Exercise-1

PART - I : FUNCTION & DIFFERENTIATION

Marked Questions may have more than one correct option.

SECTION - (A) : FUNCTION

1. Surface area of sphere as a function of its radius is $A(r) = 4\pi r^2$ the value of A(10) will be :
(1) 1358 m^2 (2) 324 m^2 (3) 314 m^2 (4) 1256 m^2

2. If $f(x) = x^2 - 1$
(1) 5 (2) 6 (3) 7 (4) 8

3. If $f(x) = x + \frac{1}{x}$, then the value of f(1) will be
(1) 2 (2) – 2 (3) 1 (4) – 1

4. Find v (0), where v (t) = 3 + 2t
(1) 5 (2) 6 (3) 3 (4) None

5. If $f(\theta) = \sin\theta$, find $f\left(\frac{\pi}{6}\right)$
(1) $\frac{\pi}{6}$ (2) $\frac{1}{2}$ (3) 2 (4) $\frac{\pi}{3}$

6. If f (x) = 5, then the value of f (10) will be
(1) 10 (2) 5 (3) 15 (4) None

SECTION - (B) : TRIGONOMETRY

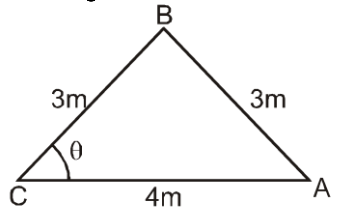
1. tan15° is equilvalent to :
(1) $(2-\sqrt{3})$ (2) $(5+\sqrt{3})$ (3) $\left(\frac{5-\sqrt{3}}{2}\right)$ (4) $\left(\frac{5+\sqrt{3}}{2}\right)$

2. $\sin^2\theta$ is equivalent to :
(1) $\left(\frac{1+\cos\theta}{2}\right)$ (2) $\left(\frac{1+\cos 2\theta}{2}\right)$ (3) $\left(\frac{1-\cos 2\theta}{2}\right)$ (4) $\left(\frac{\cos 2\theta - 1}{2}\right)$

3. sinA . sin(A + B) is equal to
(1) $\cos^2 A \cdot \cos B + \sin A \sin^2 B$ (2) $\sin^2 A \cdot \cos B + \frac{1}{2}\cos 2A \cdot \sin B$
(3) $\sin^2 A \cdot \cos B + \frac{1}{2}\sin 2A \cdot \sin B$ (4) $\sin^2 A \cdot \sin B + \cos A \cos^2 B$

4. $-\sin\theta$ is equivelent to :
(1) $\cos\left(\frac{\pi}{2}+\theta\right)$ (2) $\cos\left(\frac{\pi}{2}-\theta\right)$ (3) $\sin(\theta-\pi)$ (4) $\sin(\pi+\theta)$

5. θ is angle between side CA and CB of triangle, shown in the figure then θ is given by :



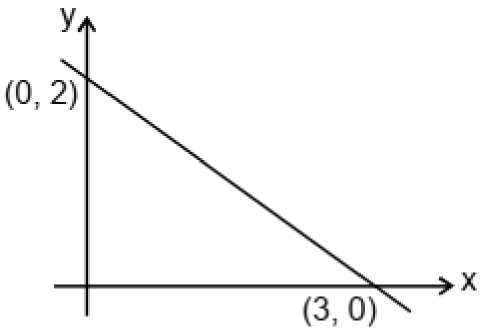
(1) $\cos\theta = \frac{2}{3}$ (2) $\sin\theta = \frac{\sqrt{5}}{3}$ (3) $\tan\theta = \frac{\sqrt{5}}{2}$ (4) $\tan\theta = \frac{2}{3}$

6. If $\tan\theta = \frac{1}{\sqrt{5}}$ and θ lies in the first quadrant, the value of cos θ is :

(1) $\sqrt{\frac{5}{6}}$ (2) $-\sqrt{\frac{5}{6}}$ (3) $\frac{1}{\sqrt{6}}$ (4) $-\frac{1}{\sqrt{6}}$

SECTION - (C) : COORDINATE GEOMETRY AND ALGEBRA

1. Calculate slope of shown line



(1) 2/3 (2) – 2/3 (3) 3/2 (4) –3/2

2. Roots of the equation $2x^2 + 5x - 12 = 0$, are

3. The speed (v) of a particle moving along a straight line is given by $v = t^2 + 3t - 4$ where v is in m/s and t in second. Find time t at which the particle will momentarily come to rest.

(1) 3 (2) 4 (3) 2 (4) 1

SECTION - (D) : DIFFERENTIATION

Find the derivative of given functions w.r.t. corresponding independent variable.

1. $y = x_2 + x + 8$

(1) $\frac{dy}{dx} = 2x + 1$ (2) $\frac{dy}{dx} = 2 + 1$ (3) $\frac{dy}{dx} = 2x - 1$ (4) $\frac{dy}{dx} = x + 1$

2. y = tan x + cot x

(1) $\tan_2 x + \text{cosec}_2 x$ (2) $\cot_2 x - \sin_2 x$ (3) $\sec_2 x - \text{cosec}_2 x$ (4) sec x + cosec x

3. $y = \ell nx + e_x$, then $\frac{d^2y}{dx^2}$ is equal to

(1) $\frac{1}{x^2} - e_x$ (2) $\frac{1}{x^2} + e_x$ (3) $\frac{1}{x} + e_x$ (4) $-\frac{1}{x^2} + e_x$

4. $y = e_x \ell nx$

(1) $e_x \ell nx + \frac{e^x}{x}$ (2) $e_x \ell nx - \frac{e^x}{x}$ (3) $e_x \ell nx - \frac{e}{x}$ (4) None of these

5. y = sin 5 x

(1) 5 cos 5 x (2) 3 cos 3 x (3) 5 cos 5x (4) 2 cos 2x

6. $(x + y)_2 = 4$

(1) $\frac{dy}{dx} = +1$ (2) $\frac{dy}{dx} = -1$ (3) $\frac{d}{dx} = -1$ (4) $\frac{dy}{d} = -1$

7. $y = 2u_3$, u = 8x – 1

(1) $\frac{dy}{dx} = 48\ (8x - 1)_2$ (2) $\frac{dy}{dx} = 58\ (5x - 1)_2$ (3) $\frac{dy}{dx} = 48\ (8x - 1)_2$ (4) $\frac{dy}{dx} = 28\ (8x - 1)$

8. Given $s = t^2 + 5t + 3$, find $\frac{ds}{dt}$, at t = 1
(1) 7 (2) 9 (3) 12 (4) 15

9. If $s = ut + \frac{1}{2}at^2$, where u and a are constants. Obtain the value of $\frac{ds}{dt}$.
(1) u – at (2) u + at (3) 2u + at (4) None of these

10. The minimum value of $y = 5x^2 - 2x + 1$ is
(1) $\frac{1}{5}$ (2) $\frac{2}{5}$ (3) $\frac{4}{5}$ (4) $\frac{3}{5}$

11. $y = \frac{2x+5}{3x-2}$
(1) $y' = \frac{-19}{(3x-2)^2}$ (2) $y' = \frac{19}{(3x-2)}$ (3) $y' = \frac{-19}{(3x+2)}$ (4) $y' = \frac{-19}{(3x+2)^2}$

12. A uniform metallic solid sphere is heated uniformly. Due to thermal expansion, its radius increases at the rate of 0.05 mm/second. Find its rate of change of volume with respect to time when its radius becomes 10 mm. (take p = 3.14)
(1) 31.4 mm^3 /second (2) 62.8 mm^3 /second (3) 3.14 mm^3 /second (4) 6.28 mm^3 /second

13. If $y = 3t_2 - 4t$; then minima of y will be at :
(1) 3/2 (2) 3/4 (3) 2/3 (4) 4/3

14. If $y = \sin(t_2)$, then $\frac{d^2y}{dt^2}$ will be -
(1) $2t\cos(t_2)$ (2) $2\cos(t_2) - 4t_2\sin(t_2)$
(3) $4t_2\sin(t_2)$ (4) $2\cos(t_2)$

15. The displacement of a body at any time t after starting is given by $s = 15t - 0.4t_2$. The velocity of the body will be 7 ms_{-1} after time :
(1) 20 s (2) 15 s (3) 10 s (4) 5 s

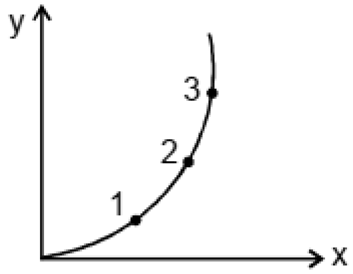
16. For the previous question, the acceleration of the particle at any time t is :
(1) –0.8 m/s_2 (2) 0.8 m/s_2 (3) –0.6 m/s_2 (4) 0.5 m/s_2

17. If velocity of particle is given by $v = 2t_4$ then its acceleration (dv/dt) at any time t will be given by :
(1) $8t_3$ (2) 8t (3) $-8t_3$ (4) t_2

18. The maximum value of xy subject to x + y = 8, is :
(1) 8 (2) 16 (3) 20 (4) 24

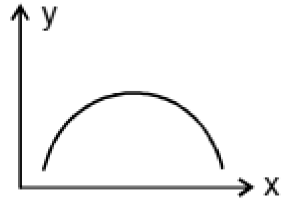
19. If $y = 3t_2 - 4t$; then minima of y will be at :
(1) 3/2 (2) 3/4 (3) 2/3 (4) 4/3

20. The slope of graph as shown in figure at points 1, 2 and is m_1, m_2 and m_3 respectively then



(1) $m_1 > m_2 > m_3$ (2) $m_1 < m_2 < m_3$ (3) $m_1 = m_2 = m_3$ (4) $m_1 = m_2 > m_3$

21. Magnitude of slope of the shown graph.



(1) First increases then decreases
(2) First decrease then increases
(3) increase
(4) decrease

