TWO DIMENSIONAL VECTORS AND MOTION

1. Two nonzero vectors have unequal magnitudes of X and Y. Which of the following could be the length of their sum? (i) 0 (ii) $X+Y$ (iii) X (iv) Y

a. (i), (iii), and (iv)
b. (ii), (iii), and (iv)
c. (ii) only
d. Any of them could be the length of the sum.

2. Let's say that the magnitude of a particle's displacement is 2 m. Which of the following values could represent the distance traveled? (i) 0 m (ii) 1 m (iii) 2 m (iv) 3 m

a. all of them
b. (i) and (ii)
c. (ii), (iii), and (iv)
d. (iii) and (iv)

3. The magnitudes of two vectors **A** and **B** are $A = 5$ units and $B = 2$ units. Select the largest and smallest values for the magnitude of the resultant vector, $\mathbf{R} = \mathbf{A}+\mathbf{B}$.

a. 2 and 5
b. 3 and 7
c. 2 and 7
d. 3 and

4. Which of the following are vectors? (i) your age (ii) your height (iii) acceleration (iv) velocity (v) speed (vi) mass

a. (iii), (iv), and (v)
b. (i), (ii), and (vi)
c. (iii) and (iv)
d. All of these

5. A Vector **A** lies in the x-y plane. For what orientations will both components be negative?

a. None. Just like for vector magnitudes, components are always positive.
b. The vector lies between 0° and 90° from the x-axis.
c. The vector lies between 90° and 180° from the x-axis.
d. The vector lies between 180° and 270° from the x-axis.

6. A book is moved once around the perimeter of a tabletop with the dimensions 1.0 m x 2.0 m. If the book ends up at its original position, what is its displacement and what is the distance it traveled?

a. Displacement of 6 m, distance traveled 6 m.
b. Displacement of 6 m, distance traveled 0 m.
c. Displacement of 0 m, distance traveled 6 m.
d. Displacement of 0m, distance traveled 0 m..

7. While traveling along a straight interstate highway you notice that the mile marker reads 260. You travel until you reach mile marker 150 and then retrace your path to the mile marker 175. What is the magnitude of your resultant displacement from mile marker 260?

a. 135 miles
b. 85 miles
c. 260 miles
d. 110 miles

8. If Vector **B** is added to Vector **A**, under what condition does the resultant vector **A + B** have magnitude $A + B$?

a. **A** and **B** are parallel and in the same direction.
b. **A** and **B** are parallel and in opposite directions.
c. **A** and **B** are perpendicular.
d. The resultant vector can never have a magnitude equal to the sum of the magnitudes of the two vectors added together.

9. Suppose that the component of Vector **A** along the direction of Vector **B** is zero. What can you conclude about the two vectors?

a. They are parallel and in the same direction.
b. They are perpendicular.
c. They are parallel and in opposite directions.
d. We cannot conclude anything from this.

10. If at least one component of a vector is a positive number, the vector cannot:

a. have any component that is negative.
b. be zero.
c. have three dimensions.
d. none of these choices.

11. If **A + B** = 0, the corresponding components of the two vectors **A** and **B** must be:

a. equal.
b. positive.
c. negative.
d. of opposite sign

12. Which of the following are reasonable values for the magnitude of a vector? (i) 0 (ii) -1 (iii) +1

a. (iii) only.
b. (i) and (ii).
c. (i) and (iii).
d. all of them

13. Under what circumstances would a nonzero vector lying in the *xy* plane have components that are equal in magnitude?

a. Always. Components of vectors are always equal in just 2 dimensions.
b. Only when the vector lies on the x- or y-axes (0°, 90°, 180°, or 270°).
c. Only when the vector lies 45° from the x- or y-axes (45°, 135°, 225°, or 315°).

d. This can never happen

14. If **A** = **B**, what can you conclude about the components of **A** and **B**?

a. The components are equal and opposite.
b. The components are equal.
c. One of the components of each must be 0.
d. You can say nothing about the components because this equation relates vectors and not the components of vectors.

15. Which of the following cannot possibly be accelerating?

a. an object moving with a constant speed
b. an object moving along a curve
c. an object moving with a constant velocity
d. Any of these could be accelerating.

