Physics 2048

Midterm Review

Midterm Exam Organization

- Topics covered: Kinematics in two dimensions, Force and Motion, Dynamics I: Motion Along a Line.
  - Part 1 – Multiple choice questions (7 questions, 4 pts. each)
  - Part 2 – Short Answers (6 questions, 6 pts. each)
  - Part 3 – Multistep Calculations (3 questions, 12 pts. Each.)

Rules

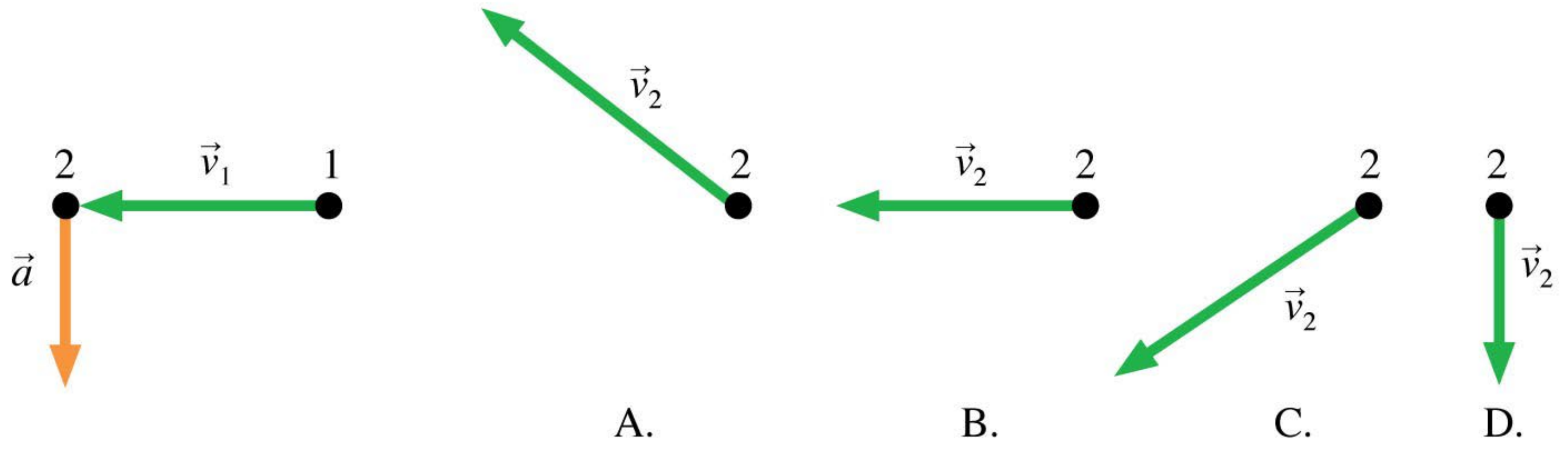
- Please come promptly at 6 PM to take your test.
- Bring only your calculator, pencil, or pen and eraser.
- No cell phones allowed to replace for calculators.
- If you don't have a calculator, please borrow it from your friends or get it from IT help desk before 5 PM.
- Formula sheets will be provided, so no need to bring your formula sheet.
- Please go to restroom and also finish your eating etc before coming to the test. You are not allowed to step out for using restroom or get use of water fountain during the exam unless there is an emergency.

Midterm Exam – Key concepts

- Understand the kinematic equations!
- Velocity and acceleration (linear and angular)
  - $v = \frac{ds}{dt}$, $a = \frac{dv}{dt}$, $\omega = \frac{d\theta}{dt}$, $\alpha = \frac{d\omega}{dt}$
- Newton's laws of motion (F=ma)
- Free body diagrams
- Friction
  - $0 \leq f_s \leq \mu_s N$
  - $f_k = \mu_k N$
- Angular Motion
  - $\omega = \frac{v}{r}, a_c = \frac{v^2}{r}, T = \frac{2\pi r}{v}, \alpha_\theta = \frac{a_t}{r}$

QuickCheck 4.1

A particle undergoes acceleration $\vec{a}$ while moving from point 1 to point 2. Which of the choices shows the velocity vector $\vec{v}_2$ as the object moves away from point 2?



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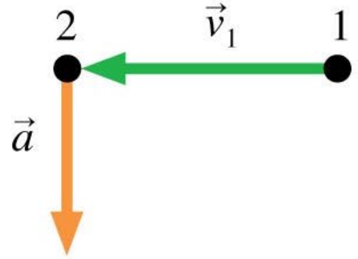
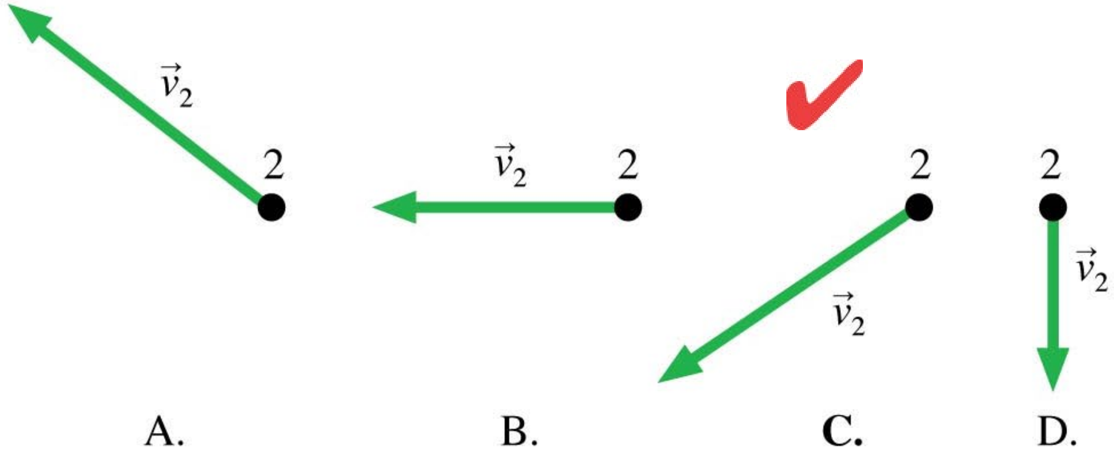
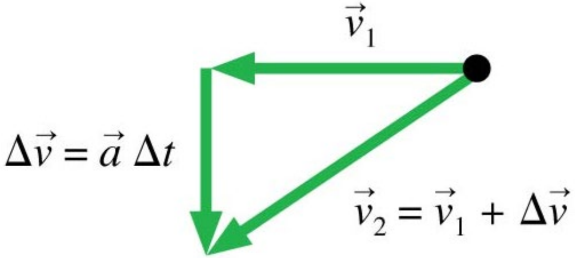
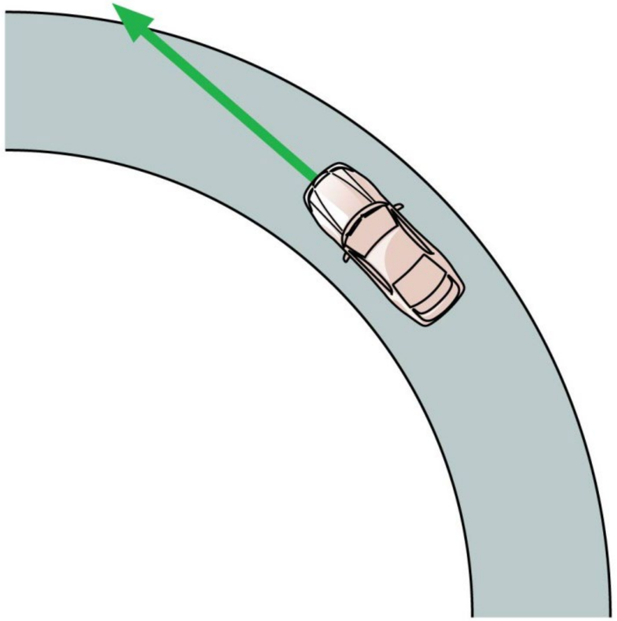






QuickCheck 4.2

A car is traveling around a curve at a steady 45 mph. Is the car accelerating?

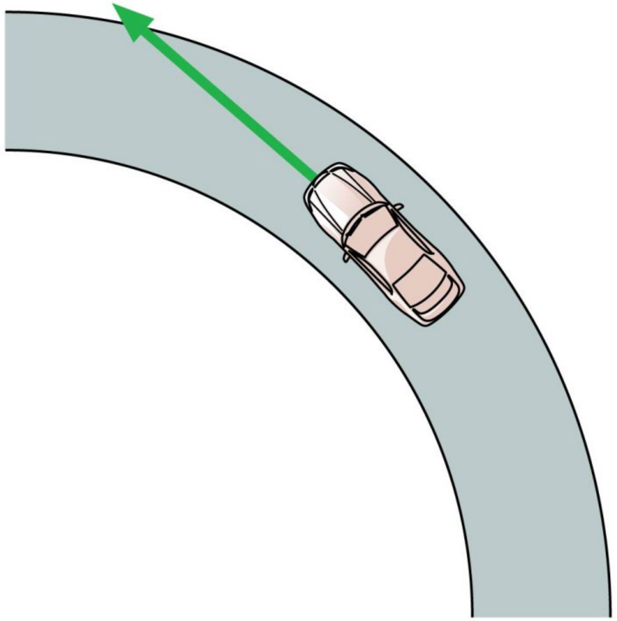


A. Yes

B. No

QuickCheck 4.2

A car is traveling around a curve at a steady 45 mph. Is the car accelerating?



✔ **A. Yes**

B. No

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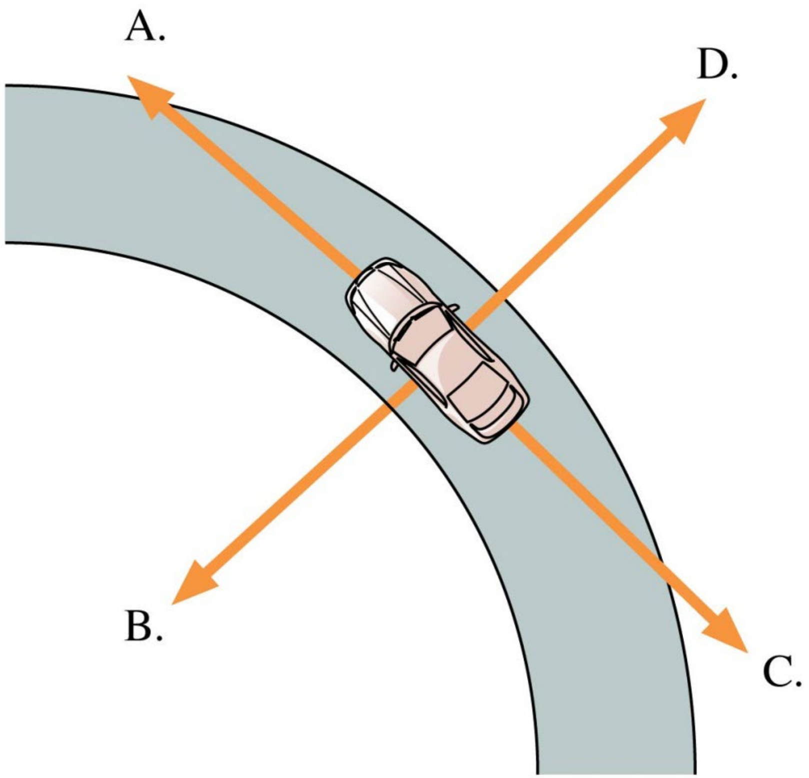
QuickCheck 4.3

A car is traveling around a curve at a steady 45 mph. Which vector shows the direction of the car's acceleration?



E. The acceleration is zero.

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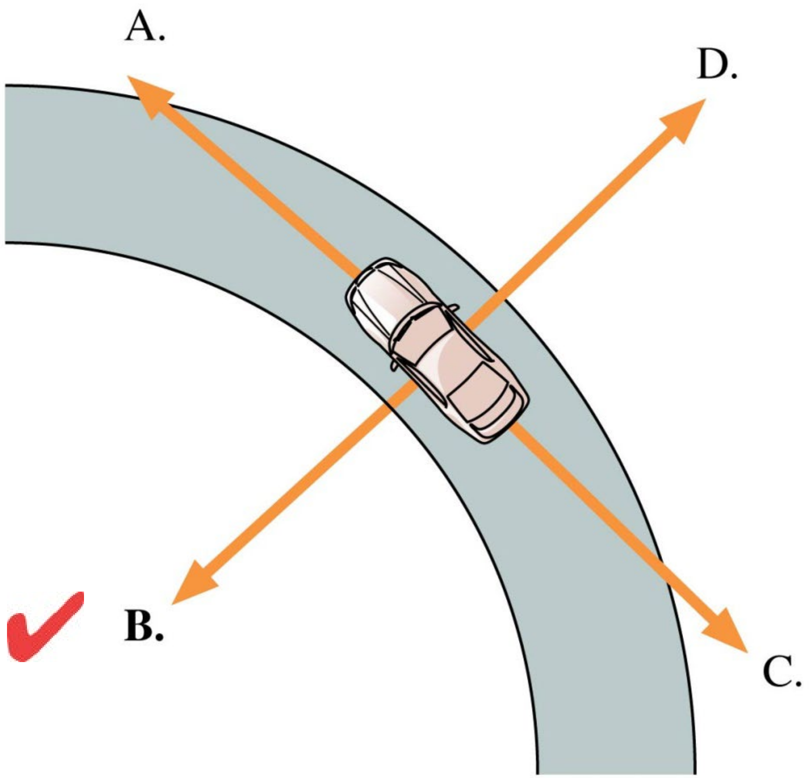
QuickCheck 4.3

A car is traveling around a curve at a steady 45 mph. Which vector shows the direction of the car's acceleration?



E. The acceleration is zero.

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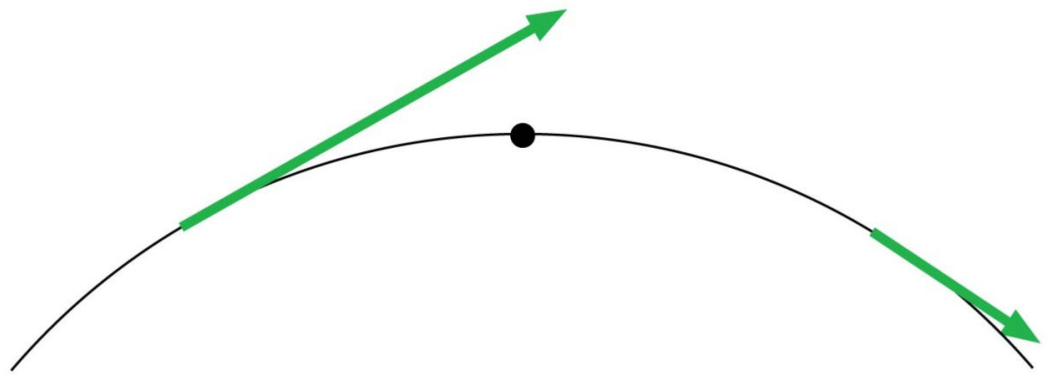
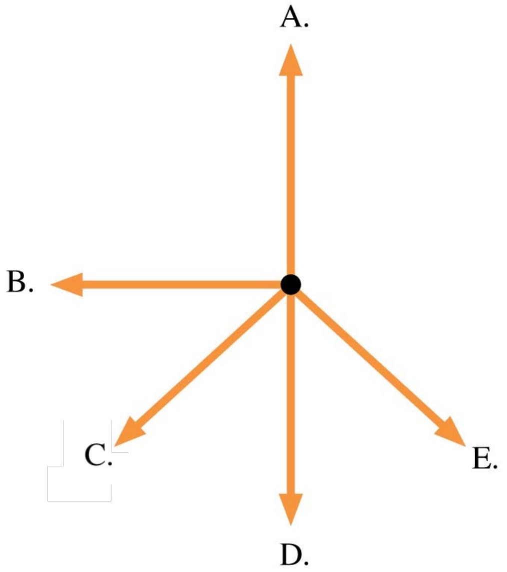
QuickCheck 4.4

A car is slowing down as it drives over a circular hill.



Which of these is the acceleration vector at the highest point?