22. $y = -x^2 + 3$

(1) $\frac{dy}{dx} = -2x, \frac{d^2y}{dx^2} = -2$
(2) $\frac{dy}{dx} = 2x, \frac{d^2y}{dx^2} = -2$
(3) $\frac{dy}{dx} = -2x, \frac{d^2y}{dx^2} = 2$
(4) none of these

23. $y = \frac{x^3}{3} + \frac{x^3}{2} + \frac{x}{4}$

(1) $\frac{dy}{dx} = x^2 - x + \frac{1}{4}, \frac{d^2y}{dx^2} = 2x + 3$
(2) $\frac{dy}{dx} = x^2 + x - \frac{1}{4}, \frac{d^2y}{dx^2} = 2x + 1$
(3) $\frac{dy}{dx} = x^2 + x + \frac{1}{4}, \frac{d^2y}{dx^2} = 2x + 1$
(4) $\frac{dy}{dx} = x^2 + x + \frac{1}{4}, \frac{d^2y}{dx^2} = 2x - 1$

24. $y = 4 - 2x - x^{-3}$

(1) $\frac{dy}{dx} = 2 + 3x^{-4}, \frac{d^2y}{dx^2} = -12x^{-5}$
(2) $\frac{dy}{dx} = -2 + 3x^{-4}, \frac{d^2y}{dx^2} = -12x^{-5}$
(3) $\frac{dy}{dx} = -2 + 3x^{-4}, \frac{d^2y}{dx^2} = 12x^{-5}$
(4) $\frac{dy}{dx} = -2 - 3x^{-4}, \frac{d^2y}{dx^2} = -12x^{-5}$

25. $y = -10x + 3\cos x$

(1) $10 - 3\sin x$ (2) $-10 + 3\sin x$ (3) $-10 + 5\sin x$ (4) $-10 - 3\sin x$

26. $y = \frac{3}{x} + 5\sin x$

(1) $-\frac{3}{x^2} + 5\cos x$ (2) $\frac{3}{x^2} + 5\cos x$ (3) $-\frac{3}{x^2} - \cos x$ (4) $-\frac{3}{x^2} - 5\cos x$

27. $y = \operatorname{cosec} x - 4\sqrt{x} + 7$

(1) $-\csc x \cot x - \frac{2}{\sqrt{x}}$
(2) $\csc x \cot x + \frac{2}{\sqrt{x}}$

(3) $-\csc x \cot x + \frac{2}{\sqrt{x}}$ (4) $\csc x \cot x + \frac{2}{\sqrt{x}}$

Find $\frac{ds}{dt}$,

28. $s = \tan t - t$

(1) $\sec^2 t + t$ (2) $\sec^2 t$ (3) $\sec t - 1$ (4) $\sec^2 t - 1$

29. $s = t^2 - \sec t + t$

(1) $2t + \sec t \tan t + 1$ (2) $2t - \sec t \tan t + 1$ (3) $2t - \sec t \tan t - 1$ (4) $2t + \sec^2 \tan t - 1$

30. $p = 5 + \frac{1}{\cot q}$, find $\frac{dp}{dq}$

(1) $\sec^2 q$ (2) $\sec^3 q$ (3) $\sec q$ (4) $\tan^2 q$

31. $p = (1 + \text{cosec } q) \cos q$, find $\frac{dp}{dq}$

(1) $\sin q - \text{cosec}^2 q$ (2) $-\sin q - \text{cosec}^2 q$ (3) $-\sin q - \cos^2 q$ (4) $\sec q - \text{cosec}^2 q$

32. $y = \sin^3 x$, find the $\frac{dy}{dx}$

(1) $3 \sin^2 x (\cos x)$ (2) $3 \sin^3 x (\cos x)$ (3) $3 \sin x (\cos x)^2$ (4) $\sin x (\cos x)$

33. $y = 5 \cos^{-4} x$, find $\frac{dy}{dx}$

(1) $20 \sin x \cos^{-5} x$ (2) $10 \sin x \cos^{-5} x$ (3) $20 \sin x \cos^{-3} x$ (4) $20 \sin x \sin^{-5} x$

Find the derivatives of the functions

34. $s = \frac{4}{3\pi} \sin 3t + \frac{4}{5\pi} \cos 5t$

(1) $\frac{4}{\pi} (\cos 3t - \sin 5t)$ (2) $\frac{4}{\pi} (\cos 3t + \sin 5t)$ (3) $\frac{4}{\pi} (\cos t - \sin t)$ (4) $\frac{4}{\pi} (\cot 3t - \sec 5t)$

35. $s = \sin\left(\frac{3\pi t}{2}\right) + \cos\left(\frac{3\pi t}{2}\right)$

(1) $\frac{3\pi}{2}\left[\cos\left(\frac{3\pi t}{2}\right) - \sin\left(\frac{3\pi t}{2}\right)\right]$ (2) $\frac{3\pi}{2}\left[\cos\left(\frac{3\pi t}{2}\right) + \sin\left(\frac{3\pi t}{2}\right)\right]$

(3) $\frac{3\pi}{2}\left[\cot\left(\frac{3\pi t}{2}\right) + \sin\left(\frac{3\pi t}{2}\right)\right]$ (4) None of these

SECTION - (E) : INTIGRATION

Find integrals of given functions

1. $\int (x^2 - 2x + 1) dx + c$

(1) $\frac{x^3}{3} + x_2 - x - c$ (2) $\frac{x^3}{3} + x + x + c$

(3) $\frac{x}{3} + x_2 + x - c$ (4) $\frac{x^3}{3} - x_2 + x + c$

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

(1) $\frac{2\sqrt{x}}{3}+2\sqrt{x}-c$ (2) $\frac{2\sqrt{x^2}}{3}-2\sqrt{x}+c$ (3) $\frac{2\sqrt{x^3}}{3}+2\sqrt{x}+c$ (4) $\frac{2\sqrt{x}}{2}+2\sqrt{x}-c$

3. $\int\frac{1}{3x}dx$

(1) $\frac{1}{3}\ell nx+x$ (2) $\frac{1}{3}\ell nx$ (3) $\frac{1}{2}\ell nx+x$ (4) $\frac{1}{3}\ell nx+x$

4. $\int x\ \sin(2x^2)\,dx$, (use , $u = 2x_2$)

(1) $-\frac{1}{4}\cos(2x_2)+C$ (2) $\frac{1}{4}\cos(2x_2)+C$ (3) $-\frac{1}{2}\cos(2x)+C$ (4) $-\frac{1}{3}\cos(3x^2)+C$

5. $\int\frac{3}{(2-x)^2}dx$

(1) $\frac{3}{2-x}+C$ (2) $\frac{2}{2-x}+C$ (3) $\frac{3}{2-x}+C$ (4) $\frac{3}{2+x}+C$

6. $\int_{-4}^{-1}\frac{\pi}{2}d\theta$

(1) $\frac{3\pi}{3}$ (2) $\frac{3\pi}{2}$ (3) $\frac{2\pi}{3}$ (4) $\frac{\pi}{2}$

7. $\int_0^1 e^x\,dx$

(1) e – 1 m(2) e + 1 (3) e – 2 (4) None of these

8. y = 2x, the area under the curve from x = 0 to x = b will be

(1) $b^2/2$ units (2) b^2 units (3) $2b^2$ units (4) b/2 units

9. $y=\int_0^{\pi}\sin x\,dx$

(1) 2 units (2) 3 units (3) 4 units (4) 5 units

10. Evaluate the following integrals :

(i) $\int x^{15}dx$ (ii) $\int x^{-3/2}dx$ (iii) $\int(3x^{-7}+x^{-1})dx$ (iv) $\int\left(\sqrt{x}+\frac{1}{\sqrt{x}}\right)^2dx$

(v) $\int\left(x+\frac{1}{x}\right)dx$ (vi) $\int\left(\frac{a}{x^2}+\frac{b}{x}\right)dx$ (a and b are constant)

11. The integral $\int_1^5 x^2dx$ is equal to

(1) $\frac{125}{3}$ (2) $\frac{124}{3}$ (3) $\frac{1}{3}$ (4) 45

12. Evaluate the following integrals (Here G,M,m,k,q_1,q_2, m are constant)

(i) $\int_R^{\infty}\frac{GMm}{x^2}dx$ (ii) $\int_{r_1}^{r_2}-k\frac{q_1q_2}{x^2}dx$ (iii) $\int_u^v Mvdv$ (iv) $\int_0^{\infty}x^{-1/2}dx$

(v) $\int_{0}^{\pi/2} \sin x dx$ (vi) $\int_{0}^{\pi/2} \cos x dx$ (vii) $\int_{-\pi/2}^{\pi/2} \cos x dx$

13. $\int x^{-\frac{3}{2}} dx$ is equal to :

(1) $\frac{-2}{\sqrt{x}}$ +C (2) $\frac{2}{\sqrt{x}}$ +C (3) $2\sqrt{x}$ +C (4) $-2\sqrt{x}$ + C

14. $\int x^{-\frac{5}{3}} dx$ is equal to :

(1) $\frac{3}{2}x^{\frac{2}{3}}$ + C (2) $-\frac{3}{2}x^{\frac{2}{3}}$ + C (3) $\frac{3}{2}x^{-\frac{2}{3}}$ + C (4) $-\frac{3}{2}x^{-\frac{2}{3}}$ + C

15. $\int x^{2019} dx$ is equal to :

(1) $\frac{X^{2020}}{2020}$ +C (2) $\frac{X^{2018}}{2018}$ + C (3) $2019X^{2018}$ +C (4) – $2012X^{2011}$ + C

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

(1) –2cos x + C (2) 2 cosx + C (3) –2 cos x (4) 2 cosx

17. $\int (\sin x + \cos x) dx$ is equal to :

(1) –cosx + sinx (2) – cosx + sinx + C

(3) cosx – sinx + C (4) – cosx – sinx + C

18. $\int (x + x^2 + x^3 + x^4) dx$ is equal to :

(1) $1+2x+3x_2+4x_3$ + C (2) $1+2x+3x_2+4x_3$

(3) $\frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4} + \frac{x^5}{5}$ + C (4) $\frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4} + \frac{x^5}{5}$

