RACE #01 UNIT AND DIMENSIONAL ANALYSIS PHYSICS

1. For $10^{(at+3)}$, the dimension of a is-

(A) $M^0 L^0 T^0$ (B) $M^0 L^0 T^1$ (C) $M^0 L^0 T^{-1}$ (D) None of these

2. Which of the following pairs of physical quantities has different dimensions ?

(A) stress, pressure (B) Young's modulus, energy density

(C) density, relative density (D) energy, torque

3. Which one of the following is not a unit of time ?

(A) lunar month (B) leap year (C) parallactic second (D) solar day

4. Two quantities whose dimensions are not same, cannot be-

(A) multiplied with each other (B) divided

(C) added or subtracted in the same expression (D) added together

5. If the units of length and force are increased four times, then the unit of energy will-

(A) becomes 8 times (B) becomes 16 times (C) decrease 16 times (D) increase 4 times

6. If the units of length , velocity and force are half, then the units of Power will be –

(A) doubled (B) halved (C) one fourth (D) remain unaffected

7. Choose the wrong statement-

(A) all quantities can be expressed dimensionally in terms of the fundamental quantities

(B) a fundamental quantity cannot be represented dimensionally in terms of the rest of fundamental quantities

(C) the dimension of a fundamental quantity, in other fundamental quantities is always zero

(D) the dimension of a derived quantity is never zero in any fundamental quantity

8. If h is height and g is acceleration due to gravity, then the dimensional formula of $\sqrt{\frac{2h}{g}}$ is the same as that of -

(A) time (B) mass (C) volume (D) velocity

9. Which of the followings is not a derived physical quantity ?

(A) Speed (B) Volume (C) Force (D) Mass

10. Dimensional formula for the linear momentum is-

(A) $[ML^0T^{-1}]$ (B) $[M^0LT^{-1}]$ (C) $[MLT^{-1}]$ (D) $[ML^{-1}T]$

11. Which of the following is dimensionless ?

(A) $\frac{v^2}{rg}$ (B) $\frac{v^2g}{r}$ (C) $\frac{vg}{r}$ (D) v^2rg

12. Which of the following is not a fundamental physical quantity ?

(A) Mass (B) Length (C) Temperature (D) Density

13. Light year is the unit of

(A) time (B) Speed (C) distance (D) None of these

14. Dimensional formula for the pressure is

(A) $[ML^{-1}T^{-2}]$ (B) $[MLT^{-2}]$ (C) $[ML^{-2}T]$ (D) $[M^{-1}L^{-1}T^{-2}]$

15. Choose the wrong statement :

(A) a dimensionally correct equation may be correct

(B) a dimensionally correct equation may be incorrect

(C) a dimensionally incorrect equation may be correct

(D) a dimensionally incorrect equation may be incorrect

16 A unitless quantity -

(A) may have a non zero dimension of any base quantity
(B) always has a non zero dimension of all base quantities
(C) never has a non-zero dimension of any base quantity
(D) does not exist

17. The velocity v of a particles is given in terms of time t by the equation. **v** = at + $\frac{b}{t+c}$. The dimension of a, b and c are

(A) L^2, T, L T^2 (B) LT^2, LT, L (C) LT^{-2}, L, T (D) L, LT, T^2

18. The equation of a wave is given by y = A sin $\omega\left\{\frac{x}{v}-k\right\}$; where ω is the angular velocity and v is the linear velocity. The dimensions of k is

(A) LT (B) T (C) T^{-1} (D) T^2

19. The time dependence of a physical quantity p is given by $p = p_0 e^{(-\alpha t^2)}$ where α is constant and t is time. The constant α

(A) is dimensionless (B) has dimensions T^{-2} (C) has dimensions T^2 (D) has dimensions of p

20. Given that y = a cos $\left(\frac{t}{p}-qx\right)$ where t is time in second and x represent distance in metre. Which of the following is true ?

(A) The unit of x is same as that of q
(B) The unit of x is same as that of p
(C) The unit of t is same as that of q
(D) The unit of t is same as that of p

21. The dimensions of $\frac{a}{b}$ in the equation P = $\frac{a-t^2}{bx}$ where P is pressure, x is distance and t is time, are

(A) $[M^2L\ T^{-3}]$ (B) $[MT^{-2}]$ (C) $[LT^{-3}]$ (D) $[ML^3T^{-1}]$

22. The equation of state of a real gas can be expressed as $\left(P+\frac{a}{V^2}\right)$(V– b) = cT, where P is the pressure, V the volume, T the absolute temperature and a, b, c are constants. What are the dimensions of 'a'–

(A) $M^0\ L^3\ T^{-2}$ (B) $M\ L^{-2}\ T^5$ (C) $M\ L^5\ T^{-2}$ (D) $M^0\ L^3\ T^0$

23. What is the physical quantity whose dimensions are $M\ L^2\ T^{-2}$ –

(A) Pressure (B) Kinetic energy (C) Power (D) Momentum

24. What is the unit of k in the relation U = $\frac{ky}{y^2+a^2}$, where U represents the potential energy, y represents the displacement and a represents the maximum displacement i.e., amplitude ?

(A) ms^{-1} (B) ms (C) Jm (D) Js^{-1}

25. A wave is represented by y = a sin (At – Bx + C) where A, B, C are constants. The Dimensions of A, B, C are-

(A) T^{-1}, L, $M^0L^0T^0$ (B) T^{-1}, L^{-1}, $M^0L^0T^0$ (C) T, L, M (D) T^{-1}, L^{-1}, M^{-1}

RACE #02 DIAMENSIONAL ANALYSIS AND ERRORS PHYSICS

1. Which of the following statements is correct about conversion of units, for example 1m = 100

(A) Conversion of units have identical dimensions on each side of the equal sign but not the same units.

(B) Conversion of units have different dimensions on each side of the equal sign but have same unit

(C) If a larger unit is used then numerical value of physical quantity is large.

(D) Due to conversion of units physical quantity to be measured will change.

2. The density of a liquid is 1000 kg m^{-3}. Its value in CGS system -

(A) 1 (B) 0.1 (C) 10 (D) 100

3. If the units of mass, length and time are doubled, unit of angular momentum will be -

(A) Doubled (B) Tripled

(C) Quadrupled (D) 8 times the original value

4. In a particular system of unit, if the unit of mass becomes twice & that of time becomes half, then 8 Joules will be written as.... units of work.

(A) 16 (B) 1 (C) 4 (D) 64

5. If the speed of light (c), acceleration due to gravity (g) and pressure (p) are taken as fundamental units, the dimensions of gravitational constant (G) are -

(A) c^0gp^{-3} (B) $c^2g^3p^{-2}$ (C) $c^0g^2p^{-1}$ (D) $c^2g^2p^{-2}$

6. The frequency of oscillation of an object of mass m suspended by means of spring of force constant K is given by f = Cm^xK^y, where C is a dimensionless constant. The value of x and y are -

(A) $x = \frac{1}{2}, y = \frac{1}{2}$ (B) $x = -\frac{1}{2}, y = \frac{1}{2}$ (C) $x = \frac{1}{2}, y = -\frac{1}{2}$ (D) $x = -\frac{1}{2}, y = -\frac{1}{2}$

7. The velocity or a body which has fallen under gravity varies as $g^a h^b$, where g is acceleration due to gravity and h is the height. The values of a and b are -

(A) a = 1, b = 1/2 (B) a = b = 1 (C) a = 1/2, b = 1 (D) a = 1/2 ; b = 1/2

8. If force F, acceleration A and time T are basic physical quantities, the dimensions of energy are –

(A) $[F^2A^{-1}T]$ (B) $[FAT^2]$ (C) $[FAT^{-2}]$ (D) $[FA^{-1}T]$

9. The velocity v of waves produced in water depends on their wavelength λ, the density of water ρ, and acceleration due to gravity g. The square of velocity is proportional to