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QuickCheck 4.4

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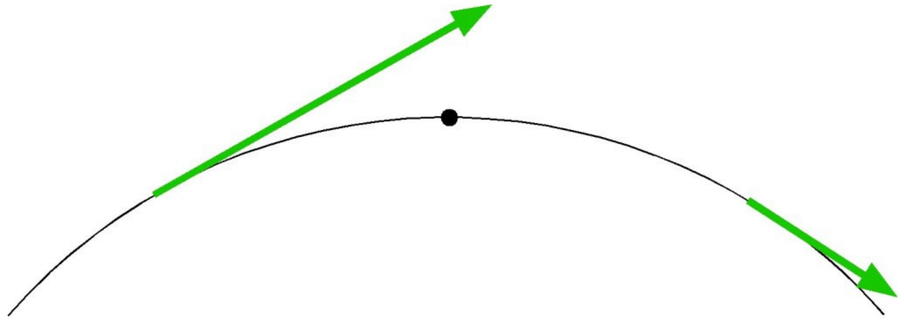

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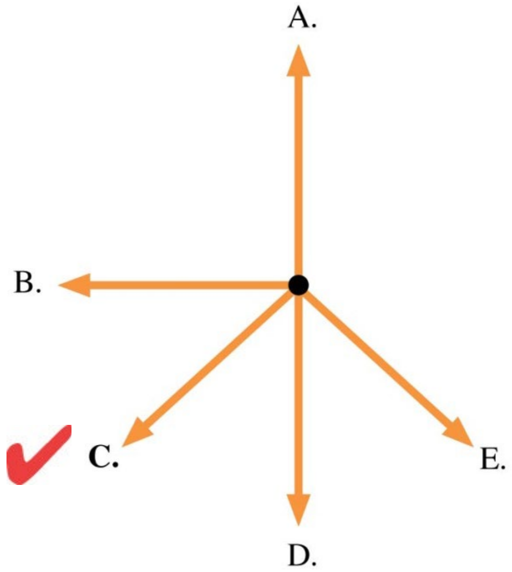

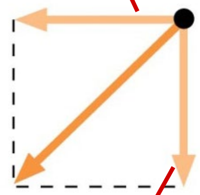

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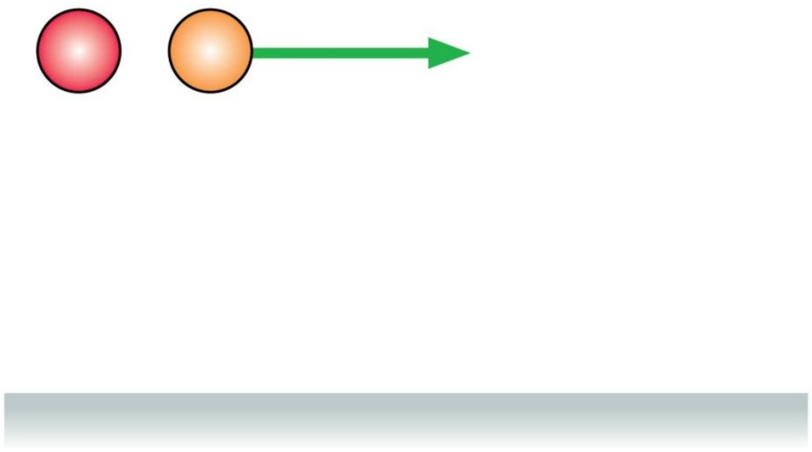
QuickCheck 4.5

A heavy red ball is released from rest 2.0 m above a flat, horizontal surface. At exactly the same instant, a yellow ball with the same mass is fired horizontally at 3.0 m/s. Which ball hits the ground first?



A. The red ball hits first.

B. The yellow ball hits first.

C. They hit at the same time.

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QuickCheck 4.5

A heavy red ball is released from rest 2.0 m above a flat, horizontal surface. At exactly the same instant, a yellow ball with the same mass is fired horizontally at 3.0 m/s. Which ball hits the ground first?

A. The red ball hits first.

B. The yellow ball hits first.

✔ **C. They hit at the same time.**

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QuickCheck 4.6

A 100 g ball rolls off a table and lands 2.0 m from the base of the table. A 200 g ball rolls off the same table with the same speed. It lands at distance

A. 1.0 m.
B. Between 1 m and 2 m.
C. 2.0 m.
D. Between 2 m and 4 m.
E. 4.0 m.

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QuickCheck 4.6

A 100 g ball rolls off a table and lands 2.0 m from the base of the table. A 200 g ball rolls off the same table with the same speed. It lands at distance

A. 1.0 m.
B. Between 1 m and 2 m.
✔ **C. 2.0 m.**
D. Between 2 m and 4 m.
E. 4.0 m.

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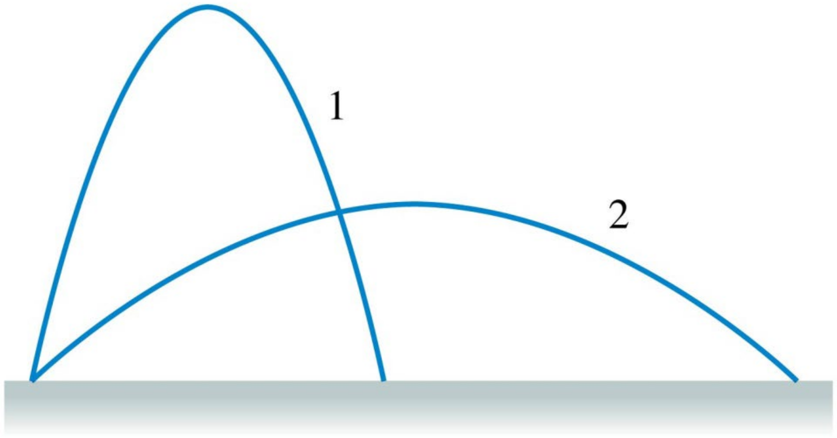
QuickCheck 4.7

Projectiles 1 and 2 are launched over level ground with the same speed but at different angles. Which hits the ground first? Ignore air resistance.



A. Projectile 1 hits first.

B. Projectile 2 hits first.

C. They hit at the same time.

D. There's not enough information to tell.

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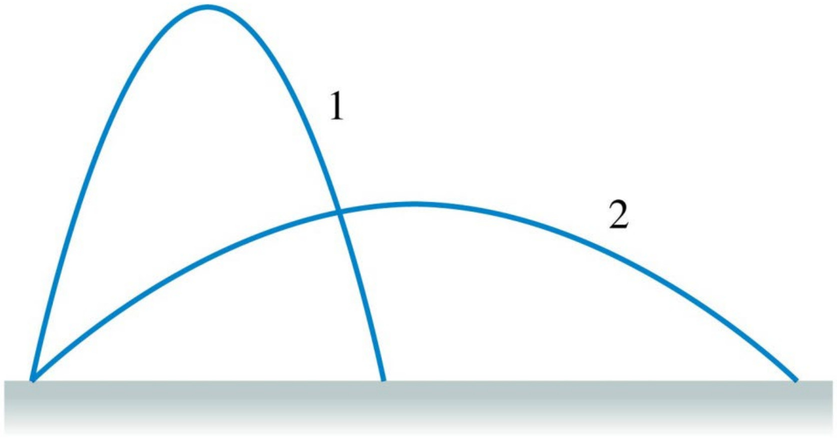
QuickCheck 4.7

Projectiles 1 and 2 are launched over level ground with the same speed but at different angles. Which hits the ground first? Ignore air resistance.



A. Projectile 1 hits first.

✔ **B. Projectile 2 hits first.**

C. They hit at the same time.

D. There's not enough information to tell.

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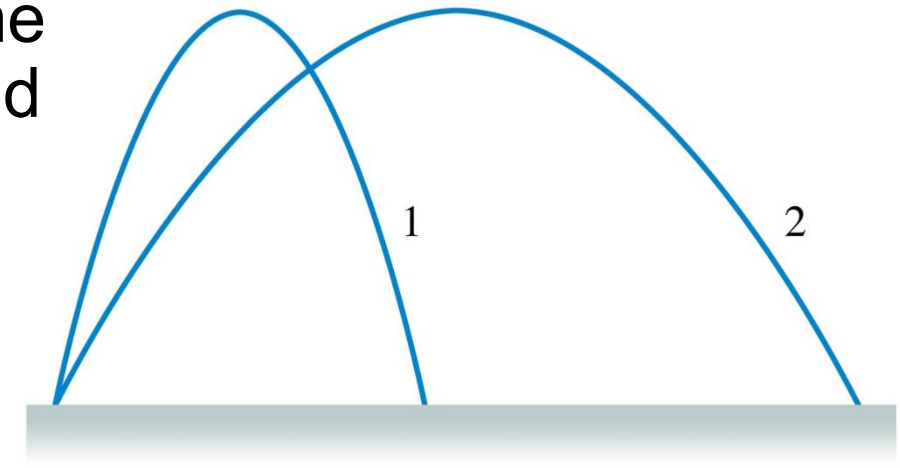
QuickCheck 4.8

Projectiles 1 and 2 are launched over level ground with different speeds. Both reach the same height. Which hits the ground first? Ignore air resistance.



A. Projectile 1 hits first.

B. Projectile 2 hits first.

C. They hit at the same time.

D. There’s not enough information to tell.

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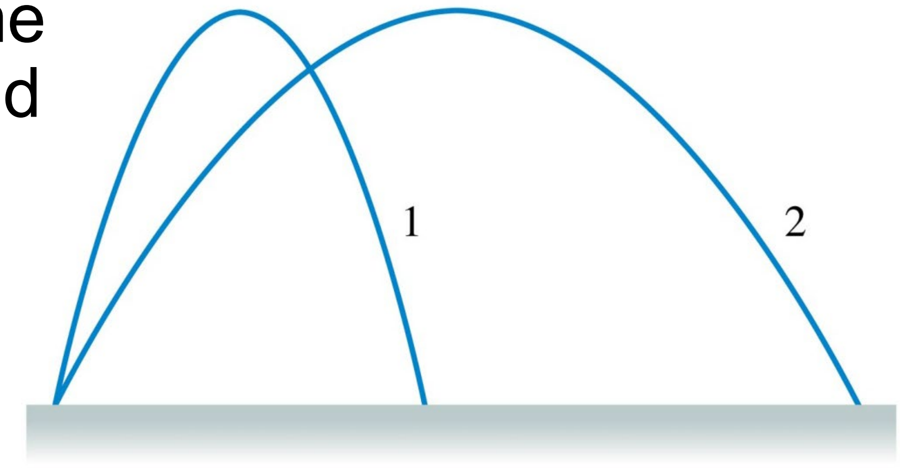
QuickCheck 4.8

Projectiles 1 and 2 are launched over level ground with different speeds. Both reach the same height. Which hits the ground first? Ignore air resistance.



A. Projectile 1 hits first.

B. Projectile 2 hits first.

✔ C. **They hit at the same time.**

D. There’s not enough information to tell.

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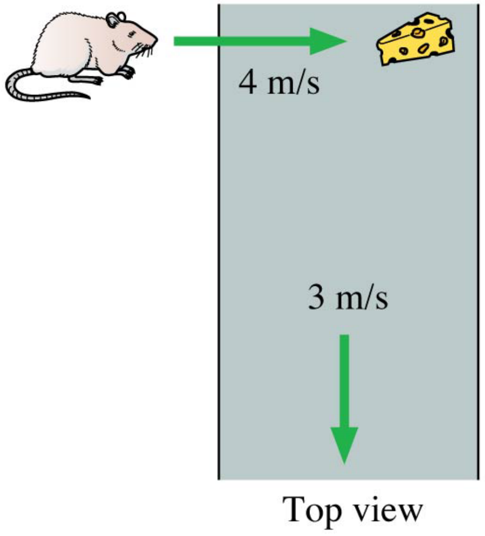
QuickCheck 4.9

A factory conveyor belt rolls at 3 m/s. A mouse sees a piece of cheese directly across the belt and heads straight for the cheese at 4 m/s. What is the mouse's speed relative to the factory floor?



A. 1 m/s
B. 2 m/s
C. 3 m/s
D. 4 m/s
E. 5 m/s

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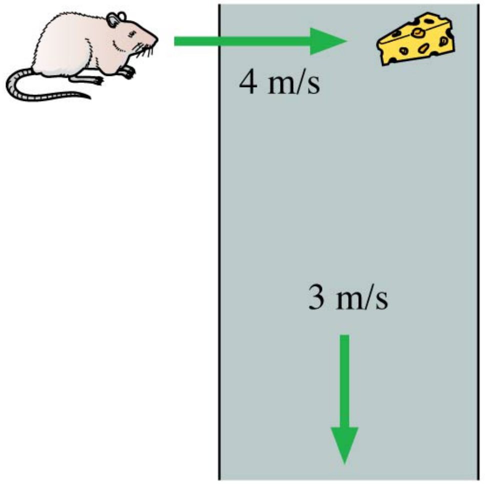
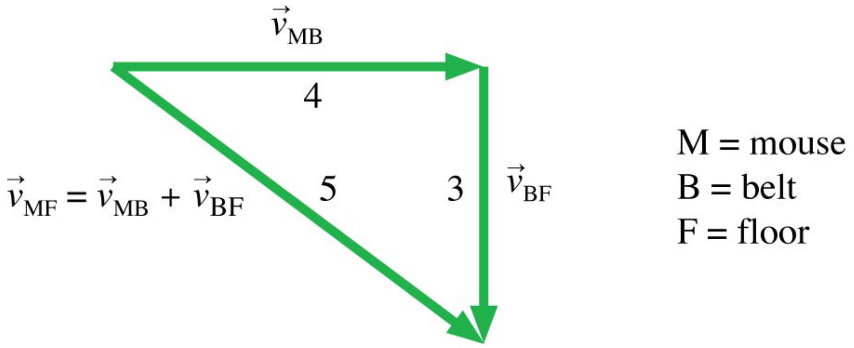
QuickCheck 4.9

A factory conveyor belt rolls at 3 m/s. A mouse sees a piece of cheese directly across the belt and heads straight for the cheese at 4 m/s. What is the mouse's speed relative to the factory floor?

A. 1 m/s
B. 2 m/s
C. 3 m/s
D. 4 m/s
✔ **E. 5 m/s**



Top view



3-4-5 right triangle

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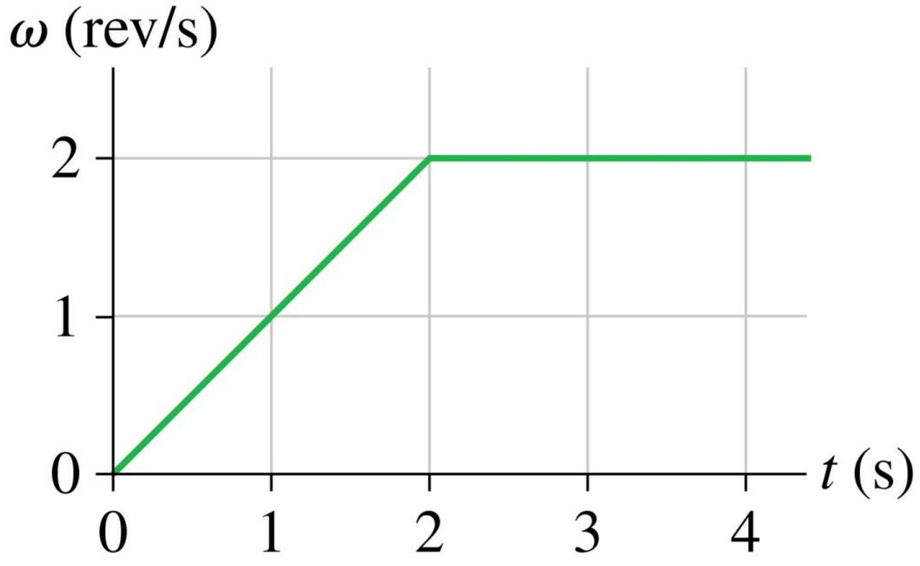
QuickCheck 4.10

This is the angular velocity graph of a wheel. How many revolutions does the wheel make in the first 4 s?



A. 1
B. 2
C. 4
D. 6
E. 8

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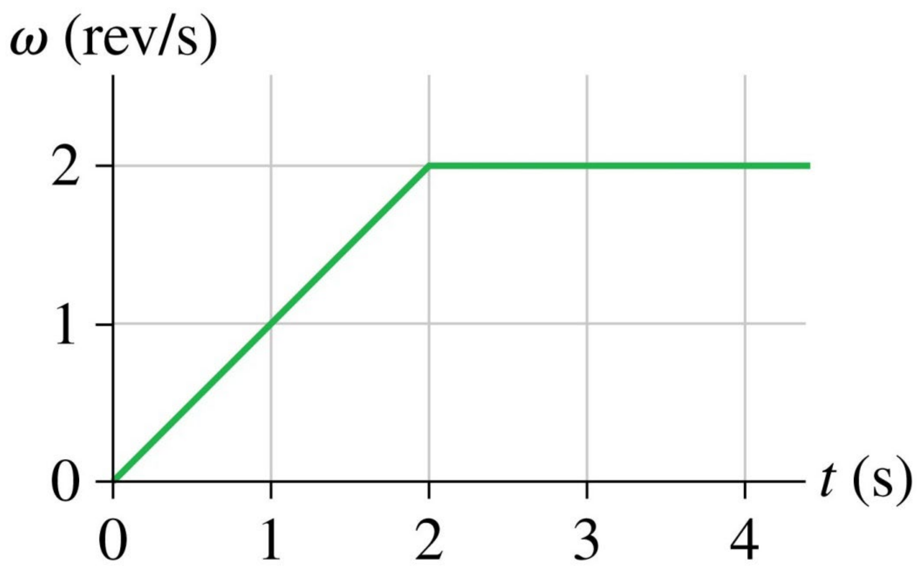
QuickCheck 4.10

This is the angular velocity graph of a wheel. How many revolutions does the wheel make in the first 4 s?



A. 1

B. 2

C. 4

D. 6

E. 8

$\Delta\theta$ = area under the angular velocity curve

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QuickCheck 4.11

A ball rolls around a circular track with an angular velocity of 4π rad/s. What is the period of the motion?

A. $\frac{1}{2}$ s
B. 1 s
C. 2 s
D. $\frac{1}{2\pi}$ s
E. $\frac{1}{4\pi}$ s

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QuickCheck 4.11

A ball rolls around a circular track with an angular velocity of 4π rad/s. What is the period of the motion?

✔ **A.** $\frac{1}{2}$ **s** $T = \frac{2\pi}{\omega}$

B. 1 s

C. 2 s

D. $\frac{1}{2\pi}$ s

E. $\frac{1}{4\pi}$ s

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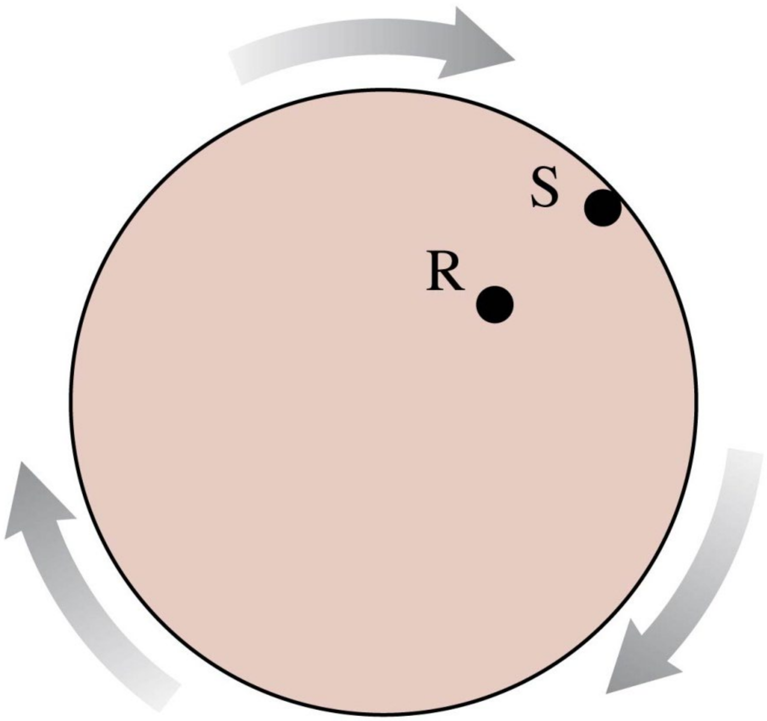
QuickCheck 4.12

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's angular velocity is ______ that of Rasheed.