19. If y = sin(ax+b) , then $\int y\, dx$ will be :

(1) $\frac{\cos(ax+b)}{a}$ + C (2) – $\frac{\cos(ax+b)}{a}$ + C

(3) a cos(ax+b)+C (4) – a cos(ax+b)+C

20. If y = $x_2\sin(x_3)$, then $\int y\, dx$ will be :

(1) $-\cos(x_3)$ + C (2) $\left(-\frac{\cos x^3}{3}\right) + C$ (3) $\cos(x_3)$ + C (4) $\frac{\cos x^3}{3} + C$

21. If y = x_2 , then area of curve y v/s x from x = 0 to 2 will be :

(1) 1/3 (2) 8/3 (3) 4/3 (4) 2/3

22. If y = t sin (t_2) then $\int y dt$ will be :

(1) $\frac{\cos(t^2)}{2}$ + c (2) $\frac{\cos(t^2)}{2}$ + c (3) $\frac{-\cos(t^2)}{2}$ + c (4) cos (t_2)

23. If x = (6y + 4) ($3y_2$ + 4y + 3) then $\int x dy$ will be :

(1) $\frac{1}{3y^2+4y+3}$ (2) $\frac{(3y^2+4y+3)^2}{2}$ + C (3) ($3y_2$ + 4y + 3) (4) $\frac{(6y+4)}{(3y^2+4y+3)}$

24. Value of $\int_0^{\pi/2} \cos 3t \; dt$ is

(1) $\frac{2}{3}$ (2) $-\frac{1}{3}$ (3) $-\frac{2}{3}$ (4) $\frac{1}{3}$

25. $\int_0^1 (t^2 + 9t + c)\, dt = \frac{9}{2}$. Then the value of 'c'.

(1) $\frac{2}{3}$ (2) $-\frac{1}{3}$ (3) $-\frac{2}{3}$ (4) $\frac{1}{3}$

26. Find the value of following integration.

$\int_0^{2\pi} \sin^2 \theta d\theta$

Here c,a are constants.

(1) π (2) 2π (3) 3π (4) 4π

27. If $y = \frac{1}{ax+b}$, then $\int y\, dx$ will be :

(1) $\frac{1}{(ax+b)^2} + C$ (2) ax + b + C

(3) $a\ell n(ax+b)+C$ (4) $\frac{\ell n(ax+b)}{a} + C$

28. $\int_\pi^{2\pi} \theta d\theta$

(1) $\frac{3\pi^2}{2}$ (2) $\frac{3\pi^3}{2}$ (3) $\frac{\pi^3}{2}$ (4) π

29. $\int_0^{\sqrt[3]{7}} x^2 dx$

(1) $\frac{7}{3}$ (2) $\frac{7}{4}$ (3) $\frac{5}{4}$ (4) 0

30. $\int_0^1 \frac{dx}{3x+2}$

(1) $\ell n\left(\frac{5}{2}\right)^{1/3}$ (2) $\ell n\left(\frac{5}{2}\right)^{1/2}$ (3) $\ell n\left(\frac{5}{2}\right)^{1/4}$ (4) None of these

31. Integrate the following :

(i) 6x (ii) x^7 (ii) $x^7 - 6x + 8$

32. Integrate the following :

(i) $2x^{-4}$ (ii) $\frac{x^{-4}}{2} + x^2$ (iii) $-x^{-4} + x - 1$

33. Integrate the following :

(i) $-\frac{2}{x^4}$ (ii) $\frac{1}{2x^4}$ (iii) $x^4 - \frac{1}{x^4}$

34. Integrate the following :

(i) $\frac{2}{3}x^{-1/3}$ (ii) $\frac{1}{3}x^{-2/3}$ (iii) $-\frac{1}{3}x^{-4/3}$

35. Integrate the following :

(i) $\pi \cos \pi x$ (ii) $\frac{\pi}{2}\cos\frac{\pi x}{2}$ (iii) $\cos\frac{\pi x}{2} + \pi \cos x$

36. Integrate the following :

(i) csc x cot x (ii) – cxc 5x cot 5x (iii) $-\pi \csc\frac{\pi x}{2}\cot\frac{\pi x}{2}$

37. $\int (x+1)dx$

(1) $\frac{x^2}{2}+2x-C$ (2) $\frac{x^2}{2}+x+C$ (3) $\frac{x^2}{2}-x+C$ (4) $\frac{x^2}{2}-x-C$

38. $\int (5-6x)dx$

(1) $5x - x^2 + C$ (2) $x - 3x^2 - C$ (3) $5x + 3x^2 + C$ (4) $5x - 3x^2 + C$

39. $\int \left(3t^2+\frac{t}{2}\right)dt$

(1) $t^2 + \frac{t^2}{4} - C$ (2) $t^2 + \frac{t^2}{4} + C$ (3) $t^3 - \frac{t^2}{4} - C$ (4) $\frac{t^3}{6} + t^4 + C$

40. $\int \left(\frac{t^2}{2}+4t^3\right)dt$

(1) $\frac{t^3}{6}+t^2+C$ (2) $\frac{t^3}{6}+t+C$ (3) $\frac{t^3}{6}-t+C$ (4) $\frac{t^3}{6}+t^4+C$

41. $\int x^{-1/3}dx$

(1) $\frac{3}{2}x^{2/3} + C$ (2) $\frac{3}{2}x^{2/5} + C$ (3) $\frac{3}{2}x^{1/3} + C$ (4) $\frac{3}{2}x^{2/7} + C$

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

(1) $\frac{x^{3/2}}{3} + 4x^{1/2} + C$ (2) $\frac{x^{3/2}}{3} + x^{1/2} + C$ (3) $\frac{x^{3/2}}{3} + 4x^{2/5} + C$ (4) $\frac{x^{3/2}}{3} + 4x^2 + C$

43. $\int \left(8y-\frac{2}{y^{1/4}}\right)dy$

(1) $4y^2 - \frac{8}{3}y^{3/4} + C$ (2) $4y^2 + \frac{8}{3}y^{3/4} + C$ (3) $y^2 - \frac{8}{3}y^{3/4} + C$ (4) $4y^2 - \frac{8}{3}y^{1/3} + C$

44. $\int 2x(1-x^{-3})dx$

(1) $x + \frac{2}{x} - C$ (2) $x^2 + \frac{2}{x} + C$ (3) $2x^2 + \frac{2}{x} + C$ (4) $5x^2 + \frac{2}{x} + C$

45. $\int (-2\cos t)dt$

(1) – 2 sin t + C (2) – 3 sin t + C (3) – 5 sin t + C (4) – 7 sin t + C

46. $\int(-5\sin t)dt$

(1) 5 cos t + C (2) 2 cos t – C (3) 5 cosec t + C (4) 5 tan t + C

47. $\int 7\sin\frac{\theta}{3}d\theta$

(1) $-21\cos\frac{\theta}{3} + C$ (2) $-14\cos\frac{\theta}{3} + C$ (3) $-42\cos\frac{\theta}{3}$ (4) $-7\cos\frac{\theta}{3} + C$

48. $\int 3\cos 5\theta + C$

(1) $\frac{3}{5}\sin 5\theta + C$ (2) $\frac{3}{5}\sin 3\theta + C$ (3) $\frac{3}{5}\cos 5\theta + C$ (4) $\frac{3}{5}\sec 5\theta + C$

49. $\int(-3\csc^2 x)dx$ dx

(1) 3 cot x + C (2) cot x + C (3) 3 tan x + C (4) 5 cot x + C

50. $\int\left(-\frac{\sec^2 x}{3}\right)dx$

(1) $\frac{-\tan x}{3} + x$ (2) $\frac{-\tan x}{3} + C$ (3) $\frac{\tan x}{5} + C$ (4) None

51. $\int\frac{\csc\theta\cot\theta}{2}d\theta$

(1) $-\frac{1}{2}\csc\theta + C$ (2) $-\frac{1}{2}\tan\theta + C$ (3) $-\frac{1}{2}\cot\theta + C$ (4) $-\frac{1}{2}\sec\theta + C$

52. $\int \frac{2}{5}\sec\theta\tan\theta\, d\theta$

(1) $\frac{2}{5}$ sec θ + C (2) $\frac{2}{5}$ cos θ + C (3) $\frac{2}{5}$ tan θ + C (4) $\frac{2}{5}$ cosec θ + C

53. $\int (4\sec x \tan - 2\sec^2 x)dx$

(1) 4 sec x – 2 tan x + C (2) 2 sec x – 2 tan x + C
(3) 4 sec x – 3 tan x + C (4) 4 sec x–5 tan x + C

54. $\int \frac{1}{2}(\csc^2 x - \text{cxc } x \cot x)dx$

(1) $-\frac{1}{2}\cot x + \frac{1}{2}\csc x + C$ (2) $\frac{1}{2}\tan x + \frac{1}{2}\csc x + C$
(3) $-\frac{1}{2}\sec x + \frac{1}{2}\csc x + C$ (4) $-\frac{1}{2}\sin x + \frac{1}{2}\csc x + C$

55. $\int (\sin 2x - \csc^2 x)dx$

(1) $-\frac{1}{2}\cos 2x - \cot x + C$ (2) $-\frac{1}{2}\cos 2x + \cot x + C$
(3) $-\frac{1}{2}\cos 3x - \cot x + C$ (4) $-\frac{1}{2}\cos 2x + \tan x + C$

56. $\int (2\cos 2x - 3\sin 3x)dx$

(1) sin 2x + cos 3x + C (2) sin 2x + cos 5x + C (3) sin 2x + cot 3x + C (4) sin 3x + cos 3x + C

57. $\int \frac{1+\cos 4t}{2}dt$

(1) $\frac{t}{2} + \frac{\sin 4t}{8} + C$ (2) $\frac{t}{2} - \frac{\sin 4t}{8} - C$ (3) $\frac{t}{3} + \frac{\sin 4t}{8} + C$ (4) All of these

