# Integrals #

$f(x) = x^3 + 3 \;/\; x^3 + 5$

$\rightarrow f'(x) = 3x^2$

# $f(x) \rightarrow$ diff. $\rightarrow \frac{d}{dx} f(x)$ $\rightarrow$ anti derivative of $f'(x) = x^3 + C$

integrate :- $\int \frac{d}{dx} f(x) \cdot dx = f(x) + C$

# $f(x) = x^2$

$\rightarrow$ diff $\rightarrow f'(x) = \frac{d}{dx} f(x) = 2x$

$f(x) = 2x$

$\downarrow$

anti-derivative of $f(x)$

int. $\rightarrow$ $\Rightarrow x^2 + C$

Ex:- $f(x) = \sin x$

$\rightarrow$ derivative of $f(x) = \cos x = f'(x)$

$\rightarrow$ anti-derivative of $f'(x) = \sin x + C$ $\leftarrow$ integration of $\cos x$

# # Integrals #

#① $\int x^n \cdot dx = \frac{x^{n+1}}{n+1} + c$

② $\int \frac{1}{x} \cdot dx = \log|x| + c$

③ $\int \sin x \cdot dx = -\cos x + c$

④ $\int \cos x \cdot dx = \sin x + c$

⑤ $\int \tan x \cdot dx = \log|\sec x| + c$

$\int \frac{\sin x}{\cos x} dx \rightarrow \cos x = t$

$-\sin x \cdot dx = dt$

$-\sin x = \frac{dt}{dx}$

$= -\int \frac{1}{t} dt = -\log|t| + c$

$= -\log(\cos x) + c$

$= \log(\cos x)^{-1} = \log|\sec x| + c$

⑥ $\int \sec^2 x \cdot dx = \tan x + c$

⑦ $\int \sec x \cdot \tan x \cdot dx = \sec x + c$

⑧ $\int \operatorname{cosec} x \cdot \cot x \, dx = -\operatorname{cosec} x + c$

⑨ $\int \operatorname{cosec}^2 x \cdot dx = -\cot x + c$

# Integrals #

(10) $\int \frac{1}{\sqrt{1-x^2}}\,dx = \sin^{-1}x + C = -\cos^{-1}x + C$ $\quad \frac{d}{dx}\sin^{-1}x = \frac{1}{\sqrt{1-x^2}}$

(14) $\int \frac{-1}{\sqrt{1-x^2}}\,dx = \cos^{-1}x + C$

(16) $\int e^x\,dx = e^x + C$

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

(17) $\int a^x\,dx = \frac{a^x}{\log_e a} + C$

(13) $\int \frac{-1}{1+x^2}\,dx = -\cot^{-1}x + C$

(18) $\int 1\,dx = x + C$

(14) $\int \frac{1}{x\sqrt{x^2-1}}\,dx = \sec^{-1}x + C$

(19) $\int 5\,dx = 5x + C$

(15) $\int \frac{1}{x\sqrt{x^2-1}}\,dx = -\operatorname{cosec}^{-1}x + C$

$f(x) = x \quad f(x) = 5x$

$f'(x) = 1 \quad f'(x) = 5$

$\int x\,dx = \frac{x^2}{2} + C$

# # Integrals #

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

Sol$^n$:- $\int \frac{x^3}{x^2} \cdot dx - \int \frac{1}{x^2} \cdot dx$

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

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

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

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

H.W $\int (\sin 2x - 4 \cdot e^{3x}) dx$

ii) $\int (x^{2/3} + 1) \cdot dx$

$= \int x^{2/3} \cdot dx + \int 1 \cdot dx$

$= \frac{x^{2/3+1}}{2/3+1} + x + C$

$= \frac{x^{5/3}}{5/3} + x + C$

$= \frac{3}{5} x^{5/3} + x + C$ A

H.W

iii) $\int \left(x^{3/2} + 2e^x - \frac{1}{x}\right) \cdot dx$

iv) $\int \frac{1-\sin x}{\cos^2 x} \cdot dx$

# $f(x) = \cos x$

$f'(x) = -\sin x$

# $f(x) = \cos 2x$

$\boxed{f'(x) = -\sin 2x \times 2}$

Q. → $f(x) = \sin 2x$

$\left[\int f(x) \cdot dx = \frac{-\cos 2x}{2} + C\right]$

$\frac{d}{dx}\left(\frac{-\cos 2x}{2}\right) = \frac{-1}{2} \times (-\sin 2x) \times 2$

$= \sin 2x$