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Date :	Sep 30 2024	**Board** :	CBSE
Class :	12	**Session # :**	1
Subject :	Mathematics	**Assignment # :**	IA1
Topic :	Integration	**Subtopic(s) :**	Inverse process, Inspection Method, Anti derivative
Lecture #:	1		

Derivatives | **Integrals (Anti derivatives)**

(i) $\frac{d}{dx}\left(\frac{x^{n+1}}{n+1}\right)=x^n$; $\int x^n\,dx=\frac{x^{n+1}}{n+1}+C,\ n\neq-1$

Particularly, we note that

$\frac{d}{dx}(x)=1$; $\int dx=x+C$

(ii) $\frac{d}{dx}(\sin x)=\cos x$; $\int \cos x\,dx=\sin x+C$

(iii) $\frac{d}{dx}(-\cos x)=\sin x$; $\int \sin x\,dx=-\cos x+C$

(iv) $\frac{d}{dx}(\tan x)=\sec^2 x$; $\int \sec^2 x\,dx=\tan x+C$

(v) $\frac{d}{dx}(-\cot x)=\operatorname{cosec}^2 x$; $\int \operatorname{cosec}^2 x\,dx=-\cot x+C$

(vi) $\frac{d}{dx}(\sec x)=\sec x\tan x$; $\int \sec x\tan x\,dx=\sec x+C$

(vii) $\frac{d}{dx}(-\operatorname{cosec} x)=\operatorname{cosec} x\cot x$; $\int \operatorname{cosec} x\cot x\,dx=-\operatorname{cosec} x+C$

(viii) $\frac{d}{dx}(\sin^{-1} x)=\frac{1}{\sqrt{1-x^2}}$; $\int \frac{dx}{\sqrt{1-x^2}}=\sin^{-1} x+C$

(ix) $\frac{d}{dx}(-\cos^{-1} x)=\frac{1}{\sqrt{1-x^2}}$; $\int \frac{dx}{\sqrt{1-x^2}}=-\cos^{-1} x+C$

(x) $\frac{d}{dx}(\tan^{-1} x)=\frac{1}{1+x^2}$; $\int \frac{dx}{1+x^2}=\tan^{-1} x+C$

(xi) $\frac{d}{dx}(-\cot^{-1} x)=\frac{1}{1+x^2}$; $\int \frac{dx}{1+x^2}=-\cot^{-1} x+C$

(xii) $\frac{d}{dx}\left(\sec^{-1} x\right)=\frac{1}{x\sqrt{x^2-1}}$; $\int \frac{dx}{x\sqrt{x^2-1}}=\sec^{-1} x+C$

(xiii) $\frac{d}{dx}\left(-\operatorname{cosec}^{-1} x\right)=\frac{1}{x\sqrt{x^2-1}}$; $\int \frac{dx}{x\sqrt{x^2-1}}=-\operatorname{cosec}^{-1}x+C$

(xiv) $\frac{d}{dx}(e^x)=e^x$; $\int e^x dx=e^x+C$

(xv) $\frac{d}{dx}(\log|x|)=\frac{1}{x}$; $\int \frac{1}{x}\,dx=\log|x|+C$

(xvi) $\frac{d}{dx}\left(\frac{a^x}{\log a}\right)=a^x$; $\int a^x dx=\frac{a^x}{\log a}+C$

$$\frac{d}{dx}(\sin 2x) = \cos 2x \times \frac{d}{dx}(2x)$$

$$= \cos 2x \times 2$$

$$= 2 \times \cos 2x$$

$$\text{or } 2\int \cos 2x\, dx = \sin 2x$$

$$\Rightarrow \boxed{\int \cos 2x\, dx = \frac{\sin 2x}{2}}$$

$$\frac{d}{dx}(x^3 + x^4)$$

$$= 3x^{3-1} + 4x^{4-1}$$

$$= 3x^2 + 4x^3$$

$$\therefore \int (3x^2 + 4x^3)\,dx$$

$$= \boxed{x^3 + x^4}$$

$$\frac{d}{dx}\left(\log_e |x|\right) = \frac{1}{x}$$

$$\therefore \boxed{\int \frac{1}{x}\,dx = \log_e |x| + C}$$

$$\int\left(\frac{x^3-1}{x^2}\right)dx$$

$$= \int\frac{x^3}{x^2}dx - \int\frac{1}{x^2}dx$$

$$= \int x\,dx - \int x^{-2}dx$$

$$= \frac{x^2}{2} + \frac{1}{x} + C$$

$$\int \operatorname{cosec} x \,(\operatorname{cosec} x + \cot x)\, dx$$

$$= \int \operatorname{cosec}^2 x \, dx + \int \operatorname{cosec} x \times \cot x \, dx$$

$$= -\cot x - \operatorname{cosec} x + C$$

$$= \frac{x^2}{2} + \frac{1}{x} + C$$

$$\int \frac{1 - \sin x}{\cos^2 x} \, dx$$

$$= \int \frac{1}{\cos^2 x} dx - \int \frac{\sin x}{\cos^2 x} \, dx$$

$$= \int \sec^2 x \, dx - \int \tan x \sec x \, dx$$

$$= \tan x - \sec x + C$$

Now Complete this Assignment #IA1:

#IA1:

Find an anti derivative (or integral) of the following functions by the method of inspection.

1. $\sin 2x$
2. $\cos 3x$
3. e^{2x}
4. $(ax + b)^2$
5. $\sin 2x - 4\, e^{3x}$

Find the following integrals in Exercises 6 to 20:

6. $\int (4\, e^{3x} + 1)\, dx$
7. $\int x^2 (1 - \frac{1}{x^2})\, dx$
8. $\int (ax^2 + bx + c)\, dx$
9. $\int (2x^2 + e^x)\, dx$
10. $\int \left(\sqrt{x} - \frac{1}{\sqrt{x}}\right)^2 dx$
11. $\int \frac{x^3 + 5x^2 - 4}{x^2}\, dx$
12. $\int \frac{x^3 + 3x + 4}{\sqrt{x}}\, dx$
13. $\int \frac{x^3 - x^2 + x - 1}{x - 1}\, dx$
14. $\int (1 - x)\sqrt{x}\, dx$
15. $\int \sqrt{x}(3x^2 + 2x + 3)\, dx$
16. $\int (2x - 3\cos x + e^x)\, dx$
17. $\int (2x^2 - 3\sin x + 5\sqrt{x})\, dx$
18. $\int \sec x (\sec x + \tan x)\, dx$
19. $\int \frac{\sec^2 x}{\operatorname{cosec}^2 x}\, dx$
20. $\int \frac{2 - 3\sin x}{\cos^2 x}\, dx.$

Choose the correct answer in Exercises 21 and 22.

21. The anti derivative of $\left(\sqrt{x} + \frac{1}{\sqrt{x}}\right)$ equals

(A) $\frac{1}{3}x^{\frac{1}{3}} + 2x^{\frac{1}{2}} + C$ (B) $\frac{2}{3}x^{\frac{2}{3}} + \frac{1}{2}x^2 + C$

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

22. If $\frac{d}{dx} f(x) = 4x^3 - \frac{3}{x^4}$ such that $f(2) = 0$. Then $f(x)$ is

(A) $x^4 + \frac{1}{x^3} - \frac{129}{8}$ (B) $x^3 + \frac{1}{x^4} + \frac{129}{8}$

(C) $x^4 + \frac{1}{x^3} + \frac{129}{8}$ (D) $x^3 + \frac{1}{x^4} - \frac{129}{8}$

End