58. $\int \frac{1-\cos 6t}{2}dt$

(1) $\frac{t}{2} + \frac{\sin 6t}{12} + C$ (2) $\frac{t}{2} - \frac{\sin 6t}{12} + C$ (3) $2\times\frac{t}{2} - \frac{\sin 6t}{12} + C$ (4) $\frac{t}{2} - \frac{\sin 6t}{12} + C$

59. $\int (1+\tan^2\theta)d\theta$

(1) tan θ + C (2) cot θ + C (3) sec θ + C (4) cosec θ + C

60. $\int_{1/2}^{3/2}(-2x+4)dx$

(1) 2 square units (2) 4 square units (3) 6 square units (4) 8 square units

Evalutae definite integrals of following functions

61. $\int_0^{\pi/2}\theta^2 d\theta$

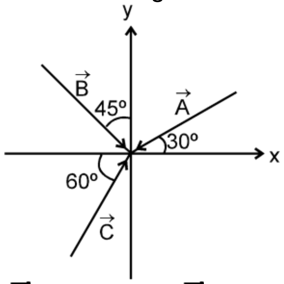
(1) $\frac{\pi^3}{24}$ (2) $\frac{\pi^2}{24}$ (3) $\frac{\pi^2}{36}$ (4) $\frac{\pi^2}{48}$

62. $\int_0^{3b}x^2 dx$

(1) $9b^3$ (2) $3b^3$ (3) $27b^3$ (4) $81\, b^3$

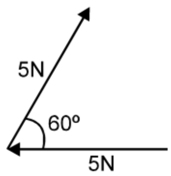
SECTION - (F) : VECTOR BASIC AND ADDITION

1. Vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are shown in figure. Find angle between



(i) $\vec{A}$ and $\vec{B}$, (ii) $\vec{A}$ and $\vec{C}$, (iii) $\vec{B}$ and $\vec{C}$.

2. The forces, each numerically equal to 5 N, are acting as shown in the Figure. Find the angle between forces?



(1) 90° (2) 180° (3)120° (4)160°

3. The vector joining the points A (1, 1, –1) and B (2, –3, 4) and pointing from A to B is -

(1) $-\hat{i} + 4\hat{j} - 5\hat{k}$ (2) $\hat{i} + 4\hat{j} + 5\hat{k}$ (3) $\hat{i} - 4\hat{j} + 5\hat{k}$ (4) $-\hat{i} - 4\hat{j} - 5\hat{k}$

4. A vector of magnitude 30 and direction eastwards is added with another vector of magnitude 40 and direction Northwards. Find the magnitude and direction of resultant with the east.

(1) 45, 50° with East (2) 53, 75 with East
(3) 53, 50° with East (4) 50, 53° with East

5. The vector sum of the forces of 10 N and 6 N can be

(1) 2 N (2) 8 N (3) 18 N (4) 20 N.

6. The vector sum of two force P and Q is minimum when the angle θ between their positive directions, is

(1) $\frac{\pi}{4}$ (2) $\frac{\pi}{3}$ (3) $\frac{\pi}{2}$ (4) π.

7. The vector sum of two vectors $\vec{A}$ and $\vec{B}$ is maximum, then the angle θ between two vectors is -

(1) 0° (2) 30° (3) 45° (4) 60°

8. Find the magnitude of $3\hat{i} + 2\hat{j} + \hat{k}$?

(1) $\sqrt{10}$ (2) $\sqrt{11}$ (3) $\sqrt{13}$ (4) $\sqrt{14}$

9. If $\vec{A} = 3\hat{i} + 4\hat{j}$ then find $\hat{A}$

(1) $\frac{3\hat{i}+4\hat{j}}{5}$ (2) $\frac{2\hat{i}+3\hat{j}}{5}$ (3) $\frac{2\hat{i}+4\hat{j}}{5}$ (4) $\frac{3\hat{i}-2\hat{j}}{5}$

10. One of the rectangular components of a velocity of 60 km h^{-1} is 30 km h^{-1}. Find other rectangular component?

(1) $30\sqrt{3}$ km h^{-1}. (2) $20\sqrt{3}$ km h^{-1}. (3) $30\sqrt{2}$ km h^{-1}. (4) $30\sqrt{2}$ km h^{-1}.

11. The x and y components of a force are 2 N and – 3 N. The force is

(1) $2\hat{i} - 3\hat{j}$ (2) $2\hat{i} + 3\hat{j}$ (3) $-2\hat{i} - 3\hat{j}$ (4) $3\hat{i} + 2\hat{j}$

12. A force of 30 N is inclined at an angle θ to the horizontal. If its vertical component is 18 N, find the horizontal component & the value of θ .

(1) 24 N ; 37^0 approx (2) 20 N ; 47^0 approx (3) 25 N ; 35^0 approx (4) 37 N ; 24^0 approx

13. The angle θ between directions of forces $\vec{A}$ and $\vec{B}$ is 90º where A = 8 dyne and B = 6 dyne. If the resultant $\vec{R}$ makes an angle α with $\vec{A}$ then find the value of 'α' ?

(1) 47º. (2) 37º. (3) 75º. (4) 120º.

14. If $\vec{A} = 3\hat{i} + 4\hat{j}$ and $\vec{B} = \hat{i} + \hat{j} + 2\hat{k}$ then find out unit vector along $\vec{A}+\vec{B}$

(1) $\frac{4\hat{i}+5\hat{j}-2\hat{k}}{\sqrt{45}}$ (2) $\frac{2\hat{i}-5\hat{j}-2\hat{k}}{\sqrt{45}}$ (3) $\frac{4\hat{i}-2\hat{j}+2\hat{k}}{\sqrt{45}}$ (4) $\frac{4\hat{i}+5\hat{j}+2\hat{k}}{\sqrt{45}}$

15. The x and y components of vector $\vec{A}$ are 4m and 6m respectively. The x,y components of vector $\vec{A}+\vec{B}$ are 10m and 9m respectively. Find the length of $\vec{B}$ and angle that $\vec{B}$ makes with the x axis.

(1) $3\sqrt{3}$, $\tan^{-1}\frac{1}{2}$ (2) $3\sqrt{5}$, $\tan^{-1}\frac{1}{2}$ (3) $3\sqrt{5}$, $\tan\frac{1}{3}$ (4) $2\sqrt{3}$, $\tan^{-1}\frac{1}{2}$

16. A vector is not changed if

(1) it is displaced parallel to itself (2) it is rotated through an arbitrary angle

(3) it is cross-multiplied by a unit vector (4) it is multiplied by an arbitrary scalar.

17. If the angle between two forces increases, the magnitude of their resultant

(1) decreases (2) increases

(3) remains unchanged (4) first decreases and then increases

18. Which of the following sets of displacements might be capable of bringing a car to its returning point?

(1) 5, 10, 30 and 50 km (2) 5, 9, 9 and 16 km

(3) 40, 40, 90 and 200 km (4) 10, 20, 40 and 90 km

19. When two vector $\vec{a}$ and $\vec{b}$ are added, the magnitude of the resultant vector is always

(1) greater than (a + b) (2) less than or equal to (a + b)

(3) less than (a + b) (4) equal to (a + b)

20. If $|\vec{A}+\vec{B}| = |\vec{A}| = |\vec{B}|$, then the angle between $\vec{A}$ and $\vec{B}$ is

(1) 0º (2) 60º (3) 90º (4) 120º.

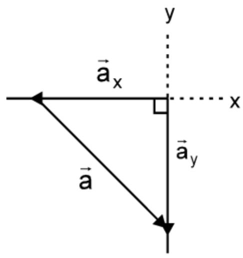
21. Vector $\vec{A}$ is of length 2 cm and is 60º above the x-axis in the first quadrant. Vector $\vec{B}$ is of length 2 cm and 60º below the x-axis in the fourth quadrant. The sum $\vec{A}+\vec{B}$ is a vector of magnitude -

(1) 2 along + y-axis (2) 2 along + x-axis (3) 1 along – x axis (4) 2 along – x axis

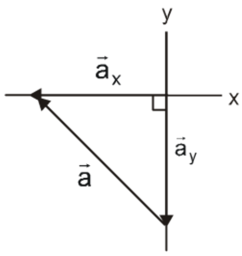
22. Which of the following is a true statement?

(1) A vector cannot be divided by another vector
(2) Angular displacement can either be a scalar or a vector.
(3) Since addition of vectors is commutative therefore vector subtraction is also commutative.
(4) The resultant of two equal forces of magnitude F acting at a point is F if the angle between the two forces is 120º.

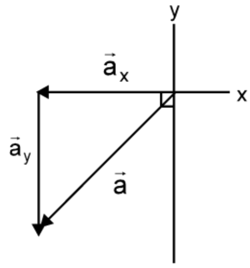
23. In the Figure which of the ways indicated for combining the x and y components of vector a are proper to determine that vector?



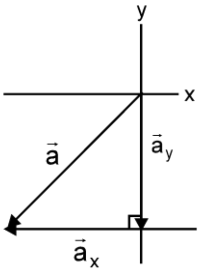
(i)



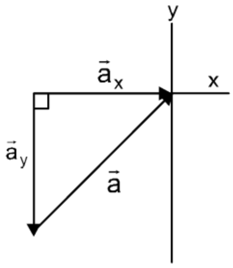
(ii)



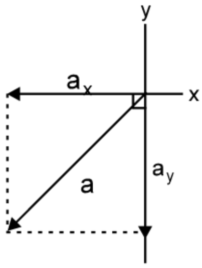
(iii)



(iv)



(v)



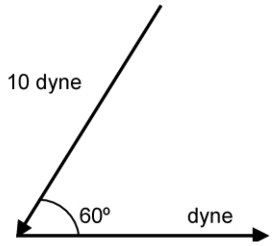
(vi)

(1) (iii) (2) (iv) (3) (vi) (4) (i), (ii) and (v).

24. Two vectors having equal magnitude of 5 units, have an angle of 60º between them. Find the magnitude of their resultant vector and its angle from one of the vectors.

