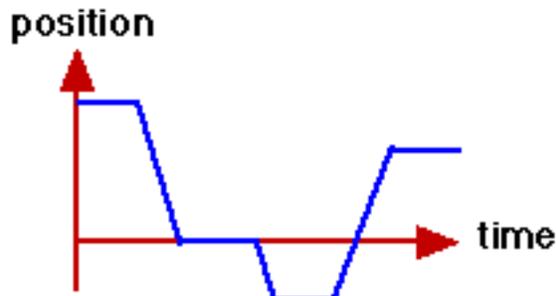


CPS lesson
Kinematics
ANSWER KEY

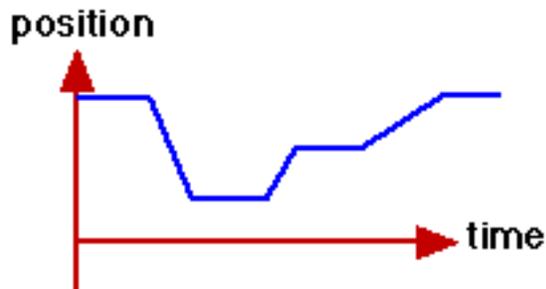
1. A person initially at P stays there for a moment, then moves to Q and stays there for a moment. She then runs quickly to R, stays there for a moment, and finally slowly strolls back to P. Which of the graphs represents this?



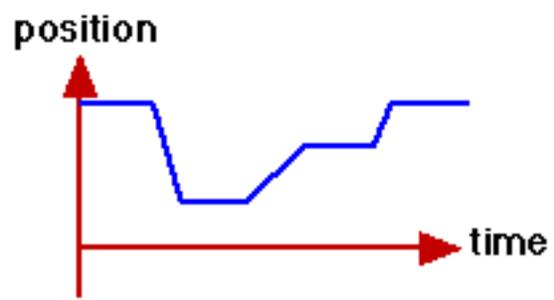
A.



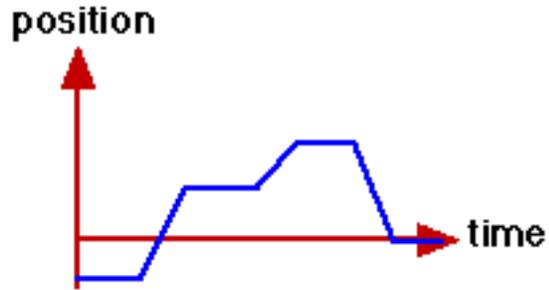
* B.



C.



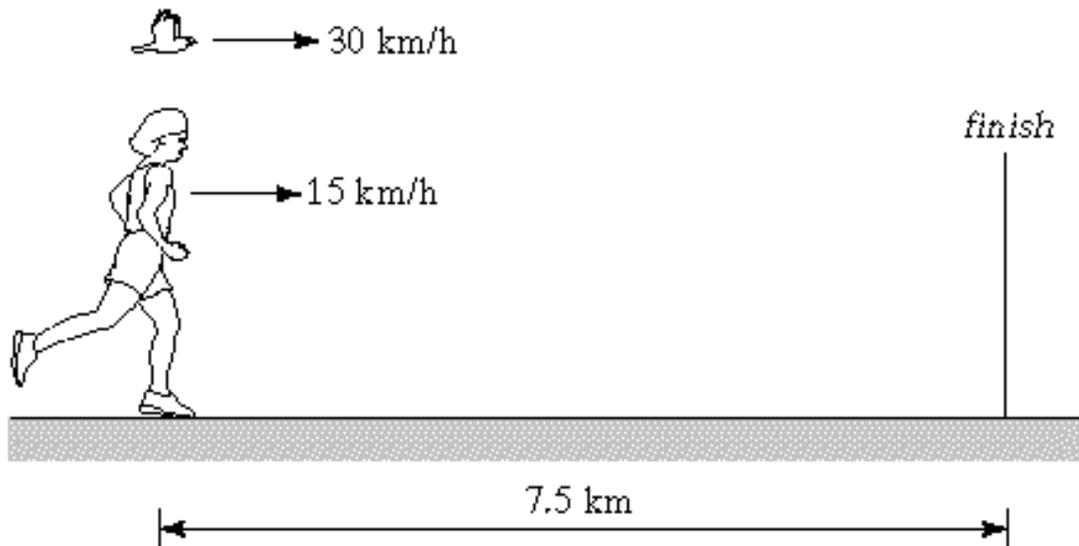
D.



