ARJUNA NEET BATCH

Practice Test 03 (01-08-2021)

(Discussion)

1. If $\vec{A} \cdot \vec{B} = \sqrt{3}\,|\vec{A} \times \vec{B}|$ then find angle between $\vec{A}$ and $\vec{B}$.

(A) 30°
(B) 60°
(C) 90°
(D) 0°

$$\vec{A} \cdot \vec{B} = \sqrt{3}\,|\vec{A} \times \vec{B}|$$

$$|A||B| \cos\theta = \sqrt{3}\,|A||B| \sin\theta$$

$$\frac{1}{\sqrt{3}} = \tan\theta$$

$$\theta = 30^\circ$$

2. $\vec{R} = \vec{A} + \vec{B}$ and $\vec{D} = \vec{A} - \vec{B}$ then find angle between $\vec{A}$ and $\vec{B}$ if $|\vec{R}| = |\vec{D}|$

(A) 0°

(B) 90°

(C) 30°

(D) 60°

$|\vec{A}+\vec{B}| = |\vec{A}-\vec{B}|$

$A^2 + B^2 + 2AB\cos\theta = A^2 + B^2 - 2AB\cos\theta$

$4AB\cos\theta = 0$

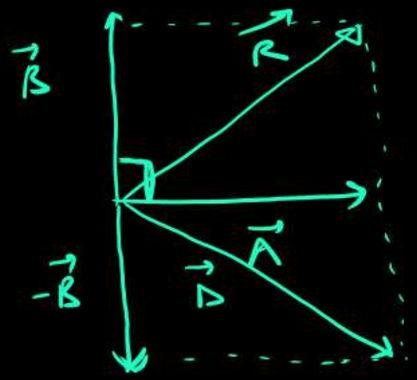
$\cos\theta = 0$

$\theta = 90^\circ$

$|\vec{R}| = |\vec{A}+\vec{B}|$

$|\vec{D}| = |\vec{A}-\vec{B}|$

$\vec{D} = \vec{A} + (-\vec{B})$



3. Which of the following option is correct

(A) $\vec{A}+\vec{B}=\vec{B}+\vec{A}$: commutative

(B) $\vec{A}\cdot\vec{B}=\vec{A}\times\vec{B}$

(C) $\vec{A}-\vec{B}=\vec{B}-\vec{A}$

(D) $\vec{A}\times\vec{B}=\vec{B}\times\vec{A}$

$\vec{R} = \vec{R}$

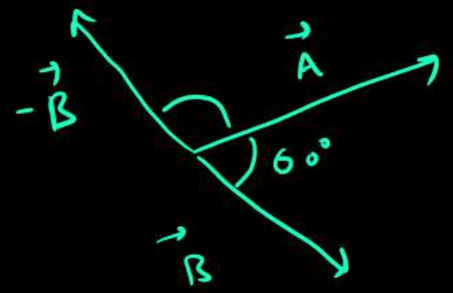
4. Angle between $\vec{A}$ and $-\vec{B}$ if angle between $\vec{A}$ and $\vec{B}$ is 60°

(A) 60°

(B) 120°

(C) 150°

(D) 30°



$180 - 60 = 120$

5. Which of the following is not a vector

(A) speed

(B) acceleration

(C) velocity

(D) force

6. Which of the following is a vector

(A) kinetic energy

(B) distance

(C) displacement

(D) relative speed

7. The vector $\vec{A}$ and $\vec{B}$ are such that $\vec{A} + \vec{B} = \vec{C}$ and A = B = C then angle between $\vec{A}$ and $\vec{B}$ is