(A) $\lambda^{-1}g^{-1}\rho^{-1}$ (B) λg (C) $\lambda\rho g$ (D) $\lambda^2g^{-2}\rho^{-1}$

10. If area (A), velocity (v) and density (ρ) are taken as the fundamental units, what is the dimensional formula for force

(A) $Av^2\rho$ (B) $A^2v\rho$ (C) $Av\rho^2$ (D) $Av\rho$

11. If force (F), acceleration (a) and time (T) are used as the fundamental units, the dimensional formula for length will be

(A) F^0aT^2 (B) Fa^0T^2 (C) Fa^2T^0 (D) F a T

12. What is the percentage error in the measurement of time period of a pendulum if maximum errors in the measurement of 'ℓ' and 'g' are 2% and 4 % respectively -

(A) 6% (B) 4% (C) 3% (D) 5%

13. The area of a rectangle of size 1.23×2.345 cm is -

(A) 2.88 cm^2 (B) 2.884 cm^2 (C) 2.9 cm^2 (D) 2.88435 cm^2

14. The length of a rod is (11.05 ± 0.05) cm. What is the length of two such rods -

(A) (22.1 ± 0.05) cm (B) (22.10 ± 0.05) cm

(C) (22.1 ± 0.05) cm (D) $(22.10 \pm 0.10$ cm)

15. The significant digits in 200.40 are -

(A) 4 (B) 5 (C) 2 (D) 3

16. The percentage error in the measurement of mass and speed are 2% and 3% respectively. How much will be the maximum error in the estimate of kinetic energy obtained by measuring mass and speed -

(A) 11% (B) 8% (C) 5% (D) 4%

17. A physical quantity is represented by the relation $Y = M^a L^b T^{-c}$. If the percentage errors in the measurement of M, L and T are respectively α %, β % and γ %, then the total error will be -

(A) $(\alpha a - \beta b + \gamma c)\%$ (B) $(\alpha a + \beta b - \gamma c)\%$

(C) $(\alpha a + \beta b + \gamma c)\%$ (D) $(\alpha a - \beta b - \gamma c)\%$

18. If x = ab, the maximum percentage error in the measurement of x will be-

(A) $\left(\frac{\Delta a}{a} \times 100\%\right) \times \left(\frac{\Delta b}{b} \times 100\%\right)$ (B) $\left(\frac{\Delta a}{a} \times 100\%\right) \div \left(\frac{\Delta b}{b} \times 100\%\right)$

(C) $\left(\frac{\Delta a}{a} - \frac{\Delta b}{b}\right) \times 100\%$ (D) $\left(\frac{\Delta a}{a} + \frac{\Delta b}{b}\right) \times 100\%$

19. A wire is of mass $(0.3 \pm .003)$ gm. The radius is (0.5 ± 0.005) cm and length is $(6 \pm .06)$ cm. The maximum percentage error in density is-

(A) 3% (B) 4% (C) 8% (D) 16%

20. An experiment measures quantities a, b, c and x is calculated from $x = \frac{ab^2}{c^3}$. If the percentage error in a, b, c are $\pm$ 1%, $\pm$ 3%, $\pm$ 2% respectively.

(A) The percentage error in x can be $\pm$ 13% (B) The percentage error in x can be $\pm$ 7%

(C) The percentage error in x can be $\pm$ 20% (D) The percentage error in x can be $\pm$ 26%

1. Find the value of (A) sin 300º (B) tan225º (C) sin15º. cos15º (D) sin (37°) cos (53°)

2. Find value of following T-ratio :

(i) cosec(–3030°) (ii) sin(1830°)

(iii) cos(–1710°) (iv) cos(–2010°)

(v) tan(2490°) (vi) $\cot\left(-\frac{15\pi}{4}\right)$

(vii) $\sin\left(\frac{31\pi}{3}\right)$ (viii) $\tan\left(\frac{19\pi}{3}\right)$

3. If $\sin\theta = \frac{1}{3}$, then $\cos\theta$ will be -

(A) $\pm\frac{8}{9}$ (B) $\pm\frac{4}{3}$ (C) $\pm\frac{2\sqrt{2}}{3}$ (D) $\pm\frac{3}{4}$

4. If $\cos\theta = \frac{4}{5}$, find $\sin\theta$ and $\cot\theta$.

5. If $\cos A = \frac{9}{41}$, find tan A and cosec A.

6. Prove that

(i) sin420° cos390° + cos(–300°) sin(–330°) = 1

(ii) tan225° cot405° + tan(765°) cot(675°) = 0

(iii)cos 570° sin 510° – sin 330° cos 390° = 0.

7. Find value of

(i) $\sin^2 15^0$ (ii) $\cos^2 15^0$

(iii) $\tan\frac{\pi}{10} + \tan\frac{3\pi}{10} + \tan\frac{7\pi}{10} + \tan\frac{9\pi}{10}$ (iv) $\sin\frac{3\pi}{5} + \sin\frac{4\pi}{5} + \sin\frac{6\pi}{5} + \sin\frac{7\pi}{5}$

(v) $\frac{\cos(360°-A)}{\sin(270°+A)} + \frac{\cot(90°+A)}{\tan(180°-A)} + \frac{\sin(90°-A)}{\sin(90°+A)}$

8. Find maximum and minimum values of expressions -

(i) $\sin\theta - \cos\theta$ (ii) $\sin\theta + \sqrt{3}\cos\theta$

(iii)5sinx + 12cosx + 10 (iv) $\frac{15+(3\cos\theta+4\sin\theta)}{15-(3\cos\theta+4\sin\theta)}$

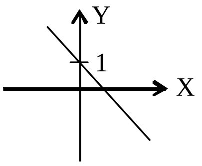
9. Find value of following T-ratio :

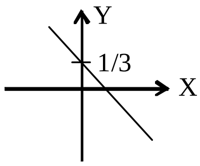
(i) sin (1°) (ii) cos(1.7°) (iii) sin(–2.4°) (iv) tan(2°)

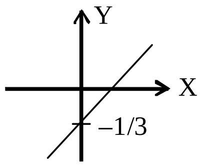
10. Find slope of a straight line

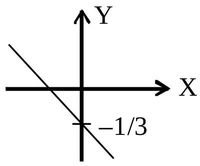
(i) $2x - 5y + 7 = 0$ (ii) $5x + 3y = 0$

11. Correct graph of $4x + 3y + 1 = 0$ is -

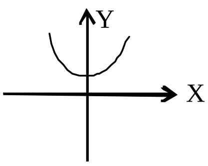
(A) 

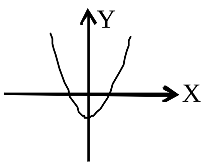
(B) 

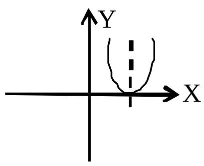
(C) 

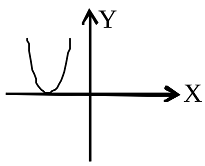
(D) 

12. Correct graph of $y - 1 = x^2$ is -

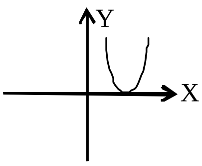
(A) 

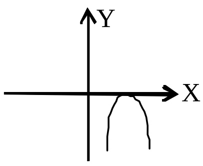
(B) 

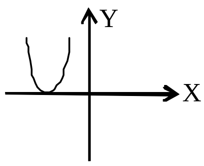
(C) 

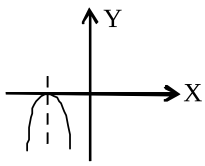
(D) 

13. Correct graph of $y = -(x + 2)^2$ is -

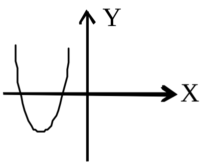
(A) 

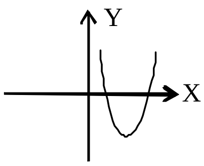
(B) 

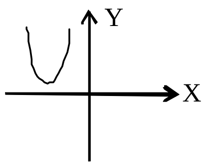
(C) 