2. An object goes from one point in space to another. After it arrives at its destination, the magnitude of the displacement is:

- A. either greater than or equal to the distance traveled
- B. always greater than the distance traveled
- C. always equal to the distance traveled
- * D. either smaller than or equal to the distance traveled
- E. either smaller or larger than the distance traveled

3. A marathoner runs at a steady 15 km/h. When the runner is 7.5 km from the finish, a bird begins flying back and forth from the runner to the finish at 30 km/h, until the runner reaches the finish. How far does the bird travel?



- A. 10 km
- * B. 15 km
- C. 20 km
- D. 30 km

4. If you drop an object in the absence of air resistance, it accelerates downward at 9.8 m/s^2 .

If instead you throw it downward, its downward acceleration after release will be:

- A. less than 9.8 m/s^2
- * B. equal to 9.8 m/s^2
- C. more than 9.8 m/s^2

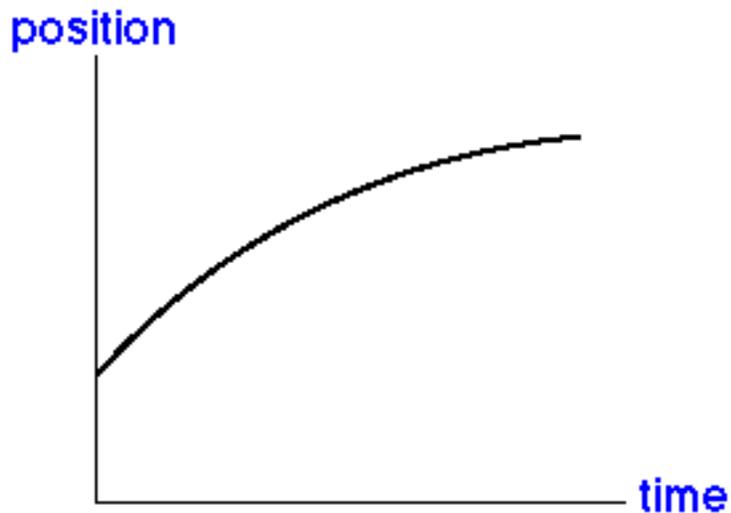
5. A person standing at the edge of a cliff throws one ball straight up and another ball straight down with the same initial speed.

Neglecting air resistance, the ball to hit the ground below the cliff with the greater speed is the one initially thrown:

- A. upward
- B. downward
- * C. both hit with the same speed

6. A train moves along a straight track according to the graph at right.

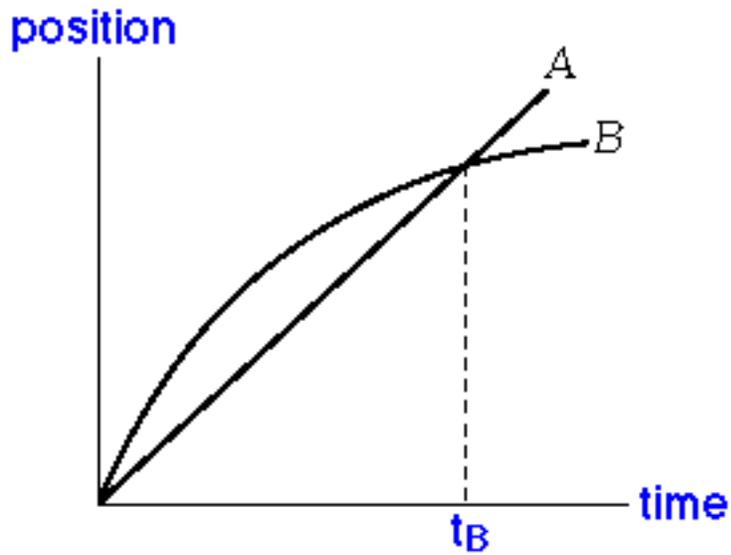
The train:



- A. speeds up the whole time
- * B. slows down the whole time
- C. speeds up part of the time and slows down part of the time
- D. moves at constant velocity

7. The graph at right is for two ships on parallel courses.

It is true that:



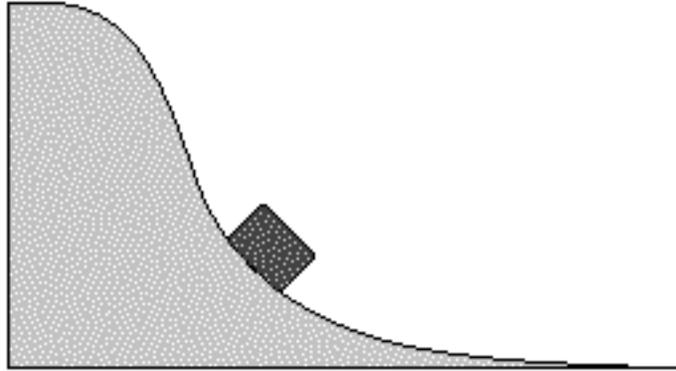
- A. At time t_B , both ships have the same velocity.
- B. Both ships speed up the whole time.
- * C. Both ships have the same velocity at some instant before t_B .
- D. At some instant, both ships have the same acceleration.

8. You throw a ball straight up into the air.

At the highest point, the ball's

- A. velocity and acceleration are both zero
- B. velocity is nonzero but acceleration is zero
- * C. acceleration is nonzero but velocity is zero
- D. velocity and acceleration are both nonzero

9. A roller coaster rolls down the track at right. As it rolls beyond the point shown, what happens to its speed and acceleration in the direction of motion?



- A. Both decrease.
- B. Speed decreases but acceleration increases.
- C. Both remain constant.
- * D. Speed increases but acceleration decreases.
- E. Both increase.

10. A ball is thrown vertically up to its highest point.

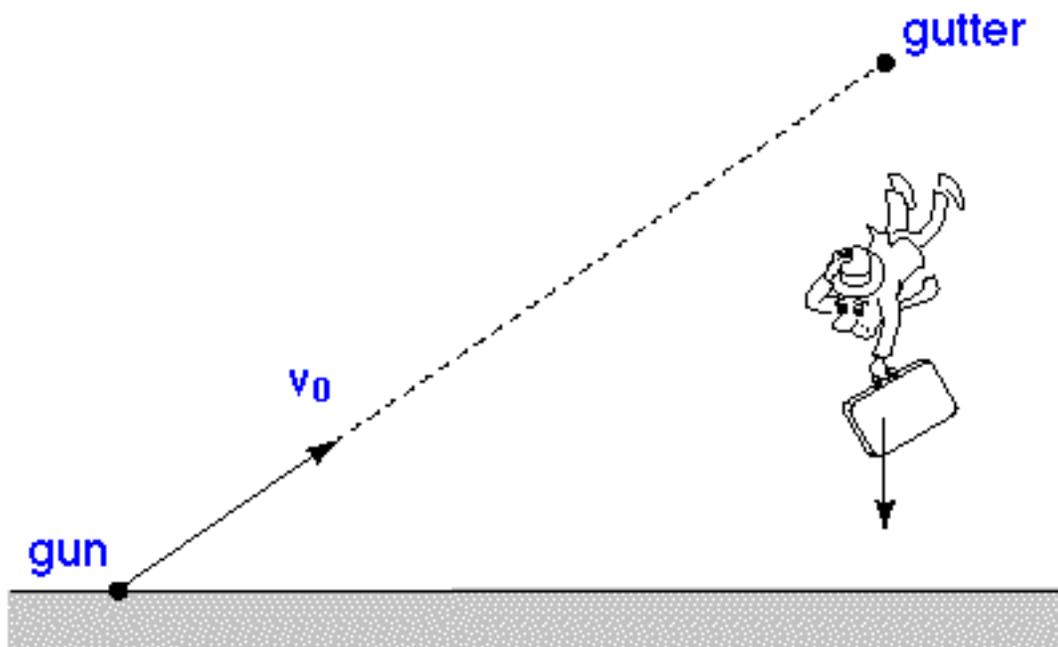
1. We film this motion and play the tape backward.
2. We watch the ball from the window of a rocket traveling up at the initial speed of the ball.