(A) 120°
(B) 90°
(C) 60°
(D) 30°

$$\vec{A} + \vec{B} = \vec{C}$$

$$\vec{A} + \vec{A} = \vec{A}$$

$$A^2 + A^2 + 2AA\cos\theta = A^2$$

$$A^2 + 2A^2\cos\theta = 0$$

$$A^2(1 + 2\cos\theta) = 0$$

$$1 + 2\cos\theta = 0$$

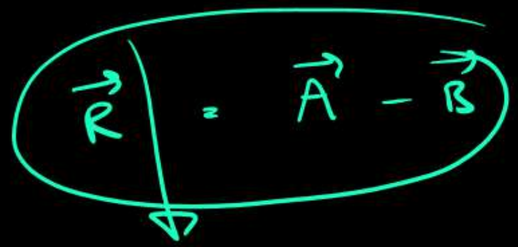
$$\cos\theta = -\frac{1}{2}$$

$$\theta = 120^\circ$$

8. For what angle between the two vectors is their resultant will be minimum ?

(A) 2π (B) π

(C) zero (D) $\pi/2$



9. Find magnitude of vector $\vec{A} = 2\hat{i} + 4\hat{j} + K$.

(A) 20

(B) 40

(C) $\sqrt{21}$

(D) 50

$$\vec{A} = 2\hat{i} + 4\hat{j} + \hat{k}$$

$$A = \sqrt{2^2 + 4^2 + 1^2}$$

$$= \sqrt{4 + 16 + 1}$$

$$= \sqrt{21}$$

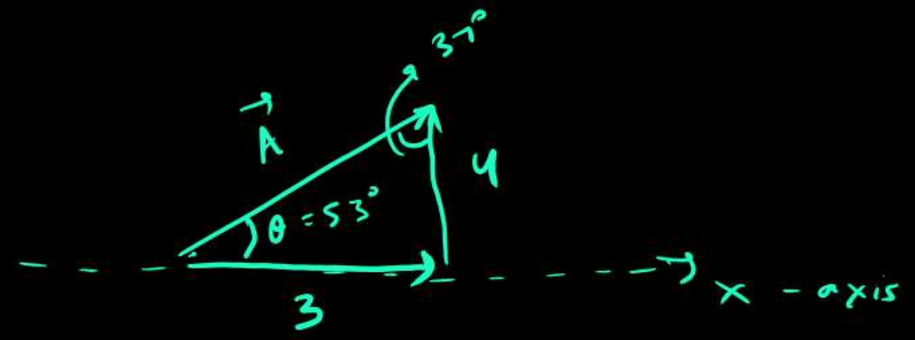
10. Find angle between $\vec{A}$ and x-axis if $\vec{A} = 3\hat{i} + 4\hat{j}$.

(A) 37°

(B) 53°

(C) 120°

(D) 60°



$\vec{A} = 3\hat{i} + 4\hat{j}$

$\tan\theta = \frac{P}{B} = \frac{4}{3}$

$\theta = \tan^{-1}\left(\frac{4}{3}\right)$

11. The angle between vector $\hat{i} + \hat{j}$ and $(\hat{j} + \hat{k})$ is

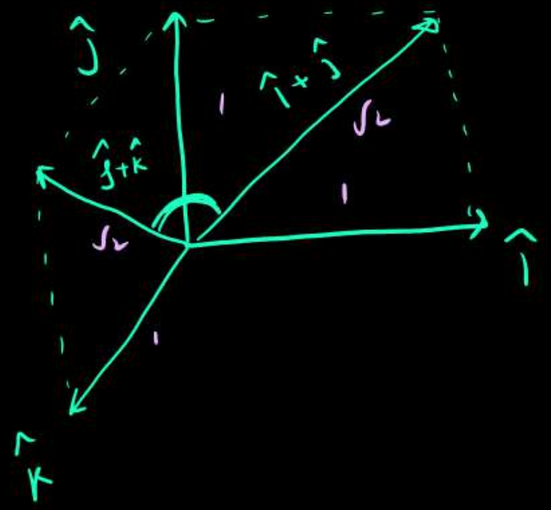
(A) 180°

(B) 0°

(C) 60°

(D) 90°

$\vec{A} \cdot \vec{B} = |A||B| \cos\theta$



$(\hat{i}+\hat{j}) \cdot (\hat{j}+\hat{k}) = \sqrt{2}\sqrt{2}\cos\theta$

$\cos\theta = \dfrac{(\hat{i}+\hat{j}) \cdot (\hat{j}+\hat{k})}{2}$

$\cos\theta = \dfrac{1}{2}$

$\theta = 60°$

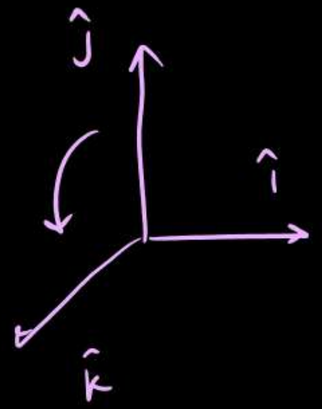
12. Which of the following is correct

(A) $\hat{i} \cdot \hat{j} = 1$

(B) $\hat{j} \times \hat{k} = \hat{i}$

(C) $\hat{i} \times \hat{j} = -k$

(D) $\hat{k} \times \hat{i} = -\hat{j}$



13. Two force of magnitude 10 N and 6 N then their vector sum cannot be equal to

(A) 6 N

(B) 10 N

(C) 3 N

(D) 15 N

14. Which of the following pair of force will give resultant of 1 N.

(A) 4N and 8N

(B) 6N and 1N

(C) 1N and 3N

(D) 7N and 8N

15. If $\vec{A} = 2\hat{i} + 4\hat{j} + 6\hat{k}$ and $\vec{B} = \hat{i} + 3\hat{j} + 5\hat{k}$ then find magnitude of $\vec{A} - \vec{B}$.

(A) $\sqrt{3}$ (B) 3

(C) 4 (D) 10

$$\vec{A} - \vec{B} = (2\hat{i} + 4\hat{j} + 6\hat{k}) - (\hat{i} + 3\hat{j} + 5\hat{k})$$

$$= \hat{i} + \hat{j} + \hat{k}$$

$$= \sqrt{1^2 + 1^2 + 1^2}$$

$$= \sqrt{3}$$

16. If vector $3\hat{i} + 4\hat{k} + \hat{j}$ is perpendicular to vector $4\hat{i} - 3\hat{j} - \alpha\hat{j}$ then find α.

