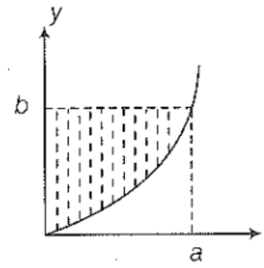
PART-B

1. The area of shaded portion is



A) $+\int_0^a ydx$ B) $+\int_0^a xdy$ C) $+\int_0^b xdy$ D) $-\int_0^b xdy$

2. Integrate the following function $\int \frac{1}{(-2x+4)} dx$

3. The rate of change of displacement with respective to time gives instantaneous velocity. The velocity of a particle at instant t is $V = (2t+5)^2\ ms^{-1}$. Find the displacement in 1s.

A) 49 m B) 36.3 m C) 7 m D) 10 m

4. The rate of change of velocity gives acceleration. The acceleration of a particle is $a = 3t^2\ ms^{-2}$. The velocity of particle at t = 0 is $1\,ms^{-1}$. Find velocity of the particle at t = 2s.

A) $12\ ms^{-1}$ B) $13\ ms^{-1}$ C) $11\ ms^{-1}$ D) $9\ ms^{-1}$

5. The acceleration of a particle is $a = a_0 - bv$, where V is velocity at instant t. The particle starts from rest at t = 0. Find velocity of the particle as function of time.

A) $V = \frac{a_0}{b}\left(1-e^{-bt}\right)$ B) $V = \frac{b}{a_0}\left(1-e^{-bt}\right)$ C) $V = \frac{a_0}{b}e^{-bt}$ D) $V = \frac{a_0}{b}\left(1-e^{bt}\right)$

6. The rate of change of velocity gives acceleration. The acceleration of a particle is $a = -\omega^2 x$, where ω is constant and x is position of the particle at instant t. Find velocity of the particle as function of x, if v = 0 at x = A.

A) $V = \omega(A-x)$ B) $V = \omega\sqrt{A^2-x^2}$ C) $V = \frac{\omega}{2}\sqrt{A^2-x^2}$ D) $V = A\omega$

7. The net force on a particle is the rate of change of momentum. If net force on a particle is $F = \left(4+3t^2\right)N$ along X-axis. Find change in momentum from t = 0 to t = 1s.

A) Zero B) 2 N-s C) 4 N-s D) 20 N-s

8. Find the value of $\int_0^4 |(1-x)|\,dx$

A) Zero B) 1 C) 4 D) 5

9. The rate of flow of charge in L-R circuit is $I = I_0\left(1-e^{-\frac{t}{\lambda}}\right)$. Find total charge flow from t = 0 to t = λ

A) $\frac{\lambda I_0}{e}$ B) λI_0 C) $e\lambda I_0$ D) $2\lambda I_0$

10. Work done by variable force is $W = \int F.dr$. If a force F= $\frac{k}{r^2}$ is acting on a body. Find work done by force when the body displaces from $r = r_0$ to $r = \infty$.

A) Zero B) $\frac{k}{r_0}$ C) $\frac{2k}{r_0}$ D) $\frac{k}{2r_0}$

11. The average value of quantity a is <a> = $\frac{\int a\ dt}{\int dt}$. If the velocity of a particle is $V = bt^2$. In time interval t = 0 to t = 1s,

A) average velocity is $\frac{b}{3}$ B) average acceleration is b

C) average velocity is zero D) average acceleration is zero

12. The electric current is $I = \frac{dq}{dt}$. Current, I = bt is passing through a wire. Find out the correct statement(s).

A) The charge flow through wire in time interval t = 0 to t = t_0 is $\frac{bt_0^2}{2}$

B) The average current through wire from t = 0 to t = t_0 is $\frac{bt_0}{2}$

C) The charge flow through wire is zero

D) The charge flow through wire from t = 0 to t = t_0 is infinity

13. The area of the region bounded by the parabola $y^2 = 4ax$, where a = 9m, its axis and two coordinates x = 4m and x = 9m is 19n. Find the value of n.

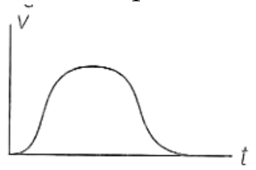
14. The area of the smaller portion of the circle $x^2 + y^2 = 4$ cut-off by the line x = 1 is $\left(\frac{n\pi - 3\sqrt{3}}{3}\right)m^2$. Find the value of n.

15. Find the area between the X-axis and the curve y =sin x from x = 0 and x = π.

16. If $V_x = \frac{dx}{dt}$ and $V_y = \frac{dy}{dt}$, where V_x and V_y are x-component and y-component of velocity, respectively. A particle is moving on a curved path as such $V_x = 10\,m/s$ and $V_y = 10(1-t)$. The relation between x and y-coordinates independent of time gives the equation of path of the particle. Find the equation of the path of the particle. If particle starts from origin of coordinate system.