A. half

B. the same as

C. twice

D. four times

E. We can't say without knowing their radii.

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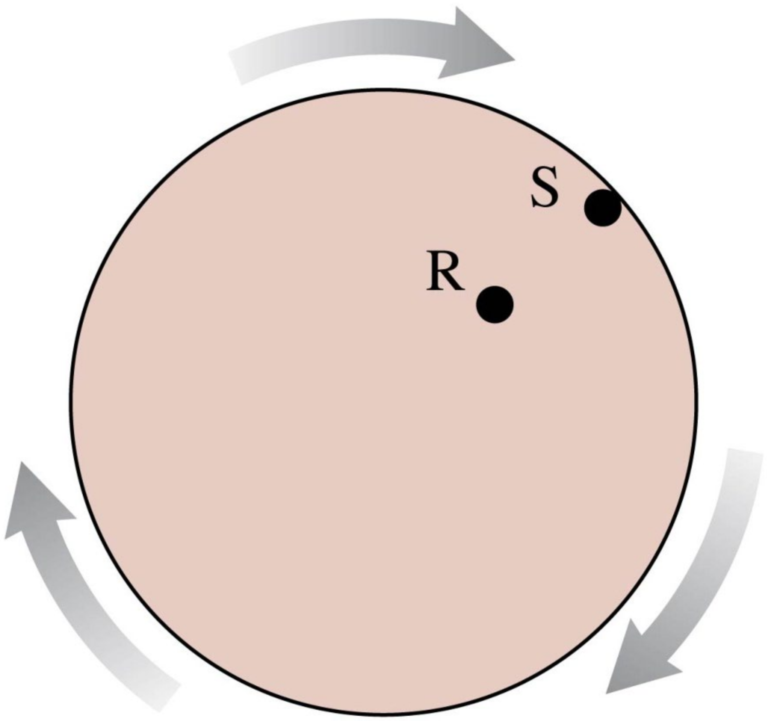
QuickCheck 4.12

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's angular velocity is ______ that of Rasheed.



A. half

✔ **B. the same as**

C. twice

D. four times

E. We can't say without knowing their radii.

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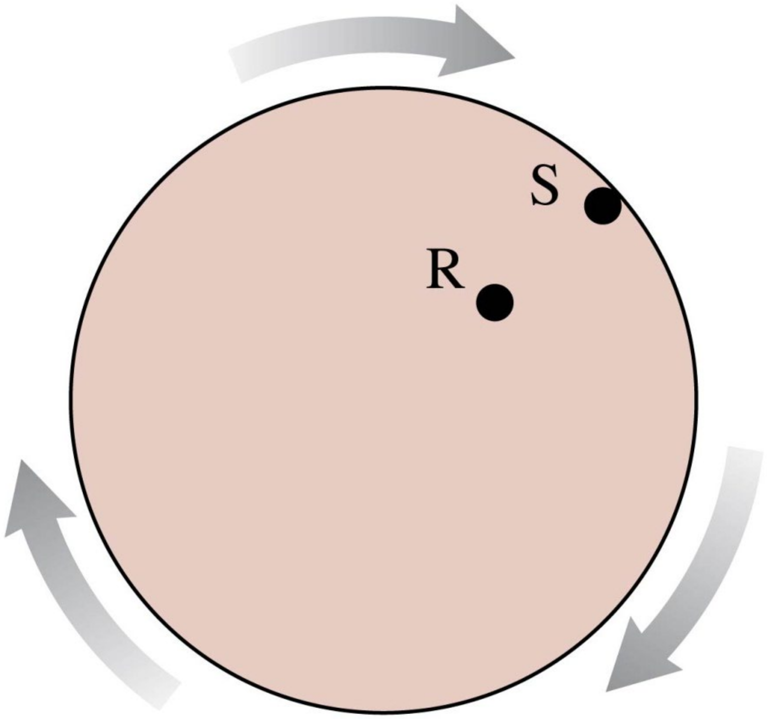
QuickCheck 4.13

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's speed is ______ that of Rasheed.



A. half

B. the same as

C. twice

D. four times

E. We can't say without knowing their radii.

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QuickCheck 4.13

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's speed is _______ that of Rasheed.

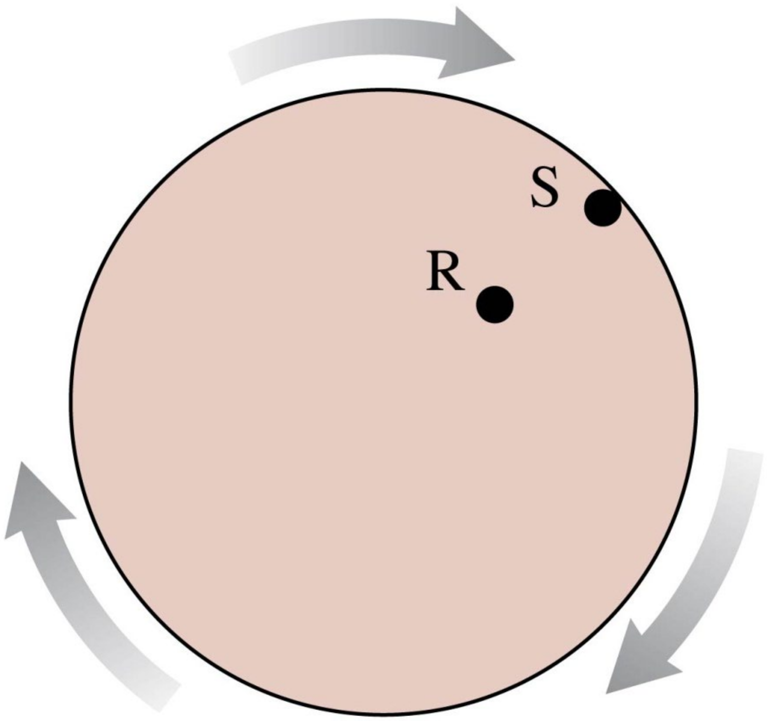
A. half

B. the same as

C. **twice** $v = \omega r$

D. four times

E. We can't say without knowing their radii.



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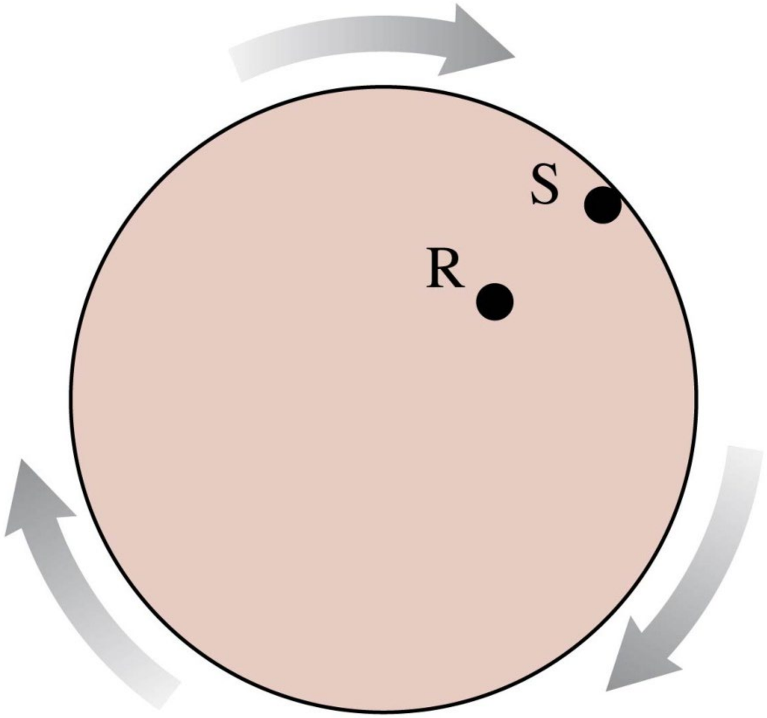
QuickCheck 4.14

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's acceleration is ______ that of Rasheed.



A. half

B. the same as

C. twice

D. four times

E. We can't say without knowing their radii.

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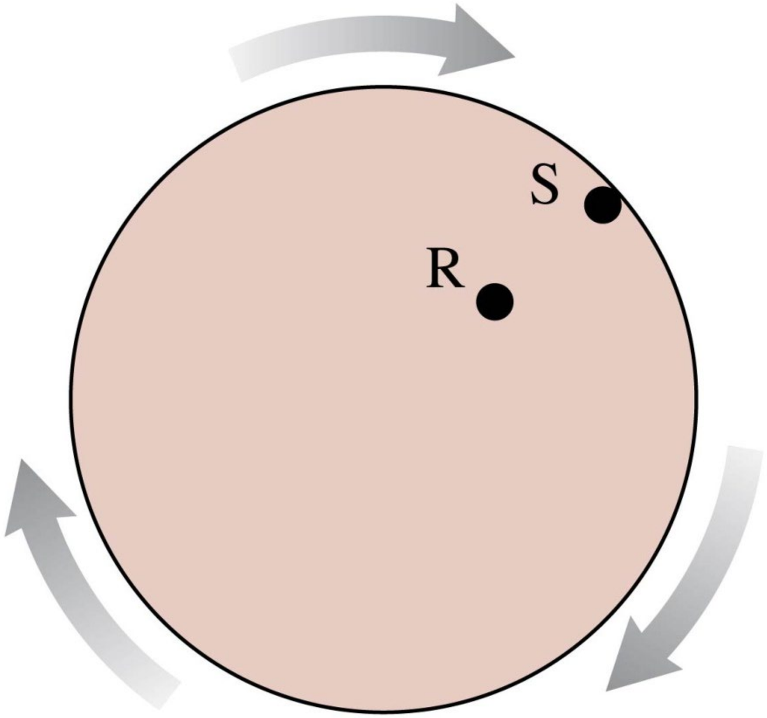
QuickCheck 4.14

Rasheed and Sofia are riding a merry-go-round that is spinning steadily. Sofia is twice as far from the axis as is Rasheed. Sofia's acceleration is _______ that of Rasheed.



A. half

B. the same as

C. twice Centripetal acceleration $a = \dfrac{v^2}{r} = \omega^2 r$

D. four times

E. We can't say without knowing their radii.

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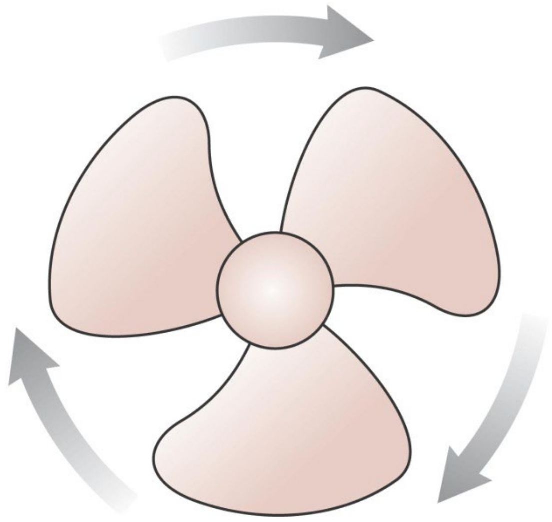
QuickCheck 4.15

The fan blade is slowing down. What are the signs of ω and α?



A. ω is positive and α is positive.

B. ω is positive and α is negative.

C. ω is negative and α is positive.

D. ω is negative and α is negative.

E. ω is positive and α is zero.

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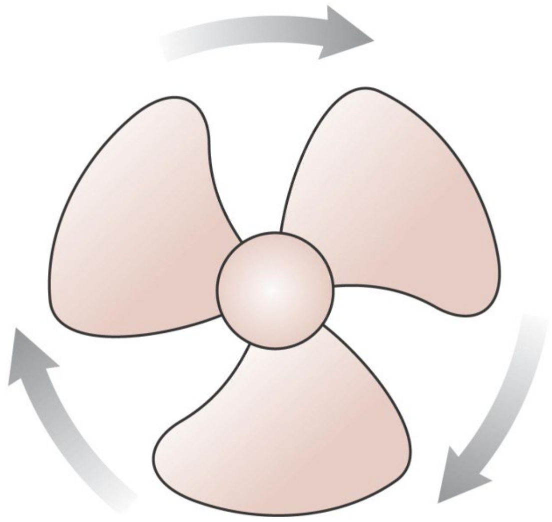
QuickCheck 4.15

The fan blade is slowing down.
What are the signs of ω and α?



A. ω is positive and α is positive.

B. ω is positive and α is negative.

✔ **C. ω is negative and α is positive.**

D. ω is negative and α is negative.

E. ω is positive and α is zero.

"Slowing down" means that ω and α have opposite signs, not that α is negative

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QuickCheck 4.16

Starting from rest, a wheel with constant angular acceleration turns through an angle of 25 rad in a time t. Through what angle will it have turned after time $2t$?

A. 25 rad

B. 50 rad

C. 75 rad

D. 100 rad

E. 200 rad

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QuickCheck 4.16

Starting from rest, a wheel with constant angular acceleration turns through an angle of 25 rad in a time t. Through what angle will it have turned after time $2t$?

A. 25 rad

B. 50 rad

C. 75 rad

✔ **D. 100 rad** $\Delta\theta \propto (\Delta t)^2$

E. 200 rad

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QuickCheck 4.17

Starting from rest, a wheel with constant angular acceleration spins up to 25 rpm in a time t. What will its angular velocity be after time $2t$?

A. 25 rpm

B. 50 rpm

C. 75 rpm

D. 100 rpm

E. 200 rpm

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QuickCheck 4.17

Starting from rest, a wheel with constant angular acceleration spins up to 25 rpm in a time t. What will its angular velocity be after time $2t$?

A. 25 rpm

✔ **B. 50 rpm** $\Delta\omega \propto \Delta t$

C. 75 rpm

D. 100 rpm

E. 200 rpm

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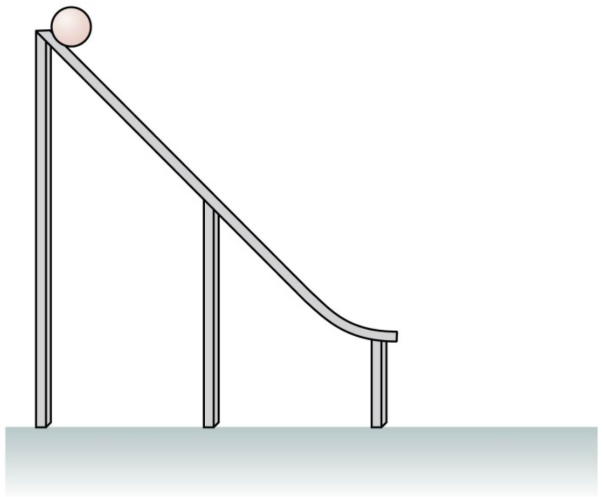
QuickCheck 5.1

A ball rolls down an incline and off a horizontal ramp. Ignoring air resistance, what force or forces act on the ball as it moves through the air just after leaving the horizontal ramp?



A. The weight of the ball acting vertically down.

B. A horizontal force that maintains the motion.

C. A force whose direction changes as the direction of motion changes.

D. The weight of the ball and a horizontal force.

E. The weight of the ball and a force in the direction of motion.

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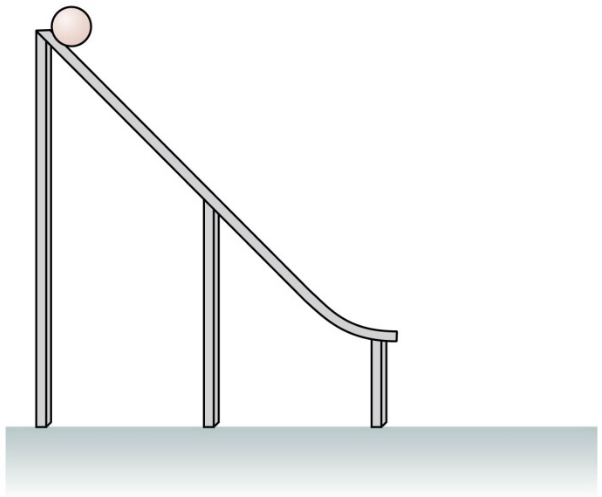
QuickCheck 5.1

A ball rolls down an incline and off a horizontal ramp. Ignoring air resistance, what force or forces act on the ball as it moves through the air just after leaving the horizontal ramp?



