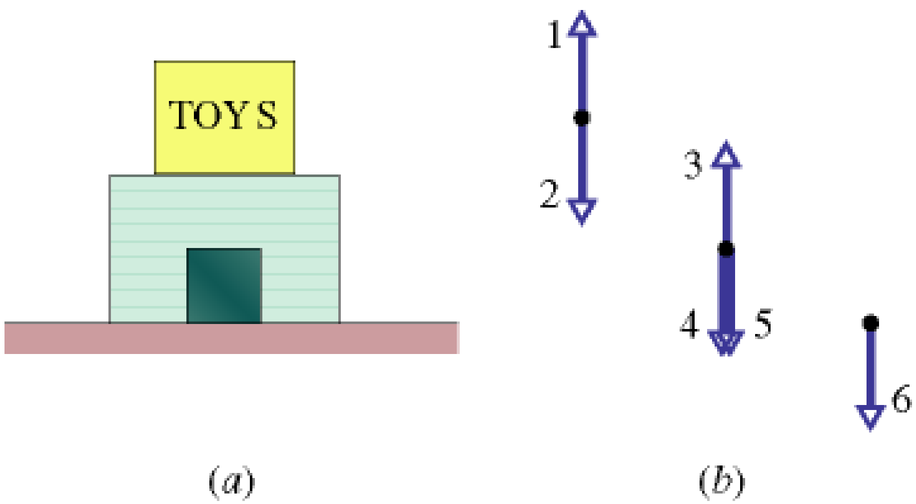
In Fig. 5-20a , a constant horizontal force Fap of magnitude 20 N is applied to block A of mass mA = 4.0 kg, which pushes against block B of mass mB = 6.0 kg.

The blocks slide over a frictionless surface, along an x axis. (a) What is the acceleration of the blocks? (b) What is the force F_{AB} on block B from block A (Fig. 5-20c)?



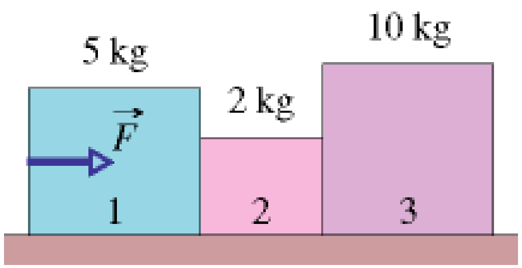
In Fig. 5-28a , a toy box is on top of a (heavier) dog house, which sits on a wood floor. In Fig. 5-28b , these objects are represented by dots at the corresponding heights, and six vertical vectors (not to scale) are shown. Which of the vectors best represents (a) the gravitational force on the dog house, (b) the gravitational force on the toy box, (c) the force on the toy box from the dog house, (d) the force on thedog house from the toy box, (e) the force on the dog house from the floor, and (f)the force on the floor from the dog house? (g) Which of the forces are equal inmagnitude? Which are (h) greatest and (i) least in magnitude?

- Koje od njih čine par akcija-reakcija?

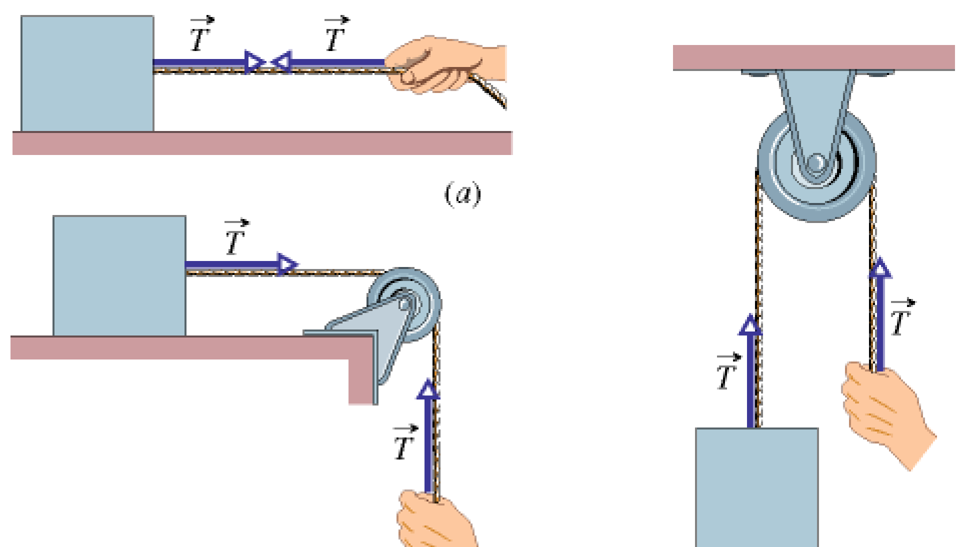


(a) 4 or 5, choose 4; (b) 2; (c) 1; (d) 4 or 5, choose 5; (e) 3; (f) 6; (g) 3 and 6; 1, 2, and 5; (h) 3 and 6; (i) 1, 2, and 5