(1) 5, 20º (2) $5\sqrt{3}$, 30º (3) 3, 40º (4) 3, 50º

25. Two forces each numerically equal to 10 dynes are acting as shown in the figure, then find resultant of these two vectors.



(1) 5 dyne (2) 10 dyne (3) 15 dyne (4) 25 dyne

26. The magnitude of pairs of displacement vectors are given. Which pairs of displacement vectors cannot be added to give a resultant vector of magnitude 13 cm ?
(1) 4 cm, 16 cm (2) 20 cm, 7 cm (3) 1 cm, 15 cm (4) 6 cm, 8 cm

27. If $\vec{A} = 3\hat{i} + 2\hat{i}$ and $\vec{B} = 2\hat{i} + 3\hat{i} - \hat{k}$, then find a unit vector along $(\vec{A} - \vec{B})$

(1) $\frac{\hat{i}+\hat{j}-\hat{k}}{\sqrt{3}}$ (2) $\frac{\hat{i}-\hat{j}-\hat{k}}{\sqrt{3}}$ (3) $\frac{\hat{i}-\hat{j}+\hat{k}}{\sqrt{3}}$ (4) $\frac{\hat{i}+\hat{j}+\hat{k}}{\sqrt{3}}$

28. If $\hat{n}$ is a unit vecot in the direction of the vector $\vec{A}$, then –

(1) $\hat{n} = \frac{\vec{A}}{|A|}$ (2) $\hat{n} = \vec{A}\,|\vec{A}|$ (3) $\hat{n} = \frac{|\vec{A}|}{\vec{A}}$ (4) $\hat{n} = \hat{n} \times \vec{A}$

29. The resultant of $\vec{A}$ and $\vec{B}$ makes an angle α with $\vec{A}$ and $\vec{B}$, then :
(1) α < β (2) α < β (3) α < β if A > B (4) α < β if A = B

30. If $\vec{P} + \vec{Q} = \vec{P} - \vec{Q}$ and θ is the angle between $\vec{P}$ and $\vec{Q}$, then
(1) θ = 0º (2) θ = 90º (3) P =0 (4) Q = 0

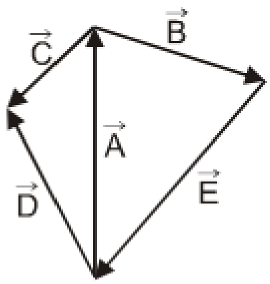
31. The magnitudes of sum and difference of two vectors are same, then the angle between them is
(1) 90º (2) 40º (3) 45º (4) 60º

32. The projection of a vector $3\hat{i} + 4\hat{k}$ on y-axis is :

(1) 5 (2) 4 (3) 3 (4) 3

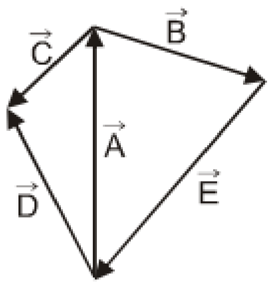
33. Two forces of 12N and 8N act upon body. The resultant force on the body has a maximum value of-
(1) 4N (2) 0N (3) 20 N (4) 8 N

34. In figure, $\vec{E}$ equals



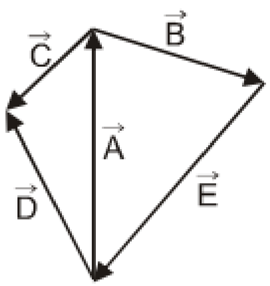
(1) $\vec{A}$ (2) $\vec{B}$ (3) $\vec{A}+\vec{B}$ (4) $-(\vec{A}+\vec{B})$

35. In figure, $\vec{D}-\vec{C}$ equals



(1) $\vec{A}$ (2) $-\vec{A}$ (3) $\vec{B}$ (4) $-\vec{B}$

36. In figure, $\vec{E}+\vec{D}-\vec{C}$ equals



(1) $\vec{A}$ (2) $-\vec{A}$ (3) $\vec{B}$ (4) $-\vec{B}$

37. Forces proportional to AB, BC and 2CA act along the sides of triangle ABC in order. Their resultant represented in magnitude and direction as
(1) CA (2) AC (3) BC (4) CB

38. A given force is resolved into components P and Q equally inclined to it. Then :
(1) P = 2Q (2) 2P = Q (3) P = Q (4) none of these

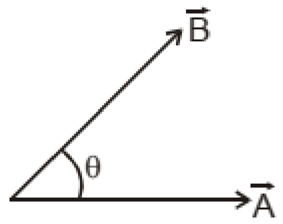
39. A particle starting from the origin (0,0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are ($\sqrt{3}$, 3). The path of the particle makes with the x-axis an angle of :
(1) 30º (2) 45º (3) 60º (4) 0º

SECTION - (G) : VECTOR MULTIPICATION

1. If $\vec{A} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = 2\hat{i} + \hat{j}$ find (a) $\vec{A}.\vec{B}$ (b) $\vec{A} \times \vec{B}$

(1) 3 and $-\hat{i} + 2\hat{j} - \hat{k}$ (2) 5 and $-\hat{i} + 2\hat{j} - \hat{k}$ (3) 1 and $-\hat{i} + 2\hat{j} + \hat{k}$ (4) 3 and $-\hat{i} - 2\hat{j} + \hat{k}$

2. If $|\vec{A}| = 4$, $|\vec{B}| = 3$ and $\theta = 60^o$ in figure, Find (a) $\vec{A}.\vec{B}$ (b) $\vec{A} \times \vec{B}$



(1) 3 and $6\sqrt{3}$ (2) 6 and $3\sqrt{3}$ (3) 6 and $3\sqrt{6}$ (4) 6 and $6\sqrt{3}$

3. Three non zero vector $\vec{A}, \vec{B}$ & $\vec{C}$ satisfy the relation $\vec{A}.\vec{B} = 0$ and $\vec{A}.\vec{C} = 0$. Then $\vec{A}$ can be parallel to :

(1) $\vec{B}$ (2) $\vec{C}$ (3) $\vec{B}.\vec{C}$ (4) $\vec{B} \times \vec{C}$

4. If $\vec{A} = 4\hat{i} + n\hat{j} - 2\hat{k}$ and $\vec{B} = 2\hat{i} + 3\hat{j} + \hat{k}$, then find the value of n so that $\vec{A} \perp \vec{B}$.

(1) n = 2 (2) n = – 1 (3) n + 1 (4) n = – 2

5. If $\vec{F} = (4\hat{i} - 10\hat{j})$ and $\vec{r} = (5\hat{i} - 3\hat{j})$, then calculate torque $(\vec{\tau} = \vec{r} \times \vec{F})$.

(1) $-38\hat{k}$ (2) $-35\hat{k}$ (3) $-55\hat{k}$ (4) $-28\hat{k}$

6. Find a unit vector perpendicular to both the vectors $(2\hat{i} + 3\hat{j} + \hat{k})$ and $(\hat{i} - \hat{j} + 2\hat{k})$

(1) $\hat{n} = \pm\frac{1}{\sqrt{83}}(7\hat{i} + 3\hat{j} + 5\hat{k})$ (2) $\hat{n} = \pm\frac{1}{\sqrt{83}}(-7\hat{i} - 3\hat{j} + 5\hat{k})$

(3) $\hat{n} = \pm\frac{1}{\sqrt{83}}(7\hat{i} - 3\hat{j} - 5\hat{k})$ (4) $\hat{n} = \pm\frac{1}{\sqrt{58}}(7\hat{i} - 3\hat{j} - 5\hat{k})$

7. Which of the following vector identities is false ?

(1) $\vec{P} + \vec{Q} = \vec{Q} + \vec{P}$ (2) $\vec{P} + \vec{Q} = \vec{Q} \times \vec{P}$ (3) $\vec{P}.\vec{Q} = \vec{Q}.\vec{P}$ (4) $\vec{P} \times \vec{Q} \neq \vec{Q} \times \vec{P}$

8. Area of a parallogram, whose diagonals are $3i + \hat{j} - 2\hat{k}$ and $i - 3\hat{j} + 4\hat{k}$ will be

(1) 14 unit (2) $5\sqrt{3}$ (3) $10\sqrt{3}$ (4) $20\sqrt{3}$

9. If $\vec{A} = \hat{i} + \hat{j}$ and $\vec{B} = \hat{i} - \hat{j}$

The value of $(\vec{A} + \vec{B}).(\vec{A} - \vec{B})$ is :

(1) $\sqrt{2}$ (2) 0 (3) $\frac{1}{2}$ (4) 2

10. Vectors $\vec{A} = \hat{i} + \hat{j} - 2\hat{k}$ and $\vec{B} = 3\hat{i} + 3\hat{j} - 6\hat{k}$ are :

(1) Parallel (2) Antiparallel

(3) Perpendicular (4) at acute angle with each other

11. If two vectors are given as :

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

and $\vec{B} = -\hat{i} - \hat{j} + \hat{k}$

then the vector which is not perpendicular to $(\vec{A} \times \vec{B})$ is:

(1) $-2\hat{i} + 4\hat{j} + 2\hat{k}$ (2) $\hat{i} + \hat{j} + \hat{k}$ (3) $25\hat{i} - 625\hat{j} - 25\hat{k}$ (4) $3\hat{i} - 2\hat{j} - 3\hat{k}$

12. If a vector $2\hat{i} + 3\hat{j} + 8\hat{k}$ is perpendicular to the vector $4\hat{i} - 4\hat{j} + \alpha\hat{k}$, then the value of α is :

[AIPMT Screening 2005]

(1) –1 (2) $\frac{1}{2}$ (3) $-\frac{1}{2}$ (4) 1

13. If the angle betwen the vectors $\vec{A}$ and $\vec{B}$ is θ, the value of the product $(\vec{B} \times \vec{A}) . \vec{A}$ is equal to :

[AIPMT Screening 2005]

(1) $BA^2 \cos\theta$ (2) $BA^2 \sin\theta$ (3) $BA^2 \sin\theta \cos\theta$ (4) zero

