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19/MHS01/393
Medicine and surgery
MAT 104
15/04/2020

Assignment

1. $\int \frac{2x}{\sqrt{4x^2-1}}\,dx = \int \frac{2x}{(4x^2-1)^{1/2}}\,dx$

$\therefore = 2\int \frac{x}{(4x^2-1)^{1/2}}\,dx$

$u = (4x^2-1)^{1/2}$

$u^2 = 4x^2-1 \quad \therefore u^2+1 = 4x^2$

$\frac{dx}{du} = \frac{1}{2}\left(\frac{u^2+1}{4}\right)^{-1/2} \cdot \frac{u}{2}$

$dx = \frac{u\,du}{4}\left(\frac{u^2+1}{4}\right)^{-1/2}$

$2\int \left(\frac{u^2+1}{4}\right)^{1/2} \cdot \frac{1}{u} \cdot \frac{u\,du}{4}\left(\frac{u^2+1}{4}\right)^{-1/2}$

$\frac{2}{4}\int \frac{u}{u}\,du$

$\frac{2}{4}\int du = \frac{1}{2}\left[u\right] + c$

$\therefore \int \frac{2x}{(4x^2-1)^{1/2}}\,dx = \frac{\sqrt{4x^2-1}}{2} + c$

or $\frac{1}{2}\sqrt{4x^2-1} + c$

② ~~$\int \frac{\sin^{-1} x}{x}$~~

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

sol →

$$\int \sin^{-1} x \cdot \left(\sqrt{1^2 - x^2}\right)^{-1} dx$$

$$u = \sin^{-1} x$$

$$\frac{du}{dx} = \frac{1}{\sqrt{1-x^2}}$$

$$du = \frac{dx}{\sqrt{1-x^2}}$$

$$du = \left(\sqrt{1^2 - x^2}\right)^{-1} dx$$

$$\int u \, du$$

$$\frac{u^2}{2} + c$$

$$= \frac{(\sin^{-1} x)^2}{2} du$$

$$\therefore \int \frac{\sin^{-1} x}{\sqrt{1-x^2}} \, dx = \frac{(\sin^{-1} x)^2}{2} du$$

③ $\int (\tan x)^6 \sec^2 x \, dx$

sol →

$u = \tan x$

$\frac{du}{dx} = \sec^2 x$

$du = \sec^2 x \, dx$

$\int u^6 \, du$

$\left[\frac{u^7}{7}\right] + C$

$= \frac{(\tan x)^7}{7} + C$

$\therefore \int (\tan x)^6 \sec^2 x \, dx = \frac{(\tan x)^7}{7} + C$