Figure 5-27 shows a group of three blocks being pushed across a frictionless floor by horizontal force . What total mass is accelerated to the right by (a) force $\vec{F}$, (b) force $\vec{F}_{21}$ on block 2 from block 1, and (c) force $\vec{F}_{32}$ on block 3 from block 2? (d) Rank the blocks according to the magnitudes of their acceleration, greatest first. (e) Rank forces $\vec{F}$, $\vec{F}_{21}$, and $\vec{F}_{32}$ according to their magnitude, greatest first. (Warm-up for Problem 31)



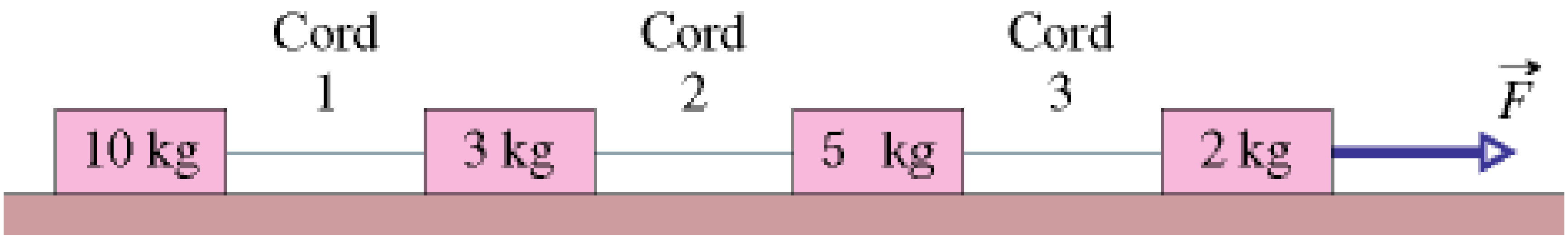
The body that is suspended by a rope in Fig. 5-10c has a weight of 75 N. Is T equal to, greater than, or less than 75 N when the body is moving downward at (a) increasing speed and (b) decreasing speed?



a) manje b) veće

A vertical force is applied to a block of mass m that lies on a floor. What happens to the magnitude of the normal force on the block from the floor as magnitude F is increased from zero if force is (a) downward and (b) upward?

- Figure 5-26 shows a train of four blocks being pulled across a frictionless floor by force .What total mass is accelerated to the right by (a) force , (b) cord 3, and (c) cord 1? (d)Rank the blocks according to their accelerations, greatest first. (e) Rank the cords according to their tension, greatest first.



In three experiments, three different horizontal forces are applied to the same block lying on the same countertop. The force magnitudes are $F1 = 12$ N, $F2 = 8$ N, and $F3 = 4$ N. In each experiment, the block remains stationary in spite of the applied force. Rank the forces according to (a) the magnitude fs of the static frictional force on the block from the countertop and (b) the maximum value fs,max of that force,greatest first.

Pr.3 In Fig. , horizontal force F1 of magnitude 10 N is applied to a box on a floor, but the box does not slide. Then, as the magnitude of vertical force F2 is increased from zero, do the following quantities increase, decrease, or stay the same: (a) the magnitude of the frictional force s on the box; (b) the magnitude of the normal force on the box from the floor; (c) the maximum value fs,max of the magnitude of the static frictional force on the box? (d) Does the box eventually slide?