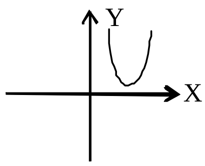
(D) 

14. Correct graph of $y = 2x^2 + 3x + 1$ is -

(A) 

(B) 

(C) 

(D) 

15. Plot the graph of

(i) $\sin 2x$ (ii) $1 + \sin x$ (iii) $1 + \cos x$ (iv) $1 - \cos x$

(v) $\sin^2 x$ (vi) $\cos^2 x$ (vii) $y = e^{-x}$ (viii) $y = -e^{-x}$

16. Plot the graph of

(i) $y = x^2 - 5x + 6$ (ii) $y = 8x - x^2$ (iii) $y = 4x - x^2 - 4$ (iv) $y = 2x - x^2 + 4$

1. $y = x^3 + 2x^2 + 7x + 8$ then $\frac{dy}{dx}$ will be -

(A) $3x^2 + 2x + 15$ (B) $3x^2 + 4x + 7$ (C) $x^3 + 2x^2 + 15$ (D) $x^3 + 4x + 7$

2. Differentiation of $2x^2 + 3x$ w.r.t. x is

(A) $4x + 3$ (B) $4x$ (C) 3 (D) $4x + 1$

3. $y = \sin x - \cos x$. Find $\frac{dy}{dx}$

4. $y = 4\sin x \cos x$. Find $\frac{dy}{dx}$

5. $\frac{d}{dx}\left(\frac{1}{x^3}\right)$ is equal to

(A) $\frac{-3}{x^4}$ (B) $\frac{x^2}{3}$ (C) $-\frac{x^2}{3}$ (D) $3x^2$

6. $\frac{d}{dx}(\log x + e^x)$ is equal to

(A) $\frac{1}{x} + xe^{x-1}$ (B) $\frac{1}{x} - e^x$ (C) $\frac{1}{x} + e^{-x}$ (D) $\frac{1}{x} + e^x$

7. $y = 2 \sin 3x$. Find $\frac{dy}{dx}$

8. $y = \sin^3 x$ Find $\frac{dy}{dx}$

9. If $y = \sin(t^2)$, then $\frac{dy}{dt}$ will be -

(A) $2t \cos(t^2)$ (B) $2 \cos(t^2) - 4t^2 \sin(t^2)$

(C) $4t^2 \sin(t^2)$ (D) $2 \cos(t^2)$

10. If $y = e^x. \cot x$ then $\frac{dy}{dx}$ will be

(A) $e^x\cot x - \text{cosec}^2x$ (B) $e^x \text{cosec}^2x$ (C) $e^x[\cot x - \text{cosec}^2x]$ (D) $e^x\cot x$

11. If $y = x \ \ell nx$ then $\frac{dy}{dx}$ will be

(A) $\ell nx + x$ (B) $1 + \ell n x$ (C) ℓnx (D) 1

12. If $y = \frac{\ell nx}{x}$ then $\frac{dy}{dx}$ will be :

(A) $\frac{1-\ell nx}{x}$ (B) $\frac{1+\ell nx}{x^2}$ (C) $\frac{1-\ell nx}{x^2}$ (D) $\frac{\ell nx - 1}{x^2}$

13. Differentiation of $\sin(x^2 + 3)$ w.r.t. x is -

(A) $\cos(x^2 + 3)$ (B) $2x\cos(x^2 + 3)$ (C) $(x^2 + 3)\cos(x^2 + 3)$ (D) $2x\cos(2x + 3)$

14. If $y = 2\sin^2\theta + \tan\theta$ then $\frac{dy}{d\theta}$ will be -

(A) $4\sin\theta\cos\theta + \sec\theta\tan\theta$ (B) $2\sin 2\theta + \sec^2\theta$

(C) $4\sin\theta + \sec^2\theta$ (D) $2\cos^2\theta + \sec^2\theta$

15. $y = \frac{2}{(3x+1)^3} + \frac{4}{(4x-3)^2}$. Find $\frac{dy}{dx}$

(A) $\frac{-18}{(3\times+1)^4} - \frac{32}{(4\times-3)^3}$ (B) $\frac{-6}{(3\times+1)^4} - \frac{8}{(4\times-3)^3}$ (C) $\frac{-6}{(3\times+1)^6} - \frac{8}{(4\times-3)^4}$ (D) $\frac{-18}{(3\times+1)^6} - \frac{32}{(4\times-3)^4}$

16. $xy = c^2$, then $\frac{dy}{dx}$

(A) $\frac{x}{y}$ (B) $\frac{y}{x}$ (C) $-\frac{x}{y}$ (D) $-\frac{y}{x}$

17. $x = at^2$; $y = 2at$, then $\frac{dy}{dx}$

(A) t (B) $\frac{1}{t}$ (C) 1 (D) None of these

18. If $Q = 4v^3 + 3v^2$, then the value of 'v' , there exist maximum of 'Q' -

(A) 0 (B) $-\frac{1}{2}$ (C) $\frac{1}{2}$ (D) None of these

19. $y = x(c - x)$ where c is a constant. Find maximum value of y.

20. If $y = 3t^2 - 4t$; then minima of y will be at :

(A) 3/2 (B) 3/4 (C) 2/3 (D) 4/3

21. The function $x^5 - 5x^4 + 5x^3 - 10$ has a maximum, when x =

(A) 3 (B) 2 (C) 1 (D) 0

22. The maximum value of xy subject to x + y = 8, is :

(A) 8 (B) 16 (C) 20 (D) 24

23. Maximum value of $f(x) = \sin x + \cos x$ is :

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

24. Maximum value of $f(x) = \sin x - \cos x$ is :

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

25. A stone thrown upwards, has its equation of motion $s = 490\,t - 4.9\,t^2$ where 's' is in metres and t is in seconds respectively. What is the maximum height reached by it ?

26. Find the maximum profit that a company can make, if the profit function is given by,

$p(x) = 41 - 24x - 18x^2$.

27. Find the maximum and minimum value of y, if the y is given by, $y = 2x^3 - 21x^2 + 60x$

1. $\int x^2$ is equal to :

(A) $\frac{x^3}{3}+C$ (B) 2x (C) $\frac{2x^3}{3}$ (D) Meaning-less

2. $\int 2\sin(x)dx$ is equal to :

(A) –2cos x + C (B) 2 cosx + C (C) –2 cos x (D) 2 cosx

3. If y = 4cos4x find $\int y\,dx$

4. $\int \frac{dt}{(6t-1)}$ is equal to -

(A) $\frac{1}{6}\log_e|6t-1|+C$ (B) $\log_e|6t-1|+C$ (C) $-\frac{1}{6}\log_e|6t-1|+C$ (D) None of these

Evaluate the following integrals :

5. $\int x^{15}dx$

6. $\int x^{-3/2}dx$

7. $\int (3x^{-7}+x^{-1})dx$

8. $\int \left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)^2 dx$

9. $\int \left(x+\frac{1}{x}\right)dx$

10. $\int \left(\frac{a}{x^2}+\frac{b}{x}\right)dx$ (Where a and b are constant)

11. $\int (3t^2-2t)\,dt$

12. $\int (\sin 4t+2t)\,dt$

Evaluate the following integrals

13. $\int_R^{\infty} \frac{GMm}{r^2}dr$

14. $\int_{r_1}^{r_2} -k\frac{q_1q_2}{r^2}dr$

15. $\int_u^v M\upsilon\, d\upsilon$

16. $\int_0^\infty x^{-1/2}\, dx$

17. $\int_0^{\pi/2} \sin x\, dx$

18. $\int_0^{\pi/2} \cos x\, dx$

19. If $y = x^2$, then area of curve y v/s x from x = 0 to 2 will be :

(A) 1/3 (B) 8/3 (C) 4/3 (D) 2/3

20. If y = sin(2x + 3) then $\int y\, dx$ will be :

(A) $\frac{\cos(2x+3)}{2}$ (B) $-\frac{\cos(2x+3)}{2} + C$ (C) – cos (2x + 3) (D) – 2cos(2x + 3)

21. $\int_{-\pi/2}^{\pi/2} \sin x\, dx$

22. $\int_{-\pi/2}^{\pi/2} \cos x\, dx$

23. If $\frac{dy}{dx} = 2x$, Find the change in y in the interval x = 1 to x = 3.

24. The derivative of y with respect to x is varrying linearly with x.At x = 0 the derivative is 2. At x = 2, derivative is 4. Find the change in the value of y between (i) x = 0 to x = 2 (ii) x = 0 to x = 6 .