(A) 20 (B) 0

(C) 4 (D) 6

$\vec{A} \cdot \vec{B} = 0$ (condition) $\theta = 90^\circ$

$(3\hat{i} + \hat{j} + 4\hat{k}) \cdot (4\hat{i} - \alpha\hat{j} - 3\hat{k}) = 0$

$12 - \alpha - 12 = 0$

$\boxed{\alpha = 0}$

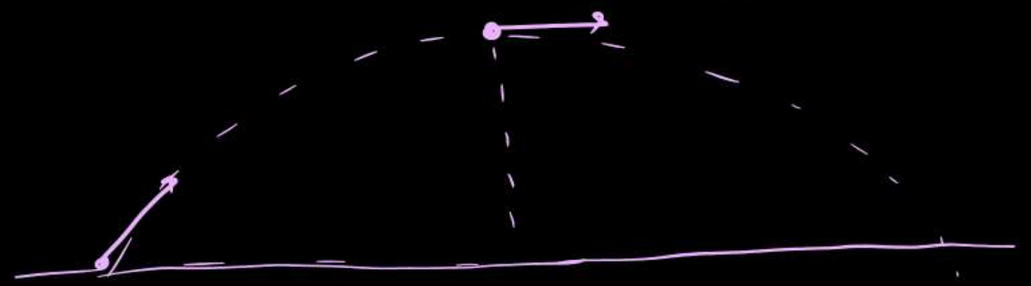
17. Ball is projected with 40 m/s at angle 30° then time after which velocity of ball becomes minimum.

(A) 2 s

(B) 4 s

(C) 8 s

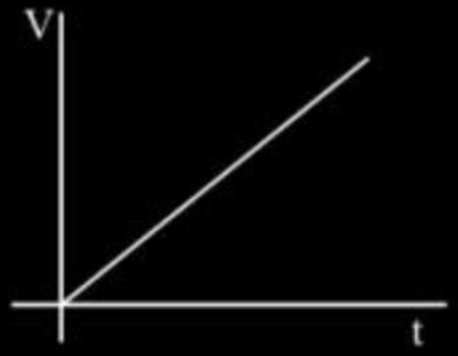
(D) 70 s

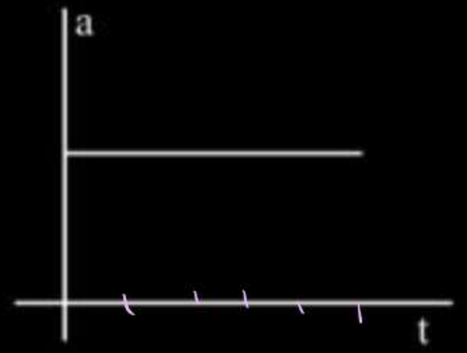


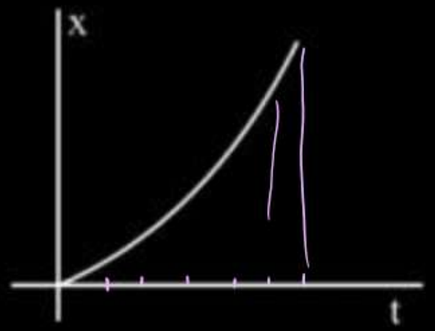
$$T = \frac{u \sin\theta}{g}$$

$$= \frac{40 \times \sin 30}{10} = 4 \times \frac{1}{2} = 2s$$

18. In which graph object is moving with constant acceleration

(A) 

(B) 

(C) 

(D) all of these

19. Object is dropped then find displacement in 3rd sec.

(A) 5 m

(B) 15 m

(C) 25 m

(D) 4 m

$$S_{nth} = u + \frac{a}{2}(2n-1)$$

$$S_3 = 0 + \frac{10}{2}(2(3)-1)$$

$$= 5(5)$$

$$= 25\,m$$

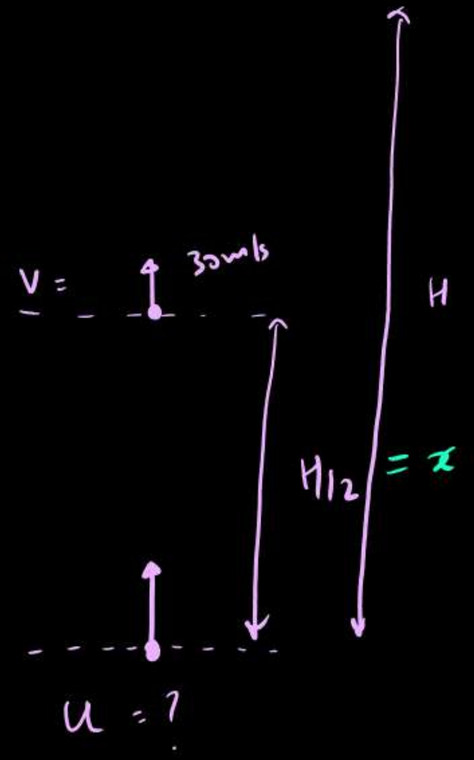
20. Ball is projected then its speed is 30 m/s at half of the maximum height then find maximum height