A. The weight of the ball acting vertically down.

B. A horizontal force that maintains the motion.

C. A force whose direction changes as the direction of motion changes.

D. The weight of the ball and a horizontal force.

E. The weight of the ball and a force in the direction of motion.

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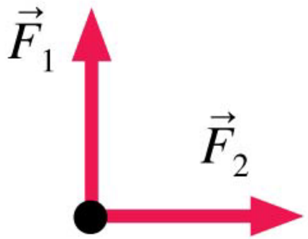
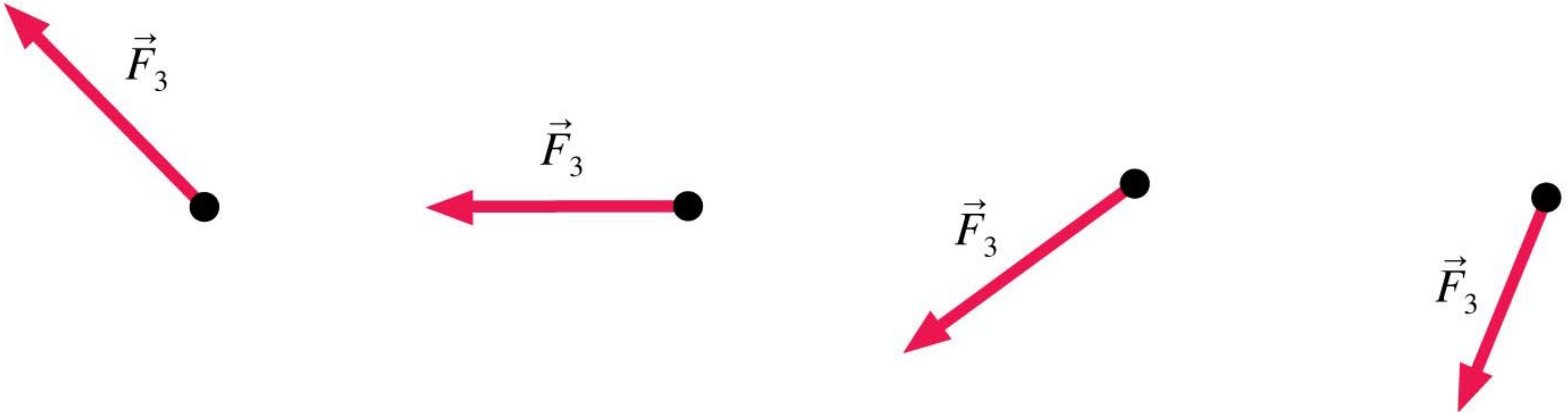
QuickCheck 5.2

The net force on an object points to the left. Two of three forces are shown. Which is the missing third force?



Two of the three forces exerted on an object



A. B. C. D.

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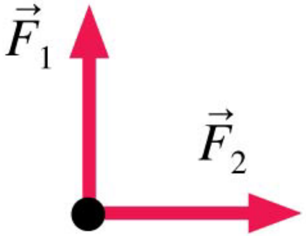
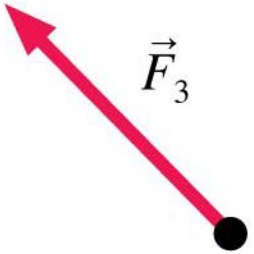
QuickCheck 5.2

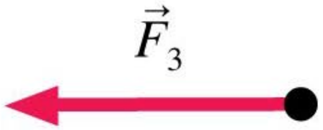
The net force on an object points to the left. Two of three forces are shown. Which is the missing third force?



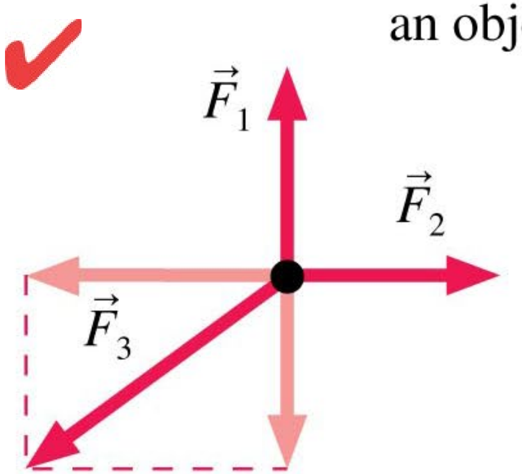
Two of the three forces exerted on an object



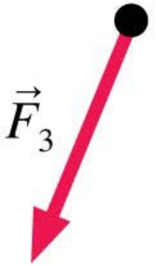
A.



B.



C.



D.

Vertical components cancel

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QuickCheck 5.3

A steel beam hangs from a cable as a crane lifts the beam. What forces act on the beam?

A. Gravity.

B. Gravity and tension in the cable.

C. Gravity and a force of motion.

D. Gravity and tension and a force of motion.

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QuickCheck 5.3

A steel beam hangs from a cable as a crane lifts the beam. What forces act on the beam?

A. Gravity.

✔ **B. Gravity and tension in the cable.**

C. Gravity and a force of motion.

D. Gravity and tension and a force of motion.

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QuickCheck 5.4

A book rests on a horizontal table. Gravity pulls down on the book. You may have learned something in a previous physics class about an upward force called the "normal force." Deep in your heart, do you really believe the table is exerting an upward force on the book?

A. Yes, I'm quite confident the table exerts an upward force on the book.
B. No, I don't see how the table can exert such a force.
C. I really don't know.

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QuickCheck 5.4

A book rests on a horizontal table. Gravity pulls down on the book. You may have learned something in a previous physics class about an upward force called the "normal force." Deep in your heart, do you really believe the table is exerting an upward force on the book?

A. Yes, I'm quite confident the table exerts an upward force on the book.
B. No, I don't see how the table can exert such a force.
C. I really don't know.

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QuickCheck 5.5

A bobsledder pushes her sled across horizontal snow to get it going, then jumps in. After she jumps in, the sled gradually slows to a halt. What forces act on the sled just after she's jumped in?

A. Gravity and kinetic friction.
B. Gravity and a normal force.
C. Gravity and the force of the push.
D. Gravity, a normal force, and kinetic friction.
E. Gravity, a normal force, kinetic friction, and the force of the push.

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QuickCheck 5.5

A bobsledder pushes her sled across horizontal snow to get it going, then jumps in. After she jumps in, the sled gradually slows to a halt. What forces act on the sled just after she's jumped in?

A. Gravity and kinetic friction.

B. Gravity and a normal force.

C. Gravity and the force of the push.

✔ **D. Gravity, a normal force, and kinetic friction.**

E. Gravity, a normal force, kinetic friction, and the force of the push.

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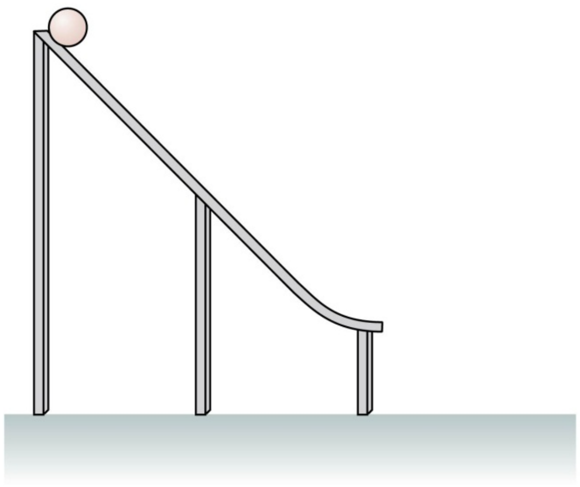
QuickCheck 5.1

A ball rolls down an incline and off a horizontal ramp. Ignoring air resistance, what force or forces act on the ball as it moves through the air just after leaving the horizontal ramp?



A. The weight of the ball acting vertically down.

B. A horizontal force that maintains the motion.

C. A force whose direction changes as the direction of motion changes.

D. The weight of the ball and a horizontal force.

E. The weight of the ball and a force in the direction of motion.

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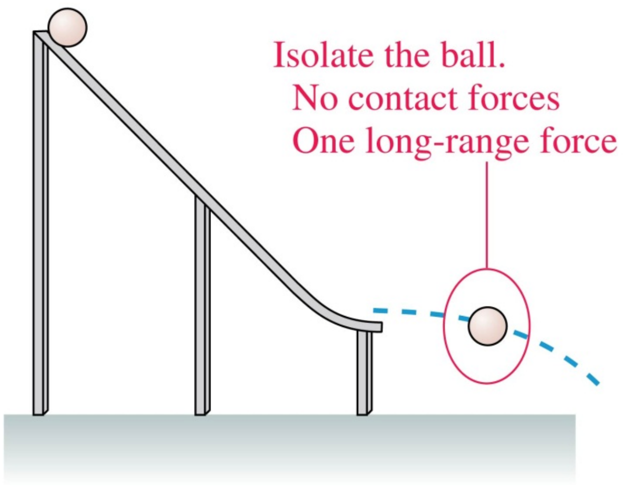
QuickCheck 5.1

A ball rolls down an incline and off a horizontal ramp. Ignoring air resistance, what force or forces act on the ball as it moves through the air just after leaving the horizontal ramp?



A. The weight of the ball acting vertically down.

B. A horizontal force that maintains the motion.

C. A force whose direction changes as the direction of motion changes.

D. The weight of the ball and a horizontal force.

E. The weight of the ball and a force in the direction of motion.

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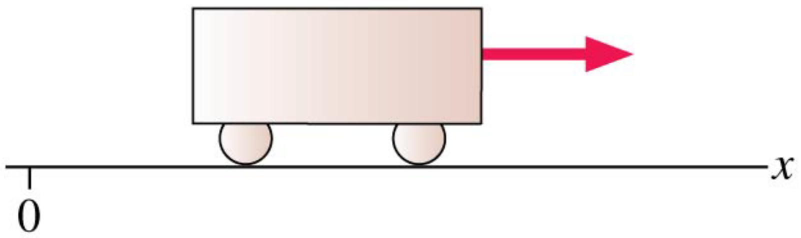
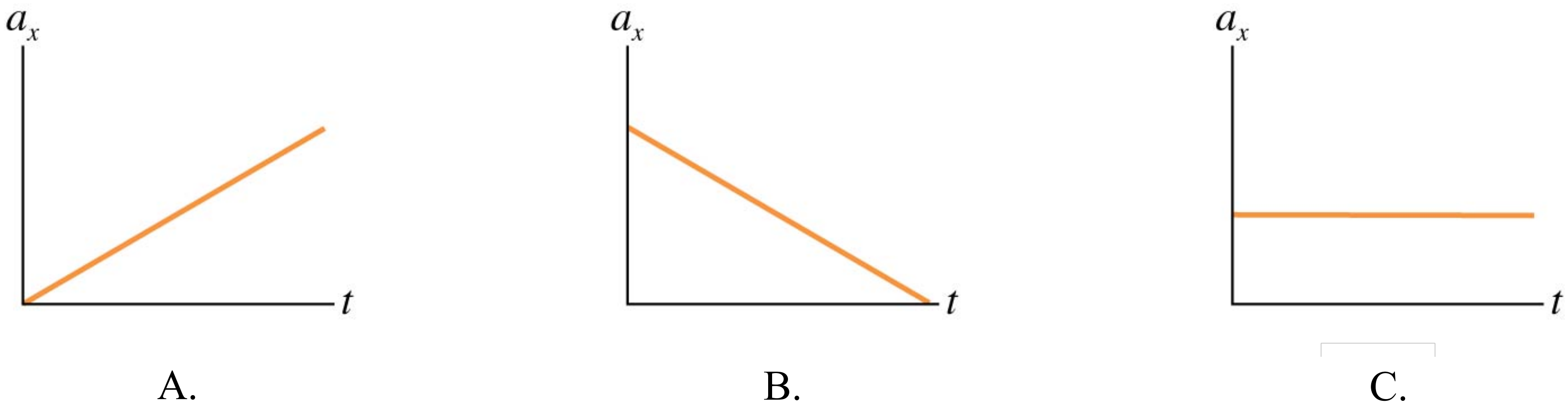
QuickCheck 5.6

A cart is pulled to the right with a constant, steady force. How will its acceleration graph look?





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QuickCheck 5.6

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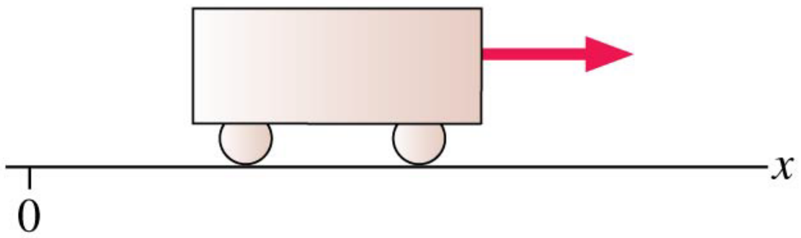

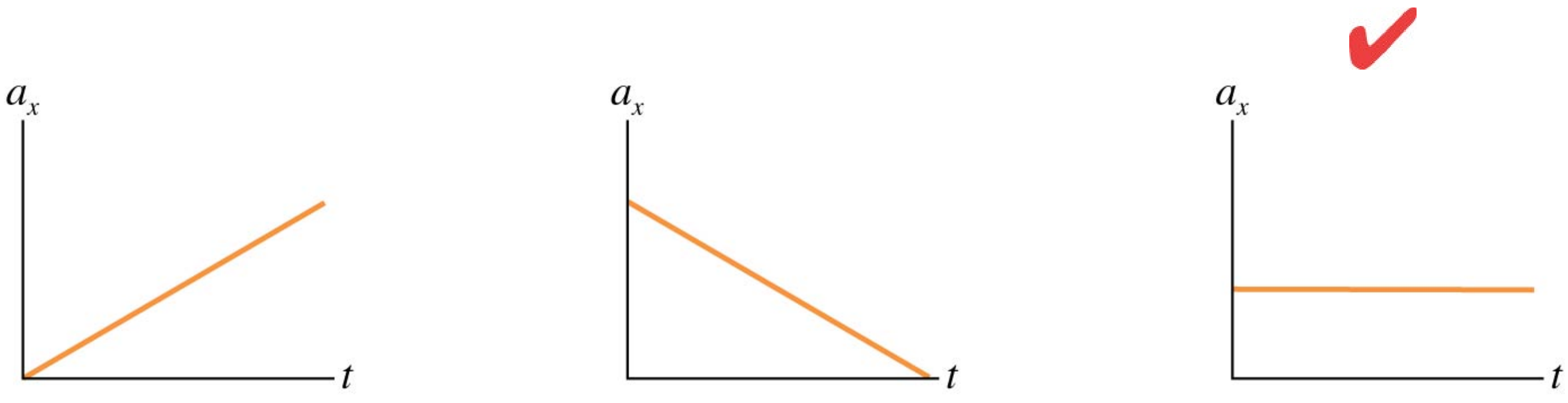

A.

B.

C.

A constant force produces a <u>constant</u> acceleration.

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QuickCheck 5.7

A constant force causes an object to accelerate at 4 m/s^2. What is the acceleration of an object with twice the mass that experiences the same force?

A. 1 m/s^2.

B. 2 m/s^2.

C. 4 m/s^2.

D. 8 m/s^2.

E. 16 m/s^2.

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QuickCheck 5.7

A constant force causes an object to accelerate at 4 m/s^2. What is the acceleration of an object with twice the mass that experiences the same force?

A. 1 m/s^2.

✔ **B. 2 m/s^2.**

$$a = \frac{F}{m}$$

C. 4 m/s^2.

D. 8 m/s^2.

E. 16 m/s^2.

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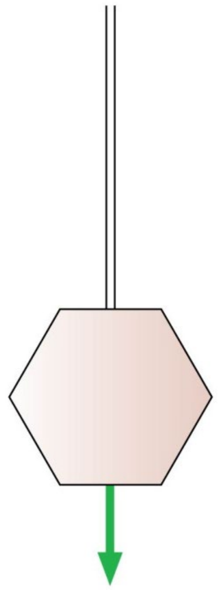
QuickCheck 5.8

An object on a rope is lowered at constant speed.
Which is true?



A. The rope tension is greater than the object's weight.

B. The rope tension equals the object's weight.

C. The rope tension is less than the object's weight.

D. The rope tension can't be compared to the object's weight.

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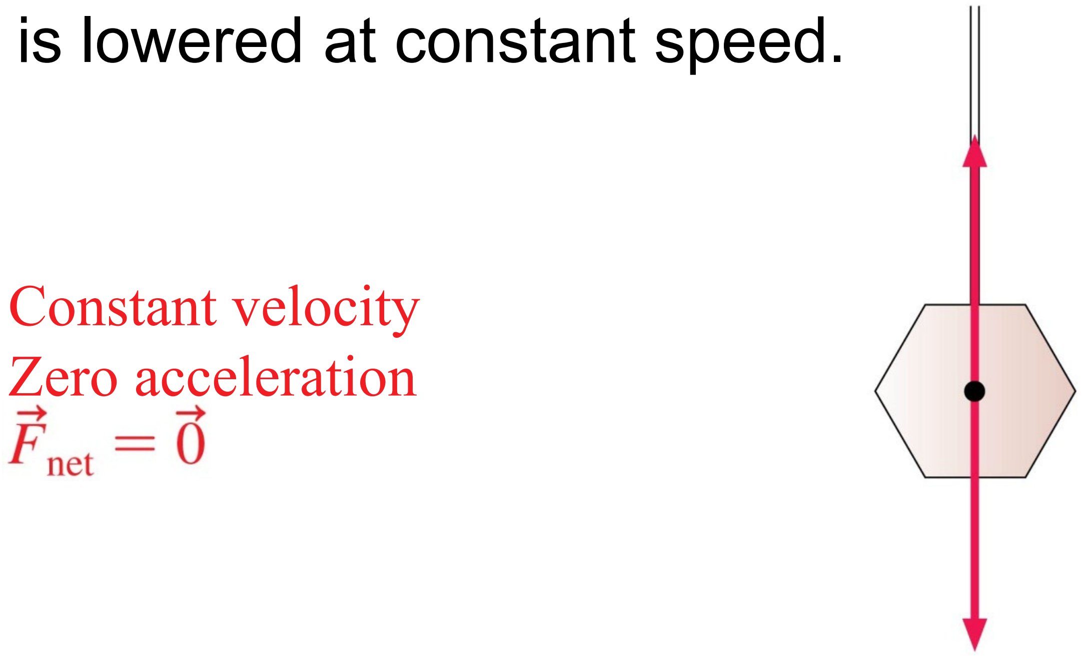
QuickCheck 5.8

An object on a rope is lowered at constant speed. Which is true?