A) $y = x - \frac{x^2}{20}$ B) $y = x + \frac{x^2}{20}$ C) $y = 20x$ D) $x = y - \frac{y^2}{20}$

17. The rate of change of velocity gives acceleration. The acceleration of a particle is $a = a_0 e^{-bt}$ in the X-direction. If particle starts from rest, its velocity versus time graph is

a.


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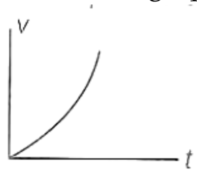

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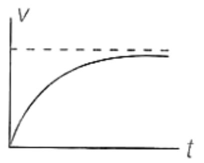

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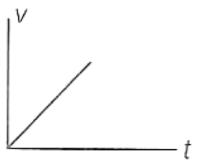
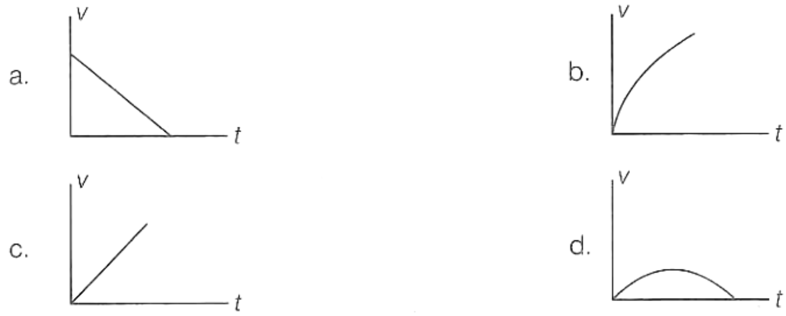


18. A particle is moving whose component of velocity along X-axis, V_x =by and the component of velocity along Y-axis is $V_y = bx$. Here, $V_x = \frac{dx}{dt}$ and $V_y = \frac{dy}{dt}$. The equation of path of the particle is

A) $x^2 + y^2$ =constant B) $x^2 - y^2$ =constant

C) xy =constant D) $x = y$ +constant

19. A particle starts from rest from x = 0 with a velocity $V = b\sqrt{x}$ along X-axis. Velocity-time graph for particle is



20. The relation between time t and distance x is $t = bx^2 + cx$, where b and c are constants. Find acceleration as function of x.

A) $\frac{2b}{(c+2bx)^3}$ B) $\frac{-2b}{(c+2bx)^3}$ C) $\frac{-b}{(c+bx)^3}$ D) $\frac{-3b}{(c+2bx)^3}$

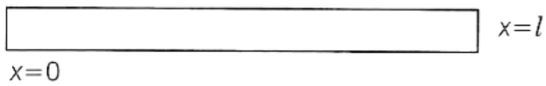
21. The conservative force is defined as $F = -\frac{\partial U}{\partial x}\hat{i} - \frac{\partial U}{\partial y}\hat{j} - \frac{\partial U}{\partial z}\hat{k}$, where U is potential energy. The potential energy of a particle is $U = \left(\frac{x^4}{4} - \frac{x^2}{2}\right)$ J. Find conservative force on the particle at x = 2 m.

A) 6 N along negative X-axis
B) 6 N along positive X-axis
C) 0 N along positive X-axis
D) Zero

22. The kinetic energy of a particle is $E_k = \frac{1}{2}mv^2$, where m is mass of particle and v is its speed. Power is the rate of change of kinetic energy. A constant power P is supplied to a particle of mass m. Find velocity of the particle as function of time.

A) $\sqrt{\frac{Pt}{m}}$ B) $\frac{2Pt}{m}$ C) $\sqrt{\frac{2Pt}{m}}$ D) $\sqrt{\frac{4Pt}{m}}$

23. The x-coordinate of centre of mass is $x_{CM} = \frac{\int x\,dm}{\int dm}$



The linear mass density (mass per unit length) of a thin rod as shown in the figure is $\lambda = \lambda_0 x$, where λ_0 is constant. Find the x-coordinate of centre of mass of rod.

A) $\frac{l}{2}$ B) $\frac{l}{3}$ C) $\frac{2l}{3}$ D) $\frac{l}{6}$

24. Potential difference $dv = -E \cdot dr$, where E is electric field. If electric field in a region is $E = -ax^2\,\hat{i}$ and potential of the origin is zero. Find potential at x = b.

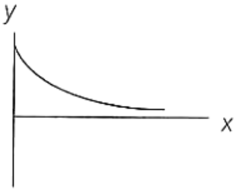
A) ab B) ab^3 C) $\frac{ab^3}{3}$ D) Zero

25. The root mean square value of current is $I_{rms} = \sqrt{\frac{\int I^2 dt}{\int dt}}$. Current through a wire is $I = I_0 \sin\omega t$. Find root mean square value of current from t = 0 to $t = \frac{2\pi}{\omega}$.