In which case is the ball observed to have a downward acceleration of 9.8 m/s^2 ?

- * A. 1 and 2
- B. only 1
- C. only 2
- D. in neither case

11. A gun is aimed straight at a criminal hanging from a building. The instant the gun is fired, the criminal lets go and drops to the ground.

The bullet:

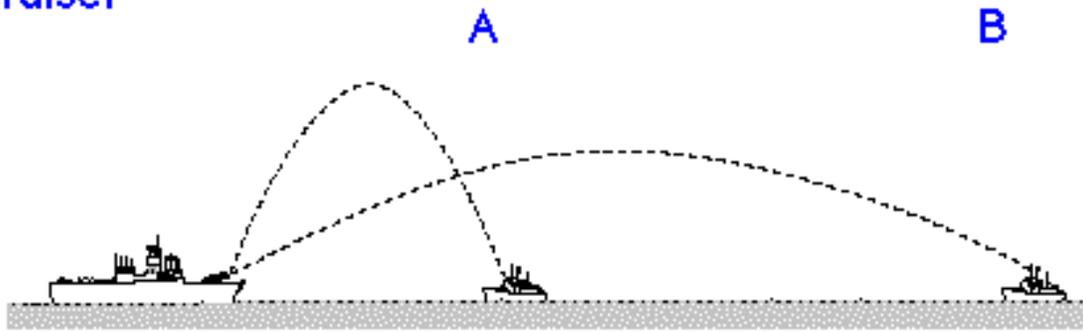


- A. hits the criminal only if v_0 is very large.
- * B. hits the criminal for any v_0 within the gun's range.
- C. passes above the criminal, at worst hitting his legs.

12. A cruiser simultaneously fires two shells at enemy ships.

Neglecting air resistance, which ship gets hit first?

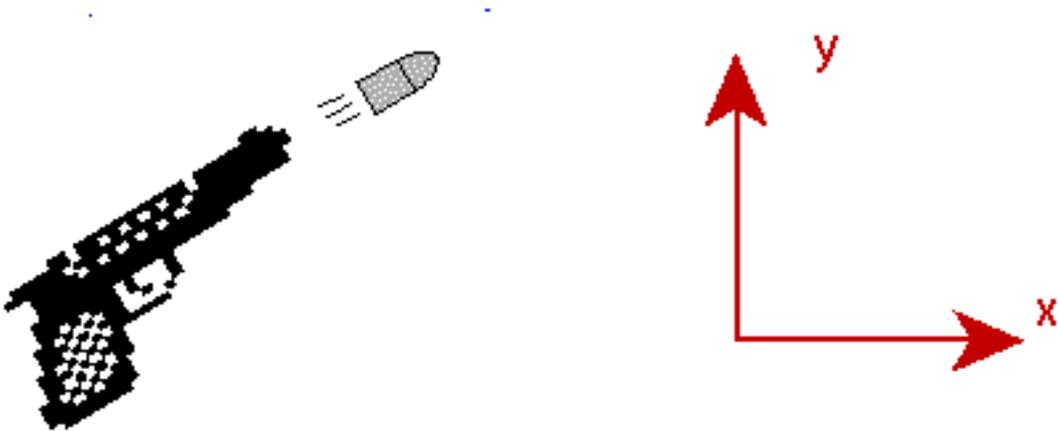
cruiser



- A. A
- * B. B
- C. Both simultaneously.
- D. It depends on whether muzzle speeds are the same.

13. A bullet is fired as shown.

Neglecting air resistance, during the bullet's flight it is true that:



- A. Only the x-component of the velocity will change.
- * B. Only the y-component of the velocity will change.

C. Neither component will change.

D. Both components will change.

14. The difference between acceleration and deceleration is:

A. Acceleration is positive while deceleration is negative.

B. Acceleration speeds up while deceleration slows down.

* C. Deceleration is a special case of acceleration in which the velocity and acceleration point in opposite directions.