14. $\vec{A}$ and $\vec{B}$ are two vectors and θ is the angle between them, if $|\vec{A} \times \vec{B}| = \sqrt{3}\,(\vec{A} \bullet \vec{B})$ the value of θ is :

[AIPMT screeing 2007]

(1) 60º (2) 45º (3) 30º (4) 90º

15. Two forces P and Q acting at a point are such that if P is reversed, the direction of the resultant is turned through 90º . Then

(1) P = Q (2) P =2Q

(3) P = $\frac{Q}{2}$ (4) No relation between P and Q

16. The vector sum of two forces is perpendicular to their vector differences. In that case, the forces :

[AIPMT Screening 2003]

(1) are not equal to each other in magnitude (2) cannot be predicted

(3) are equal to each other (4) are equal to eah other in magnitude

17. If $|\vec{A} \times \vec{B}| = \sqrt{3}\ .\ \vec{A}, \vec{B}$ then the value of $|\vec{A} + \vec{B}|$ is : **[AIPMT Screening 2004]**

(1) $(A^2 + B^2 + AB)^{1/2}$ (2) $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$ (3) A + B (4) $(A^2 + B^2 + \sqrt{3}AB)^{1/2}$

Exercise-2

1. Velocity as a function of time is
$V(t) = \sin^2 t - \cos(2t)$

Then the value of $v\left(\frac{\pi}{3}\right)$ will be :

(1) $\frac{2}{3}$ (2) $\frac{1}{4}$ (3) $\frac{3}{4}$ (4) $\frac{5}{4}$

2. If $f = 2\pi \frac{x^3y^5}{\sqrt{z}}$ then log f is equal to :

(1) $\log 2\pi + 3 \log x + 5 \log y + \frac{1}{2} \log z$ (2) $\log 2\pi + 3 \log x + 5 \log y - \frac{1}{2} \log z$

(3) $\log 2\pi - 3 \log x + 5 \log y + \frac{1}{2} \log z$ (4) $\log 2\pi + 3 \log x + 5 \log y + \log z$

3. Which of following are true

(1) $\sin37° + \cos37° = \sin53° + \cos53°$ (2) $\sin37° - \cos37° = \cos53° - \sin53°$

(3) $\tan37° + 1 = \tan 53° - 1$ (4) $\tan37° \times \tan53° = 1$

4. If $y_1 = A \sin\theta_1$ and $y_2 = A \sin \theta_2$ then

(1) $y_1 + y_2 = 2A \sin\left(\frac{\theta_1+\theta_2}{2}\right) \cos\left(\frac{\theta_1-\theta_2}{2}\right)$ (2) $y_1 + y_2 = 2A \sin \theta_1 \sin\theta_1$

(3) $y_1 - y_2 = 2A \sin\left(\frac{\theta_1-\theta_2}{2}\right) \cos\left(\frac{\theta_1+\theta_2}{2}\right)$ (4) $y_1 , y_2 = -2A^2 \cos\left(\frac{\pi}{2}+\theta_1\right) .\cos\left(\frac{\pi}{2}-\theta_2\right)$

5. If $R_2 = A_2 + B_2 + 2AB \cos\theta$, if $|A| = |B|$ then value of magntitude of R is equivalent to :

(1) $2A\cos\theta$ (2) $A\cos\frac{\theta}{2}$ (3) $2A\cos\frac{\theta}{2}$ (4) $2B\cos\frac{\theta}{2}$

6. A particle starting from the origin (0, 0) moves in a straight line in the (x, y) plane. Its coordinates at a later time are ($\sqrt{3}$, 3). The path of the particle makes with the x-axis an angle of :

[AIPMT screeing 2007]

(1) 30º (2) 45º (3) 60º (4) 0º

7. Find the value of a if distance between the point (–9cm, a cm) and (3cm, 3 cm) is 13 cm.

(1) 6 cm (2) 8 cm (3) 10 cm (4) 12 cm

8. $y = \ell n x_2 + \sin x$

(1) $\frac{dy}{dx} = \frac{2}{x} + \cos x$, $\frac{d^2y}{dx^2} = \frac{-2}{x^2} - \sin x$ (2) $\frac{dy}{dx} = \frac{2}{x} - \cos x$, $\frac{d^2y}{dx^2} = \frac{-2}{x^2} + \sin x$

(3) $\frac{dy}{dx} = -\frac{2}{x} + \cos x$, $\frac{d^2y}{dx^2} = \frac{-2}{x^2} - \sin x$ (4) $\frac{dy}{dx} = -\frac{2}{x} - \cos x$, $\frac{d^2y}{dx^2} = \frac{2}{x^2} - \sin x$

9. $y = \sqrt[7]{x} + \tan x$

(1) $\frac{dy}{dx} = -\frac{x^{-\frac{6}{7}}}{7} + \sec^2 x$, $\frac{d^2y}{dx^2} = \frac{-6}{49} x^{\frac{-13}{7}} - 2\tan x \sec^2 x$

(2) $\frac{dy}{dx} = \frac{x^{-\frac{6}{7}}}{7} + \sec^2 x$, $\frac{d^2y}{dx^2} = \frac{-6}{49} x^{\frac{-13}{7}} + 2\tan x \sec^2 x$

(3) $\frac{dy}{dx} = \frac{x^{-\frac{6}{7}}}{7} - \sec^2 x$, $\frac{d^2y}{dx^2} = \frac{-6}{49} x^{\frac{-13}{7}} - 2\tan x \sec^2 x$

(4) $\frac{dy}{dx} = \frac{x^{-\frac{6}{7}}}{7} + \sec^2 x$, $\frac{d^2y}{dx^2} = \frac{6}{49} x^{\frac{-13}{7}} + 2\tan x \sec^2 x$

Find derivative of given functions w.r.t. the corresponding independent variable.

10. $y = \left(x+\frac{1}{x}\right)\left(x - \frac{1}{x} + 1\right)$

(1) $\frac{dy}{dx} = 1 + 2x + \frac{2}{x^3} - \frac{1}{x^2}$ (2) $\frac{dy}{dx} = 1 + 2x - \frac{2}{x^3} - \frac{1}{x^2}$

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

11. $r = (1 + \sec\theta)\sin\theta$, r' is &

(1) $\frac{dr}{d\theta} = \cos\theta + \sec^2\theta$ (2) $\frac{dr}{d\theta} = \cos\theta - \sec^2\theta$ (3) $\frac{dr}{d\theta} = \cos\theta + \tan^2\theta$ (4) $\frac{dr}{d\theta} = \cos\theta + \sec^2\theta$

12. $q = \sqrt{2r - r^2}$, find $\frac{dq}{dr}$

(1) $\frac{1-r}{\sqrt{2r-r^2}}$ (2) $\frac{1+r}{\sqrt{2r+r^2}}$ (3) $\frac{1-r}{\sqrt{3r+r}}$ (4) $\frac{1-r}{\sqrt{2r-r^2}}$

Find $\frac{dy}{dx}$

13. $y = \frac{\cot x}{1+\cot x}$, y' is &

(1) $\frac{-\csc^2 x}{(1+\cot x)^2}$ (2) $\frac{-\csc^2 x}{(1-\cot x)^2}$ (3) $\frac{-\csc^2 x}{(1+\cot x)^2}$ (4) $\frac{-\csc^2 x}{(1+\tan x)^2}$

14. $y = \frac{\ell nx + e^x}{\tan x}$, then $\frac{dy}{dx}$ is

(1) $\frac{\tan x\left(e^x + \frac{1}{x}\right) + \sec^2 x(e^x + \ell nx)}{\tan^2 x}$ (2) $\frac{\tan x\left(e^x + \frac{1}{x}\right) - \sec^2 x(e^x + \ell nx)}{\tan^2 x}$

(3) $\frac{\tan x\left(e^x - \frac{1}{x}\right) - \sec^2 x(e^x + \ell nx)}{\tan^2 x}$ (4) $\frac{\tan x\left(e^x + \frac{1}{x}\right) - \sec^2 x(e^x - \ell nx)}{\tan^2 x}$

Find $\frac{dy}{dx}$ as a function of x

15. $x_3 + y_3 = 18\ xy$

(1) $\frac{dy}{dx} = \frac{18y+3x^2}{3y^2+18x}$ (2) $\frac{dy}{dx} = \frac{15y+3x^2}{3y^2-18x}$ (3) $\frac{dy}{dx} = \frac{18y-3x^2}{3y^2-18x}$ (4) $\frac{dy}{dx} = \frac{18y-3x^2}{3y^2+12x}$

16. Find two positive numbers x & y such that x + y = 60 and xy is maximum -

(1) 15, 45 (2) 30, 30 (3) 20, 40 (4) 10, 50

Find integrals of given functions.

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

(1) $-\frac{1}{x} - \frac{1}{2x^2} + C$ (2) $\frac{1}{x} + \frac{1}{2x^2} + C$ (3) $3 - \frac{1}{2x^2} + C$ (4) $-\frac{1}{x} + \frac{1}{2x^2} + C$

18. $\int (1-\cot^2 x)\ dx$

(1) 2x + cot x + C (2) x + cot x + C (3) 2x – cot x + C (4) 2x + tan x + C

19. $\int \cos\theta(\tan\theta + \sec\theta)\ d\theta$

(1) – cos θ + θ + C (2) – cos θ – θ + C (3) – cosec θ + θ + C (4) – 2cos θ + θ + C

20. $\int \sqrt{3-2s}\ ds$

(1) $-\frac{1}{3}(3-2s)_{2/3} + C$ (2) $-\frac{1}{3}(3-2s)_{3/2} + C$

(3) $-\frac{1}{3}(3+2s)_{3/2} + C$ (4) None of these

21. $\int \frac{dx}{\sqrt{5x+8}}$

(1) $\left[\frac{2}{5}\sqrt{5x+8}\right] + C$ (2) $\left[\frac{2}{5}\sqrt{3x-8}\right] + C$ (3) $\left[\frac{2}{5}\sqrt{5x-4}\right] - C$ (4) $\left[\frac{2}{5}\sqrt{5x-4}\right]$

22. $\int_0^{\sqrt{\pi}} x \sin x^2\ dx$

(1) 1 (2) 2 (3) 3 (4) 1

Use a definite integral to find the area of the region between the given curve and the x–axis on the interval [0,b],

23. $y = 3x_2$

(1) b^3 (2) b^2 (3) b (4) b^5

24. Two vectors $\vec{a}$ and $\vec{b}$ inclined at an angle θ w.r.t. each other have a resultant $\vec{c}$ which makes an angle β with $\vec{a}$. If the directions of $\vec{a}$ and $\vec{b}$ are interchanged, then the resultant will have the same

(1) magnitude (2) direction

(3) magnitude as well as direction (4) neither magnitude nor direction.