A. The rope tension is greater than the object's weight.

✔ **B. The rope tension equals the object's weight.**

C. The rope tension is less than the object's weight.

D. The rope tension can't be compared to the object's weight.

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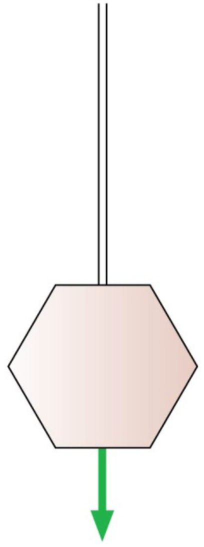
QuickCheck 5.9

An object on a rope is lowered at a steadily decreasing speed. Which is true?



A. The rope tension is greater than the object's weight.

B. The rope tension equals the object's weight.

C. The rope tension is less than the object's weight.

D. The rope tension can't be compared to the object's weight.

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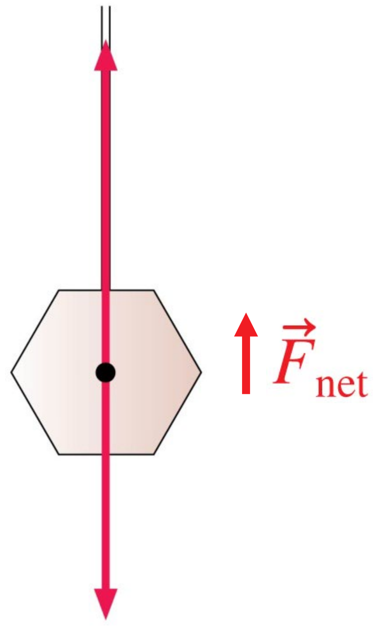
QuickCheck 5.9

An object on a rope is lowered at a steadily decreasing speed. Which is true?

Decreasing downward velocity
Acceleration vector points up
$\vec{F}_{net}$ points up



- ✔ **A. The rope tension is greater than the object's weight.**
- B. The rope tension equals the object's weight.
- C. The rope tension is less than the object's weight.
- D. The rope tension can't be compared to the object's weight.

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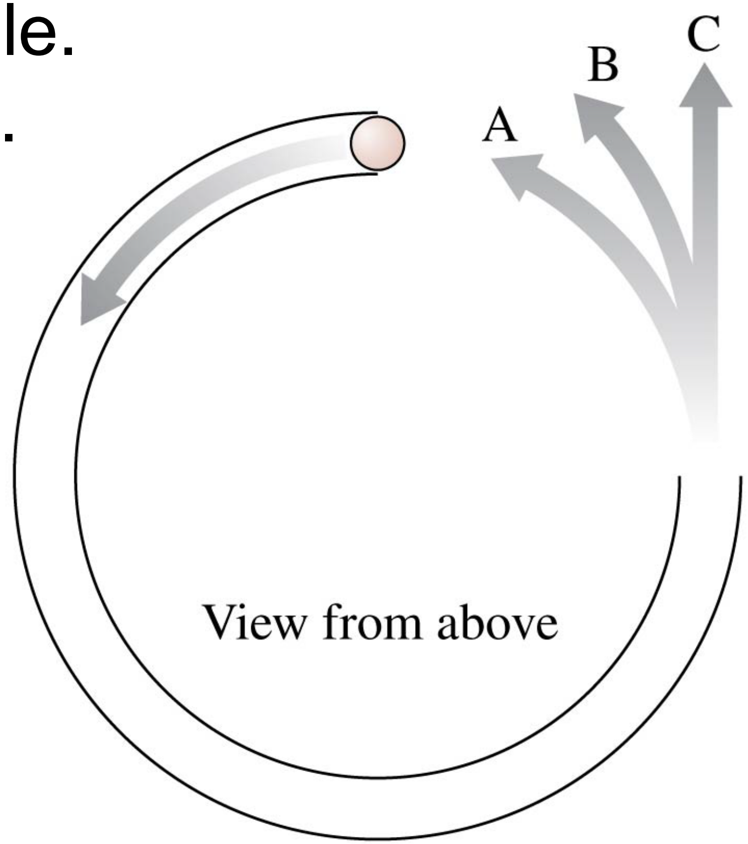
QuickCheck 5.10

A hollow tube lies flat on a table.
A ball is shot through the tube.
As the ball emerges from the other end, which path does it follow?



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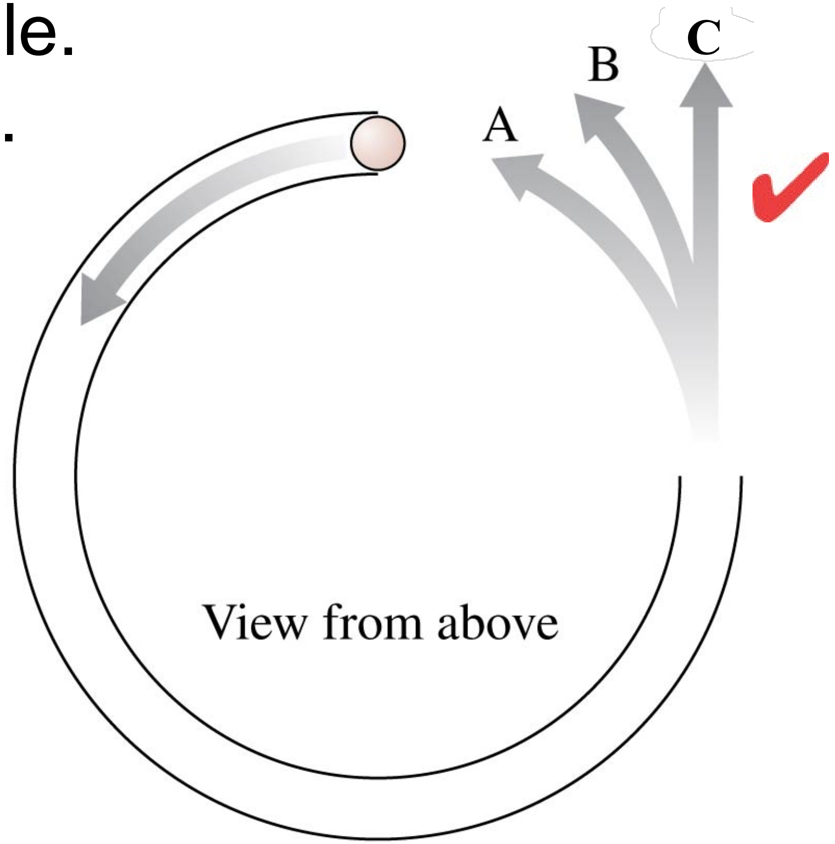
QuickCheck 5.10

A hollow tube lies flat on a table.
A ball is shot through the tube.
As the ball emerges from the other end, which path does it follow?



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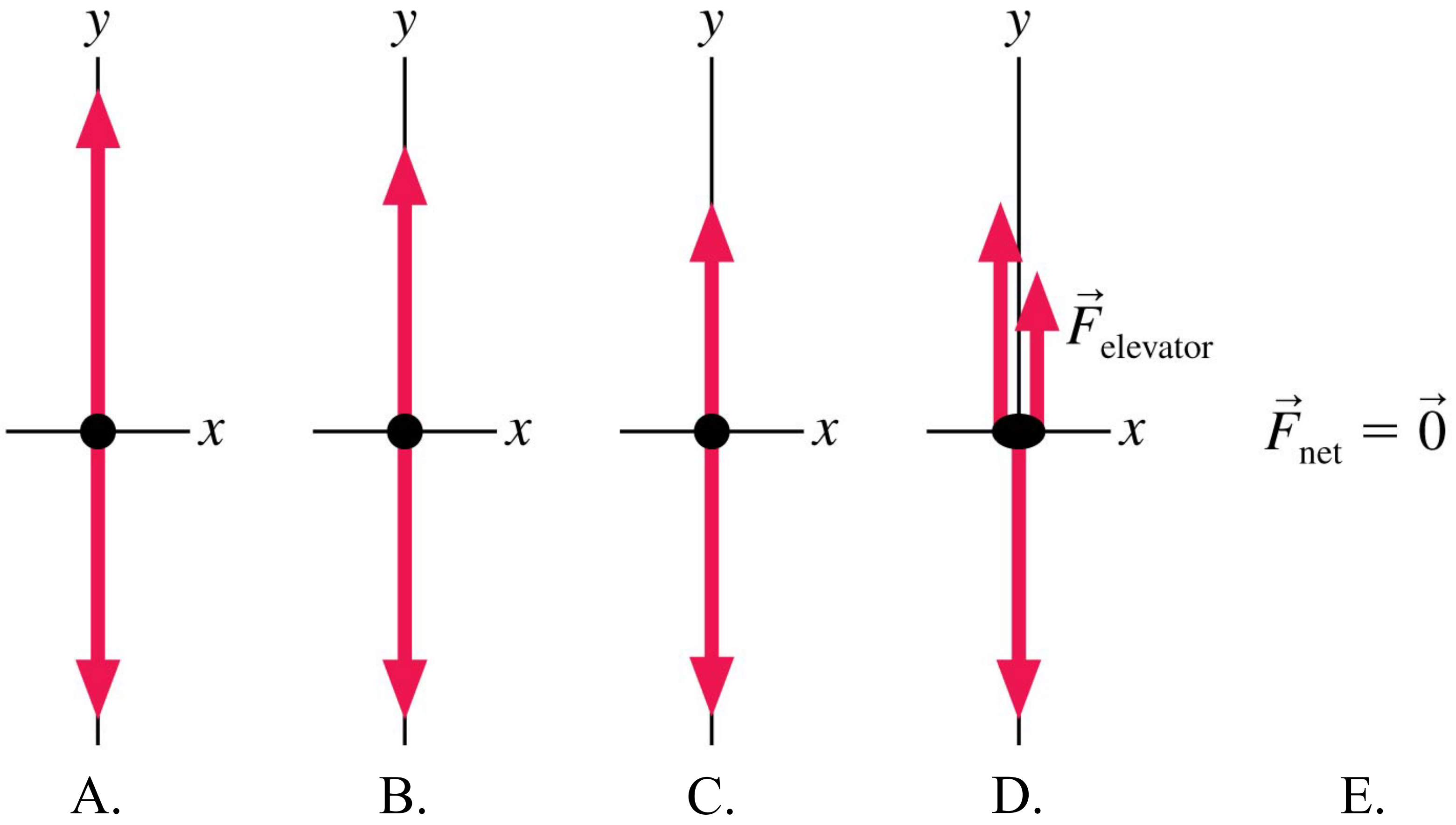
QuickCheck 5.11

An elevator, lifted by a cable, is moving upward and slowing. Which is the correct free-body diagram?



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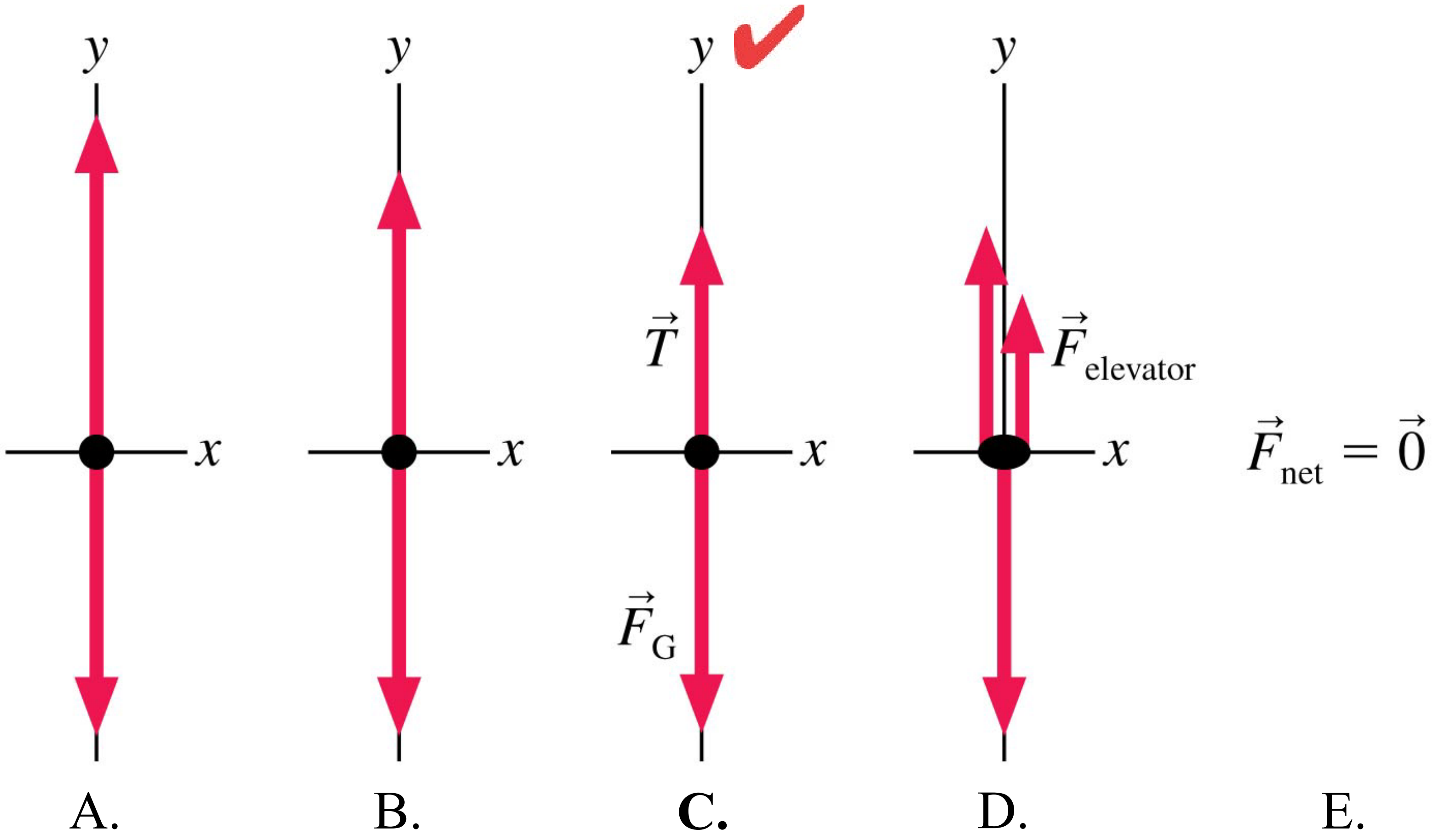
QuickCheck 5.11

An elevator, lifted by a cable, is moving upward and slowing. Which is the correct free-body diagram?



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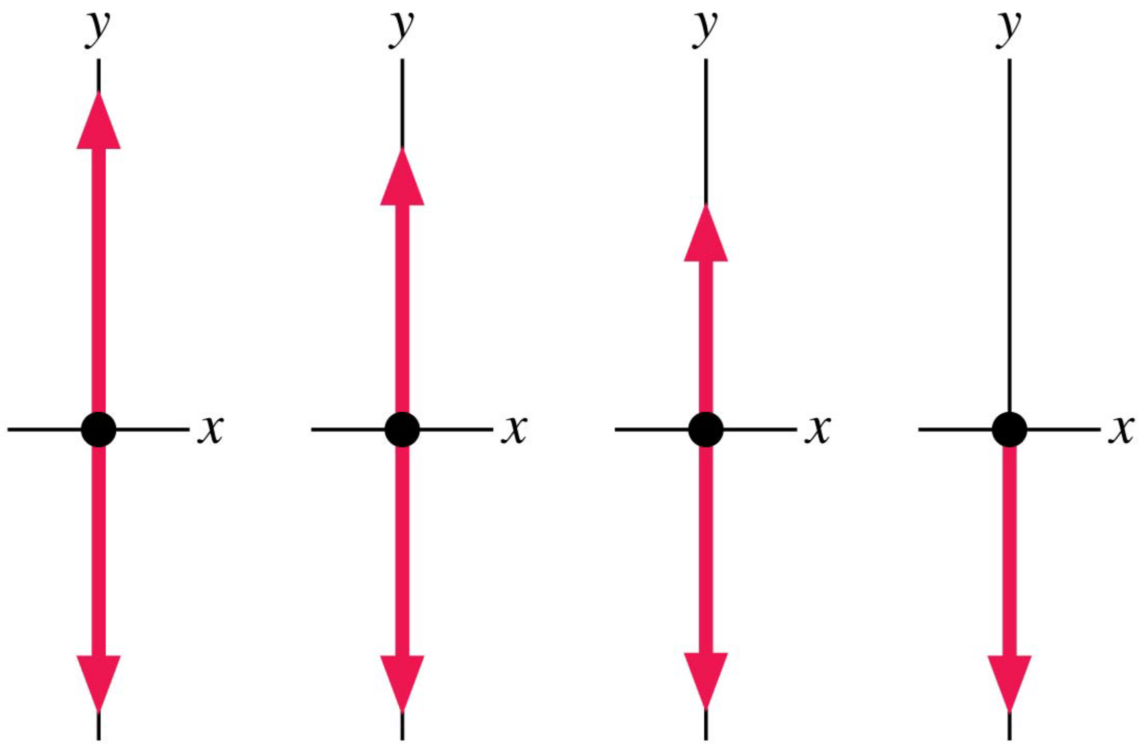
QuickCheck 5.12

A ball has been tossed straight up. Which is the correct free-body diagram just after the ball has left the hand? Ignore air resistance.