25. A vessel is kept under a variable flow. The rate of volume of liquid $\frac{dV}{dt} = 4t - t^2$ cm^3/s where t is time in sec. If the vessel gets filled in time the flow stops, the volume of the vessel is

(A) 32 cm^3 (B) $\frac{64}{3} cm^3$ (C) $\frac{32}{3} cm^3$ (D) 64 cm^3

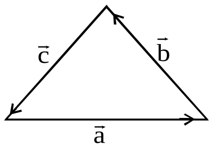
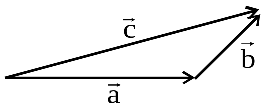
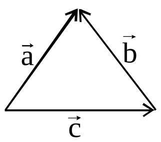
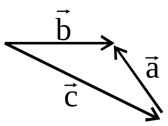
26. If velocity is derivative of position, find the change in position in the time interval t = 0s to t = 1 s, given that velocity $v = 2\sqrt{t}$ m/s

(A) $\frac{1}{3}$m (B) $\frac{2}{3}$m (C) 1m (D) $\frac{4}{3}$m

27. If acceleration is derivative of velocity, the change in velocity in the time interval t = 0 to t = $\frac{\pi}{2}$ given that acceleration a = sin 2t m/s^2

(A) 2 m/s (B) 1 m/s (C) $\frac{1}{2}$m/s (D) 0 m/s

1. Column-I show vector diagram relating three vectors $\vec{a}, \vec{b}$ and $\vec{c}$. Match the vector equation in column-II, with vector diagram in column-I :

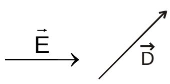
Column-I	**Column-II**
(A) 	(P) $\vec{a}-(\vec{b}+\vec{c})=0$
(B) 	(Q) $\vec{b}-\vec{c}=\vec{a}$
(C) 	(R) $\vec{a}+\vec{b}=-\vec{c}$
(D) 	(S) $\vec{a}+\vec{b}=\vec{c}$

2. A vector $\vec{A}$ is directed along 30° west of north direction and another vector $\vec{B}$ along 15° south of east. Their resultant cannot be in ______________ direction.

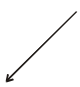
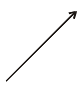
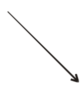
(A) North (B) East (C) North-East (D) South

PARAGRAPH FOR QUESTION NO. 03 TO 05

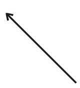
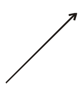
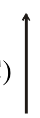
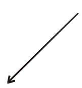
Two vectors $\vec{A}$ and $\vec{B}$ of unknown magnitudes are along $\vec{E}$ & $\vec{D}$ (as shown below) respectively :

3. 

Then $(\vec{A}-\vec{B})$ could be -

(A)  (B)  (C)  (D) 

4. $\vec{A}+\vec{B}$ could be :

(A)  (B)  (C)  (D) 

5. Angle between $\vec{A}$ and $\vec{B}$ is

(A) obtuse
(B) Acute
(C) obtuse or acute depending upon there magnitudes
(D) None of these

6. If $\vec{C}$ is another vector represented as $\uparrow$ then $(\vec{A}-\vec{B}+\vec{C})$ could be

(A) $\nearrow$ (B) Null vector (C) $\longleftarrow$ (D) $\swarrow$

7. The sum of magnitudes of two forces acting at a point is 16N. If their resultant is normal to the smaller force and has a magnitude of 8N, find the forces.

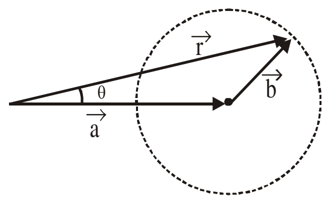
8. A force $\vec{F}$ of magnitude 12 N is resultant of two vectors $\vec{P}$ and $\vec{Q}$. The sum of the magnitudes of $\vec{P}$ and $\vec{Q}$ is 18 N. The direction of $\vec{Q}$ is at right angles to $\vec{F}$. Find the magnitude of $\vec{Q}$.

9. Three vectors $\vec{P}$, $\vec{Q}$ and $\vec{R}$ are such that $|\vec{P}|=|\vec{Q}|, |\vec{R}|=\sqrt{2}|\vec{P}|$ and $\vec{P}+\vec{Q}+\vec{R}=\vec{0}$. Find the angle between $\vec{P}$ & $\vec{R}$ (in degrees).

10. If $\vec{A}$ and $\vec{B}$ are two non–zero vectors such that $|\vec{A}+\vec{B}| = \dfrac{|\vec{A}-\vec{B}|}{2}$ and $|\vec{A}| = 2|\vec{B}|$ then the angle between $\vec{A}$ and $\vec{B}$ is :

(A) 37º (B) 53º (C) $\cos^{-1}(-3/4)$ (D) $\cos^{-1}(-4/3)$

11. Keeping one vector constant, if direction of other to be added in the first vector is changed continuously, tip of the resultant vector describes a circle. In the following figure vector $\vec{a}$ is kept constant. When vector $\vec{b}$ added to $\vec{a}$ changes its direction, the tip of the resultant vector $\vec{r}=\vec{a}+\vec{b}$ describes circle of radius b with its center at the tip of vector $\vec{a}$. Maximum angle between vector $\vec{a}$ and the resultant $\vec{r}=\vec{a}+\vec{b}$ is



(A) $\tan^{-1}\left(\dfrac{b}{r}\right)$ (B) $\tan^{-1}\left(\dfrac{b}{\sqrt{a^2-b^2}}\right)$ (C) $\cos^{-1}$ (r/a) (D) $\cos^{-1}$ (a/r)

12. When the vector sum of three co-planar forces, A, B and C, is parallel to A, we can conclude that B and C

(A) must be equal and opposite.

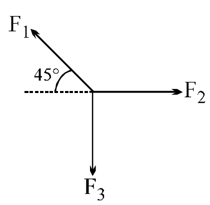
(B) must have equal and opposite components perpendicular to A.

(C) must have equal and opposite components parallel to A.

(D) must have equal and opposite components parallel and perpendicular to A.

13. Three forces $\vec{F}_1$, $\vec{F}_2$ and $\vec{F}_3$ are represented as shown. Each of them is of equal magnitude.

Column-I (Combination)	**Column-II (Approximate Direction)**
(A) $\vec{F}_1+\vec{F}_2+\vec{F}_3$	(P) $\nwarrow$
(B) $\vec{F}_1-\vec{F}_2+\vec{F}_3$	(Q) $\searrow$
(C) $\vec{F}_1-\vec{F}_2-\vec{F}_3$	(R) $\swarrow$
(D) $\vec{F}_2-\vec{F}_1-\vec{F}_3$	(S) $\nearrow$



1. If $\vec{A}$ is $2\hat{i}+9\hat{j}+4\hat{k}$, then $4\vec{A}$ will be :

(A) $8\hat{i}+16\hat{j}+36\hat{k}$ (B) $8\hat{i}+36\hat{k}+16\hat{j}$ (C) $8\hat{i}+9\hat{j}+16\hat{k}$ (D) $8\hat{i}+36\hat{j}+16\hat{k}$

2. If vectors $\vec{A}=\hat{i}+2\hat{j}+4\hat{k}$ and $\vec{B}=5\hat{i}$ represent the two sides of a triangle, then the third side of the triangle can have length equal to