15. The position of an object in m is $x = 2 + 3t + 4t^3$ with t in s.

Its initial position, velocity, and acceleration are:

* A. 2 m, 3 m/s, 0 m/s²

B. 2 m, 3 m/s, 4 m/s²

C. 2 m, 3 m/s, 8 m/s²

D. 2 m, 3 m/s, 12 m/s²

E. 2 m, 3 m/s, 24 m/s²

16. A driver slams on the brakes when he sees a downed tree. The car uniformly decelerates at -5.60 m/s^2 for 4.20 s, making skid marks 62.4 m long. With what speed does the car hit the tree?

A. 0 m/s

* B. 3.10 m/s

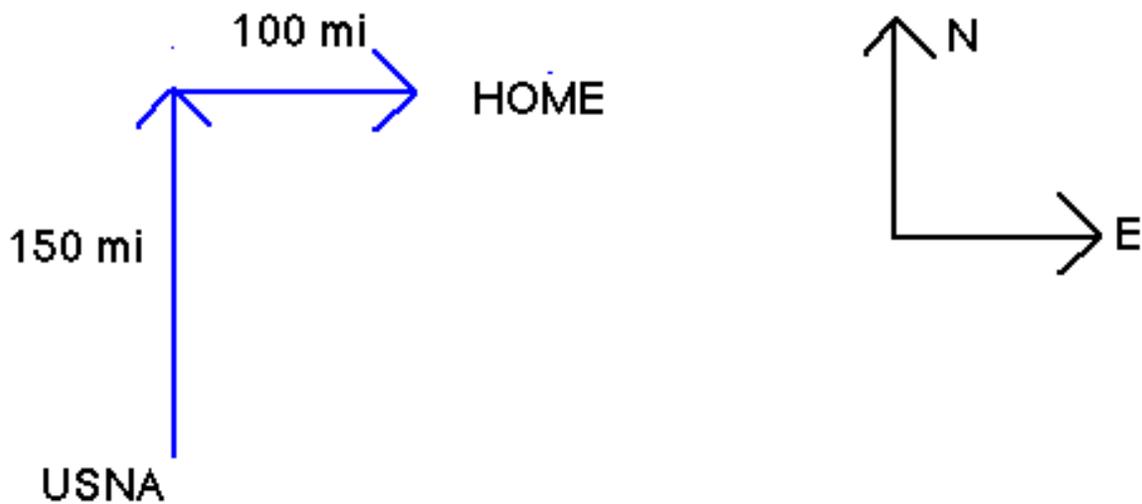
C. 11.8 m/s

D. 14.9 m/s

E. 26.7 m/s

17. You drive 250 miles in 5 hours following the indicated route.

What is your average velocity?



A. 50 mph NE

* B. 36 mph at 34° E of N

C. 50 mph at 34° E of N

D. 36 mph E

18. A cop pulls you over for doing 75 mph in a 65 mph zone.

Her radar detector measured your:

A. average speed

B. average velocity

- * C. instantaneous speed
- D. instantaneous acceleration

19. What is the difference between speed and velocity?

- A. Speed is the average of velocity.
- B. Speed is an instantaneous quantity while velocity is an average.
- C. Speed has both magnitude and direction. Velocity only has magnitude.
- * D. Velocity is a vector. Speed is the magnitude of that vector.

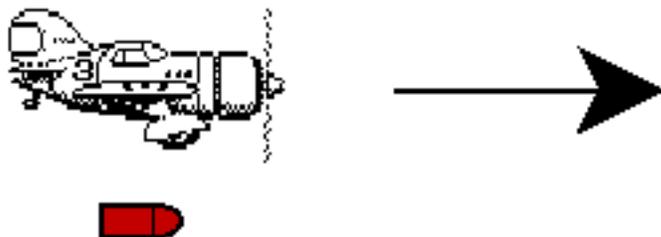
20. Which of the following is not an example of projectile motion?

- * A. A cruise missile launched from a submarine.
- B. Michael Jordan's free throws.
- C. The atomic bomb dropped from the Enola Gay.
- D. All of A to C are projectiles.
- E. None of A to C are projectiles.

