RELATIVE MOTION, HOME WORK SHEET-1

Relative Motion

1. Two particle are moving with velocity v_1 and v_2. Their relative velocity is the maximum, when the angle between their velocities is :

(A) zero (B) $\pi/4$ (C) $\pi/2$ (D) π

2. A car A is goig north east at 80 kmh-1 and another car B is going south east with a velocity of 60 kmh^{-1}. The velocity of A relative to B makes an angle with the north equal to

(A) $\tan^{-1}\left(\frac{2}{7}\right)$ (B) $\tan^{-1}\left(\frac{7}{2}\right)$ (C) $\tan^{-1}(7)$ (D) $\tan^{-1}\left(\frac{1}{7}\right)$

3. A coin is released inside a lift at a height of 2 m from the floor of the lift. The height of the lift is 10m. The lift is moving with an acceleration of 11 m/s^2 downwards. The time after which the coin will strike with the lift is:

(A) 4 s (B) 2 s (C) $\frac{4}{\sqrt{21}}s$ s (D) $\frac{2}{\sqrt{1}}s$

4. A ship is travelling due east at 10 km/h. A ship heading 30° east of north is always due north from the first ship. The speed of the second ship in km/h is-

(A) $20\sqrt{2}$ (B) $20\sqrt{3/2}$ (C) 20 (D) $20\sqrt{2}$

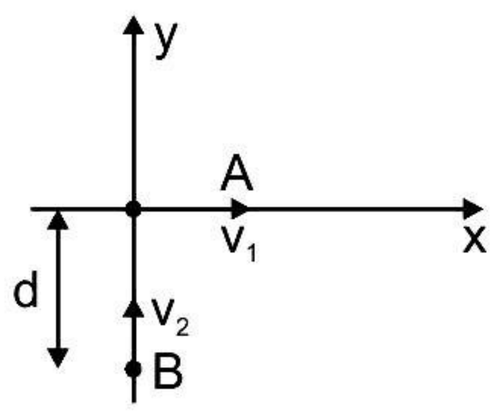
5. Three ships A, B & C are in motion. The motion of A as seen by B is with speed v towards north - east. The motion of B as seen by C is with speed v towards the north - west. Then as seen by A, C will be moving towards

(A) north (B) south (C) east (D) west

6. Three stones A, B and C are simultaneously projected from same point with same speed. A is thrown upwards. B is thrown horizontally and C is thrown downwards from a building. When the distance between stone A and C becomes 10 m, then distance between A and B will be :

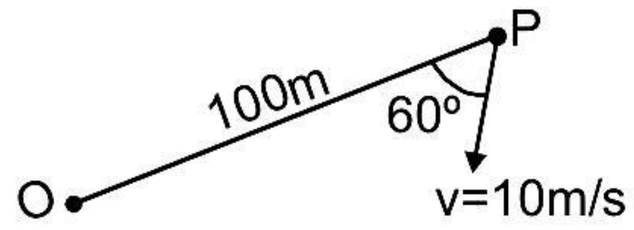
(A) 10 m (B) 5 m (C) $5\sqrt{2}\,m$ (D) $10\sqrt{2}\,m$

7. Two particles A and B move with velocities v_1 and v_2 respectively along the x & y axis. The initial separation between them is 'd' as shown in the fig. Find the least distance between them during their motion.



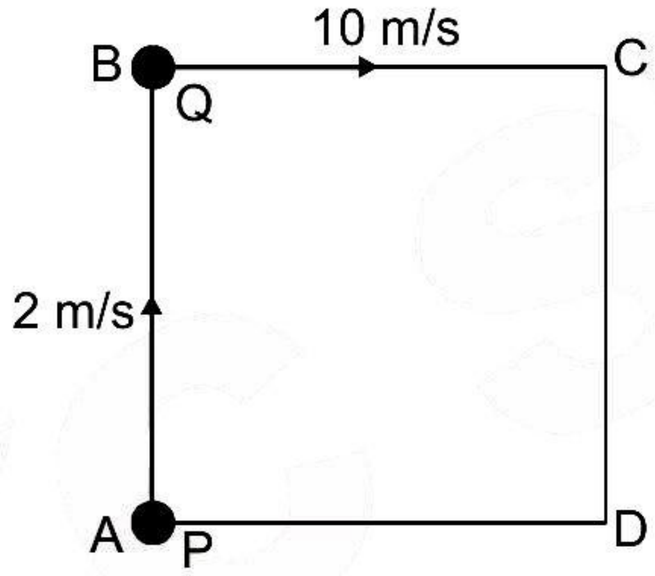
(A) $\frac{d.v_1^2}{v_1^2+v_2^2}$ (B) $\frac{d.v_2^2}{v_1^2+v_2^2}$ (C) $\frac{d.v_1}{\sqrt{v_1^2+v_2^2}}$ (D) $\frac{d.v_2}{\sqrt{v_1^2+v_2^2}}$

8. P is a point moving with constant speed 10 m/s souch that its velocity vector always maintains an angle 60° with line OP as shown in figure (O is a fixed point in space). The initial distance between O and P is 100 m. After what time shall P reach O.