(A) 6 (B) $\sqrt{56}$ (C) both of the above (D) none of the above

3. A particle is situated at the origin of a coordinate system. The following forces begin to act on the particle simultaneously $\vec{F}_1=5\hat{i}-5\hat{j}+5\hat{k}$, $\vec{F}_2=2\hat{i}+8\hat{j}+6\hat{k}$, $\vec{F}_3=-6\hat{i}+4\hat{j}-7\hat{k}$, $\vec{F}_4=-\hat{i}-3\hat{j}-2\hat{k}$. Then the net force is in

(A) in X–Y plane (B) in Y–Z plane (C) in Z–X plane (D) along X–axis

4. Consider east as positive x-axis, north as positive y-axis and vertically upward direction as z-axis. A helicopter first rises up to an alitude of 100 m than flies straight in north 500 m and then suddenly takes a turn towards east and travels 1000 m east. What is position vector of helicopter. (Take starting point as origin)

(A) $1000\hat{i}-500\hat{j}+100\hat{k}$ (B) $1000\hat{i}+500\hat{j}-100\hat{k}$

(C) $1000\hat{i}+500\hat{j}+100\hat{k}$ (D) $-1000\hat{i}+500\hat{j}+100\hat{k}$

5. A bird moves from point (1, –2) to (4, 2). If the speed of the bird is 10 m/s, then the velocity vector of the bird is

(A) $5(\hat{i}-2\hat{j})$ (B) $5(4\hat{i}+2\hat{j})$ (C) $0.6i+0.8\hat{j}$ (D) $6\hat{i}+8\hat{j}$

6. Consider east as positive x-axis, north as positive y-axis. A girl walks 10 m east first time then 10 m in a direction 30° west of north for the second time and then third time in unknown direction and magnitude so as to return to her initial position. What is her third displacement in unit vector notation.

(A) $-5\hat{i}-5\sqrt{3}\ \hat{j}$ (B) $5\hat{i}-5\sqrt{3}\ \hat{j}$ (C) $-5\hat{i}+5\sqrt{3}\ \hat{j}$ (D) She can not return

7. If $\vec{a}=2\hat{i}+\sqrt{5}\hat{j}$ & $\vec{b}=5\hat{i}+\sqrt{5}\hat{j}+4\hat{k}$, then find a vector of same magnitude as of $\vec{a}$ and parallel to vector $\vec{a}-\vec{b}$

(A) $\dfrac{7\hat{i}+2\sqrt{5}\hat{j}+4\hat{k}}{3}$ (B) $-3\hat{i}-4\hat{k}$ (C) $\dfrac{-9\hat{i}-12\hat{k}}{5}$ (D) $9\hat{i}+12\hat{k}$

8. Which of the following expression does not give vector having unit magnitude :-

(A) $\dfrac{\vec{a}-\vec{b}}{|\vec{a}-\vec{b}|}$ (B) $\dfrac{\hat{a}-\hat{b}}{|\hat{a}-\hat{b}|}$

(C) $(\hat{a}+\hat{b})$, when angle between $\hat{a}$ & $\hat{b}$ is 120º (D) $(\hat{a}-\hat{b})$, when angle between $\hat{a}$ & $\hat{b}$ is 120º

9. Two vectors in the *x–y* plane of magnitude 3 units each make angle of 60° between them, where one is along *x*-axis. If the vectors are rotated by 30° each in same direction the *x*-component of their resultant will be

(A) $2\sqrt{3}$ units (B) $\dfrac{3\sqrt{3}}{2}$units (C) $3\sqrt{3}$ units (D) 6 units

Paragraph for Question no. 10 to 12

A boy lost in a jungle finds a note. In the note was written the following things.

Displacements

1. 300 m 53° South of East.
2. 400 m 37° North of East
3. 500 m North
4. 500 √2 m North-West
5. 500 m South

He starts walking at speed 2 m/s following these displacements in the given order.

10. How far and in which direction is he from the starting point after 5 min. and 50 s?

(A) 500 m due East (B) 500 m due West
(C) 700 m due South-West (D) 700 m due North-East

11. How far and in which direction is he from the starting point after 10 minutes?

(A) 500 √2 m due North (B) 1200 m due North-East
(C) 500√2 m due North-East (D) 900 m due 37° North of East

12. How far and in which direction has finally displaced after all the displacements in the note?

(A) 500√2 m due North-East (B) 500 m due North
(C) 866 m due North-West (D) 500√3 m due 60° North of West

Paragraph for Question no. 13 to 15

A boy A starts from a point P runs some distance towards east then turns 53° towards north and runs 75 m further to reach point Q. The boy maintains constant speed of 5 m/s in running from P to Q. Another boy B starts 2 s after A from point P and runs 100 m in a direction 37° north of east with a constant speed. Both of them meet at point Q.

13. How far in the east direction, has the boy A ran?

(A) 25 m (B) 30 m (C) 35 m (D) 40 m

14. How long the boy A has to run to reach point Q.

(A) 20 s (B) 22 s (C) 24 s (D) 25 s

15. Magnitude of average velocity of the boy A is closest to

(A) 5 m/s (B) 4.45 m/s (C) 4.54 m/s (D) 3.75 m/s

Paragraph for Question no. 16 to 19

If two vectors are represented by two adjacent sides of a parallelogram which are directed away from their common point then their sum (i.e. resultant vector) is given by the diagonal of the parallelogram passing away through that common point. On the basis of above theory, answer the following questions.

16. If two vectors of magnitude of 5 and 3 are added such that angle between resultant and vector of magnitude 5 is maximum and it will be

(A) 37° (B) 53° (C) 90° (D) 180°

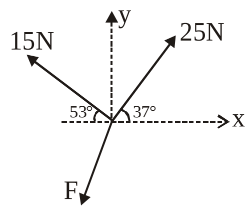
17. If two vectors of magnitude of 5 and 3 are added such that angle between resultant and vector of magnitude 3 is maximum and it will be

(A) 37° (B) 53° (C) 90° (D) 180°

18. A vector $\vec{A}$ of unknown magnitude makes 127° or 37° with another vector of magnitude 5. What is the minimum possible magnitude of resultant vector?

(A) 3 or 5 (B) 4 or 5 (C) 0 or 3 (D) Data insufficient

19. Three forces are acting on an object shown in diagram. Their resultant is zero. The $\vec{F}$ is :-



(A) $-11\hat{i}-27\hat{j}$ (B) $-20\hat{i}-27\hat{j}$
(C) $11\hat{i}-3\hat{j}$ (D) $20\hat{i}-3\hat{j}$

1. A particle is moving eastward with a velocity of 5m/s In 10 s, the velocity changes to 5m/s northward. Find the average acceleration in this time.

(A) zero
(B) $\frac{1}{\sqrt{2}}$ m/s^2 towards north-west
(C) $\frac{1}{\sqrt{2}}$ m/s^2 towards north-east
(D) $\frac{1}{2}$ m/s^2 towards north-west

2. A boy walks to his school at a distance of 6 km with a speed of 2.5 km/h, and walks back with a constant speed by 4 km/h.Find his average speed for trip expressed in km/h.

(A) $\frac{24}{13}$ (B) $\frac{40}{13}$ (C) 3 (D) 4.8

3. If the distance 's' travelled by a body in time 't' is given by $s = \frac{a}{t} + bt^2$ then the acceleration equals

(A) $\frac{2a}{t^3} + 2b$ (B) $\frac{2s}{t^2}$ (C) $2b - \frac{2a}{t^3}$ (D) $\frac{s}{t^2}$

4. A particle moves such that its position x varies with time according to relation $x = 2t - t^2$, where x is in metres and time in seconds. The incorrect statement about the particle is

(A) Velocity of the particle in interval $t = 0$ to $t = 2$ sec is in positive x-direction.
(B) Speed of the particle is 1 m/s at $t = \frac{3}{2}$ s.
(C) Displacement travelled in the interval $t = 0$ to $t = 2$s is zero.
(D) Its speed first increases then decreases.