A. B. C. D.

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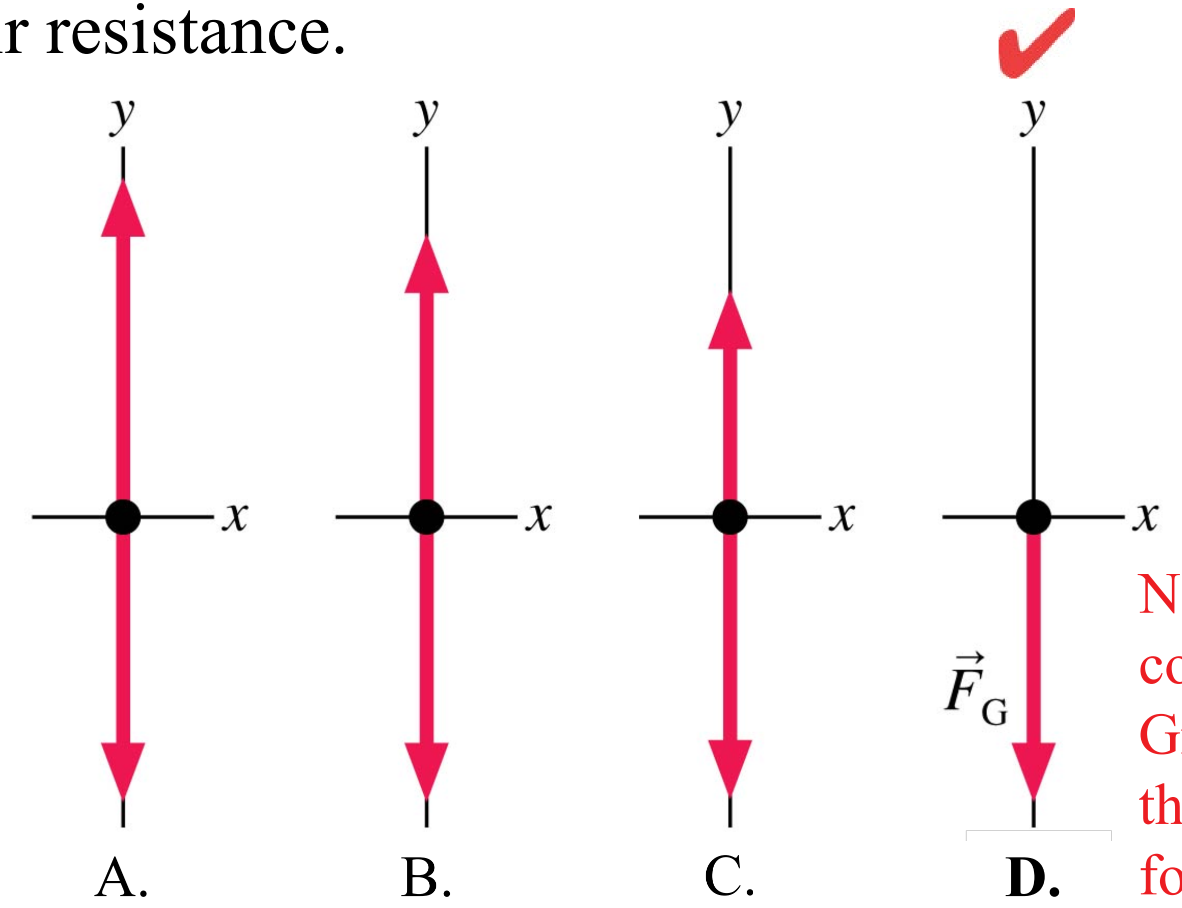
QuickCheck 5.12

A ball has been tossed straight up. Which is the correct free-body diagram just after the ball has left the hand? Ignore air resistance.



No points of contact. Gravity is the only force.

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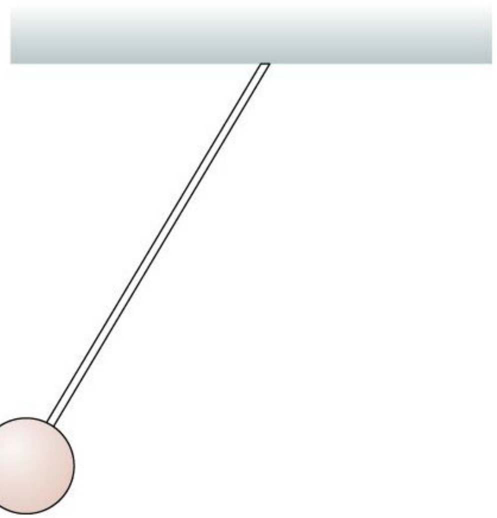
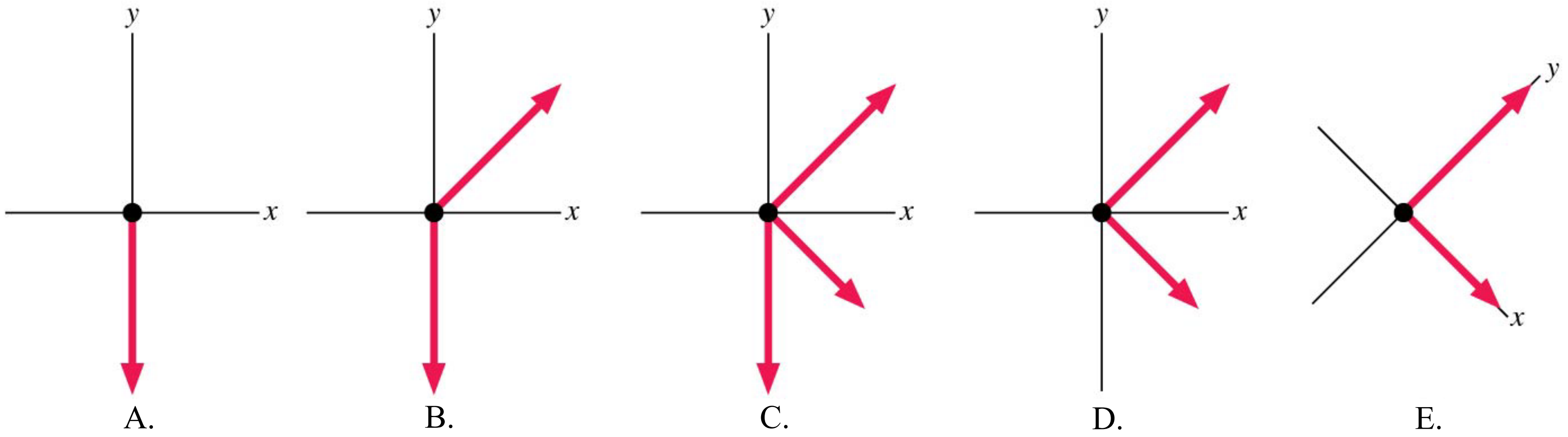
QuickCheck 5.13

A ball, hanging from the ceiling by a string, is pulled back and released. Which is the correct free-body diagram just after its release?





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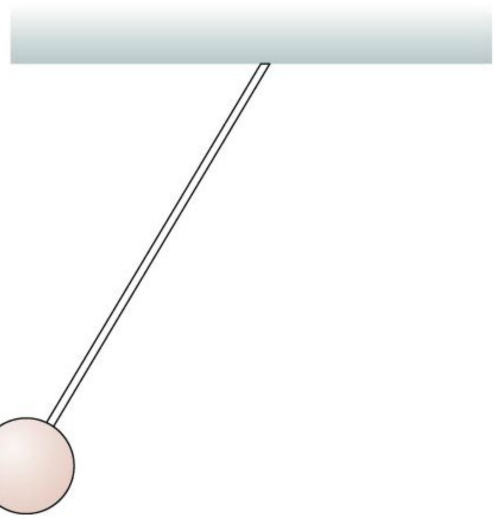
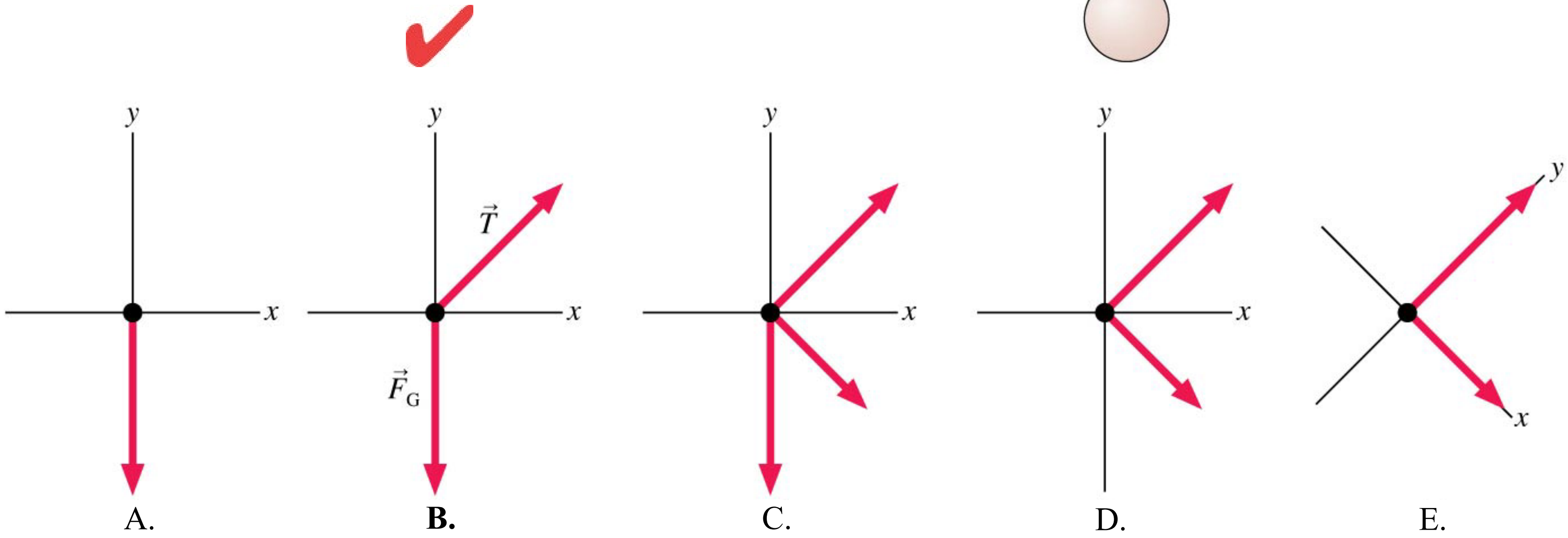
QuickCheck 5.13

A ball, hanging from the ceiling by a string, is pulled back and released. Which is the correct free-body diagram just after its release?





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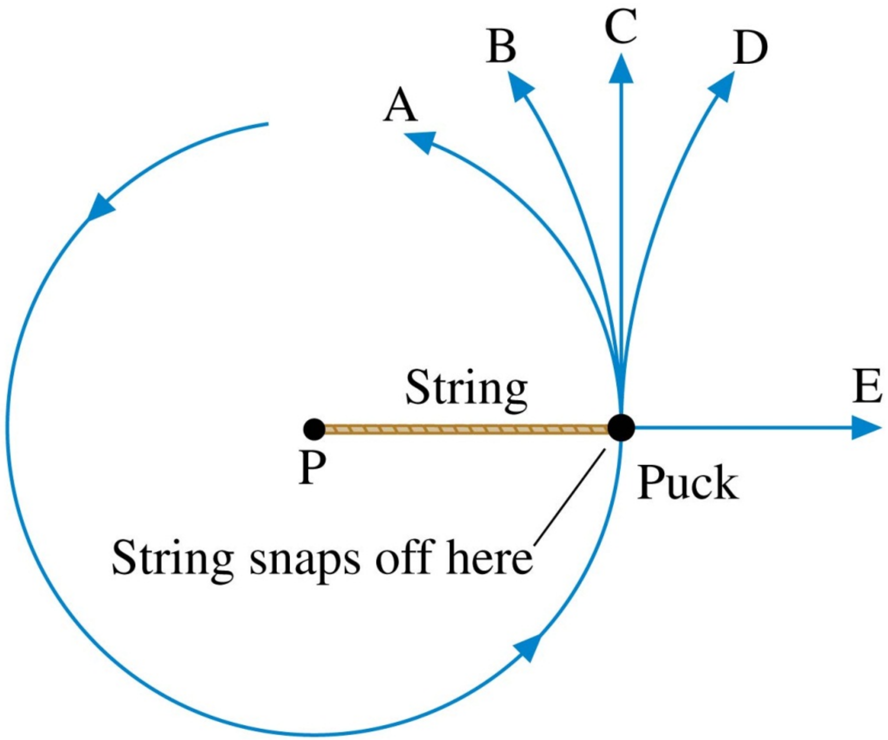
QuickCheck 6.1

The figure shows the view looking down onto a sheet of frictionless ice. A puck, tied with a string to point P, slides on the ice in the circular path shown and has made many revolutions. If the string suddenly breaks with the puck in the position shown, which path best represents the puck's subsequent motion?



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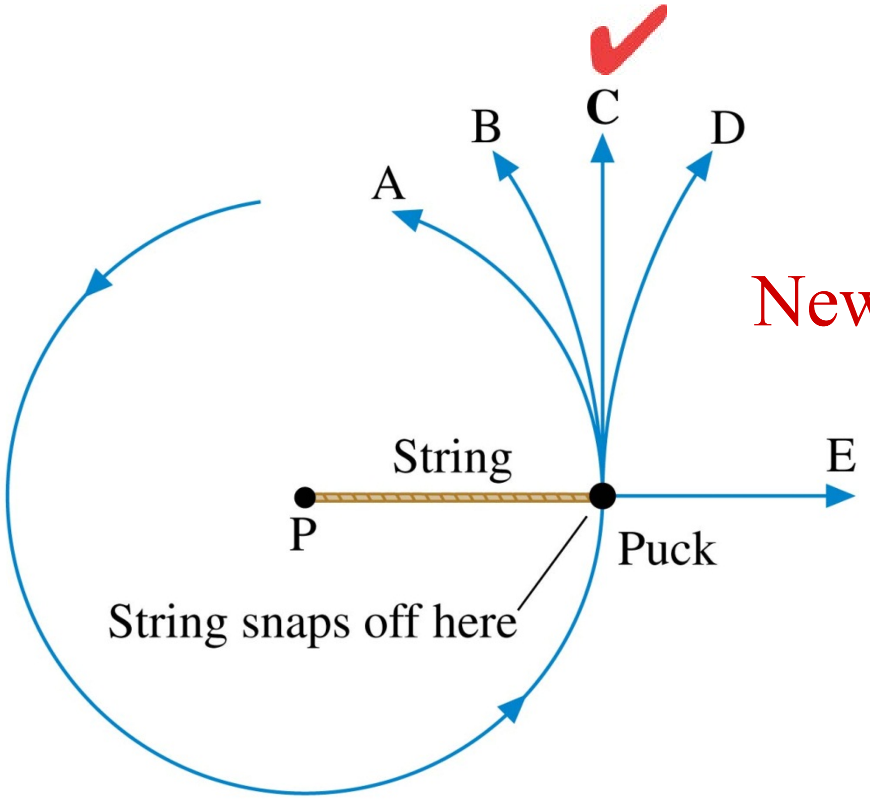

Newton's first law!

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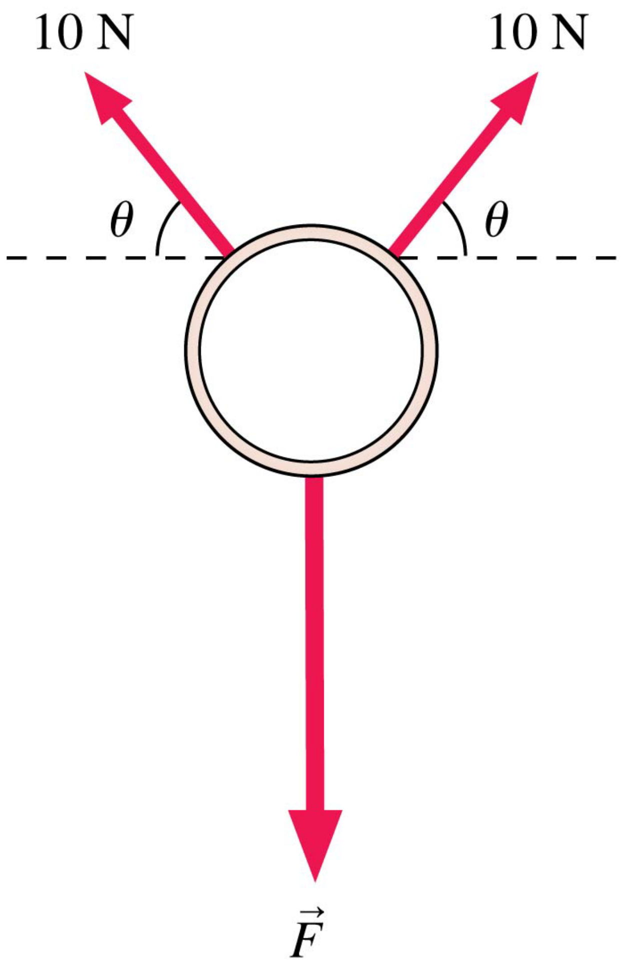
QuickCheck 6.2

A ring, seen from above, is pulled on by three forces. The ring is not moving. How big is the force F?



A. 20 N

B. $10\cos\theta$ N

C. $10\sin\theta$ N

D. $20\cos\theta$ N

E. $20\sin\theta$ N

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QuickCheck 6.2

A ring, seen from above, is pulled on by three forces. The ring is not moving. How big is the force F?