(A) 10 sec. (B) 15 sec. (C) 20 sec (D) $20\sqrt{3}$ sec

9. Two men P & Q are standing at corners A & B of square ABCD of side 8m. They start moving along the track with constant speed 2 m/s and 10 m/s respectively. The time when they will meet for the first time, is equal to :



(A) 2 sec (B) 3 sec (C) 1 sec (D) 6 sec

10. An express train is moving with a velocity v_1. Its driver finds another train is moving on the same track in the same direction with velocity v_2. To escape collision, driver applies a retardation a on the train. The minimum time of escaping collision will be

(A) $t = \frac{v_1 - v_2}{a}$ (B) $t = \frac{v_1^2 - v_2^2}{2}$ (C) None (D) Both

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ANSWERS

HOME WORK SHEET-1

1. D	2. D	3. A	4. C	5. B
6. C	7. C	8. C	9. B	10. A

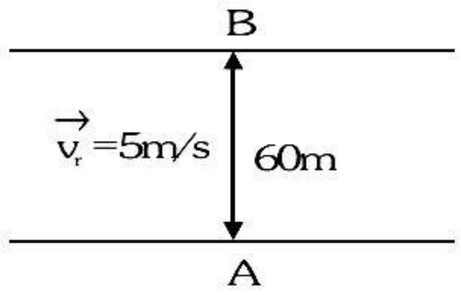
RELATIVE MOTION, HOME WORK SHEET-2

Applications of Relative Motion

1. Raindrops are falling vertically with a velocity 10m/s. To a cyclist moving on a straight road the rain drops appear to be coming with a velocity of 20m/s. The velocity of cyclist is :-

(A) 10m/s (B) $10\sqrt{3}$ m/s (C) 20 m/s (D) $20\sqrt{3}$ m/s

2. A man is crossing a river flowing with velocity of 5m/s. He reaches a point directly across at distance of 60 m in 5s. His velocity in still water should be :–



(A) 12 m/s (B) 13 m/s (C) 5 m/s (D) 10 m/s

3. A person standing on the excalator takes time t_1 to reach the top of a tower when the escalator is moving. He takes time t_2 to reach the top of the tower when the excalator is standing. How long will he take if the walks up a moving escalator?

(A) $t_2 - t_1$ (B) $t_2 + t_1$ (C) $t_1t_2/(t_1 - t_2)$ (D) $t_1t_2/(t_1 + t_2)$

4. A battalion of soldiers is ordered to swim across ariver 500 ft wide. At what minimum rate should they swim perpendiculat to river flow in order to avoid being washed away by the waterfall 300 ft downstream. The speed of current being 3 m.p.h. :

(A) 6 m.p.h. (B) 5 m.p.h. (C) 4 m.p.h. (D) 2 m.p.h.

5. A car with a vertical wind shield moves along in a rain stom at the speed of 40 km/hr. The rain drops fall vertically with a terminal speed of 20 m/s. The angle with the vertical at which the rain drop strike the wind shield is -

(A) $\tan^{-1}$ (5/9) (B) $\tan^{-}$ (9/5) (C) $\tan^{-1}$ (3/2) (D) $\tan^{-1}(3)$

6. An airplane is flying with velocity $50\sqrt{2}\ km/hour$ in north-east direction. Wind is blowing at 25 km/hr from north to south. What is the resultant displacement of airplane in 2 hours?

7. An airplane piolot sets a compass course due west and maintains an air speed of 240 km. hr^{-1}. After flying for ½ hr, he finds himself over a town that is 150 km west and 40 km south of his starting point.

(a) Find the wind velocity, in magnitude and direction.

(b) If the wind velocity were 120 km. hr^{-1} due soulth, in what direction should the pilot set his course in order to travel due west? TAke the same air speed of 240 km. hr^{-1}.

8. A bus is going southwards at 5m/s. To a man sitting in bus a car appears to move towards west at $2\sqrt{6}\, m/s$. What is the actual speed of car?

(A) 4m/s (B) 3m/s (C) 7m/s (D) None of these

9. A girl walking on a road with velocity of 8kph. Suddenly rain starts falling at 10kph in vertically downward direction. The velocity of rain w.r.t. to girl is

(A) $\sqrt{7}\, kph$ (B) $\sqrt{13}\, kph$ (C) $\sqrt{6}\, kph$ (D) $\sqrt{164}\, kph$

10. A boat of sent across (perpendicular) a river with a velocity 8kph. If the resultant velocity of boat is 10 kph, the river is flowing with velocity.

(A) 6 kph (B) $\sqrt{13}\, kph$ (C) $\sqrt{6}\, kph$ (D) $\sqrt{109}\, kph$

ANSWERS

HOME WORK SHEET-2

1. B	2. B	3. D	4. B	5. A
6. $50\sqrt{5}\, km$	7. (a) 100 km/hr, 37° W of S		(b) 30° N of W	8. C
9. D	10. A			