(A) 20 m

(B) 80 m

(C) 90 m

(D) 40 m



$$2as = v^2 - u^2$$

$$-2 \times 10 \times x = (30)^2 - u^2$$

$$-20x = 900 - u^2$$

$$20\left(\frac{u^2}{4g}\right) = 900 - u^2$$

$$\frac{u^2}{2} = 900$$

$$u^2 = 1800$$

$$H_{max} = \frac{u^2}{2g}$$

$$= \frac{1800}{2 \times 10} \quad (g = 10)$$

$$H_{max} = 90$$

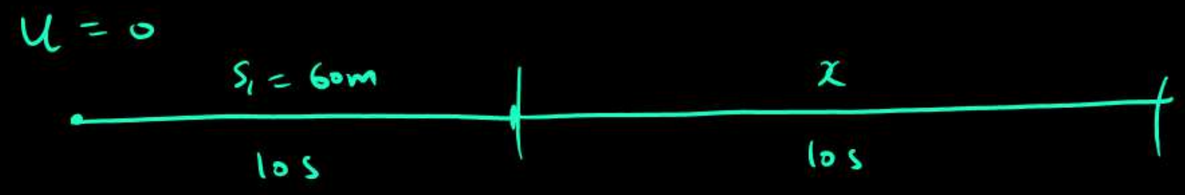
21. Object starts its motion from rest and constant acceleration moves 60 m in 10 sec then find displacement in next 10 sec.

(A) 60 m

(B) 180 m

(C) 30 m

(D) 120 m



$s_2 = s_1 + x$

$s_2 = 60 + x$

$s_2 = ut + \frac{1}{2}at^2$

$60 + x = \frac{1}{2}a(20)^2$ — (II)

$s_1 = \frac{1}{2}a(10)^2$

$60 = \frac{1}{2}a(10)^2$ — (I)

$\frac{60+x}{60} = \frac{\frac{1}{2}a(20)(20)}{\frac{1}{2}a(10)(10)}$

$60 + x = 240$

$x = 240 - 60$

$x =$

22. Which of the following is correct for distance and displacement

(A) $\frac{\text{distance}}{\text{displacement}} > 1$

(B) $\frac{\text{distance}}{\text{displacement}} < 1$

(C) $\frac{\text{distance}}{\text{displacement}} \geq 1$

(D) $\frac{\text{distance}}{\text{displacement}} = 1$

dist > disp

dist = disp

23. If position of object $x = t^2 - 6t + 4$ then find time when object comes to at rest

(A) 2s

(B) 3s

(C) 6s

(D) 4s

$$x = t^2 - 6t + 4$$

$$v = \frac{dx}{dt} = 2t - 6$$

$$v = 2t - 6$$

$$0 = 2t - 6$$

$$6 = 2t$$

$$t = 3s$$

24. If velocity of object $v = at^2 - bt$ then find time when velocity will be minimum.

(A) $\frac{b}{a}$

(B) $\frac{a}{b}$

(C) $\frac{b}{2a}$

(D) $\frac{2a}{b}$

$V = at^2 - bt$

$0 = \frac{dv}{dt} = 2at - b$

$2at - b = 0$

$2at = b$

$t = \frac{b}{2a}$

25. Ball (A) is projected upward and ball (B) is projected downward with same speed 10 m/s then find relative acceleration of A w.r.t. B.

(A) g

(B) 2g

(C) 0

(D) $-g$

$$\vec{a}_{A,B} = \vec{a}_A - \vec{a}_B$$

$$= 10 - 10$$

$$= 0$$

26. In an experiment, the percentage of error occurred in the measurement of physical quantities A, B, C and D are 1%, 2%, 3% and 4% respectively. Then the maximum percentage of error in the measurement X, where $X = \frac{A^2 B^{1/2}}{C^{1/3} D^3}$, will be

(A) 10%

(B) (3/13)%

(C) 16%

(D) −10%

$$\frac{\Delta X}{X} = 2\frac{\Delta A}{A} + \frac{1}{2}\frac{\Delta B}{B} + \frac{1}{3}\frac{\Delta C}{C} + 3\frac{\Delta D}{D}$$

$$= 2(1\%) + \frac{1}{2}(2\%) + \frac{1}{3}(3\%) + 3(4\%)$$

$$= 2\% + 1\% + 1\% + 12\%$$

$$\frac{\Delta X}{X} = 16\%$$

27. Planck's constant (h), speed of light in vacuum (c) and Newton's gravitational constant (G) are three fundamental constants. Which of the following combinations of these has the dimension of length ?