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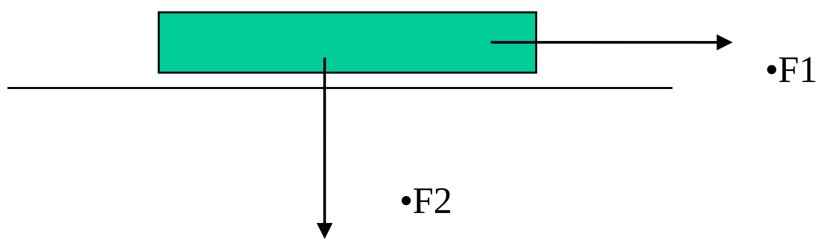
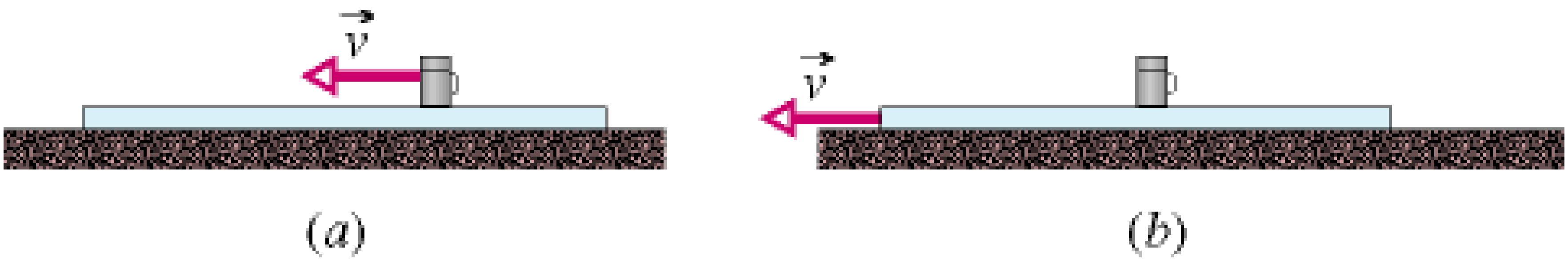


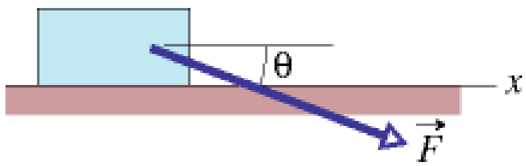
Resenja a)isto b)raste c)raste e)ne

In Fig. 6-13a , a “Batman” thermos is sent sliding leftward across a long plastic tray.What are the directions of the kinetic frictional forces on (a) the thermos and (b) the tray from each other? (c) Does the former increase or decrease the speed of the thermos relative to the floor? In Fig. 6-13b , the tray is now sent sliding leftward beneath the thermos. What now are the

directions of the kinetic frictional forces on (d) the thermos and (e) the tray from each other? (f) Does the former increase or decrease the speed of the thermos relative to the floor? (g) Do kinetic frictional forces always slow objects?



Pr 1.In Fig., 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_x; (b) f_s; (c) N; (d) $f_{s,\max}$? (e) If, instead, the box is sliding and θ is increased, does the magnitude of the frictional force on the box increase, decrease, or remain the same?



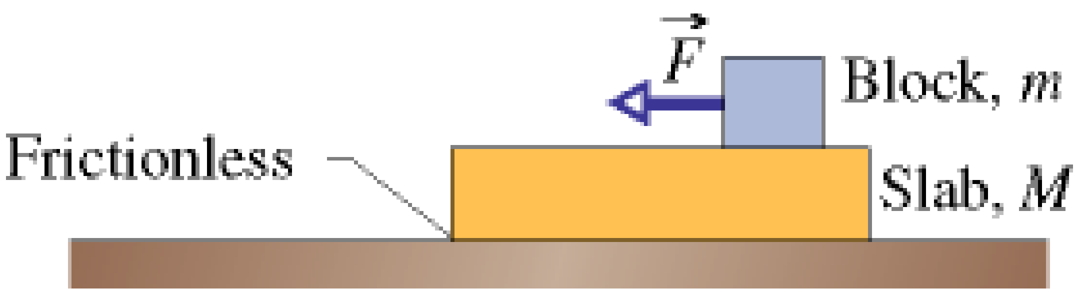
$\vec{F}$

Rjesenja a)opada b)opada c)raste d) raste e)raste

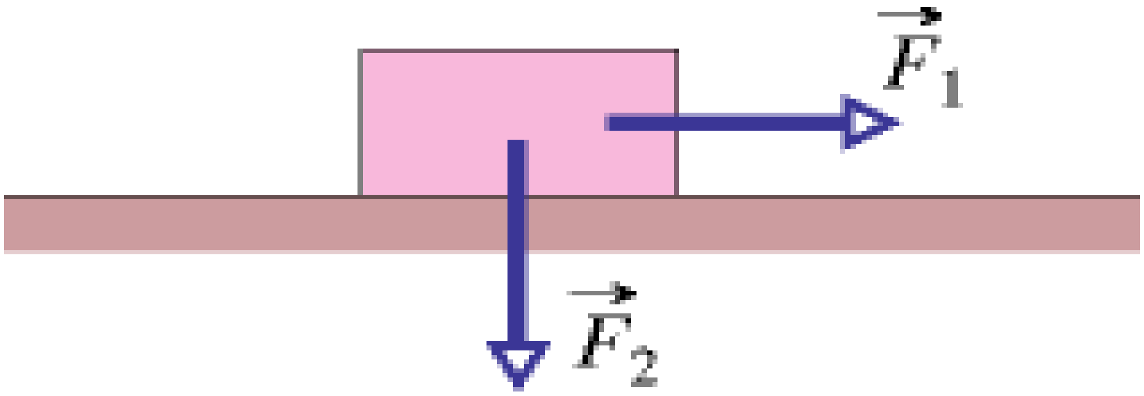
Pr.2 If you press an apple crate against a wall so hard that the crate cannot slide down the wall, what is the direction of (a) the static frictional force s on the crate from the wall and (b) the normal force on the crate from the wall? If you increase your push, what happens to (c) fs, (d) N, and (e) fs,max?

