PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 6

Total Marks : 33

Max. Time : 36 min.

Topic : Mathematical Tools

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.4	**(3 marks, 3 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]**

1. 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) $(x^2 + 6x + 1)$

2. 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) $\frac{(6y+4)}{(3y^2+4y+3)}$

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

4. $\int\left[(x)^{1/3} - \frac{1}{(x)^{1/3}}\right] dx$ 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) $\frac{3}{4}(x)^{4/3} - \frac{3}{2}(x)^{2/3} + c$

5. Integrate the following : $\int (\sin 4t + 2t)\,dt$

6. Integrate the following : $\int (2t - 4)^{-4}\,dt$

7. 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

8. 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

9. 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.

10. 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

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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

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

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

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

Δq = total charge flown between $t = \frac{\pi}{9}$ to $\frac{\pi}{6}$