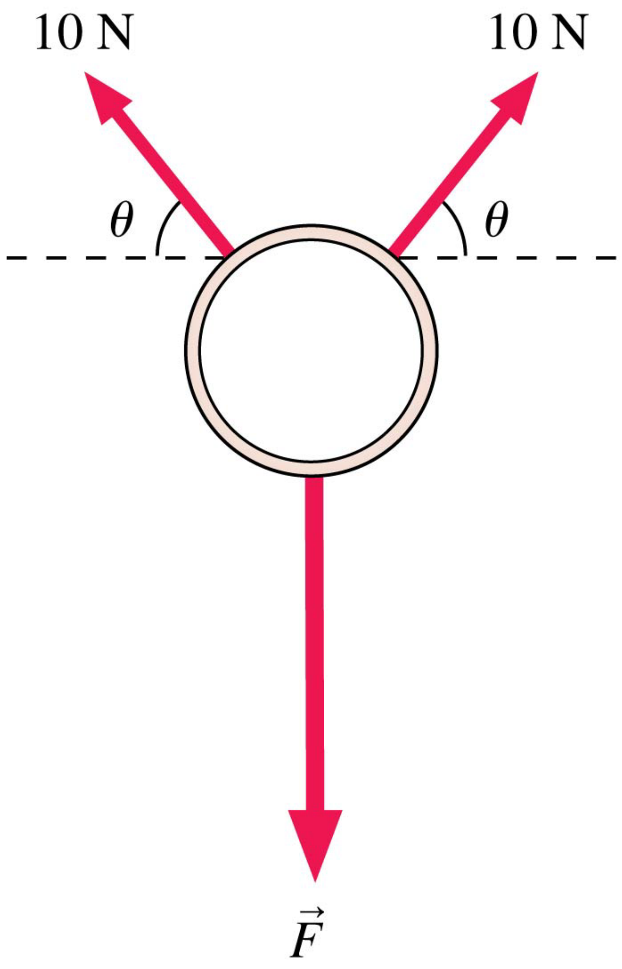
A. 20 N

B. $10\cos\theta$ N

C. $10\sin\theta$ N

D. $20\cos\theta$ N

E. **$20\sin\theta$ N**



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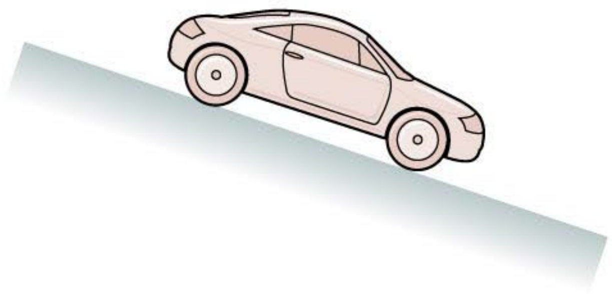
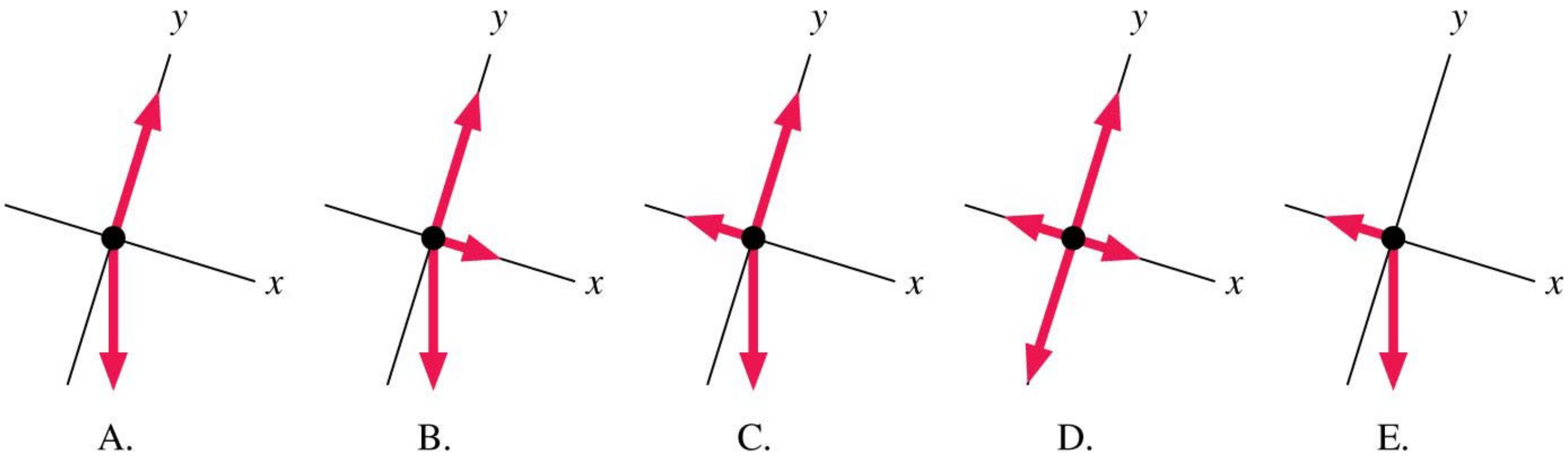
QuickCheck 6.3

A car is parked on a hill. Which is the correct free-body diagram?





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QuickCheck 6.3

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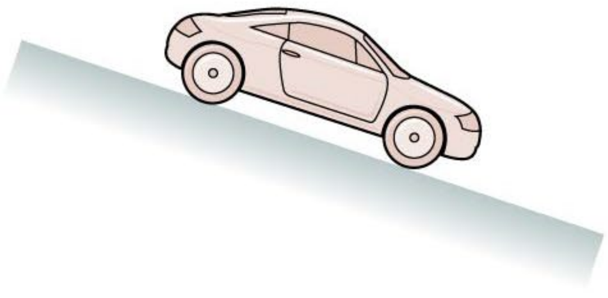

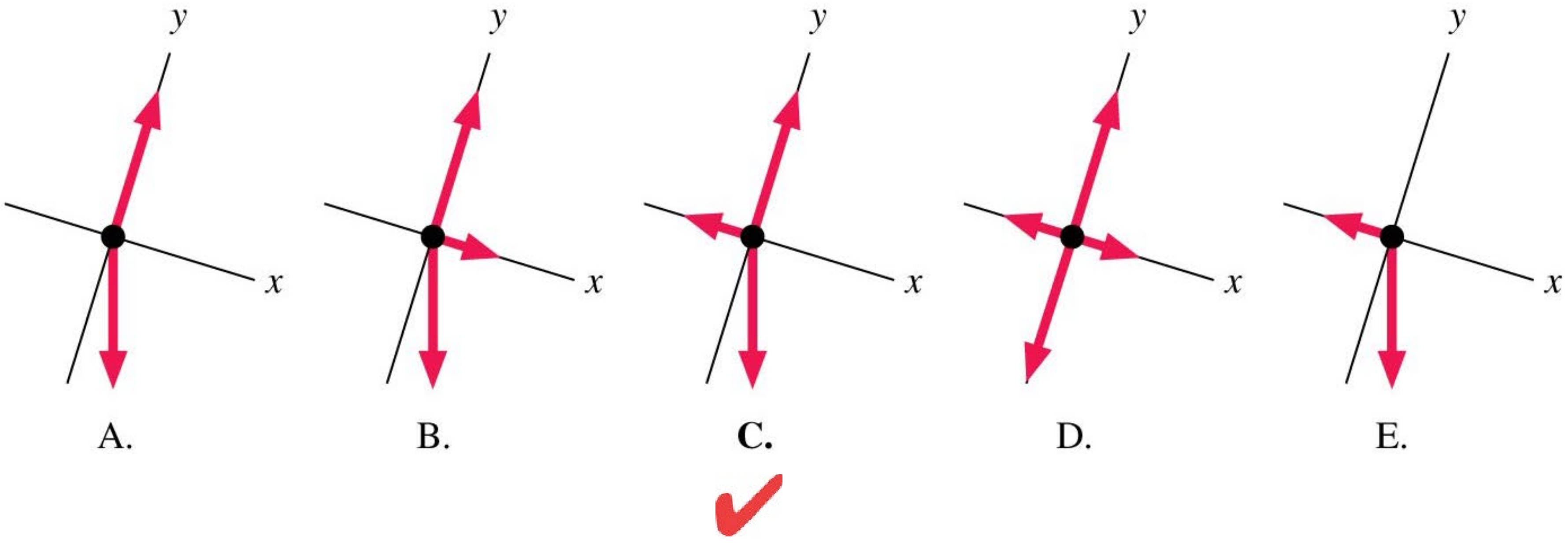

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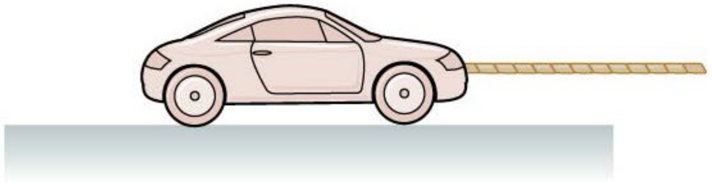
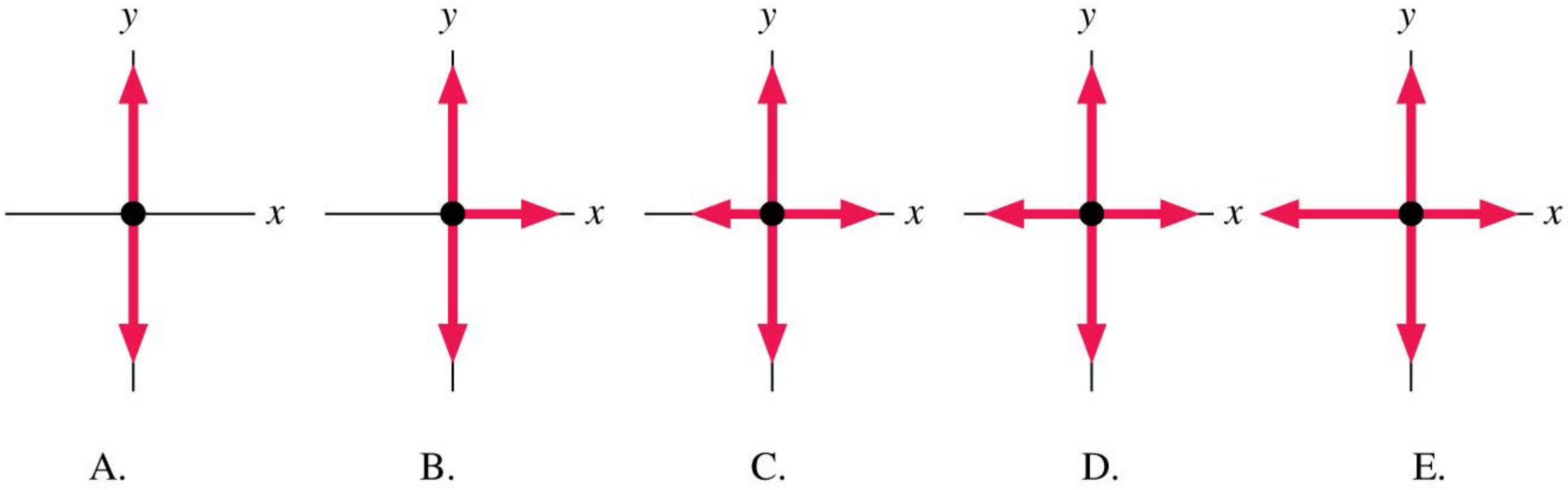
QuickCheck 6.4

A car is towed to the right at constant speed. Which is the correct free-body diagram?





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QuickCheck 6.4

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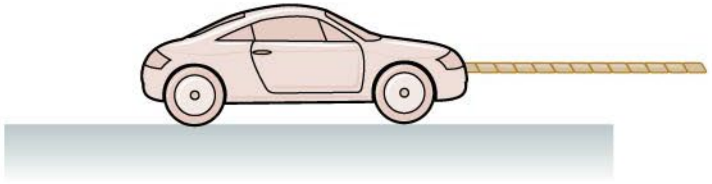

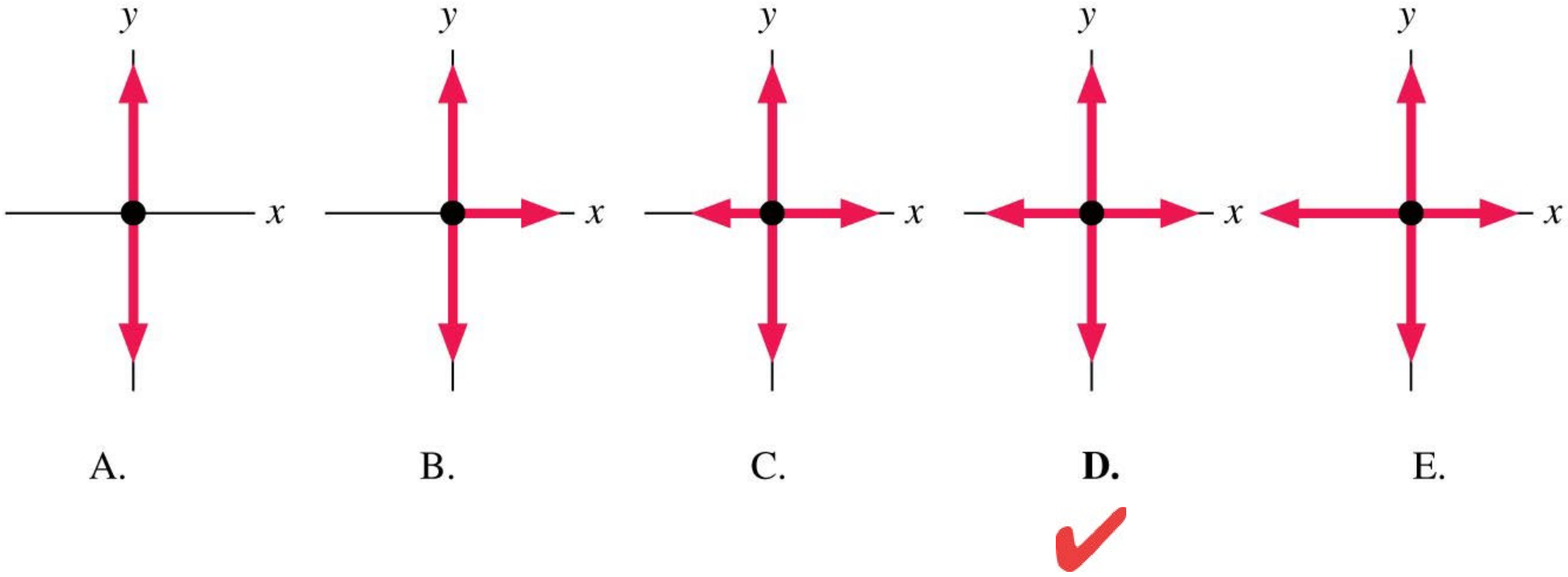

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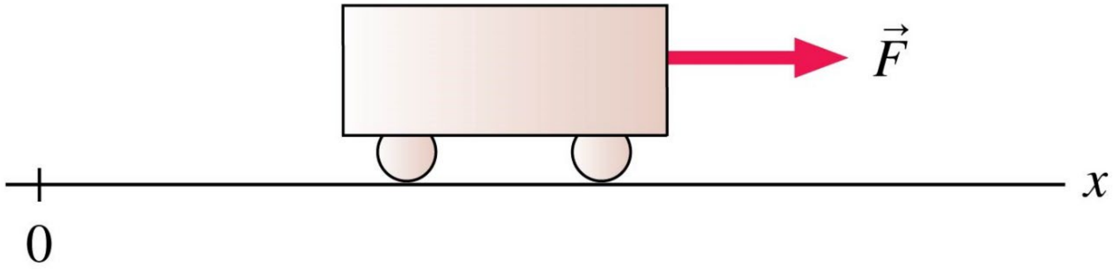
QuickCheck 6.5

The cart is initially at rest. Force $\vec{F}$ is applied to the cart for time Δt, after which the car has speed v. Suppose the same force is applied for the same time to a second cart with twice the mass. Friction is negligible. Afterward, the second cart's speed will be



A. $\frac{1}{4}v$

B. $\frac{1}{2}v$

C. v

D. $2v$

E. $4v$

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QuickCheck 6.5

The cart is initially at rest. Force $\vec{F}$ is applied to the cart for time Δt, after which the car has speed v. Suppose the same force is applied for the same time to a second cart with twice the mass. Friction is negligible. Afterward, the second cart's speed will be

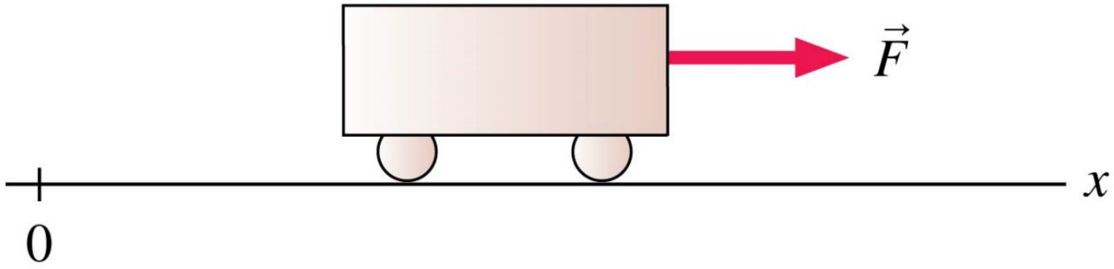
A. $\frac{1}{4}v$

B. $\frac{1}{2}v$

C. v

D. $2v$

E. $4v$



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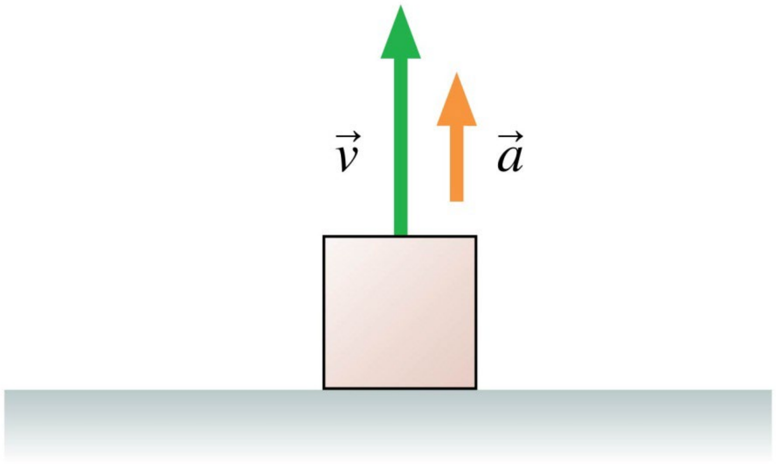
QuickCheck 6.6

The box is sitting on the floor of an elevator. The elevator is accelerating upward. The magnitude of the normal force on the box is



A. $n > mg$.

B. $n = mg$.

C. $n < mg$.

D. $n = 0$.

E. Not enough information to tell.

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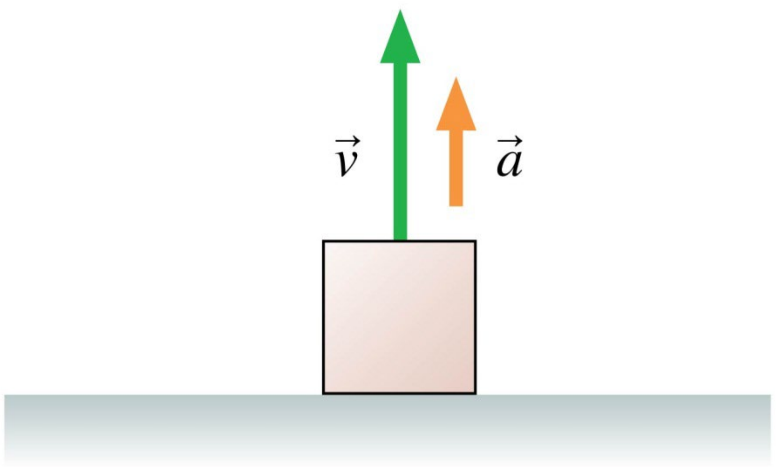
QuickCheck 6.6

The box is sitting on the floor of an elevator. The elevator is accelerating upward. The magnitude of the normal force on the box is



✔ **A.** $\boldsymbol{n > mg}$.