16. Consider the following controls in an automobile: gas pedal, brake, steering wheel. The control(s) in this list that cause(s) an acceleration of the car is/are:

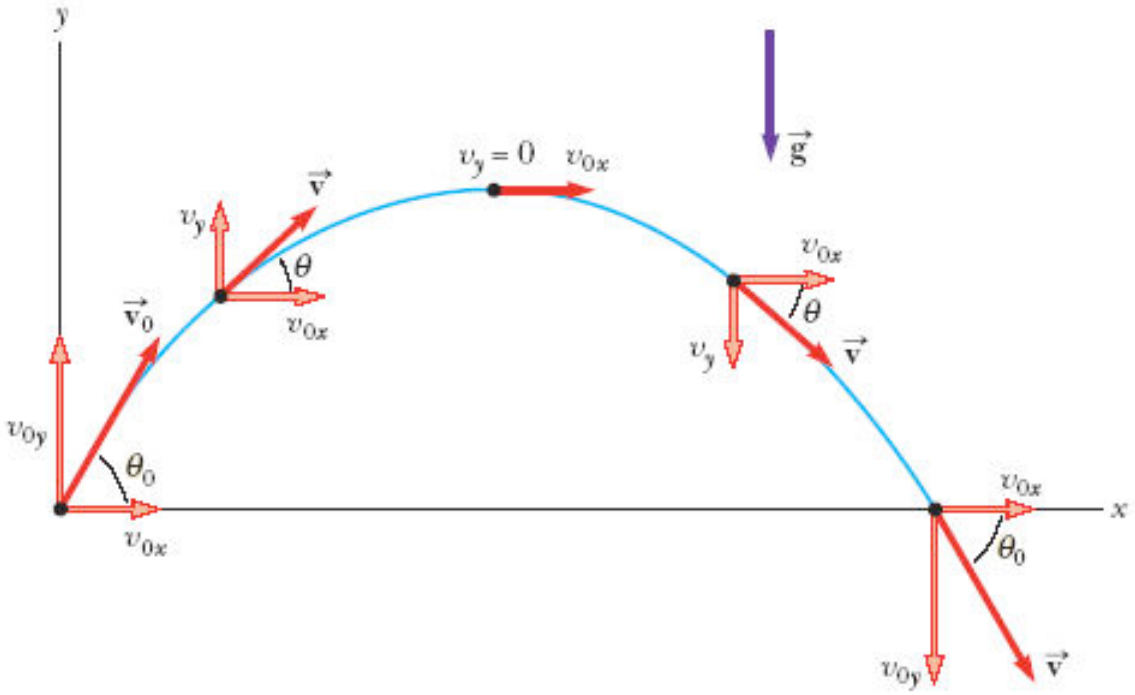
a. the gas pedal and the brake but not the steering wheel.
b. only the brake.
c. only the gas pedal.
d. all three controls.

17. Suppose you are running at constant velocity and you wish to throw a ball such that you will catch it as it comes back down. Neglecting air resistance, in what direction should you throw the ball relative to you?

a. at an angle to the ground that depends on your running speed
b. in the forward direction
c. straight up
d. none of these

18. As a projectile thrown upward at a non-vertical angle moves in a parabolic path, at what point along its path are the velocity and acceleration vectors for the projectile parallel to each other?

a. nowhere
b. at the highest point
c. at the point just before the projectile lands
d. at the launch point

