

Topic : Mathematical Tools

Type of Questions

Single choice Objective ('-1' negative marking) Q.1 to Q.4

(3 marks, 3 min.)

M.M., Min.

[12, 12]

Subjective Questions ('-1' negative marking) Q.5 to Q.7

(4 marks, 5 min.)

[12, 15]

Comprehension ('-1' negative marking) Q.8 to Q.10

(3 marks, 3 min.)

[9, 9]

- If $y = 2x^3 + 3x^2 + 6x + 1$, then $\frac{dy}{dx}$ will be -
(A) $6(x^2 + x + 1)$ (B) $6(x^2 + x + 2)$ (C) $6x^2 + 3x$ (D) $(x^2 + 6x + 1)$
- If $x = (6y + 4)(3y^2 + 4y + 3)$ then $\int x dy$ will be :
(A) $\frac{1}{3y^2 + 4y + 3}$ (B) $\frac{(3y^2 + 4y + 3)^2}{2} + C$ (C) $(3y^2 + 4y + 3)$ (D) $\frac{(6y + 4)}{(3y^2 + 4y + 3)}$
- If $f(x) = \frac{x+1}{x-1}$, then the value of $f(f(f(x)))$ is :
(A) $\frac{x-1}{x+1}$ (B) 1 (C) $\frac{x+1}{x-1}$ (D) x
- $\int \left[(x)^{1/3} - \frac{1}{(x)^{1/3}} \right] dx$ is equal to :
(A) $x^{4/3} - x^{2/3} + c$ (B) $\frac{4}{3} x^{2/3} - \frac{2}{3} x^{2/3} + c$ (C) $\frac{3}{4} x^{4/3} - \frac{2}{3} x^{1/3} + c$ (D) $\frac{3}{4} (x)^{4/3} - \frac{3}{2} (x)^{2/3} + c$
- Integrate the following : $\int (\sin 4t + 2t) dt$
- Integrate the following : $\int (2t - 4)^{-4} dt$
- Integrate the following : $\int \frac{dt}{(6t-1)}$

COMPREHENSION

If charge flown through a cross section of wire in one direction during 0 to t is given by $q = 3 \sin(3t)$ then

- Find out the amount of charge flowing through the wire till $t = \left(\frac{\pi}{6}\right)$ seconds.
(A) 3 coulombs (B) 6 coulombs (C) 1 coulomb (D) Zero coulomb
- Find out the current flowing through the wire at $t = \frac{\pi}{9}$ second.
(A) 4.5 Amp (B) $4.5\sqrt{3}$ Amp (C) $\sqrt{3}/2$ Amp (D) 9 Amp.
- Find out the area under $i - t$ curve from $t = \frac{\pi}{9}$ to $t = \frac{\pi}{6}$ seconds :
(A) $3 \left[\frac{2-\sqrt{3}}{2} \right]$ (B) $3 \left[\frac{2+\sqrt{3}}{2} \right]$ (C) $\left[\frac{2-\sqrt{3}}{2} \right]$ (D) $\left[\frac{2+\sqrt{3}}{2} \right]$

Answers Key

DPP NO. - 6

1. (A) 2. (B) 3. (C) 4. (D)
5. $-\frac{1}{4} \cos 4t + t^2 + C$ 6. $= -\frac{(2t-4)^{-3}}{6} + C$
7. $\frac{1}{6} \log(6t-1) + C$ 8. (A) 9. (A)
10. (A) 11. (C)

Hint & Solutions

DPP NO. - 6

1. $y = 2x^3 + 3x^2 + 6x + 1$
- $$\frac{dy}{dx} = 6x^2 + 6x + 6$$
- $$= 6(x^2 + x + 1)$$
2. Let $3y^2 + 4y + 3 = t \Rightarrow (6y + 4) dy = dt$
- Then $\int x dy = \int t dt = \frac{t^2}{2} + C$
- $$= \frac{(3y^2 + 4y + 3)^2}{2} + C$$
3. $f(f(x)) = \frac{\left(\frac{x+1}{x-1}\right) + 1}{\left(\frac{x+1}{x-1}\right) - 1} = x$
- $$f(f(f(x))) = \frac{x+1}{x-1}$$
4. $\int x^{1/3} dx - \int x^{-1/3} dx = \frac{(x)^{1/3+1}}{\left(\frac{1}{3}+1\right)} - \frac{(x)^{-1/3+1}}{\left(-\frac{1}{3}+1\right)} + c$
- $$= \frac{3}{4} (x)^{4/3} - \frac{3}{2} (x)^{2/3} + c.$$
5. $\int (\sin 4t + 2t) dt = -\frac{1}{4} \cos 4t + t^2 + C.$

6. $u = 2t - 4$

$$\frac{du}{dt} = 2$$

$$\int \frac{u^{-4} du}{2} = \frac{1}{2} \left(\frac{u^{-3}}{-3} \right) + C$$

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

7. $u = 6t - 1$

$$\frac{dx}{dt} = 6$$

$$\frac{1}{6} \int \frac{du}{u}$$

$$= \frac{1}{6} \log u + C$$

$$= \frac{1}{6} \log (6t - 1) + C$$

Ans. $\frac{1}{6} \log (6t - 1) + C$

8. $q = 3 \sin 3t$

$$q\left(\frac{\pi}{6}\right) - q(0) = q$$

$$q = 3 \sin 3 \times \frac{\pi}{6} = 3 \text{ coulombs}$$

9. $i = \frac{dq}{dt} = 3 \times 3 \cos(3t) \Rightarrow i|_{t=\frac{\pi}{9}} = 9 \cos\left(3 \cdot \frac{\pi}{9}\right)$

$$= 9 \cos\left(\frac{\pi}{3}\right) = \frac{9}{2} \text{ A}$$

10. $\Delta q = 3 \sin 3t \Big|_{\pi/9}^{\pi/6} = 3 \left[1 - \frac{\sqrt{3}}{2} \right] = 3 \left[\frac{2 - \sqrt{3}}{2} \right]$

$$\Delta q = \text{total charge flown between } t = \frac{\pi}{9} \text{ to } \frac{\pi}{6}$$