5. The velocity of a particle traveling in a straight line is given by $v(t) = 5 - 6e^{-t/2}$ m/s, where time t is in seconds and $t \geq 0$. If the particle is observed at x=7m at the instant t = 0, its position x is expressed as function of time $x(t) = kt + le^{-t/2} + m$. Find numerical value of $\frac{k+m}{\ell}$.

6. A particle is moving in a straight line according to equation $x = \frac{t^3}{3} - \frac{5}{2}t^2 + 6t$. The time interval in which velocity i.e. instantaneous rate of change of position w.r.t. time is negative is

(A) $0 < t < 3$ (B) $0 < t < 2$ (C) $2 < t < 3$ (D) $t > 3$ and $t < 2$

7. The position of a particle varies according to the expression x = t(t – 1)(t – 2) then

(A) Velocity will be zero at $t_2 = 1 - \frac{1}{\sqrt{3}}$ second that $t_2 = 1 + \frac{1}{\sqrt{3}}$ sec
(B) Acceleration changes its direction between $t_1 = 0$ and $t_2 = 2$
(C) Acceleration remains constant in direction between $t_1 = 0$ and $t_2 = 2$
(D) None of these

8. A scooter going due east at 10 m s^{-1} turns right through an angle of 90°. If the speed of the scooter remains unchanged in taking this turn, the change in the velocity of the scooter is :

(A) 20.0 m s^{-1} in south-western direction
(B) zero
(C) 10.0 m s^{-1} in south-east direction
(D) 14.14 m s^{-1} in south-western direction

9. The position x of a particle varies with time (t) as $x = at^2 - bt^3$. The acceleration at time t of the particle will be equal to zero, where t is equal to :–

(A) $\frac{2a}{3b}$ (B) $\frac{a}{b}$ (C) $\frac{a}{3b}$ (D) zero

10. A particle moves along a straight line such that its displacement at any time t is given by $s = t^3 - 6t^2 + 3t + 4$ metres. The velocity when the acceleration is zero is

(A) $3ms^{-1}$ (B) $-12ms^{-1}$ (C) $42\ ms^{-1}$ (D) $-9ms^{-1}$

11. The displacement of a particle starting from rest (at t = 0) is given by $s = 6t^2 - t^3$ The time at which the particle will attain zero velocity again, is

(A) 4s (B) 8s (C) 12s (D) 16s

12. A car moves along a straight line whose equation of motion is given by $s = 12t + 3t^2 - 2t^3$where s is in metres and t is in seconds. The velocity of the car at start will be :–

(A) 7 m/s (B) 9 m/s (C) 12 m/s (D) 16 m/s

13. Velocity of a body moving in a straight line is $v = (t^2 + 2t+1)$ kg m/s. Acceleration of the body at t = 2 s is

(A) $6\ ms^{-2}$ (B) $8\ ms^{-2}$ (C) $4\ ms^{-2}$ (D) $2\ ms^{-2}$

14. The displacement of a body is given to be proportional to the cube of time elapsed. Acceleration of the body is proportional to :

(A) t^4 (B) t^3 (C) t^2 (D) t

15. A point moves rectilinearly. Its position x at time t is given by $x^2 = t^2 + 1$. Its acceleration at time t is:

(A) $\frac{1}{x^3}$ (B) $\frac{1}{x} - \frac{1}{x^2}$ (C) $-\frac{t}{x^2}$ (D) none of these

16. The initial velocity of a particle is u and the acceleration is given by (kt), where k is a positive constant. The distance travelled in time t is :

(A) $s = ut^2 + kt^2$ (B) $s = ut + (kt^3/6)$ (C) $s = ut + (kt^3/2)$ (D) $s = (ut^2/2) + (kt^3/6)$

17. A body starts from the origin and moves along the X-axis such that the velocity at any instant is given by $4t^3 - 2t$, where *t* is in sec and velocity in ms^{-1}. What is the acceleration of the particle, when it is 2 m from the origin

18. A particle has a velocity of $v = 8 - 2t\ ms^{-1}$ and moves in a straight line. It is at origin at t = 0. When will it pass through the origin again.

19. A particle has a velocity of $v = 10 - 2t\ ms^{-1}$ and moves in a straight line.Find the distance traveled in 10 s

20. A particle has an acceleration $a = 10 - 5t\ ms^{-2}$ and moves in a straight line initially at rest (a) Find the velocity after 4 s (b) Find the distance traveled in 6 s (c) draw the v-t graph.

21. A particle has an acceleration $a = 4\sqrt{x}\ ms^{-2}$ and moves in a straight line with zero velocity at x = 0. Find the velocity of the particle at x = 1.

22. A particle has an acceleration $a = -2x\ ms^{-2}$ and moves in a straight line with velocity 4 m/s at x = 0.Find the value of x at which it stops.

23. Velocity of a particle varies with position as per the equation $v = \frac{1}{x}$. At t = 0 the position is 2 m. Find the position at t = 1 s.

24. A particle is given velocity of 5 m/s and its acceleration is $a = -2v$, where *v* is its velocity at any time *t*. Find the velocity v at any time *t*. Also find the total distance travelled.

25. A particle starts and has acceleration $a = 5 - 2v$, where *v* is its velocity at any time *t*.Find the velocity v at any time. Also find the terminal velocity.

1. A particle moving under constant acceleration on a straight path has a speed of 10 m/s in east direction. After 4 seconds its speed is 30 m/s in west direction. The **CORRECT** statements about the particle are

(A) Acceleration of the particle is 10 m/s^2 towards west.

(B) Acceleration of the particle is 5 m/s^2 towards east.

(C) Displacement of the particle in first two seconds is zero.

(D) Displacement of the particle in first two seconds is 30 m.

2. A body is moving from rest under constant acceleration and let s_1 be the displacement in the first p-1 sec and s_2 be the displacement in the first p sec. The displacement in $(p^2 - p + 1)$th sec will be

(A) $s_1 + s_2$ (B) $s_1 - s_2$ (C) s_1s_2 (D) s_1/s_2

3. A particle starts with a velocity of 2 ms^{-1} and moves in a straight line with an acceleration = (– 0.1) m/s^2. The time when its displacement is 15 m is/are

(A) 20 s (B) 30 s (C) 10s (D) 40 s

4. Mark the **CORRECT** statements :

(A) Average velocity for an interval of time is always smaller than average speed.

(B) For a rectilinear motion with uniform acceleration, average velocity equals mean of initial and final velocity for the interval.

(C) For uniformly accelerated rectilinear motion if velocity at the start is in same direction as acceleration, distance travelled can be calculated using formula $S = ut + \frac{1}{2}at^2$, where symbols have usual meaning.

(D) Instantaneous velocity is equal to average velocity for a vanishingly small interval near the instant

5. A man holds four balls 180 m above the ground and drops them at regular intervals of time so that when the first ball hits ground, the fourth ball is just leaving his hand. At this time, the second and third balls from the ground are at the positions

(A) 160 m and 100 m respectively (B) 80 m and 20 m respectively

(C) 20 m and 80 respectively (D) 100 m and 160 m respectively

Paragraph for Question 5 and 6

An auto-mobile and a truck start from rest at the same instant, with the automobile initially at some distance behind the truck. The truck has a constant acceleration of 2.0 m/s^2 and the automobile has acceleration 3.4 m/s^2. The automobile overtakes the truck after the truck has moved 40 m.

6. How much time does, it take for the automobile to overtake the truck ?

(A) 20 s (B) $\sqrt{10}$ s (C) 2 s (D) $2\sqrt{10}$ s

7. How far was the automobile behind the truck initially?

(A) 28 m (B) 26 m (C) 38 m (D) 18 m

8. Two runners Ram and Shyam in a 144 m race start from the same place, but one runner gives the other a little advantage. The first runner, Ram, starts right away and runs at a constant velocity of 8.0 m/s. The second runner, Shyam, waits two seconds and then runs at a velocity of 9.0 m/s. How much is the separation between them (in m) when the race is just about to finish?