(A) $\frac{\sqrt{hG}}{c^{3/2}}$

(B) $\frac{\sqrt{hG}}{c^{5/2}}$

(C) $\sqrt{\frac{hc}{G}}$

(D) $\sqrt{\frac{Gc}{h^{3/2}}}$

'h' = N m s = Kg m/s² m s

'G' = N m²/kg² = kg m/s² m²/kg²

'c' = m/s = m/s

$L = \frac{\sqrt{hG}}{c^{3/2}}$

$$'h' = Nms = [MLT^{-2}][L][T] = [ML^2T^{-1}]$$

$$'G' = Nm^2/kg^2 = [MLT^{-2}][L]^2[M]^{-2}$$

$$'c' = m/s = [LT^{-1}]$$

$$l \propto h^a G^b c^c$$

$$l = h^{1/2} G^{1/2} c^{-3/2}$$

$$l = \frac{\sqrt{Gh}}{c^{3/2}}$$

$$[M^0L^1T^0] = [ML^2T^{-1}]^a [M^{-1}L^3T^{-2}]^b [LT^{-1}]^c$$

$$[M^0L^1T^0] = [M^{a-b} L^{2a+3b+c} T^{-a-2b-c}]$$

$$a - b = 0$$

$$a = b$$

$$2a + 3b + c = 1$$

$$2a + 3b - 3b = 1 \Rightarrow a = \frac{1}{2}$$

$$b = \frac{1}{2}$$

$$-a - 2b - c = 0$$

$$-3b - c = 0$$

$$-3b = c$$

$$c = -\frac{3}{2}$$

28. Which of the following has the dimensions of pressure ?

(A) $[MLT^{-2}]$

(B) $[ML^{-1}T^{-2}]$

(C) $[ML^{-2}T^{-2}]$

(D) $[M^{-1}L^{-1}]$

$$P = \frac{F}{A} = \frac{ML T^{-2}}{L^2}$$

$$[ML^{-1}T^{-2}]$$

29. Of the following quantities, which one has dimensions different from the remaining three?

(A) Energy per unit volume $\quad \frac{E}{V} = \frac{ML^2T^{-2}}{L^3} = [ML^{-1}T^{-2}]$

(B) Force per unit area $\quad F/A = \frac{MLT^{-2}}{L^2} = [ML^{-1}T^{-2}]$

(C) Product of voltage and charge per unit volume

(D) Angular momentum

$$L = mvr$$

$$= [M][LT^{-1}][L]$$

$$= [ML^2T^{-1}]$$

30. If the error in the measurement of radius of a sphere is 2%, then the error in the determination of volume of the sphere will be

(A) 8%

(B) 2%

(C) 4%

(D) 6%

$$V = \frac{4}{3}\pi r^3$$

$$\frac{\Delta V}{V} = 3\frac{\Delta r}{r}$$

$$= 3(2\%)$$

$$= 6\%$$

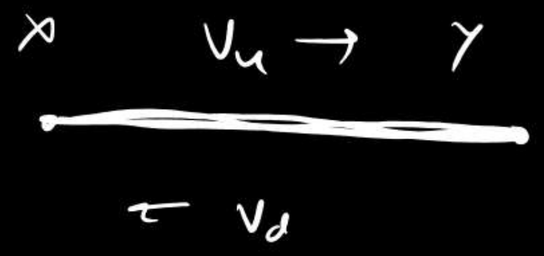
31. A car moves from X to Y with a uniform speed v_u and returns to X with a uniform speed v_d. The average speed for this round trip is

(A) $\sqrt{v_u v_d}$

(B) $\frac{v_d v_u}{v_d + v_u}$

(C) $\frac{v_u + v_d}{2}$

(D) $\frac{2v_d v_u}{v_d + v_u}$



$\frac{2v_1v_2}{v_1+v_2}$

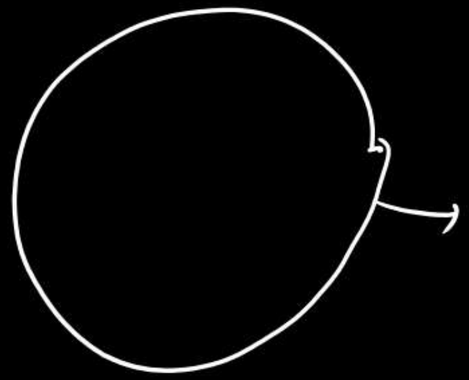
32. A car runs at a constant speed on a circular track of radius 100 m, taking 62.8 seconds for every circular lap. The average velocity and average speed for each circular lap respectively is

(A) 10 m/s, 0

(B) 0, 0

(C) 0, 10 m/s

(D) 10 m/s, 10 m/s



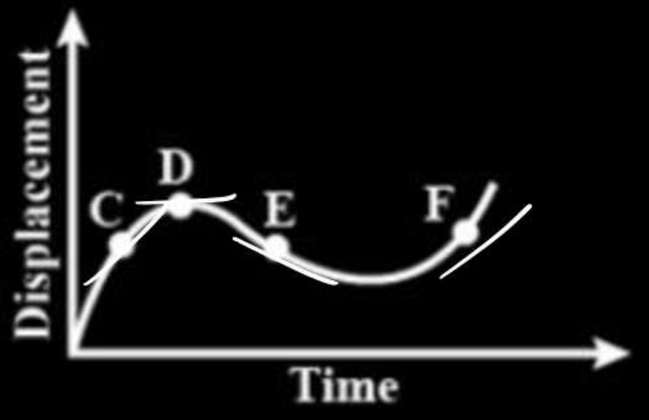
$V_{av} = 0$

$$V = \frac{2\pi r}{T}$$

$$= \frac{2 \times 3.14 \times 100}{62.8} \text{ m/s}$$

$$V = 10$$

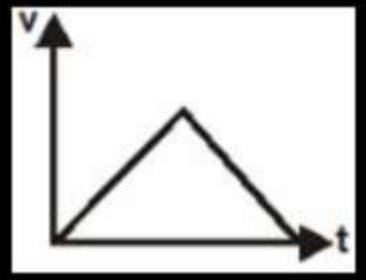
33. The displacement-time graph of a moving particle is shown below. The instantaneous velocity of the particle is negative at the point