Figure shows a block of mass *m* on a slab of mass *M* and a horizontal force applied to the block, causing it to slide over the slab. There is friction between the block and the slab (but not between the slab and the floor). (a) What mass determines the magnitude of the frictional force between the block and the slab? (b) At the block–slab interface, is the magnitude of the frictional force acting on the block greater than, less than, or equal to that of the frictional force acting on the slab? (c) What are the directions of those two frictional forces? (d) If we write Newton's second law for the slab, what mass should be multiplied by the acceleration of the slab?

a)m b)iste c)suprotne IIINj zd)M



In Fig. 6-14 , horizontal force F 1 of magnitude 10 N is applied to a box on a floor,but the box does not slide. Then, as the magnitude of vertical force F2 is increased from zero, do the following quantities increase, decrease, or stay the same: (a) the magnitude of the frictional force fs on the box; (b) the magnitude of the normal force on the box from the floor; (c) the maximum value fs,max of the magnitude of the static frictional force on the box? (d) Does the box eventually slide?



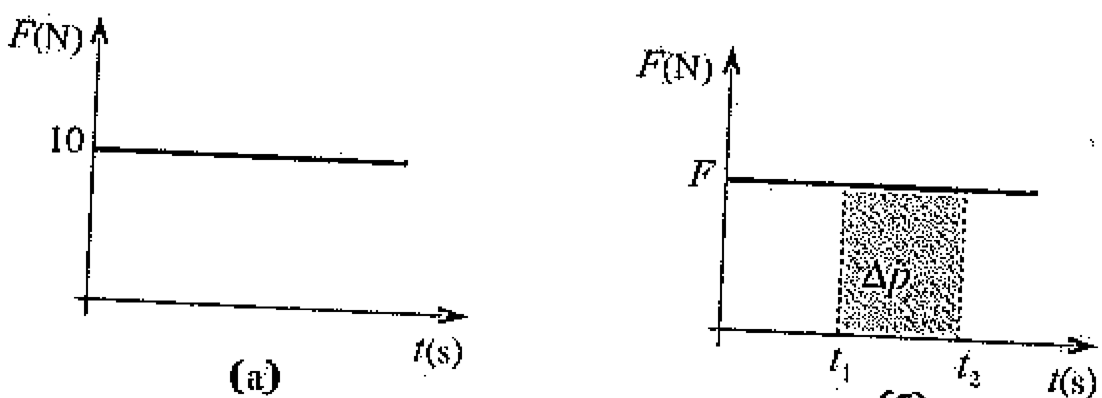
Пример. На тело које мирује у тренутку $t_0 = 0$ почне да делује сила сталног правца и смера. Нацртати график зависности силе од времена и наћи промену импулса тела у временском интервалу од $t_1 = 5\,\mathrm{s}$ до $t_2 = 10\,\mathrm{s}$, ако:

а) сила има константан интензитет $F = 10\,\mathrm{N}$;

б) интензитет силе се мења са временом по закону $F = k \cdot t$, где је $k = 1\,\mathrm{N/s}$.

а) График зависности силе од времена приказан је на слици 144 (а). Како је интензитет силе константан, то је:

$$F = \frac{\Delta p}{t_2 - t_1}, \quad \text{односно} \quad \Delta p = F(t_2 - t_1) = 10\,\mathrm{N} \cdot 5\,\mathrm{s} = 50\,\frac{\mathrm{kg \cdot m}}{\mathrm{s}}.$$



Слика 144

Приметимо да је *промена импулса једнака осенченој површини на графику* (слика б).

In Fig. 5-19*a* , a passenger of mass m = 72.2 kg stands on a platform scale in an elevator cab
We are concerned with the scale readings when the cab is stationary, and when it is moving up or down.