B. $n = mg$.

C. $n < mg$.

D. $n = 0$.

E. Not enough information to tell.

Upward acceleration requires a net upward force.

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QuickCheck 6.7

An astronaut takes her bathroom scales to the moon, where $g = 1.6 \text{ m/s}^2$. On the moon, compared to at home on earth:

A. Her weight is the same and her mass is less.

B. Her weight is less and her mass is less.

C. Her weight is less and her mass is the same.

D. Her weight is the same and her mass is the same.

E. Her weight is zero and her mass is the same.

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QuickCheck 6.7

An astronaut takes her bathroom scales to the moon, where $g = 1.6 \text{ m/s}^2$. On the moon, compared to at home on earth:

A. Her weight is the same and her mass is less.

B. Her weight is less and her mass is less.

✔ **C. Her weight is less and her mass is the same.**

D. Her weight is the same and her mass is the same.

E. Her weight is zero and her mass is the same.

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QuickCheck 6.8

A 50-kg student ($mg = 490$ N) gets in a 1000-kg elevator at rest and stands on a metric bathroom scale. As the elevator accelerates upward, the scale reads

A. > 490 N.

B. 490 N.

C. < 490 N but not 0 N.

D. 0 N.

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QuickCheck 6.8

A 50-kg student ($mg = 490$ N) gets in a 1000-kg elevator at rest and stands on a metric bathroom scale. As the elevator accelerates upward, the scale reads

✔ **A. > 490 N.**

B. 490 N.

C. < 490 N but not 0 N.

D. 0 N.

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QuickCheck 6.9

A 50-kg student (mg = 490 N) gets in a 1000-kg elevator at rest and stands on a metric bathroom scale. As the elevator accelerates upward, the student's weight is

A. > 490 N.

B. 490 N.

C. < 490 N but not 0 N.

D. 0 N.

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QuickCheck 6.9

A 50-kg student (mg = 490 N) gets in a 1000-kg elevator at rest and stands on a metric bathroom scale. As the elevator accelerates upward, the student's weight is

✔**A. > 490 N.**

B. 490 N.

C. < 490 N but not 0 N.

D. 0 N.

Weight is reading of a scale on which the object is stationary *relative to the scale.*

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QuickCheck 6.10

A 50-kg student ($mg = 490$ N) gets in a 1000-kg elevator at rest and stands on a metric bathroom scale. Sadly, the elevator cable breaks. What is the student's weight during the few second it takes the student to plunge to his doom?

A. > 490 N.

B. 490 N.

C. < 490 N but not 0 N.

D. 0 N.

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QuickCheck 6.10

A 50-kg student ($mg = 490$ N) gets in a 1000-kg elevator at rest and stands on a metric bathroom scale. Sadly, the elevator cable breaks. What is the student's weight during the few second it takes the student to plunge to his doom?

A. > 490 N.

B. 490 N.

C. < 490 N but not 0 N.

✔**D. 0 N.** The bathroom scale would read 0 N. Weight is reading of a scale on which the object is stationary *relative to the scale*.

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QuickCheck 6.11

A 50-kg astronaut ($mg = 490$ N) is orbiting the earth in the space shuttle. Compared to on earth:

A. His weight is the same and his mass is less.
B. His weight is less and his mass is less.
C. His weight is less and his mass is the same.
D. His weight is the same and his mass is the same.
E. His weight is zero and his mass is the same.

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QuickCheck 6.11

A 50-kg astronaut ($mg = 490$ N) is orbiting the earth in the space shuttle. Compared to on earth:

A. His weight is the same and his mass is less.

B. His weight is less and his mass is less.

C. His weight is less and his mass is the same.

D. His weight is the same and his mass is the same.

✔ **E. His weight is zero and his mass is the same.**

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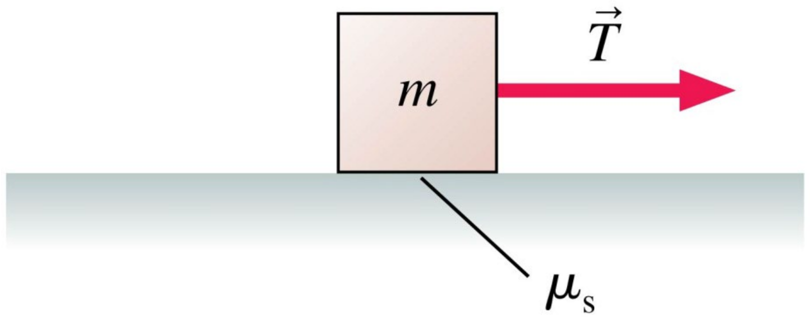
QuickCheck 6.12

A box on a rough surface is pulled by a horizontal rope with tension T. The box is not moving. In this situation:



A. $f_s > T$.

B. $f_s = T$.

C. $f_s < T$.

D. $f_s = \mu_s mg$.

E. $f_s = 0$.

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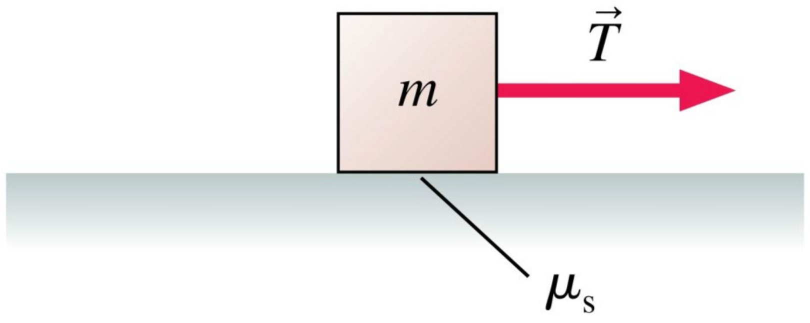
QuickCheck 6.12

A box on a rough surface is pulled by a horizontal rope with tension T. The box is not moving. In this situation:



A. $f_s > T$.

✔ **B.** $\boldsymbol{f_s = T}$. Newton's first law.

C. $f_s < T$.

D. $f_s = \mu_s mg$.

E. $f_s = 0$.

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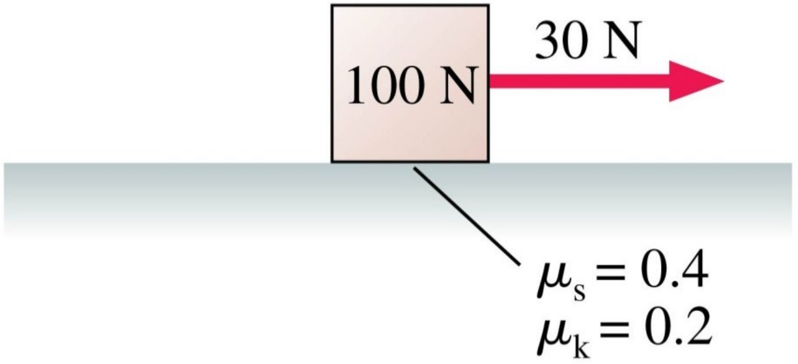
QuickCheck 6.13

A box with a weight of 100 N is at rest. It is then pulled by a 30 N horizontal force.

Does the box move?



A. Yes

B. No

C. Not enough information to say.

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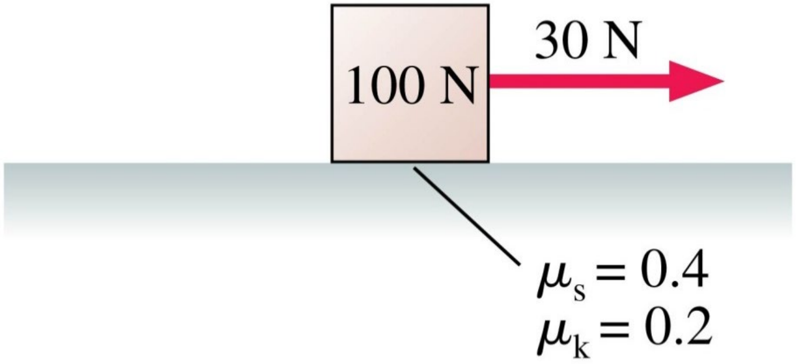
QuickCheck 6.13

A box with a weight of 100 N is at rest. It is then pulled by a 30 N horizontal force.



Does the box move?

A. Yes

✔ **B. No** $30\text{ N} < f_{s\,max} = 40\text{ N}$

C. Not enough information to say.

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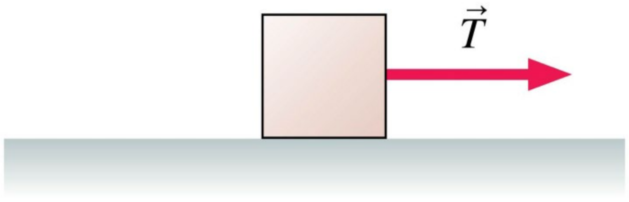
QuickCheck 6.14

A box is being pulled to the right over a rough surface. $T > f_k$, so the box is speeding up. Suddenly the rope breaks.



What happens? The box

A. Stops immediately.

B. Continues with the speed it had when the rope broke.

C. Continues speeding up for a short while, then slows and stops.

D. Keeps its speed for a short while, then slows and stops.

E. Slows steadily until it stops .

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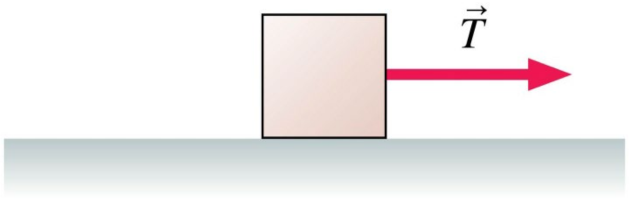
QuickCheck 6.14

A box is being pulled to the right over a rough surface. $T > f_k$, so the box is speeding up. Suddenly the rope breaks.



What happens? The box

A. Stops immediately.

B. Continues with the speed it had when the rope broke.

C. Continues speeding up for a short while, then slows and stops.

D. Keeps its speed for a short while, then slows and stops.

✔ **E. Slows steadily until it stops.**

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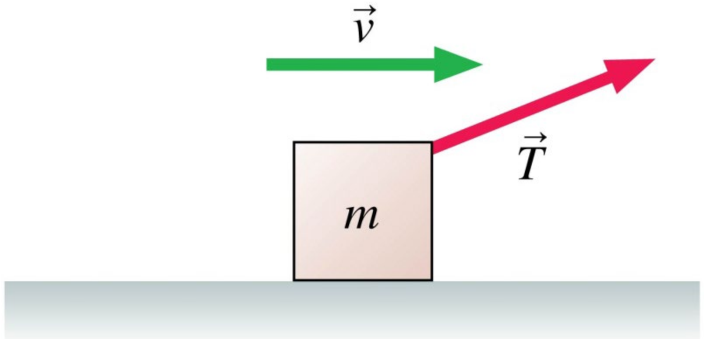
QuickCheck 6.15

A box is being pulled to the right at steady speed by a rope that angles upward. In this situation:



A. $n > mg$.

B. $n = mg$.

C. $n < mg$.

D. $n = 0$.

E. Not enough information to judge the size of the normal force.

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QuickCheck 6.15

A box is being pulled to the right at steady speed by a rope that angles upward. In this situation:

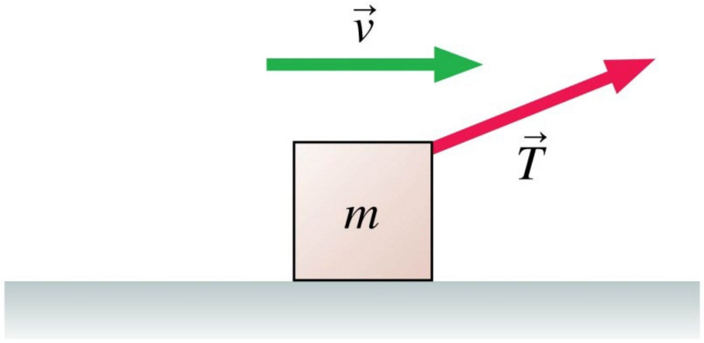
A. $n > mg$.

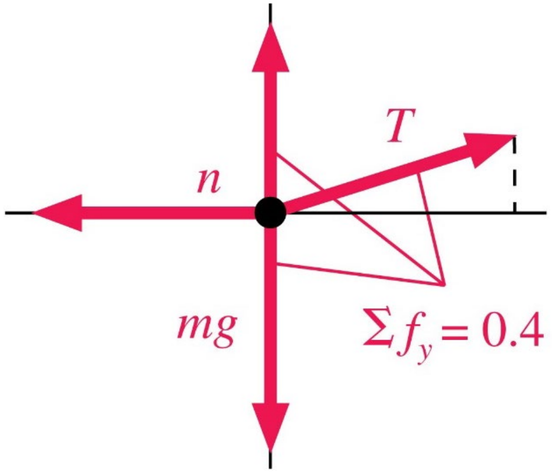
B. $n = mg$.

✔ **C. $n < mg$.**

D. $n = 0$.

E. Not enough information to judge the size of the normal force.





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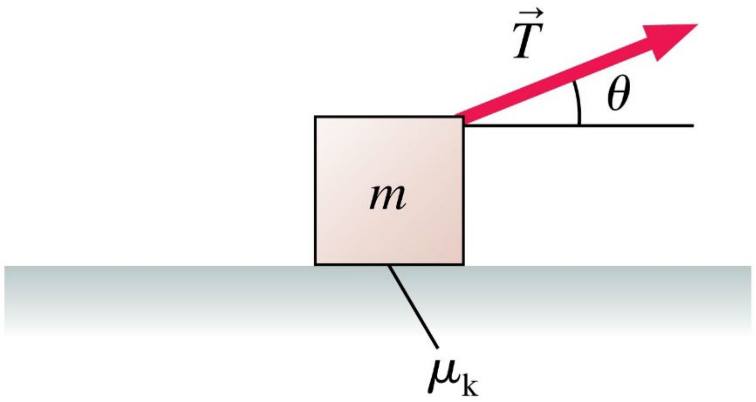
QuickCheck 6.16

A box is being pulled to the right by a rope that angles upward. It is accelerating. Its acceleration is



A. $\dfrac{T}{m}(\cos\theta + \mu_k \sin\theta) - \mu_k g.$

B. $\dfrac{T}{m}(\cos\theta - \mu_k \sin\theta) - \mu_k g.$

C. $\dfrac{T}{m}(\sin\theta + \mu_k \cos\theta) - \mu_k g.$

D. $\dfrac{T}{m} - \mu_k g.$

E. $\dfrac{T}{m}\cos\theta - \mu_k g.$

You'll have to work this one out.
Don't just guess!

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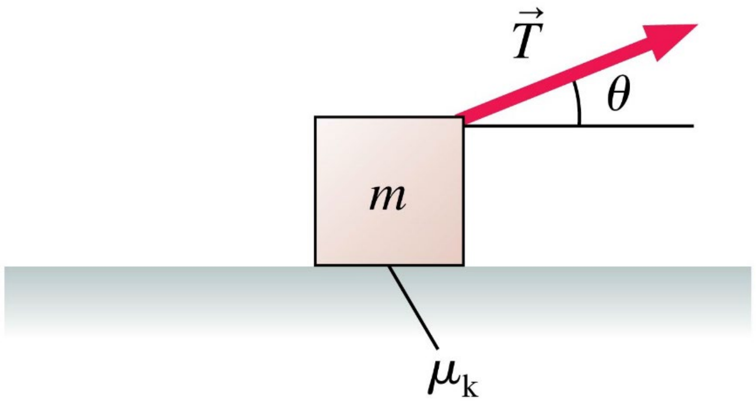
QuickCheck 6.16

A box is being pulled to the right by a rope that angles upward. It is accelerating. Its acceleration is



A. $\dfrac{T}{m}(\cos\theta + \mu_k \sin\theta) - \mu_k g.$

B. $\dfrac{T}{m}(\cos\theta - \mu_k \sin\theta) - \mu_k g.$

C. $\dfrac{T}{m}(\sin\theta + \mu_k \cos\theta) - \mu_k g.$

D. $\dfrac{T}{m} - \mu_k g.$

E. $\dfrac{T}{m}\cos\theta - \mu_k g.$

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