

1. A 120 m long train is moving in a direction with speed 20 m/s. A train B moving with 30 m/s in the opposite direction and 130 m long crosses the first train in a time.

(a) 6 s

(b) 36 s

(c) 38 s

(d) None of these

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2. Two trains are moving with equal speed in opposite directions along two parallel railway tracks. If the wind is blowing with speed u along the track so that the relative velocities of the trains with respect to the wind are in the ratio $1 : 2$, the speed of each must be
- (a) $3u$ (b) $2u$ (c) $5u$ (d) $4u$

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3. A 150 m long train is moving to north at a speed of 10 m/s. A parrot flying towards south with a speed of 5 m/s crosses the train. The time taken by the parrot to cross the train would be

(a) 30 s

(b) 15 s

(c) 18 s

(d) 10 s

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4. Two cars are moving in the same direction with the same speed 30 km/h. They are separated by a distance of 5 km, the speed of a car moving in the opposite direction if it meets these two cars at an interval of 4 min, will be
- (a) 40 km/h (b) 45 km/h (c) 30 km/h (d) 15 km/h

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5. 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, the 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) $t = \frac{v_1^2 - v_2^2}{2a}$

(c) None

(d) Both

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6. Two cars A and B are travelling in the same direction with velocities v_1 and v_2 ($v_1 > v_2$). When the car A is at a distance d behind the car B, the driver of the car A applied the brake producing a uniform retardation a . There will be no collision when

(a) $d < \frac{(v_1 - v_2)^2}{2a}$

(b) $d < \frac{(v_1^2 - v_2^2)}{2a}$

(c) $d > \frac{(v_1 - v_2)^2}{2a}$

(d) $d > \frac{(v_1^2 - v_2^2)}{2a}$

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7. A ball A is thrown up vertically with a speed u and at the same instant another ball B is released from a height h .
At time t , the speed of A relative to B is

- (a) u (b) $2u$ (c) $u - gt$ (d) $\sqrt{u^2 - gt}$

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9. A car A is going north-east at 80 km/h and another car B is going south-east at 60 km/h. The direction of the velocity of A relative to B makes an angle with the north equal to:

(a) $\tan^{-1}(2/7)$

(b) $\tan^{-1}(7/2)$

(c) $\tan^{-1}(7)$

(d) $\tan^{-1}(1/7)$

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10. Rain is falling vertically downward with velocity 4 m/s. A man is moving horizontally with velocity 3 m/s, the velocity of rain with respect to man is

- (a) 5 m/s at an angle $\tan^{-1}(4/3)$ with horizontal
- (b) 5 m/s at an angle $\tan^{-1}(3/4)$ with vertical
- (c) 5 m/s at an angle $\tan^{-1}(4/3)$ with vertical
- (d) both (a) and (b)

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11. Two boys are standing at the ends A and B of a ground where $AB=a$, the boy at B starts running in a direction perpendicular to AB with velocity v_1 . The boy at A starts running simultaneously with velocity v and catches the other boy in a time t , where t is

(a) $\frac{a}{v + v_1}$

(b) $\frac{a}{v - v_1}$

(c) $\frac{a}{\sqrt{v^2 + v_1^2}}$

(d) $\frac{a}{\sqrt{v^2 - v_1^2}}$

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12. A ship is traveling due east at a speed of 15 km/h. Find the speed of a boat heading 30° east of north if it appears always due north from the ship.

- (a) 30 km/h (b) $\frac{15\sqrt{3}}{2}$ km/h (c) $10\sqrt{3}$ km/h (d) 20 km/h

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13. Three particles A, B and C are situated at the vertices of an equilateral triangle ABC of side d at $t = 0$. Each of the particles moves with constant speed v , always has its velocity along AB, B along BC and C along CA. At what time will the particles meet each other?

(a) $2d/3v$

(b) $d/3v$

(c) $3d/2v$

(d) $4d/3v$

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14. Four particles A, B, C and D are situated at the vertices of a rectangle of side d at $t = 0$. Each of the particles moves with constant speed v . A always has its velocity along AB, B along BC, C along CD and D along DA. At what time will the particles meet each other?

(a) $2d/3v$

(b) d/v

(c) $3d/2v$

(d) $4d/3v$

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15. Six particles situated at the corners of a regular hexagon of side a move at a constant speed v . Each particle maintains a direction towards the particle at the next corner the time the particle will to meet each other.

(a) $2d/3v$

(b) $2d/v$

(c) $3d/2v$

(d) $4d/3v$

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16. A particle A is at origin and particle B is at distance $y = -d$ at $t = 0$. They move with constant velocity v . A towards positive x-axis and B towards origin. The time at which distance between them is minimum and minimum distance will be

(a) $\frac{d}{2v}, d$

(b) $\frac{d}{v}, \frac{d}{\sqrt{2}}$

(c) $\frac{d}{2v}, \frac{d}{\sqrt{2}}$

(d) $\frac{d}{v}, d$

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- 17.** A police jeep is chasing with a velocity of 45 km/h a. Thief in another jeep moving with a velocity of 153 km/h . Police fires a bullet with muzzle velocity of 180 m/s . The velocity with which it will strike the jeep of the thief is
- (a) 150 m/s (b) 27 m/s (c) 450 m/s (d) 250 m/s

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18. A cart is moving horizontally along a straight line with constant speed 30 m/s. A projectile is to be fired from the moving cart in such a way that it will return to the cart after the cart has moved 80 m. At what speed (relative to the cart) must the projectile be fired? (Take $g = 10 \text{ m/s}^2$)