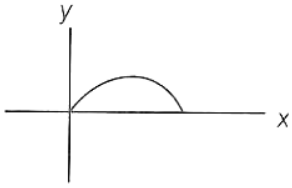
A) I_0 B) I_0^2 C) $\frac{2I_0}{\pi}$ D) $\frac{I_0}{\sqrt{2}}$

26. If $y = \frac{b^2 x}{(a^2 + x^2)^{3/2}}$, the y-x graph for $x \ge 0$ is

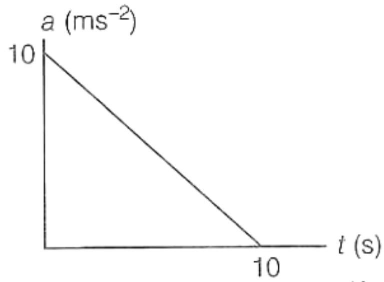
a. 

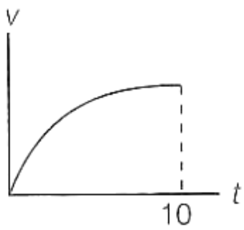
b. 

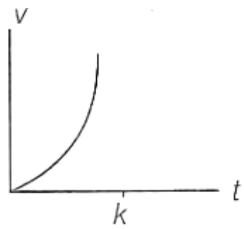
c. 

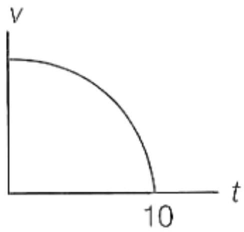
d. 

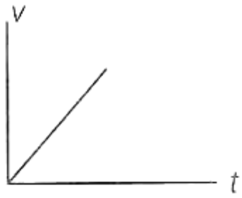
27. The rate of change of velocity with respect to time is acceleration of the particle. A particle starts from rest. Its acceleration versus time graph is as shown in figure. The displacement versus time graph for the particle is



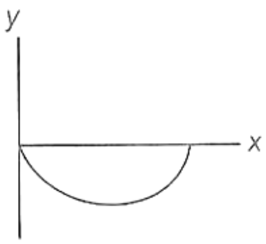
a. 

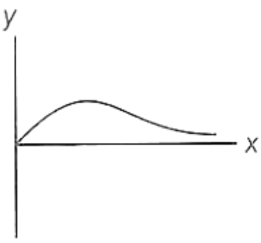
b. 

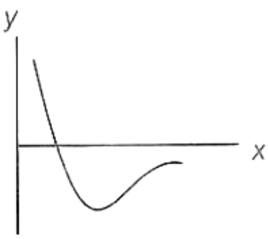
c. 

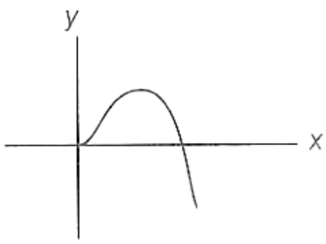
d. 

28. If $-\frac{dy}{dx} = -kx + ax^3$. Here, k and a are positive constants. For $x \geq 0$, y-x graph is

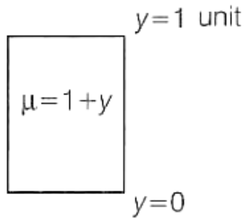
a. 

b. 

c. 

d. 

29. Apparent depth $= \int \frac{dy}{\mu}$



Where, μ is refractive index of the medium. But optical path $=\int \mu\, dy$. In the medium as shown in figure,

A) Apparent depth is ln 2

B) apparent depth is ln 3

C) optical path is ln 2 unit

D) optical path is $\frac{3}{2}$ unit

30. If velocity of a particle is $v=\frac{dx}{dt}$ and acceleration of the particle is $a=\frac{dv}{dt}$. The acceleration of a particle moving along X-axis is $-\frac{1}{2x^2}\,ms^{-2}$. At t = 0m x = 1m and v = 0. Find its magnitude of velocity (in ms^{-1}) at x = 0.5 m.

31. If $y=\frac{15}{4(0.75\sin\theta+\cos\theta)}$. Find minimum value of $|y|$

32. If a particle is in stable equilibrium, potential energy is minimum. If potential energy of a particle is $U=\left(\frac{1}{r^2}-\frac{2}{r}\right)J$. Find the value of r (in metre) at stable equilibrium of the particle.

PART-B:KEY

1.	C	2.	$-\frac{1}{2}\ln(-2x+4)+k$			3.	B	4.	D	5.	A	6.	B
7.	C	8.	D	9.	A	10.	B	11.	AB	12.	AB	13.	4
14.	4	15.	2	16.	A	17.	C	18.	B	19.	C	20.	B
21.	A	22.	C	23.	C	24.	C	25.	D	26.	C	27.	A
28.	D	29.	AD	30.	1	31.	3	32.	1				