9. A ball is thrown vertically upwards with a velocity 'u' from the balloon descending with velocity V. The ball will pass by the balloon after time.

(A) $\frac{u-V}{2g}$ (B) $\frac{u+V}{2g}$ (C) $\frac{2(u-V)}{g}$ (D) $\frac{2(u+V)}{g}$

10. With what velocity a ball be projected vertically so that the distance covered by it in 5th second is twice the distance it covers in its 6th second while ascending

(A) 58.8 m/s (B) 49 m/s (C) 65 m/s (D) 19.6 m/s

11. A particle is thrown upwards from ground. It experiences a constant resistance force which can produce a retardation of 2 m/s^2. The ratio of time of ascent to the time of descent is [g = 10 m/s^2]

(A) 1 : 1 (B) $\sqrt{\frac{2}{3}}$ (C) $\frac{2}{3}$ (D) $\sqrt{\frac{3}{2}}$

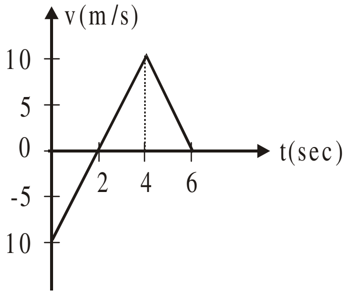
12. The greatest acceleration or deceleration that a train may have is a. The minimum time in which the train may reach from one station to the other separated by a distance d is

(A) $\sqrt{\frac{d}{a}}$ (B) $\sqrt{\frac{2d}{a}}$ (C) $\frac{1}{2}\sqrt{\frac{d}{a}}$ (D) $2\sqrt{\frac{d}{a}}$

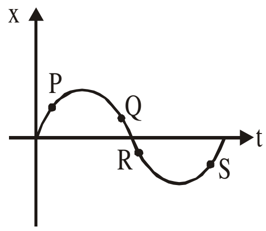
13. From the top of a tower, a stone is thrown up and reaches the ground in time t_1. A second stone is thrown down with the same speed and reaches the ground in time t_2. A third stone is released from rest and reaches the ground in time t_3.

(A) $t_3 = \frac{1}{2}(t_1 + t_2)$ (B) $t_3 = \sqrt{t_1 t_2}$ (C) $\frac{1}{t_3} = \frac{1}{t_2} - \frac{1}{t_1}$ (D) $t_3^2 = t_1^2 - t_2^2$

14. The figure shows the graph of velocity-time for a particle moving in a straight line. If the average speed for 6 sec is 'b' and the average acceleration from 0 sec to 4 sec is 'c' find magnitude of bc (in m^2/s^3)



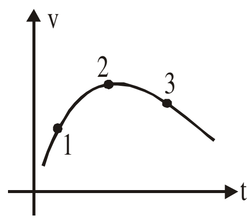
15. A car is moving along a straight line. It's displacement (x) - time(t) graph is shown in column II. Match the entries in column I with points on graph.



Column-I	Column-II
(A) x $\rightarrow$ negative, v$\rightarrow$ positive, a$\rightarrow$ positive	(P) P
(B) x $\rightarrow$ positive, v$\rightarrow$ negative, a$\rightarrow$ negative	(Q) Q
(C) x $\rightarrow$ negative, v$\rightarrow$ negative, a$\rightarrow$ positive	(R) R
(D) x $\rightarrow$ positive, v$\rightarrow$ positive, a$\rightarrow$ negative	(S) S

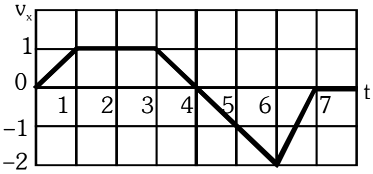
16. A particle is moving along a straight line. Its v-t graph is as shown in figure.

Point 1, 2 and 3 marked on graph are three different instants. Column-I has fill in the blanks, which are to be filled by the entries in column-II.



Column I	Column II
(A) a_1 is ....a_2	(P) Parallel to
(B) v_1 is ....v_2	(Q) Anti parallel to
(C) v_3 is ....v_1	(R) Greater than (in magnitude)
(D) a_1 is ....v_1	(S) Less than (in magnitude)

1. A point travels along the x axis with a velocity whose projection v_x, is presented as a function of time by the plot as shown in figure.



Assuming the coordinate of the point x = 0 at the moment t = 0, draw the approximate time dependence plots for the acceleration a_x, the x coordinate, and the distance covered s.

2. A point moves rectilinearly with deceleration whose modulus depends on the velocity v of the particle as $a = \alpha\sqrt{v}$, where α is a positive constant. At the initial moment the velocity of the point is equal to v_0. What distance will it traverse before it stops? What time will it take to cover that distance?

3. At the moment t = 0 a particle leaves the origin and moves in the positive direction of the x axis. Its velocity varies with time as $\vec{v} = \vec{v}_0(1 - t/\tau)$, where $\vec{v}_0$ is the initial velocity vector whose modulus equals v_0 = 10.0 cm/s; τ = 5.0 s. Find:

(a) the x coordinate of the particle at the moment of time 10 s

(b) the moments of time when the particle is at the distance 21. 0cm from the origin

(c) the distance s covered by the particle during the first 4.0 s and 8.0 s.

4. A stone is dropped from a certain height which can reach the ground in 5 sec. It is stopped after three seconds of its fall and then is again released. The total time taken by the stone to reach the ground will be

(A) 6 s (B) 6.5 s (C) 7 s (D) 7.5 s

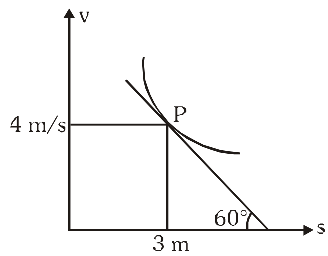
5. The velocity of a particle moving on the x-axis is given by $v = x^2 + x$ where v is in m/s and x is in m. Find its acceleration in m/s^2 when passing through the point x = 2m

(A) 0 (B) 5 (C) 11 (D) 30

6. A train stopping at two stations 5 km apart takes 5 min on the journey from one of the station to the other. Assuming that its first accelerates with a uniform acceleration α and then that of uniform retardation β. if units of mass, length, and time are kg, km and min respectively then

(A) $\frac{1}{\alpha}+\frac{1}{\beta}=2$ (B) $\frac{1}{\alpha}+\frac{1}{\beta}=\frac{2}{5}$ (C) $\frac{1}{\alpha}+\frac{1}{\beta}=\frac{5}{2}$ (D) $\frac{1}{\alpha}+\frac{1}{\beta}=\frac{1}{2}$

7. A particle is moving along a straight line whose velocity-displacement graph is as shown in figure :
A tangent is drawn at point P on the graph. At the point P



(A) the particle is speeding up

(B) numerical value of velocity and acceleration of the particle are equal

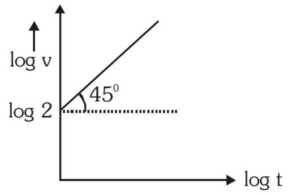
(C) numerical value of velocity is more than the numerical value of acceleration of the particle

(D) numerical value of acceleration is more than the numerical value of velocity of the particle

8. A particle retards from v_0 with an acceleration a = – kt , where k is a positive constant. The total distance covered by the particle is –

(A) $\sqrt{\frac{2v_0^3}{3k}}$ (B) $\sqrt{\frac{8v_0^3}{9k}}$ (C) $\sqrt{\frac{8v_0^3}{3k}}$ (D) $\sqrt{\frac{2v_0^3}{9k}}$

9. Figure shows the plot of velocity versus time on a log–log scale. Assuming straight line motion and the particle to start from origin, the distance covered at the end of t = 3s is



(A) 9 m (B) 18 m (C) 10 m (D) Can't be determined

10. Acceleration of a particle is defined as $a = \left(75V^2 - 30V + 3\right)$ (m/s²), find constant speed achieved by the particle.