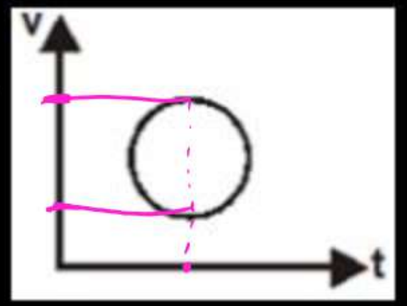
(A) E
(B) F
(C) C
(D) D

34. Which of the following curve does not represent motion in one dimension ?

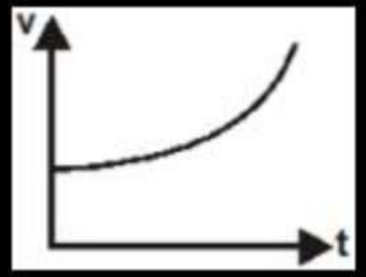
(A)



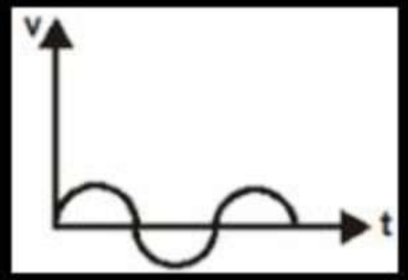
(B)



(C)



(D)



35. A body starts from rest, what is the ratio of the distance travelled by the body during the 4th and 3rd second ?

(A) $\frac{7}{5}$

(B) $\frac{5}{7}$

(C) $\frac{7}{3}$

(D) $\frac{3}{7}$

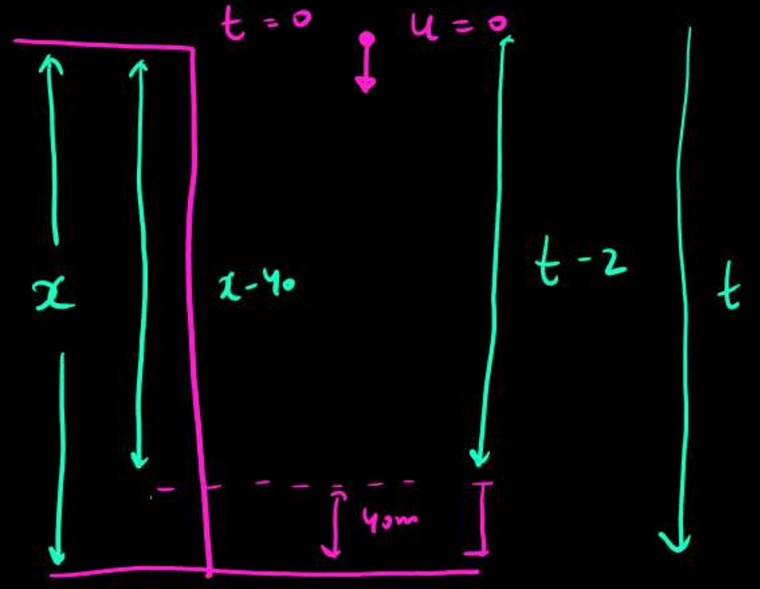
$S_{nth} = u + \frac{a}{2}(2n-1)$ $= \frac{a}{2}(7)$ $= 5\ a_{ms}$

$= \frac{a}{2}(5)$ $= S_{3\text{-}sec}$

36. A body dropped from top of a tower fall through 40 m during the last two seconds of its fall. The height of tower is ($g = 10\ m/s^2$)

(A) 60 m (B) 45 m

(C) 80 m (D) 50 m



$$s = \cancel{ut}^{0} + \frac{1}{2}at^2$$

$$x = \frac{1}{2}(10)\,t^2$$

$$x = 5t^2$$

$$x = 5(3)^2$$

$$\boxed{x = 45\ m}$$

$$x - 40 = \frac{1}{\cancel{2}}(\cancel{10}^{5})(t-2)^2$$

$$5t^2 - 40 = 5(t^2 + 4 - 4t)$$

$$\cancel{5t^2} - 40 = \cancel{5t^2} + 20 - 20t$$

$$20t = 60$$

$$\boxed{t = 3s}$$

37. What will be the ratio of the distance moved by a freely falling body from rest in 4^{th} and 5^{th} seconds of journey ?

(A) 4 : 5 (B) 7 : 9

(C) 16 : 25 (D) 1 : 1

$$\frac{S_{4th}}{S_{5th}} = \frac{\frac{g}{2}(2(4)-1)}{\frac{g}{2}(2(5)-1)} = \frac{7}{9}$$

38. A car is moving along a straight road with a uniform acceleration. It passes through two points P and Q separated by a distance with velocity 30 km/h and 40 km/h respectively. The velocity of the car midway between P and Q is