21. The range of a projectile is:

- A. the total distance it travels.
- B. the horizontal distance from launch to impact.
- C. how far it travels vertically.
- * D. how far it traveled horizontally when it returns to its initial height.

22. A bomb is dropped from a plane flying to the right. What is the bomb's trajectory as seen from the ground?



A.



B.



C.



* D.



23. Near earth's surface, freefall acceleration:

- A. depends on the mass of an object.
- B. depends on the distance to the surface of the earth.
- C. is a scalar equal to 9.8 m/s^2 .
- * D. is a vector equal to 9.8 m/s^2 downward.
- E. depends on the prevailing winds.

24. A feather and a bowling ball are simultaneously dropped off the Leaning Tower of Pisa. The feather takes longer to hit the ground because:

- A. the feather has less mass.
- B. the feather weighs less.
- * C. the feather is less aerodynamic.
- D. the bowling ball experiences a larger gravitational force.

25. A ball is thrown straight up into the air.

As it is traveling upward, its acceleration:

- * A. equals g and points downward.

- B. equals g and points upward.
- C. is less than g and points upward.
- D. is greater than g and points downward.
- E. is zero.

26. (1) Acceleration always changes an object's speed.
(2) If an object is not moving, its acceleration must be zero.
(3) Once an object is moving, acceleration is irrelevant.

- A. only (1) is false
- B. only (2) is false
- C. only (3) is false
- * D. all of the statements are false
- E. all of the statements are true

27. At one instant, an object has the velocity shown. The acceleration is constant. What is its velocity a short while later?



A.



B.



C.



* D.



28. A block has a negative velocity in 1D. A negative acceleration is applied. The block:

- A. comes to and remains at rest.
- * B. speeds up.
- C. slows down.
- D. changes direction.
- E. maintains constant velocity.

29. What is freefall?

- A. An object falling at terminal velocity.
- B. An object whose initial velocity is zero.
- * C. An object whose acceleration is g .
- D. A moving object which is not in contact with any other bodies.

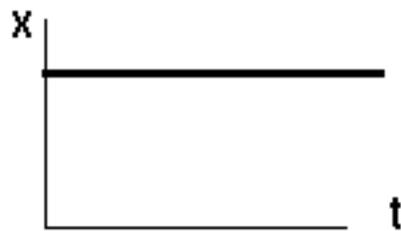
30. Which of the following could represent a ball rolling horizontally at constant speed?



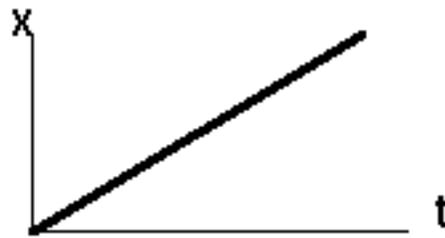
A.

t (s)	= 0	1	2	3	4	5
x (m)	= 0	1	4	9	16	25

B.



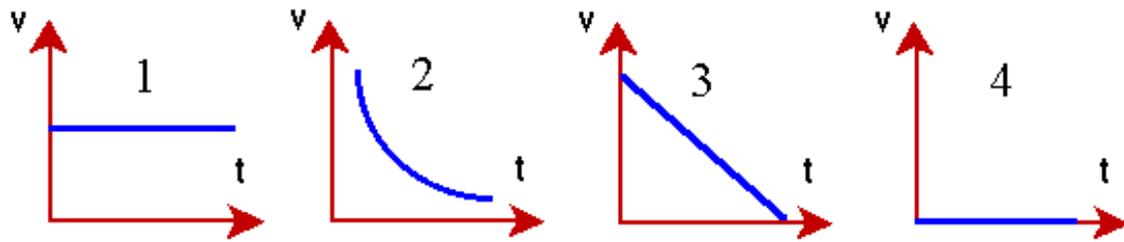
* C.



D.

$$v = 5t$$

31. For which graph is the acceleration zero?



- A. only 1
- B. only 2
- C. only 3
- D. only 4
- * E. for more than one graph

32. A car is traveling east at 50 km/h. It rounds a curve and 5 seconds later it is traveling north at 50 km/h. What is its average acceleration?