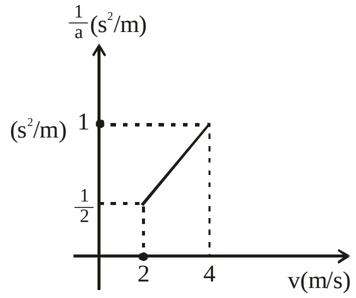
(A) 3 m/s (B) $\frac{1}{5}$ m/s

(C) 5 m/s (D) It will never achieve constant speed.

11. Velocity of an object depends on displacement as $V^{3/2} = K8(y)^{3/4}$, where V is velocity (in m/s), y is displacement (in meter) & K is constant, then acceleration in m/s² when y = 16

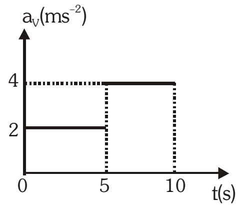
(A) 8 $K^{2/3}$ (B) 8 (C) 8$K^{4/3}$ (D) 32 $K^{4/3}$

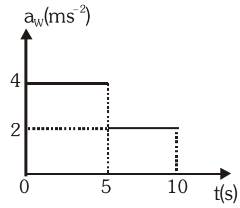
12. Given graph is $\frac{1}{\text{acceleration}}$ vs velocity graph. If the time interval during which velocity changes from 2m/s to 4m/s is given by Δt seconds. Then find the value of 2Δt



(A) 3 (B) 4 (C) 5 (D) 6

13. Two motorcycles V and W starts from rest and move together for the same time interval. Their acceleration–time graphs are as follows :





Which of the following statement is incorrect?

(A) Both the motorcycle attain the same velocity after 10 second

(B) Both the motorcycle travel the same distance in 10 seconds

(C) The distance travelled by the motorcycle W is more than that of motorcycle V in first 5 seconds

(D) The velocity of motorcycle W is more than that of V just after 5 second

ANSWER KEY

RACE-01

1.	(C)	**2.**	(C)	**3.**	(C)	**4.**	(C)	**5.**	(B)	**6.**	(C)	**7.**	(D)	**8.**	(A)	**9.**	(D)
10.	(C)	**11.**	(A)	**12.**	(D)	**13.**	(C)	**14.**	(A)	**15.**	(C)	**16**	(C)	**17.**	(C)	**18.**	(B)
19.	(B)	**20.**	(D)	**21.**	(B)	**22.**	(C)	**23.**	(B)	**24.**	(C)	**25.**	(B)				

RACE-02

1.	(A)	**2.**	(A)	**3.**	(C)	**4.**	(B)	**5.**	(C)	**6.**	(B)	**7.**	(D)	**8.**	(B)	**9.**	(B)
10.	(A)	**11.**	(A)	**12.**	(C)	**13.**	(A)	**14.**	(D)	**15.**	(B)	**16.**	(B)	**17.**	(C)	**18.**	(D)
19.	(B)	**20.**	(A)														

RACE-03

1. (A) $-\sqrt{3}/2$ (B) 1 (C) 1/4 (D) 9/25

2. (i) – 2 (ii) 1/2 (iii) 0 (iv) $-\sqrt{3}/2$ (v) $-1/\sqrt{3}$ (vi) 1 (vii) $\sqrt{3}/2$ (viii) $\sqrt{3}$

3. (C) **4.** $\sin\theta = \pm 3/5, \cot\theta = \pm 4/3$ **5.** tan A = $\pm 40/9$, cosec A = ± 41/40

7. (i) $\frac{2-\sqrt{3}}{4}$, (ii) $\frac{2+\sqrt{3}}{4}$, (iii) 0, (iv) 0, (v) + 1

8. (i) $\sqrt{2}, -\sqrt{2}$ (ii) 2, –2 (iii) 23, -3 (iv) 2, 1/2 **9.** (i) $\frac{\pi}{180}$ (ii) 1 (iii) $\frac{-\pi}{75}$ (iv) $\frac{\pi}{90}$

10. (i) $\frac{2}{5}$ (ii) $-\frac{5}{3}$ **11.** (D) **12.** (A) **13.** (D) **14.** (A)

RACE-04

1. (B) **2.** (A) **3.** cos x + sin x **4.** 4 cos 2x **5.** (A) **6.** (D) **7.** 6 cos 3x

8. 3 $\sin^2 x$ cos x **9.** (A) **10.** (C) **11.** (B) **12.** (C) **13.** (B) **14.** (B) **15.** (A)

16. (D) **17.** (B) **18.** (B) **19.** $c^2/4$ **20.** (C) **21.** (C) **22.** (B) **23.** (D) **24.** (D)

25. 12250 m **26.** 49 **27.** 52, 25

RACE-05

1. (D) **2.** (A) **3.** sin 4x + c **4.** (A) **5.** $\frac{x^{16}}{16}+c$ **6.** $-2x^{-1/2}+c$

7. $\frac{-1}{2x^6}+\log_e x+c$ **8.** $\frac{x^2}{2}+\log_e x+2x+c$ **9.** $\frac{x^2}{2}+\log_e x+c$ **10.** $\frac{-a}{x}+b\log_e x+c$

11. $t^3 - t^2 + c$ **12.** $-\frac{\cos 4t}{4}+t^2+c$ **13.** $+\frac{GmM}{R}$ **14.** $kq_1q_2\left[\frac{1}{r_2}-\frac{1}{r_1}\right]$

15. $\frac{m(v^2-u^2)}{2}$ **16.** ∞ **17.** 1 **18.** 1 **19.** (B) **20.** (B) **21.** 0 **22.** 2

23. 8 **24.** (i) 6 (ii) 30 **25.** (C) **26.** (D) **27.** (B)

RACE-06

1. A-R, B-S, C-P, D-Q **2.** (D) **3.** (A,B,D) **4.** (B) **5.** (B) **6.** (ABCD)
7. 6N & 10N **8.** Q = 5 **9.** 135° **10.** (C) **11.** (ABC) **12.** (B)
13. A-Q, B-R, C-P, D-S

RACE-07

1. (D) **2.** (C) **3.** (B) **4.** (C) **5.** (D) **6.** (A) **7.** (C) **8.** (D) **9.** (B)
10. (A) **11.** (C) **12.** (B) **13.** (C) **14.** (B) **15.** (C) **16.** (A) **17.** (D) **18.** (B)
19. (A)

RACE-08

1. (B) **2.** (B) **3.** (A) **4.** (A) **5.** 0 **6.** (C) **7.** (B) **8.** (D) **9.** (C)
10. (D) **11.** (A) **12.** (C) **13.** (A) **14.** (D) **15.** (A) **16.** (B) **17.** 22 ms^{-2} **18.** 8 sec.
19. 50 m **20.** (a) zero, (b) $\frac{160m}{3}$ **21.** $\frac{4}{\sqrt{3}}m/s$ **22.** $2\sqrt{2}m/s$ **23.** $\sqrt{6}$ m
24. $v = 5e^{-2t}$, 2.5 m **25.** $v = 5/2\,(1 - e^{-2t})$, 2.5 m/s

RACE-09

1. (AC) **2.** (A) **3.** (BC) **4.** (BCD) **5.** (D) **6.** (D) **7.** (A) **8.** 0 **9.** (D)
10. (B) **11.** (B) **12.** (D) **13.** (B) **14.** 25 **15.** P-S, B-Q, C-R, D-P
16. A-R, B-P,S, C-PR, D-P

RACE-10

2. (a) $s = (2/3\alpha)\, v_0^{3/2}$; (b) $t = 2\sqrt{v_0}/\alpha$ **3.** (a) x = 0 (b) 3s, 7s (c) 24 m, 34 m. **4.** (C)
5. (D) **6.** (C) **7.** (D) **8.** (B) **9.** (A) **10.** (B) **11.** (C) **12.** (A) **13.** (B)