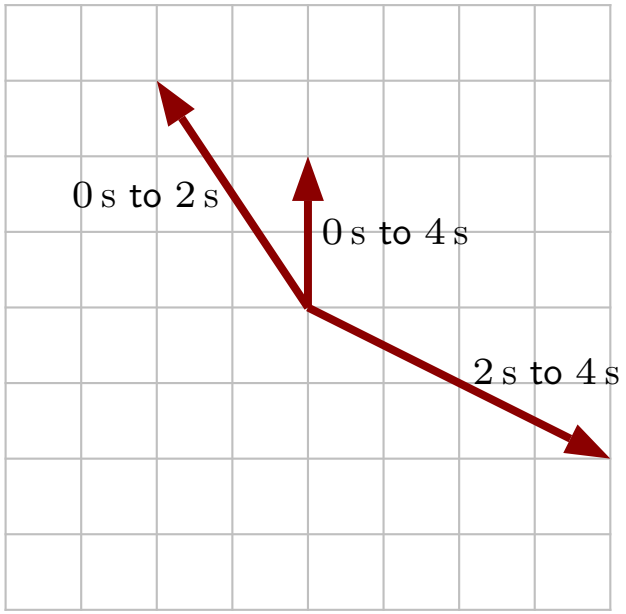
Question 1

A man pushes an object across a horizontal sheet of ice, such as in the PhET animation "Forces and Motion". The man pushes the crate for an initial period of $4\,\mathrm{s}$ and after this the crate loses contact with the man's hand but continues to slide to the right. Which of the following is/are true?

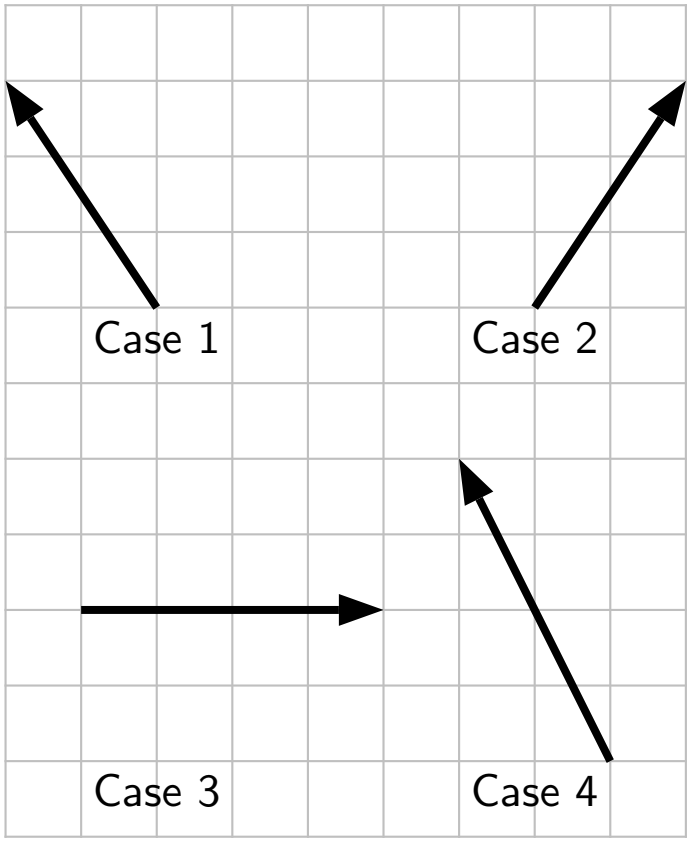
1. The man never exerts a force on the crate.
2. The man exerts a force on the crate during all times that the crate is moving.
3. The man only exerts a force on the crate *during* the initial period of $2\,\mathrm{s}$.
4. The man only exerts a force on the crate *after* the initial period of $2\,\mathrm{s}$.

Question 2

The following force vectors act on one object during various times as indicated.

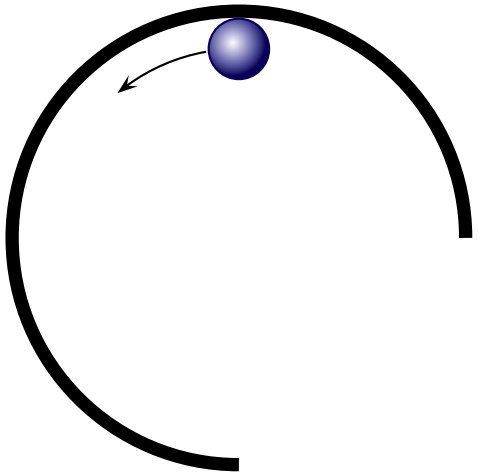


Which of the following best represents the net force acting on the object at $3\,\mathrm{s}$?