(a) 10 m/s

(b) $10\sqrt{8} \text{ m/s}$

(c) $\frac{40}{3} \text{ m/s}$

(d) None of these

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19. A boat is moving with a velocity $3\mathbf{i} + 4\mathbf{j}$ with respect to the ground. The water in the river is moving with a velocity $-3\mathbf{i} - 4\mathbf{j}$ with respect to the ground. The relative velocity of the boat with respect to water is

(a) $8\mathbf{j}$

(b) $-6\mathbf{i} - 8\mathbf{j}$

(c) $6\mathbf{i} + 8\mathbf{j}$

(d) $5\sqrt{2}$

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20. A boat is sent across a river with a velocity of 8 km/h. If the resultant velocity of the boat is 10 km/h, the river is flowing with a velocity of

(a) 12.8 km/h

(b) 6 km/h

(c) 8 km/h

(d) 10 km/h

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21. A man takes 3 h to cover a certain distance along the flow and takes 6 h to cover the same distance opposite to flow. In how much time he will cross this distance in still water.

(a) 3.5 h

(b) 4 h

(c) 4.5 h

(d) 5 h

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22. A river 500 m wide is flowing at a rate of 4 m/s. A boat is sailing at velocity of 10 m/s with respect to the water, in a direction perpendicular to the river. The time taken by the boat to reach the opposite bank

(a) 30 s

(b) 40 s

(c) 50 s

(d) 60 s

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23. In the previous problem, the distance traveled by boat along the flow is

(a) 50 m

(b) 100 m

(c) 150 m

(d) 200 m

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24. The speed of a boat is 5 km/h in still water. It crosses a river of width 1 km along the shortest possible path in 15 min. The velocity of the river water is.

(a) 1 km/h

(b) 3 km/h

(c) 4 km/h

(d) 5 km/h

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- 25.** A man cross a 320 m wide river perpendicular to the current in 4 min. If in still water he can swim with a speed $\frac{5}{3}$ time that of the current, then the speed of the current, in m/min is
- (a) 30 (b) 40 (c) 50 (d) 60

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26. A man can swim in still water at a speed of 3 km/h. He wants to cross a river that flows at 2 km/h and reach the point directly opposite to his starting point. In which direction should he try to swim

(a) $\sin^{-1}(2/3)$

(b) $\sin^{-1}(2/5)$

(c) $\sin^{-1}(3/4)$

(d) $\sin^{-1}(3/5)$

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27. In the previous problem. How much time will he take to cross the river if the river is 500 m wide?

(a) $6\sqrt{5}$ min

(b) $3\sqrt{5}$ min

(c) $2\sqrt{5}$ min

(d) $5\sqrt{3}$ min

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28. A man can swim at a speed of 3 km/h in still water. He wants to cross a 500 m wide river flowing at 2 km/h. He keeps himself always at an angle of 120° with the river flow while swimming. The time he takes to cross the river is

(a) $10/\sqrt{3}$ min

(b) $20/\sqrt{3}$ min

(c) $30/\sqrt{3}$ min

(d) $40/\sqrt{3}$ min

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29. In the previous problem, how far from the point directly opposite to the starting point does the man reach the opposite bank

(a) $\frac{1}{6}\sqrt{3}$ km

(b) $\frac{2}{3}\sqrt{3}$ km

(c) $\frac{4}{3}\sqrt{3}$ km

(d) $\frac{5}{3}\sqrt{3}$ km

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- 30.** A person aiming to reach the exactly opposite point on the bank of a stream is swimming with a speed of 0.5 m/s at an angle of 120° with the direction of flow of water. The speed of water in the stream is
- (a) $1/\text{ms}$ (b) 0.5 m/s (c) 0.25 m/s (d) 0.433 m/s

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- 31.** A river is flowing from west to east with a speed of 5 m/min. A man can swim in still water with a velocity 10 m/min. In which direction should the man swim so as to take the shortest possible path to go to the south.
- (a) 30° with downstream (b) 60° with downstream (c) 120° with downstream (d) South

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- 32.** A river is flowing from east to west at a speed of 5 m/min. A man on south bank of river. Capable of swimming 10 m/min in still water, wants to swim across the river in the shortest time. He should swim
- (a) Due north
(b) Due north-east
(c) Due north-east with double the speed of river
(d) None of these

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33. A man can swim with velocity v relative to water. He has to cross a river of width d flowing with a velocity u ($u > v$). The distance traveled by man along the flow is x . when he reaches to opposite bank For x to be minimum the person should swim at an angle α with the direction of the flow of water, where α is

- (a) $\sin^{-1}(v/u)$ (b) $\sin^{-1}(u/u)$ (c) $\frac{\pi}{2} + \sin^{-1}(v/u)$ (d) $\frac{\pi}{2} + \sin^{-1}(u/v)$

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ANSWER KEY

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|-----|---|-------|
| 1. | d | 21.b |
| 2. | a | 22. c |
| 3. | d | 23. d |
| 4. | b | 24.b |
| 5. | a | 25.d |
| 6. | c | 26. a |
| 7. | a | 27. a |
| 8. | c | 28. b |
| 9. | d | 29. a |
| 10. | d | 30. c |
| 11. | d | 31.c |
| 12. | a | 32. a |
| 13. | a | 33. c |
| 14. | b | |
| 15. | b | |
| 16. | c | |
| 17. | a | |
| 18. | d | |
| 19. | c | |
| 20. | b | |

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