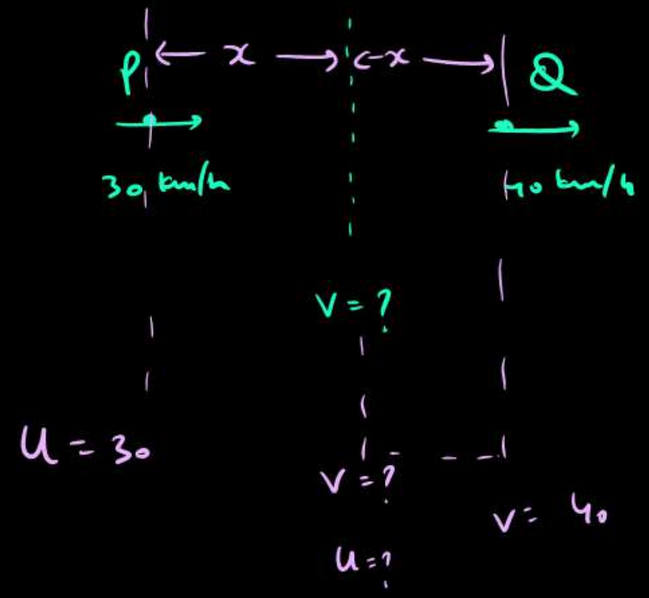
(A) 33.3 km/h

(B) $20\sqrt{2}$ km/h

(C) $25\sqrt{2}$ km/h

(D) 35 km/h

$2ax = v^2 - 30^2$



$2ax = 40^2 - v^2$

$v^2 - 30^2 = 40^2 - v^2$

$v^2 + v^2 = 40^2 + 30^2$

$2v^2 = 1600 + 900$

$2v^2 = 2500$

$v^2 = \frac{2500}{2}$

$v = \sqrt{\frac{2500}{2}} = \frac{50\sqrt{2}}{\sqrt{2}\sqrt{2}}$

$= 25\sqrt{2}$

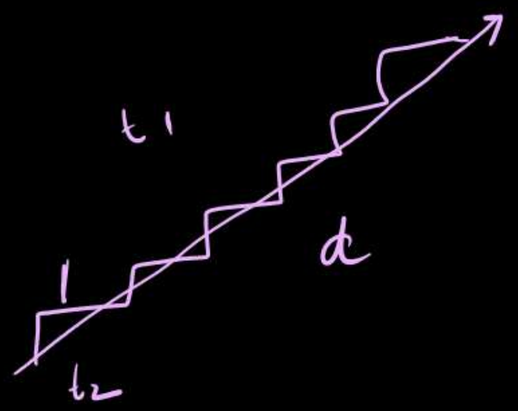
39. Preeti reached the metro station and found that the escalator was not working. She walked up the stationary escalator in time t_1. On other days, if she remains stationary on the moving escalator, then the escalator takes her up in time t_2. The time taken by her to walk up on the moving escalator will be

(A) $\frac{t_1 t_2}{t_2 - t_1}$

(B) $\frac{t_1 t_2}{t_2 + t_1}$

(C) $t_1 - t_2$

(D) $\frac{t_1 + t_2}{2}$



$V_p = \frac{d}{t_1}$

$V_e = \frac{d}{t_2}$

$V_p + V_e = \frac{d}{t}$

$\frac{d}{t_1} + \frac{d}{t_2} = \frac{d}{t}$

$\frac{1}{t} = \frac{1}{t_1} + \frac{1}{t_2}$

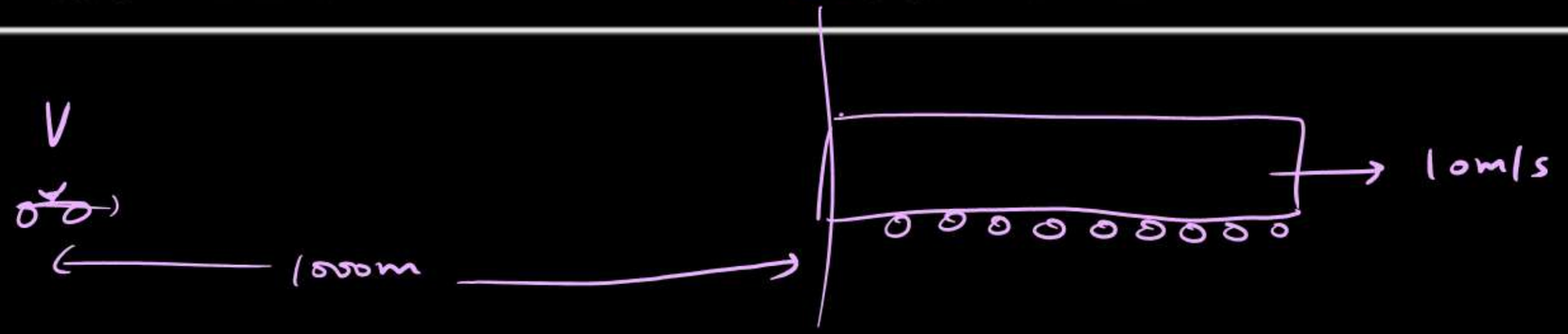
$\frac{1}{t} = \frac{t_1 + t_2}{t_1 t_2}$

$t = \frac{t_1 t_2}{t_1 + t_2}$

40. A bus is moving with a speed of 10 ms^{-1} on a straight road. A scooterist wishes to overtake the bus in 100 s. If the bus is at a distance of 1 km from the scooterist, with what speed should the scooterist chase the bus ?