Question 3

A nearly complete hoop is placed on a perfectly frictionless horizontal table. A marble is placed inside the hoop and given an initial push so that it rolls touching the inside of the hoop. Viewed *from above:*

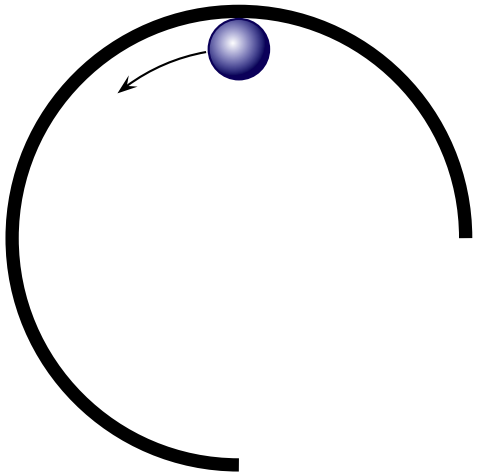


The marble slides at a constant speed while in contact with the hoop. Which of the following is true *while the marble slides along the hoop?*

1. The net force on the marble is zero.
2. The net force on the marble is not zero.
3. There is not enough information to decide whether the net force on the marble is zero or not.

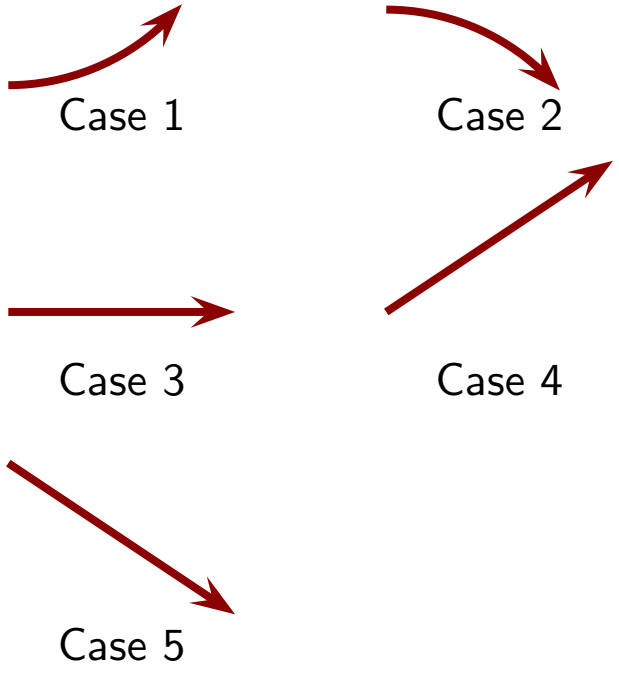
Question 4

A nearly complete hoop is placed on a perfectly frictionless horizontal table. A marble is placed inside the hoop and given an initial push so that it rolls touching the inside of the hoop. Viewed *from above:*



The effects of the earth's gravity and the table cancel each other.

Which of the following best describes the trajectory of the marble after it leaves the hoop?



Warm Up Question 1

A spacecraft, that had been launched from Earth, is eventually extremely distant from all stars, planets and other objects. Does the spacecraft still need to use its rockets or propulsion system to move with a constant speed? Explain your answer.

1. No. There is no atmosphere to resist forward motion.
2. No. The speed is unchanged until a force acts on the spacecraft.
3. No. Newton's First Law.
4. Yes.

Warm Up Question 2

King Zog observes a block on a horizontal frictionless surface. The block can be pulled by identical springs, each of which is stretched the same length. He believes that with a single spring the block will move with a constant velocity. He then considers the same block pulled by two such springs pulling in the same direction. He guesses that the block will move with a faster constant velocity than when just one spring is used. What advice would you offer to him regarding the velocity of the block when two springs are attached? Explain your answer.

1. The block will not move with constant velocity in either case.
2. Two springs provides twice the force, therefore twice the velocity.
3. The velocity will be the same.

Question 5

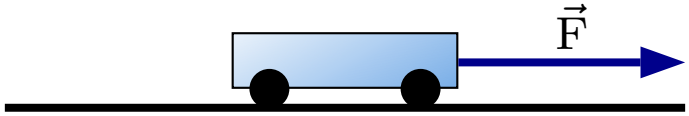
A cart moves along a horizontal surface to the right. During a particular period the cart slows down while moving to the right. The earth's gravitational force is irrelevant here and friction can be ignored.

Which of the following is true regarding the net force on the cart during this period?

1. $\vec{\mathrm{F}}_{\mathrm{net}} = 0.$
2. $\vec{\mathrm{F}}_{\mathrm{net}} \neq 0$ and points $\uparrow$
3. $\vec{\mathrm{F}}_{\mathrm{net}} \neq 0$ and points $\downarrow$
4. $\vec{\mathrm{F}}_{\mathrm{net}} \neq 0$ and points $\rightarrow$
5. $\vec{\mathrm{F}}_{\mathrm{net}} \neq 0$ and points $\leftarrow$

Question 6

A $1\,\mathrm{kg}$ cart moving along a horizontal surface is acted on by one force that constantly pulls from the right. The earth's gravitational force is irrelevant here and friction can be ignored.



The cart is initially at rest and after $2\,\mathrm{s}$ it reaches a velocity of $8\,\mathrm{m/s}$.

The same force is applied to a cart with the same mass, but initially moving with velocity $4\,\mathrm{m/s}$ right. The force is applied for $2\,\mathrm{s}$. The velocity of this cart after $2\,\mathrm{s}$ is (choose one):

1. $8\,\mathrm{m/s}$
2. $12\,\mathrm{m/s}$
3. $16\,\mathrm{m/s}$
4. $32\,\mathrm{m/s}$