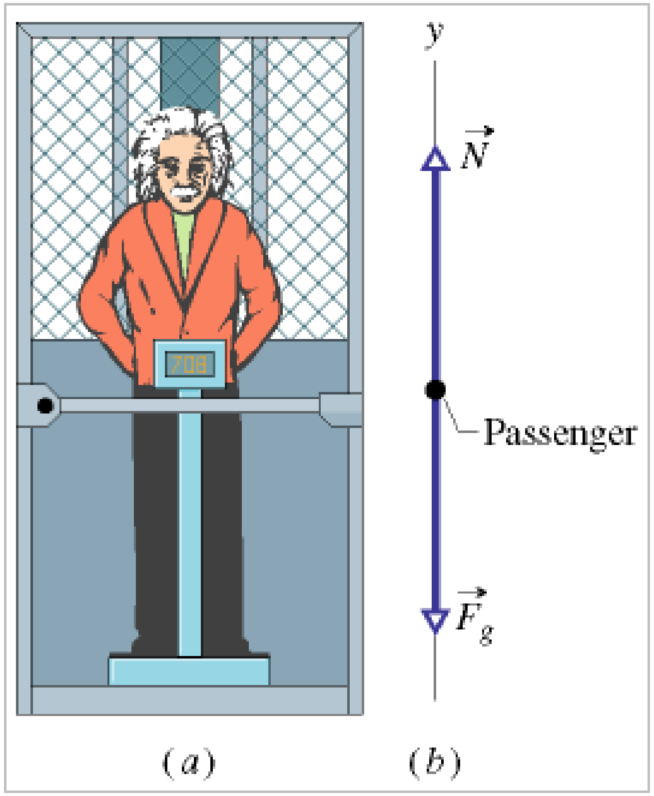
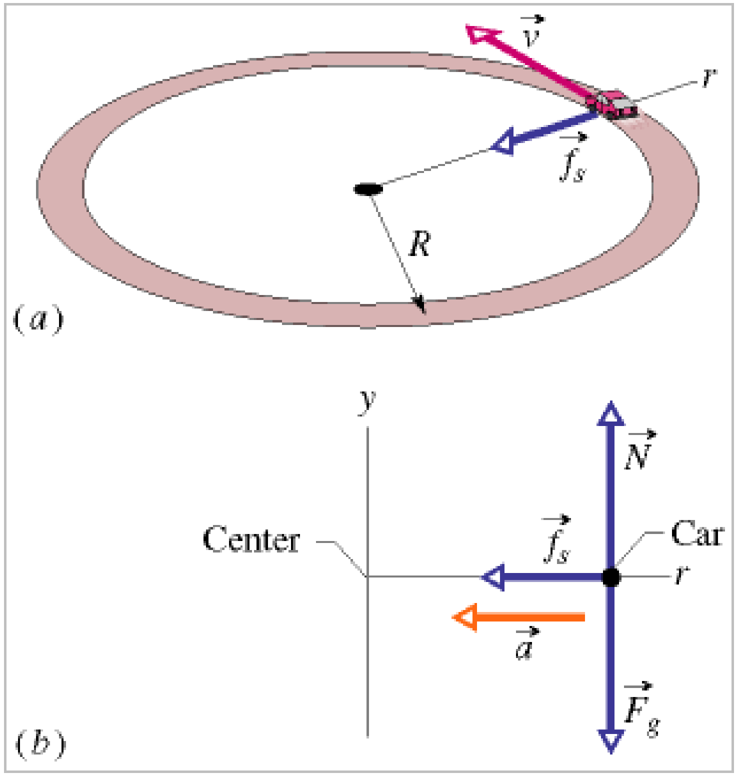


Fig. 5-19 Sample Problem 5-8 . (*a*) A passenger stands on a platform scale that indicates his weight or apparent weight. (*b*) The free-body diagram for the passenger, showing the normal force $\vec{N}$ on him from the scale and the gravitational force $\vec{F}_g$.

(a) Find a general solution for the scale reading, whatever the vertical motion of the cab.
(b) What does the scale read if the cab is stationary or moving upward at a constant 0.50 m/s?
(c) What does the scale read if the cab accelerates upward at 3.20 m/s^2 and downward at 3.20 m/s^2?

(d) During the upward acceleration in part (c), what is the magnitude F_{net} of the net force on the passenger, and what is the magnitude $a_{p,cab}$ of the passenger's acceleration as measured in the frame of the cab? Does $F_{net} = ma_{p,cab}$?

In this sample problem what does the scale read if the elevator cable breaks, so that the cab f freely; that is, what is the apparent weight of the passenger in free fall?



$\vec{v}$
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(b)