(A) 40 $m\ s^{-1}$ (B) 25 $m\ s^{-1}$

(C) 10 $m\ s^{-1}$ (D) 20 $m\ s^{-1}$



100 s

$S = \frac{D}{T}$

$V_{rel} = (V - 10)$

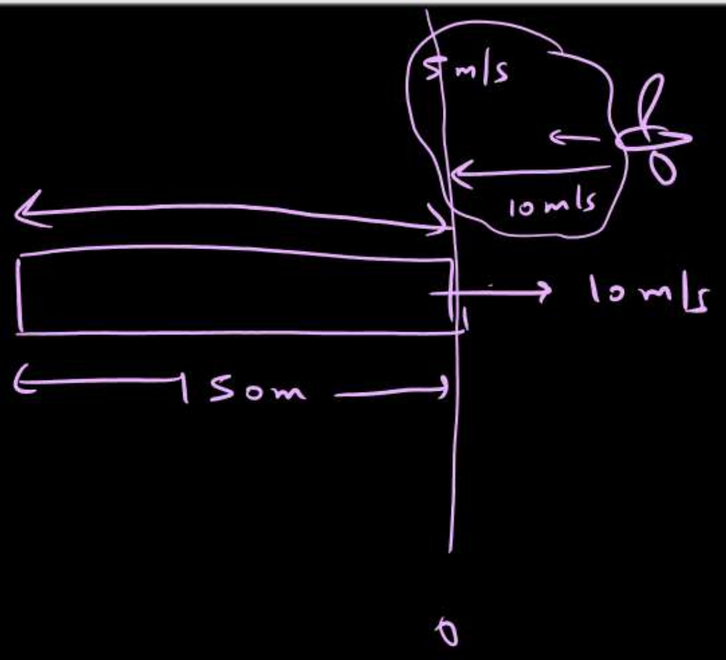
$V - 10 = \frac{1000}{100}$

$V = 20\ m/s$

41. A train of 150 metre length is going towards north direction at a speed of 10 m/s. A parrot flies at the speed of 5 m/s towards south direction parallel to the railways track. The time taken by the parrot to cross the train is

(A) 12 s (B) 8 s

(C) 15 s (D) 10 s



$S = \frac{D}{T}$

$15 = \frac{150}{t}$

$t = \frac{150}{15}$ 10s

42. A particle has initial velocity $(3\hat{i} + 4\hat{j})$ and has acceleration $(0.4\hat{i} + 0.3\hat{j})$. Its speed after 10 s is

(A) 7 units

(B) $7\sqrt{2}$ units

(C) 8.5 units

(D) 10 units

$\vec{u} = 3\hat{i} + 4\hat{j}$

$\vec{a} = 0.4\hat{i} + 0.3\hat{j}$

$\vec{v} = ?$

$\vec{v} = \vec{u} + \vec{a}t$

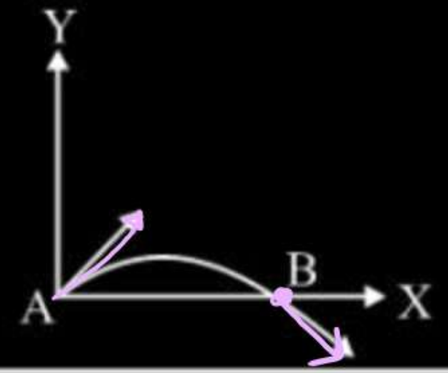
$\vec{v} = (3\hat{i} + 4\hat{j}) + (0.4\hat{i} + 0.3\hat{j}) \times 10$

$= (3\hat{i} + 4\hat{j}) + (4\hat{i} + 3\hat{j})$

$\vec{v} = 7\hat{i} + 7\hat{j}$

$|v| = \sqrt{7^2 + 7^2} = 7\sqrt{2}$

43. The velocity of a projectile at the initial point A is $(2\hat{i} + 3\hat{j})$ m/s. Its velocity (in m/s) at point B is

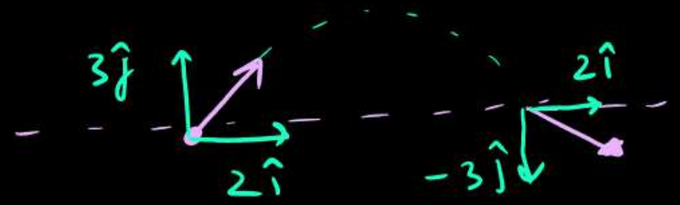


(A) $2\hat{i} - 3\hat{j}$

(B) $2\hat{i} + 3\hat{j}$

(C) $-2\hat{i} - 3\hat{j}$

(D) $-2\hat{i} + 3\hat{j}$



44. The horizontal range and the maximum height of a projectile are equal. The angle of projection of the projectile is

(A) $\theta = \tan^{-1}\left(\frac{1}{4}\right)$

(B) $\theta = \tan^{-1}(4)$

(C) $\theta = \tan^{-1}(2)$

(D) $\theta = 45°$

$$R = H$$

$$\frac{u^2 \sin 2\theta}{g} = \frac{u^2 \sin^2\theta}{2g}$$

$$2 \sin\theta\cos\theta = \sin\theta \frac{\sin\theta}{2}$$

$$2 \times 2 = \tan\theta$$

$$4 = \tan\theta$$

$$\theta = \tan^{-1}(4)$$

45. The speed of a projectile at its maximum height is half of its initial speed. The angle of projection is

(A) 60°
(B) 15°
(C) 30°
(D) 45°

$\frac{V}{2} = V\cos\theta$

$\frac{1}{2} = \cos\theta$

$\theta = 60°$