- A. zero
- B. 10 km/h/s
- * C. 14 km/h/s
- D. 20 km/h/s
- E. 50 km/h/s

33. The slope of the curve on a position vs time graph is equal to the particle's:

- A. displacement
- B. acceleration
- C. average velocity
- * D. instantaneous velocity

34.

It is possible for an object's instantaneous velocity and instantaneous acceleration to have opposite signs.

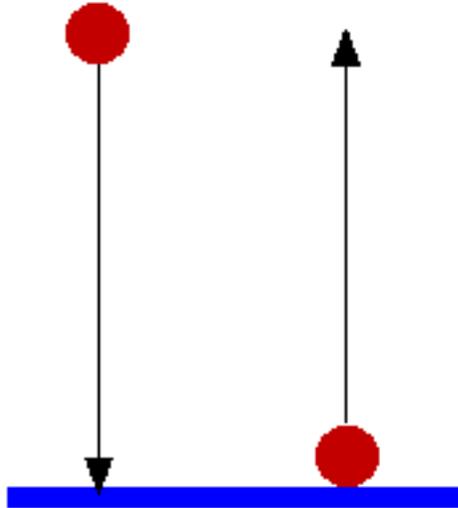
- * A. True
- B. False

35. Neglecting air resistance, an object dropped from a plane flying at constant velocity will:

- A. quickly lag behind the plane
- * B. remain vertically below the plane
- C. move ahead of the plane
- D. it depends on whether the plane is flying horizontally

36. Which are true for a ball bouncing without loss?

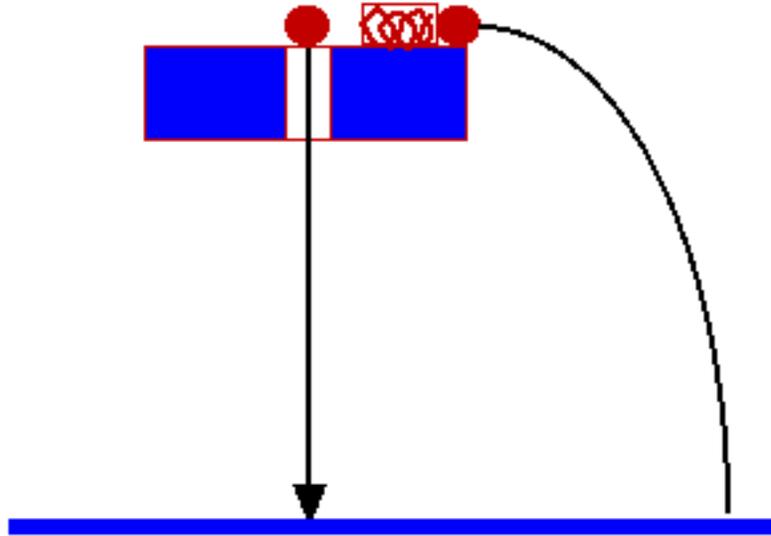
1. Speed is unchanged.
2. Velocity is unchanged.
3. Speed is reversed.
4. Velocity is reversed.



- A. 1 and 2
- * B. 1 and 4
- C. 2 and 3
- D. 3 and 4
- E. none of the above

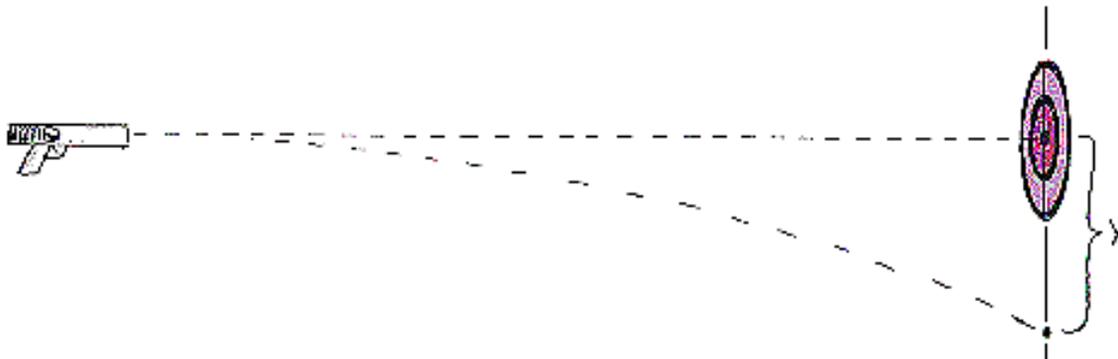
37. Two balls are released simultaneously, one dropping vertically and the other fired horizontally with a spring.