25. Two vectors $\vec{A}$ and $\vec{B}$ lie in a plane. Another vector $\vec{C}$ lies outside this plane. The resultant $\vec{A}+\vec{B}+\vec{C}$ of these three vectors

(1) can be zero
(2) cannot be zero
(3) lies in the plane of $\vec{A}$ & $\vec{B}$
(4) lies in the plane of $\vec{A}$ & $\vec{A}+\vec{B}$

26. The rectangular components of a vector are (2, 2). The corresponding rectangular components of another vector are (1, $\sqrt{3}$). Find the angle between the two vectors

(1) 10º (2) 15º (3) 20º (4) 25º

27. Given : $\vec{a}+\vec{b}+\vec{c}$ = 0. Out of the three vectors $\vec{a}, \vec{b}$ and $\vec{c}$ two are equal in magnitude. The magnitude of the third vector is $\sqrt{2}$ times that of either of the two having equal magnitude. The angles between the vectors are:

(1) 90º, 135º,. 135º (2) 30º, 60º, 90º (3) 45º, 45º, 90º (4) 45º, 60º, 90º

28. Let $\vec{a}$ and $\vec{b}$ be two non-null vectors such that $|\vec{a}+\vec{b}| = |\vec{a}-2\vec{b}|$. Then the value of $\frac{|\vec{a}|}{|\vec{b}|}$ may be :

(1) $\frac{1}{4}$ (2) $\frac{1}{8}$ (3) 1 (4) 2

29. A truck travelling due north at 20 ms^{-1} turns west and travels with same speed. What is the change in velocity ? **[RPMT Entrance Exam 2005]**

(1) 20$\sqrt{2}$ ms^{-1} south-west
(2) 40 ms^{-1} south-west
(3) 20 $\sqrt{2}$ ms^{-1} north-west
(4) 40 ms^{-1} north-west

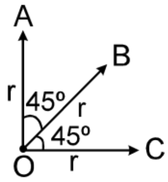
30. Determine that vector which when added to the resultant of $\vec{P} = 2\hat{i}+7\hat{j}-10\hat{k}$ and $\vec{Q} = \hat{i}+2\hat{j}+3\hat{k}$ gives a unit vector along X-axis.

(1) $-2\hat{i}-9\hat{j}+7\hat{k}$ (2) $+2\hat{i}+9\hat{j}-7\hat{k}$ (3) $-2\hat{i}+7\hat{j}+9\hat{k}$ (4) $+2\hat{i}-5\hat{j}+3\hat{k}$

31. Two vectors acting in the opposite directions have a resultant of 10 units. If they act at right angles to each other, then the resultant is 50 units . Calculate the magnitude of two vectors .

(1) P = 40 ; Q = 30 (2) P = 30 ; Q = 40 (3) P = 80 ; Q = 50 (4) P = 30 ; Q = 40

32. Find the resultant of the three vectors $\vec{OA}$, $\vec{OB}$ and $\vec{OC}$ each of magnitude r as shown in figure?



(1) r(1 + $\sqrt{2}$) (2) $r(1-\sqrt{2})$ (3) $(1+\sqrt{2})$ (4) $r(1+\sqrt{2})^2$

33. A car is moving on a straight road due north with a uniform speed of 50 km h^{-1} when it turns left through 90º. If the speed remains unchanged after turning, the change in the velocity of the car in the turning process is

(1) zero
(2) 50 $\sqrt{2}$ km h^{-1} S-W direction
(3) 50 $\sqrt{2}$ km h^{-1} N-W direction
(4) 50 km h^{-1} due west.

34. Six forces, 9.81 N each, acting at a point are coplanar. If the angles between neighboring forces are equal, then the resultant is

(1) 0 N (2) 9.81 N (3) 2 × 9.81 N (4) 3 × 9.81 N.

35. At what angle must the two forces (x + y) and (x – y) act so that the resultant may be $\sqrt{(x^2+y^2)}$?

(1) $\cos^{-1}\left[\frac{-(x^2+y^2)}{2(x^2-y^2)}\right]$ (2) $\cos^{-1}\left[\frac{-2(x^2-y^2)}{x^2+y^2}\right]$ (3) $\cos^{-1}\left[\frac{-(x^2+y^2)}{x^2-y^2}\right]$ (4) $\cos^{-1}\left[\frac{(x^2-y^2)}{x^2+y^2}\right]$

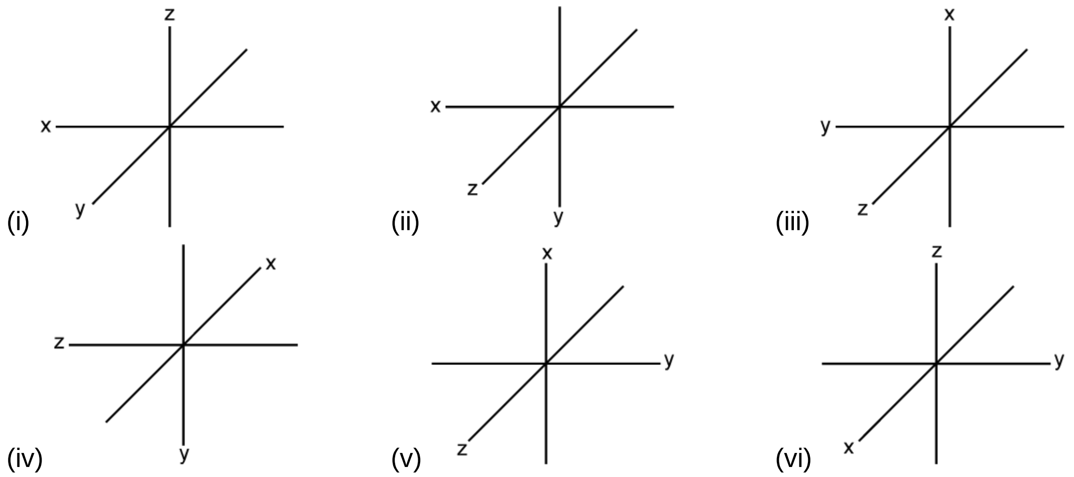
36. The magnitude of scalar product of two vectors is 8 and that of vector product is $8\sqrt{3}$. The angle between them is :

(1) 30º (2) 60º (3) 120º (4) 150º

37. A vector $\vec{A}$ points vertically downward & $\vec{B}$ points towards east, then the vector product $\vec{A}\times\vec{B}$ is

(1) along west (2) along east (3) zero (4) along south

38. Which of the arrangement of axes in Fig. can be labelled "right-handed coordinate system"? As usual, each axis label indicates the positive side of the axis.



(1) (i), (ii) (2) (iii), (iv) (3) (vi) (4) (v)

39. The unit vector perpendicular to each of the vectors $3\hat{i}+\hat{j}+2\hat{k}$ and $2\hat{i}-2\hat{j}+\hat{k}$ is given by

(1) $\frac{1}{\sqrt{3}}(\hat{i}-\hat{j}-\hat{k})$ (2) $\frac{1}{\sqrt{3}}(\hat{i}+\hat{j}+\hat{k})$ (3) $\frac{5\hat{i}+\hat{j}+4\hat{k}}{\sqrt{46}}$ (4) $\pm\frac{5\hat{i}+\hat{j}-4\hat{k}}{\sqrt{42}}$

40. Three vectors $\vec{A},\vec{B}$ and $\vec{C}$ are such that $\vec{A}=\vec{B}+\vec{C}$ and their magnitudes are in ratio 5 : 4 : 3 respectively. Find angle between vector $\vec{A}$ and $\vec{C}$

(1) 35º (2) 53º (3) 60º (4) 75º

41. A car travels 6 km towards north at an angle of 45° to the east and then travels distance of 4 km towards north at an angle 135° to east. How far is the point from the starting point ? What angle does the straight line joining its initial and final position makes with the east ? **[AIIMS 2008]**

(1) $\sqrt{50}$ km and $\tan^{-1}(5)$ (2) 10 km and $\tan^{-1}(\sqrt{5})$

(3) $\sqrt{52}$ km and $\tan^{-1}(5)$ (4) $\sqrt{52}$ km and $\tan^{-1}(\sqrt{5})$

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

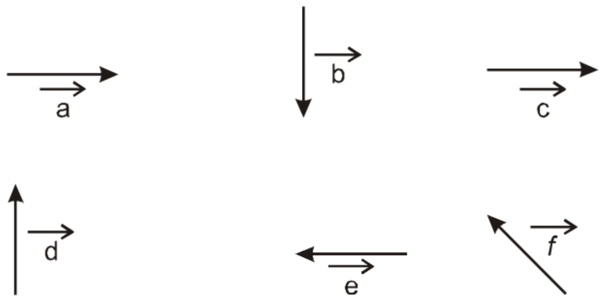
1. The vectors $\vec{A}$ and $\vec{B}$ are such that :

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

The angle between the two vectors is : **[AIPMT Screening 2006]**

(1) 90° (2) 60° (3) 75° (4) 45°

2. Six vectors, $\vec{a}$ through $\vec{f}$ have the mangitudes and directions indicated in the figure.Which of the following statements is true ? **[AIPMT Screening 2010]**



(1) $\vec{b} + \vec{c} = \vec{f}$ (2) $\vec{d} + \vec{c} = \vec{f}$ (3) $\vec{d} + \vec{e} = \vec{f}$ (4) $\vec{b} + \vec{e} = \vec{f}$

3. If dimensions of critical velocity υ_c of a liquid flowing through a tube are expressed as $[\eta^x \rho^y r^x]$, where η, ρ and r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x, y and z are given by : **[AIPMT 2015]**

(1) –1, –1, 1 (2) –1, –1, –1 (3) 1,1,1 (4) 1, –1, –1

4. If vectors $\vec{A} = \cos\omega t\ \hat{i} + \sin\omega t\ \hat{j}$ and $\vec{B} = \cos\frac{\omega t}{2}\ \hat{i} + \sin\frac{\omega t}{2}\ \hat{j}$ are functions of time, then the value of t at which they are orthogonal to each other is : **[AIPMT 2015]**

(1) $t = \frac{\pi}{2\omega}$ (2) $t = \frac{\pi}{\omega}$ (3) t = 0 (4) $t = \frac{\pi}{4\omega}$

5. If the magnitude of sum of two vectors is equal to the magnitude of difference of the two vectors, the angle between these vectors is : **[AIPMT_2016]**

(1) 180° (2) 0° (3) 90° (4) 45°

6. A particle moves so that its position vector is given by $\vec{r} = \cos\omega t\hat{x} + \sin\omega t\hat{y}$. Where ω is a constant. Which of the following is true? **[AIPMT_2016]**

(1) Velocity is perpendicular to $\vec{r}$ and acceleration is directed away from the origin.