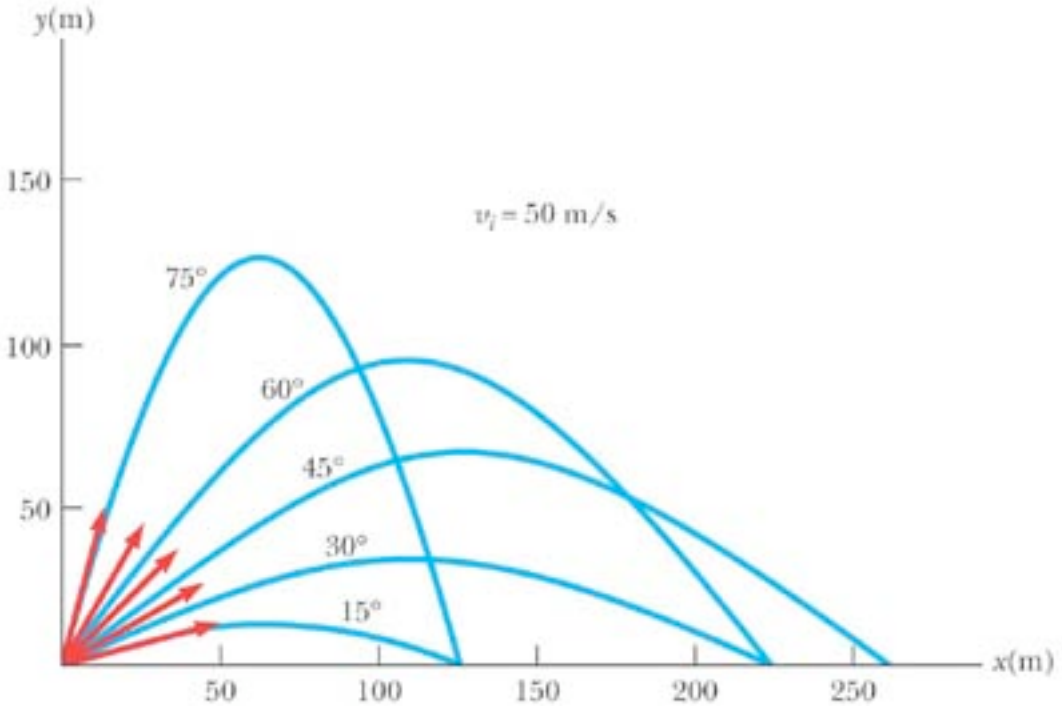


19. As a projectile thrown upward at a non-vertical angle moves in a parabolic path (such as in the Figure above), at what point along its path are the velocity and acceleration vectors for the projectile perpendicular to each other?

a. nowhere
b. at the highest point
c. at the point midway between the launch point and the highest point
d. at the launch point

20. Rank the launch angles for the five paths (next page) in the accompanying figure with respect to the time of flight, from the shortest time of flight to the longest.

a. 15°, 30°, 45°, 60°, 75°
b. 75°, 60°, 45°, 30°, 15°
c. 45°, 60°, 30°, 75°, 15°
d. They all take the same time to land because they are all launched with the same initial speed.



21. A particle moves along a path and its speed increases. In which of the following cases are its acceleration and velocity vectors parallel?

a. never
b. When the path is a parabola.
c. When the path is circular.
d. When the path is straight.

22. A stream of water is leaking from the roof of a train into the cab below, to the dismay of the passengers in the cab. The train is moving with a constant speed of 100 km/hour. An observer from outside the train sees the situation through the train window as the train passes by. Which observer(s) see a parabolic path for the water as it moves through the air of the cab?

a. the observer from outside the train
b. the passengers within the cab
c. neither the observer from outside the train nor the passengers within the cab

d. both the observer from outside the train and the passengers within the cab

23. Which of the following quantities, if any, remain constant as a projectile moves through its parabolic trajectory: (i) speed. (ii) acceleration. (iii) horizontal component of velocity. (iv) vertical component of velocity.

a. (i) only
b. (ii) and (iv).
c. (ii) and (iii).
d. all of them.

24. Determine which of the following objects obey the equations of projectile motion developed in Chapter 3. (i) A ball is thrown in an arbitrary direction. (ii) A jet airplane crosses the sky with its engines thrusting the plane forward. (iii) A rocket leaves the launch pad. (iv) A rocket moving through the sky after its engines have failed. (v) A stone is thrown underwater.

a. All of them obey the equations of projectile motion.
b. (ii), (iii) and (iv) only.
c. (i) and (v) only.
d. (i) and (iv) only.

25. A sailor drops a wrench from the top of a sailboat's mast while the boat is moving steadily and rapidly in a straight line. Where will the wrench hit the deck?

a. behind the mast, along the direction opposite to the motion of the boat
b. in front of the mast, along the direction of the motion of the boat
c. at the base of the mast
d. impossible to tell

26. Two cars, A and B, are moving with constant velocities, $\mathbf{v}_{AL}$ and $\mathbf{v}_{BL}$, across a vacant parking lot, the velocities given with respect to the lot thus explaining the L in the subscripts. What is the relative velocity, $\mathbf{v}_{AB}$, of car A as seen from car B?

a. $\mathbf{v}_{AL} + \mathbf{v}_{BL}$
b. $\mathbf{v}_{AL} - \mathbf{v}_{BL}$
c. $\mathbf{v}_{BL} - \mathbf{v}_{AL}$
d. $-\mathbf{v}_{AL} - \mathbf{v}_{BL}$

Solution: b, d, b, c, d, c, b, a, b, b, d, c, c, b, c, d, c, a, b, a, d, a, c, d, c, b