What happens?



- A. The dropped ball hits the floor first.
- B. The fired ball hits the floor first.
- * C. The balls hit simultaneously.
- D. The order depends on the spring.

38. A spring-loaded gun is aimed directly at a distant bull's eye. Because of gravity, the projectile misses and hits at distance y below the target. Ignoring air drag, to hit the bull's eye the gun should be aimed above it by a distance of:

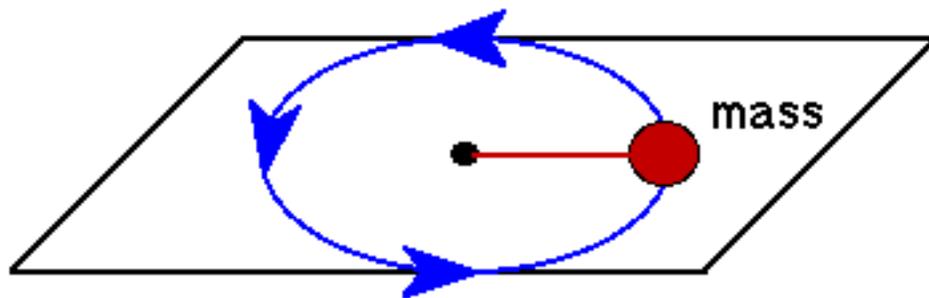


- A. exactly y .

- B. slightly less than y .
- * C. slightly more than y .
- D. depends on its speed.

39. A mass on a string revolves in a horizontal plane at constant speed.

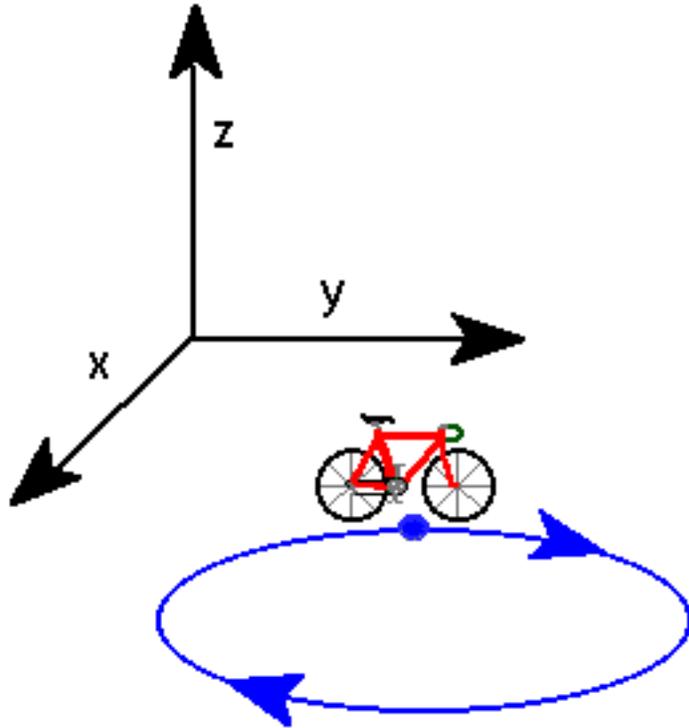
Its centripetal acceleration is:



- A. tangent to its velocity
- B. zero
- C. perpendicular to the string
- * D. radially inward
- E. radially outward

40. A cyclist rides around a circular track at constant speed.

At the instant shown, in what direction is her acceleration?



- * A. x
- B. y
- C. z
- D. none of the above

41. In uniform circular motion, the speed of an object is constant.

- * A. True
- B. False

42.

In uniform circular motion, the acceleration of an object is:

A. zero

B. constant

* C. neither of the above