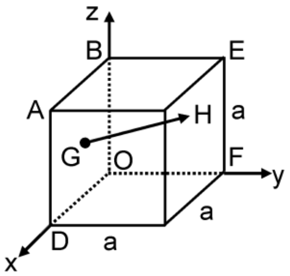
(2) Velocity and acceleration both are perpendicular to $\vec{r}$.

(3) Velocity and acceleration both are parallel to $\vec{r}$.

(4) Velocity is perpendicular to $\vec{r}$ and acceleration is directed towards the origin.

PART - II : JEE (MAIN) / AIEEE PROBLEM (PREVIOUS YEARS)

1. In the cube of side 'a' shown in the figure, the vector from the central point of the face ABOD to the central point of the face BEFO will be : **[Main 2019]**



(1) $\frac{1}{2}a(\hat{j}-\hat{k})$ (2) $\frac{1}{2}a(\hat{j}-\hat{i})$ (3) $\frac{1}{2}a(\hat{k}-\hat{i})$ (4) $\frac{1}{2}a(\hat{i}-\hat{k})$

2. Two forces P and Q, of magnitude 2F and 3F, respectively are at an angle θ with each other. If the force Q is doubled, then their resultant also gets doubled. Then, the angle θ is : **[Main 2019]**

(1) 30° (2) 60° (3) 90° (4) 120°

3. Two vectors $\vec{A}$ and $\vec{B}$ have equal magnitudes. The magnitude of $(\vec{A}+\vec{B})$ is 'n' times the magnitude of $(\vec{A}-\vec{B})$. The angle between $\vec{A}$ and $\vec{B}$ is : **[Main 2019]**

(1) $\sin^{-1}\left[\frac{n-1}{n+1}\right]$ (2) $\cos^{-1}\left[\frac{n^2-1}{n^2+1}\right]$ (3) $\sin^{-1}\left[\frac{n^2-1}{n^2+1}\right]$ (4) $\cos^{-1}\left[\frac{n-1}{n+1}\right]$

Answers

EXERCISE - 1

PART - I

SECTION - (A)

1.	(4)	**2.**	(4)	**3.**	(1)	**4.**	(3)	**5.**	(2)	**6.**	(2)

SECTION - (B)

1.	(1)	**2.**	(3)	**3.**	(3)	**4.***	(1,2,4)	**5.***	(1,2,3)	**6.**	(1)

SECTION - (C)

1.	(2)	**2.**	(3)	**3.**	(4)

SECTION - (D)

1.	(1)	**2.**	(3)	**3.**	(4)	**4.**	(1)	**5.**	(1)	**6.**	(2)	**7.**	(1)
8.	(1)	**9.**	(2)	**10.**	(3)	**11.**	(4)	**12.**	(2)	**13.**	(3)	**14.**	(2)
15.	(3)	**16.**	(1)	**17.**	(1)	**18.**	(2)	**19.**	(3)	**20.**	(2)	**21.**	(2)
22.	(1)	**23.**	(3)	**24.**	(2)	**25.**	(4)	**26.**	(1)	**27.**	(1)	**28.**	(4)
29.	(2)	**30.**	(1)	**31.**	(2)	**32.**	(1)	**33.**	(1)	**34.**	(1)	**35.**	(1)

SECTION - (E)

1.	(4)	**2.**	(3)	**3.**	(4)	**4.**	(1)	**5.**	(1)	**6.**	(1)	**7.**	(1)
8.	(2)	**9.**	(1)										

10. (i) $\frac{x^{16}}{16} + C$ (ii) $-2x^{-1/2} + C$ (iii) $x^{-6}/2 + \ln x + C$ (iv) $x^2/2 + \ln x + 2x + C$
(v) $x^2/2 + \ln x + C$ (vi) $-a/x + b\ln x + C$

11. (2)

12. (i) GMm/R (ii) $Kq_1q_2\left[\frac{1}{r_2} - \frac{1}{r_1}\right]$ (iii) $M\left[\frac{v^2}{2} - \frac{u^2}{2}\right]$
(iv) ∞ (v) 1 (vi) 1 (vii) 2

13.	(1)	**14.**	(4)	**15.**	(1)	**16.**	(1)	**17.**	(2)	**18.**	(3)	**19.**	(2)
20.	(2)	**21.**	(2)	**22.**	(3)	**23.**	(2)	**24.**	(2)	**25.**	(2)	**26.**	(1)
27.	(4)	**28.**	(1)	**29.**	(1)	**30.**	(1)						

31. (i) $3x^2 + C$ (ii) $\frac{x^8}{8} + C$ (iii) $\frac{x^8}{8} - 3x^2 + 8x + C$

32. (i) $\frac{-2}{3x^3} + C$ (ii) $\frac{-x^{-3}}{6} + \frac{x^3}{3} + C$ (ii) $\frac{-x^{-3}}{3} + \frac{x^2}{2} - x + C$

33. (i) $\frac{2}{3x^3} + C$ (ii) $\frac{-x^{-3}}{6} + C$ (iii) $\frac{x^5}{5} + \frac{1}{3x^3} + C$

34. (i) $x^{2/3} + C$ (ii) $x^{1/3} + C$ (iii) $x^{-1/3} + C$

35. (i) $\sin\pi x + C$ (ii) $\sin\frac{\pi x}{2} + C$ (iii) $\frac{2}{\pi}\sin\frac{\pi x}{2} + \pi\sin x + C$

36. (i) $\sin\pi x + C$ (ii) $\sin\frac{\pi}{2}x + C$ (iii) $\frac{2}{\pi}\sin\frac{\pi}{2}x + \pi\sin x + C$

37.	(2)	**38.**	(4)	**39.**	(2)	**40.**	(4)	**41.**	(1)	**42.**	(1)	**43.**	(1)
44.	(2)	**45.**	(1)	**46.**	(1)	**47.**	(1)	**48.**	(1)	**49.**	(1)	**50.**	(2)
51.	(1)	**52.**	(1)	**53.**	(1)	**54.**	(1)	**55.**	(2)	**56.**	(1)	**57.**	(1)
58.	(2)	**59.**	(1)	**60.**	(1)	**61.**	(1)	**62.**	(1)				

SECTION - (F)

1. (i) 105º , (ii) 150º , (iii) 105º.

2.	(3)	**3.**	(3)	**4.**	(4)	**5.**	(2)	**6.**	(4)	**7.**	(1)	**8.**	(4)
9.	(1)	**10.**	(1)	**11.**	(1)	**12.**	(1)	**13.**	(2)	**14.**	(4)	**15.**	(2)
16.	(1)	**17.**	(1)	**18.**	(2)	**19.**	(2)	**20.**	(4)	**21.**	(2)	**22.**	(1)
23.	(1)	**24.**	(2)	**25.**	(2)	**26.**	(3)	**27.**	(3)	**28.**	(1)	**29.**	(3)
30.	(4)	**31.**	(1)	**32.**	(4)	**33.**	(3)	**34.**	(4)	**35.**	(1)	**36.**	(4)
37.	(1)	**38.**	(3)	**39.**	(3)								

SECTION - (G)

1.	(1)	**2.**	(4)	**3.**	(4)	**4.**	(4)	**5.**	(1)	**6.**	(3)	**7.**	(2)
8.	(3)	**9.**	(2)	**10.**	(1)	**11.**	(2)	**12.**	(3)	**13.**	(4)	**14.**	(1)
15.	(1)	**16.**	(4)	**17.**	(1)								

EXERCISE - 2

1.	(4)	**2.**	(2)	**3.**	(1)	**4.**	(1, 3)	**5.**	(3, 4)	**6.**	(3)	**7.**	(2)
8.	(1)	**9.**	(2)	**10.**	(3)	**11.**	(1)	**12.**	(1)	**13.**	(1)	**14.**	(1)
15.	(3)	**16.**	(2)	**17.**	(1)	**18.**	(1)	**19.**	(1)	**20.**	(2)	**21.**	(1)
22.	(1)	**23.**	(1)	**24.**	(1)	**25.**	(2)	**26.**	(2)	**27.**	(1)	**28.**	(3,4)
29.	(1)	**30.**	(1)	**31.**	(1)	**32.**	(1)	**33.**	(2)	**34.**	(1)	**35.**	(1)
36.	(2, 3)	**37.**	(4)	**38.**	(1, 2, 3)	**39.**	(4)	**40.**	(2)	**41.**	(3)		

EXERCISE - 3

PART - I

1.	(1)	**2.**	(3)	**3.**	(4)	**4.**	(2)	**5.**	(3)	**6.**	(4)

PART - II

1.	(2)	**2.**	(4)	**3.**	(2)